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قسم تقنيات التمريض/المستوى الأول
فرع التمريض+فرع الاسعاف الفوري

"وظائف الأعضاء "

"Physiology"

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Lecture (1)

Introduction of physiology

Physiology is the study of how living organisms work. Human physiology is the science of the mechanical, physical, and biochemical functions of normal humans or human tissues or organs. Human Physiology focuses principally at the level of organs and systems.

Human body, the physical substance of the human organism, composed of living cells and extracellular materials and organized into tissues, organs, and systems.

Human anatomy and physiology are treated in many different articles. For detailed discussions of specific tissues, organs, and systems, *see* human blood; cardiovascular system; digestive system, human; endocrine system, human; renal system; skin; human muscle system; nervous system; reproductive system, respiration, sensory reception, skeletal system.

An organ is a collection of tissues joined in a structural unit to serve a common function

Although organs consist of multiple tissue types, many organs are composed of the main tissue that is associated with the organ's major function and other tissues that play supporting roles. The main tissue may be unique to that specific organ. For example, the main tissue of the heart is cardiac muscle, which performs the heart's major function of pumping blood and is found only in the heart. The heart also includes nervous and connective tissues that are required for it to perform its major function. For example, nervous tissues control the beating of the heart, and connective tissues make up heart valves that keep blood flowing in just one direction through the heart.

The human body contains five organs that are considered vital for survival. They are the heart, brain, kidneys, liver, and lungs. If any of the five vital organs stops functioning, the death of the organism is imminent without medical intervention.

The heart is located in the center of the chest, and its function is to keep blood flowing through the body. Blood carries substances to cells that they need and also carries away wastes from cells.

The brain is located in the head and functions as the body's control center. It is the seat of all thoughts, memories, perceptions, and feelings.

The two kidneys are located in the back of the abdomen on either side of the body. Their function is to filter blood and form urine, which is excreted from the body.

The liver is located on the right side of the abdomen. It has many functions, including filtering blood, secreting bile that is needed for digestion, and producing proteins necessary for blood clotting.

The two lungs are located on either side of the upper chest. Their main function is exchanging oxygen and carbon dioxide with the blood.

homeostasis

In biology, homeostasis is the state of study internal physical and chemical conditions maintained by living systems. This dynamic state of equilibrium is the condition of optimal functioning for the organism and includes many variables, such as body temperature and fluid balance, being kept within certain pre-set limits (homeostatic range). Other variables include the pH of extracellular fluid, the concentrations of sodium, potassium and calcium ions, as well as that of the blood sugar level, and these need to be regulated despite changes in the environment, diet, or level of activity. Each of these variables is controlled by one or more regulators or homeostatic mechanisms, which together maintain life.

Blood composition

Blood : It is the vital alkaline liquid which circulates in a closed system of blood vessels .

Blood is very important for life because it supply the body tissues and cells with oxygen (O_2) and nutrients and remove their waste products .

Blood characters

1- Red colour .

2-Viscous .

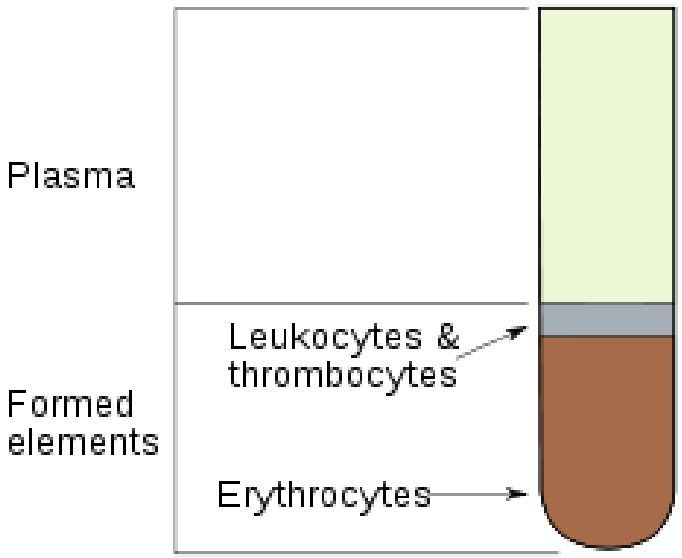
3- Slightly alkaline (pH of blood 7.4)

4- Volume : In adult 5-6 Liters , In newborn infant 300 cc.

Consistency of blood : Blood consist of 2 parts

1- Blood cells 45% .

2- Liquid (plasma) part 55% .



Blood

55% plasma consists of:

1- Water 91.5%

2- Proteins 7%

a- Albumin 4.2 %

b- Globulin 2.5%

c- Fibrinogen 0.3%

3- Solutes 1.5%

a- Respiratory gasses(O_2 ,Co_2)

b- Nutrient

e.g glucose ,Fatty acids Amino acids .

c- Hormones .

d- Electrolytes.

e- Non protein nitrogenous substances , like (Urea , Uric acid) .

Blood cells

1- Red blood cells R.B.C. (Erythrocytes)

2- White blood cells W.B.C. (Leucocytes)

3- Platelets (Thrombocytes)

Plasma : It is the straw colour (slight yellow) alkaline fluid in which the blood cells float . It forms 55% of whole blood .

Function of blood :

1- Transport:-

a- Nutrient as glucose , Amino acid , Vitamins and minerals from small intestine to all body .

b- Waste products like urea ,uric acid and creatinine and also excess of water to the kidney to be excreated in urine .

c- Respiratory gasses like oxygen (O_2) from lungs to the body cells and (Co_2) from cells to the lungs .

d- Hormones from the endocrine glands to the site of their functions .

e- Antibodies in disseafe condition .

2- Regulation:-

a- Keeps the body temperature constant .

b- Keeps the fluid and electrolytes contents inside and outside the cells constant

c- Keeps the pH of body fluids constant .

3- Defence:-

a- By phagocytic action of white blood cells against bacteria , toxins and foreign bodies .

b- By antibodies formation .

c- Prevents blood loss from the body by clotting formation .

Blood cells

Red blood cells R.B.C.	White blood cells W.B.C.	Platelets
(Erythrocytes)	(Leucocytes)	(Thrombocytes)
Function : Transport	Defence	Clotting

<u>Origin of blood cells :</u>

Haemopoiesis : formation of blood cells in the red bone marrow from the haemocytoblast (stem cell) . It is a continuous process but diminish with aging (old person suffer from anaemia) .

In Infant : Red bone marrow of all the bones .

In Adult : Red bone marrow of the membranous bones e.g sternum , ribs ,vertebrae.

White Blood cells W.B.C. (Leucocytes)

W.B.C. are colourless nucleated cells of different types shape and size . All of them larger than R.B.C. but much less in number .

Normal range of W.B.C. = 4000-11000 cells /mm^3 (In Both ♂ and ♀)

Normal average = 8000 cells /mm^3

Decrease of Leucocyte count ⟶ Leucocytopenia

e.g : - In Typhoid fever

- Long Analgesic therapy .

Increase of Leucocyte count ⟶ Leucocytosis

Slight increase occurs in simple infection (Tonsillitis).

More increase occurs in appendicitis .

Large increase of Leucocyte count ⟶ Leukemia .

Life span: different according to type , but not more than 7-10 days .

Origin: spleen ,lymph nodes .

Function : Protection of body from disease .

Types of W.B.C.

Granulocytes70%	A granulocytes 30%
- Neutrophils 60-65%	- Lymphocytes 25%
- Eosinophils 1-5%	- Monocyte 5%
- Basophils 0-1%	

● **Granulocytes :**

Called also polymorphonuclear cells multiple nucles and different shape .Also called phagocytes .

The granulocytes are characterized by presence of granules in the cytoplasm , the function of this cells are phagocytosis of bacteria and foreign bodies in acute infection . The granules release enzyme which lyse the bacteria .

Types of granulocytes

1- Neutrophils (60-65%)

The granules in cytoplasm coloured with natural dye ,the nucleus is irregular in shape and lobulated 2-5 lobes .

Function : Nutrophils form the first line of defence mechanism of the body against disease by phagocytosis .

Increase of Neutrophils ⟶ Neutrophilia

2- Eosinophils (1-5%)

The granules coloured with acidic dye (eosin) ,nucleus of 2 lobes.

Function : Anti –Allergic cells

Increase of eosinophils⟶Eosinophils (in parasitic infection)

3-Basophils (0-1%)

The granules are big in size coloured with basic dye ,the nucleus of 2 lobes .

Function : product of heparin (anticoagulant)

Increase of Basophils ⟶ Basophilia (in tumours)

●**Agranulocytes :**No granules in the cytoplasm .

1- Lymphocytes (25%)

Function :Formation of antibodies , increase of lymphocyte in viral disease .

2- Monocyte (5%) :The biggest W.B.C. ,longer life span ,kidney shape nucleus

Function: phagocytosis (2 nd line of defence mechanism).

Increase of monocyte occurs in chronic infection (in Tuberculosis&Burcillosis)

Red blood cells R.B.C.

Also called erythrocyte ,these are circular biconcave non –nucleated discs in colour due to the presence of haemoglobin in it , very small in size having a diameters of 7.5 μ.

Thickness 2 μ. at periphery

1 μ. at center

So that the R.B.C. are able to pass through the capillaries wall .

R.B.C. have a cell membrane which is selectively.

The life span is 120 days .

Number : R.B.C. are the most numerous cells in the blood .

In males = $4.9 \times 10^6 - 5.4 \times 10^6 /mm^3$

In females = $3.9 \times 10^6 - 4.5 \times 10^6 /mm^3$

↓ R.B.C. ….. Anaemia

↑ R.BC….. Polycethemia a- physiologically (1-In infants 2- people living in high placer)

b- pathologically (cancer in red bone marrow)

Function of R.B.C. :

R.B.C. carry the respiratory gasses of the (O_2 and Co_2)by the haemoglobin which it contains .

Important factors in formation of R.B.C. :

1-Protein in diet .

2- Iron (Fe) in diet ♂ : needs 5 mg /day

♀ : needs 10 mg /day

3- Vit B12 (an animal protein) .

4- Folic acid in green vegetables , liver and spleen .

5- Intrinsic factor : It is a substance secreated from the gastric mucosa which helps in the absorption of vit B12 from small intestine .

The decrease of any of the above substance will lead to aneamia.

Iron ⟶ Iron deficiency anaemia .

Vit B12 ⟶ Megaloblastic anaemia .

Folic acid ↗

Intrinsic factor ⟶ pernicious anaemia

Origin of R.B.C. : Red bone marrow .

Haemocytoblast ⟶ proerythroblast (with nucleus) ⟶ normoblast (smaller and loose it's nucleus) ⟶ mature erythrocyte (In circulation) .

Erythropoietin :

It is a hormone secreated from the kidney in case of hypoxia as in case of anaemia . This hormone will stimulate the bone marrow to produce more R.B.C. in chronic renal disease ⟶ Anaemia .

Haemoglobin (Hb)

A complex protein which gives the red colour to the erythrocytes. Hb consists of protein (globin) combined with an iron containing pigment (Haem) .

The normal R.B.C. contains 100% of Hb.

Normal range of Hb :

Males : 13-18 gm /dL.

Females :11-16 gm/dL.

Functions of Hb:

1- Hb has a strong affinity to combine with O2 forming the unstable oxyhaemoglobin .(bright red in colour) .

Hb + O_2 ⟶ Oxyhaemoglobin (In the lungs).

2- Hb combine with CO2 forming dark red unstable carbominhaemoglobin .

Hb + CO_2 ⟶ Carbominhaemoglobin (at body tissue).

3- Hb has also a strong affinity to combine with the poisonous gas CO forming carboxy haemoglobin which is stable and person may die of Anoxia .

Hb + CO ⟶ Carboxy haemoglobin.

Fate and Haemolysis of R.B.C. :

After haemolysis of R.B.C. most of Iron and globin protein is used to build up new R.B.C. , the rest will be taken by the reticulo-endothelial system which are phagocytes present in bone marrow , spleen , liver . At beginning Hb loose its O_2 and so become dark blue in colour . Then change to green due to presence of bilivirdin which is converted to bilirubin (yellow pigment) . This is transferd through plasma liver cells where it will be excreated as bile through the common bile duct in to the duodenum , then go to large intestine to be excreated to outside with faeces as stericoblin . If this process fails at any step it will lead to Jaundice .

Jaundice

Failure to excreate bilirubin by normal way gives rise to Jaundice : yellowish discolouration of of skin , conjunctiva of eyes due to accumulation of bilirubin in blood more than normal limit (0.2- 1.2 mg/100ml) . Urine becomes dark brown due to presence of bile pigment .

Types of Jaundice :

1- Pre – hepatic J.

This is due to excessive break down of red blood (Haemolysis) and the liver can't deal with the large amount of bilirubin produced .

e.g physiological J. which occurs in the baby shortly after birth .

2- Hepatocellular J.

Due to liver disease as in viral hepatitis and Jaundice caused by drugs and poisions.

3- Post – hepatic J.

Is caused by the blockage of the common bile duct due to an impact gall stone or carcinoma of head of pancreas .

Platelets (Therombocytes)

They are minute spherical structures (fragments of cells) fund in the blood .

Characters :

- Size :very small , the diameter 2-4 μ .
- Normal range : 150000- 400000 /mm^3 .

Decrease thrombocytes ⟶ Thrombocytopenia

- Origin : Red bone marrow (Megakaryoblast) .

Function of platelets :

1- Stopping of bleeding in small injury (as pin prick) by aggregation of platelets and formation of platelets plug (Temporary plug) .

2- Clotting mechanism in big wound by perminant clot formation .

Haemostasis : process of stoppage of bleeding . It is of 3 steps

1- Step I : Vascular spasm .

2- Step II : Formation of platelets plug (Temporary) .

3- Step III : Formation of blood clot (Perminant).

Bleeding time = 2-7 minutes

Coagulation time = 5-15 minutes

Factors which affect coagulation :

1- Increase of temperature .

2- (Ca)salts .

3- Injury of blood vessels .

4- Stasis of blood circulation .

5- Foreign body .

6- Vit. K .

Anticoagulants: Factors which slow the blood clot formation .

Inside the body :

1- Intact blood vessel .

2-Good blood circulation .

3- Removal of the activated clotting factors by the liver .

4- Antithrombin .

5- Plasmin .

6- Heparin : natural substance present in liver , lungs , heart , muscles and basophiles .

Outside the body

1- Decrease of temperature (blood stored 4 c^{o})

2- Sodium salts and potassium salts .

3- Heparin .

4- Oral anticoagulant , e.g : Dicumoral

5- E.D.T.A. (Ethylen diamine tetracetic acid).

Lecture (2)

Blood groups

1- ABO System .

2- Rh System .

There is agglutinogen in R.B.C. and there is agglutinin in plasma .

Blood groub	Agglutinogen in R.B.C.	Agglutinin in plasma	%
A	A	Anti B	42%
B	B	Anti A	9%
AB	A+B	---	3%
O	---	Anti A+ Anti B	46%
Rh^+	D	---	85%
Rh^-	---	---	15%

In blood transfusion : Examine the blood group of the donor and recipient .

Rh system :

Rh factor : It is another agglutinogen called D .

Anti D is formed when :

1- If person Rh^- received blood from Rh^+ person .

2- In the marriage of Rh^- woman an Rh^+ man so the foetus may be Rh+ and so Anti D antibodies are formed in the mother's plasma during labour when mixing of the mother's blood with the foetal blood , baby will be in danger of death inside the uterus or to deliver with severe Jaundice a condition called Erythroblastosis foatalis .

Rx. : Anti D immunoglobulin given to mother directly after labour .

O^- : Is the universal donor which can be given to all other groups without any fear of agglutination because there is no agglutinogen on the R.B.C.

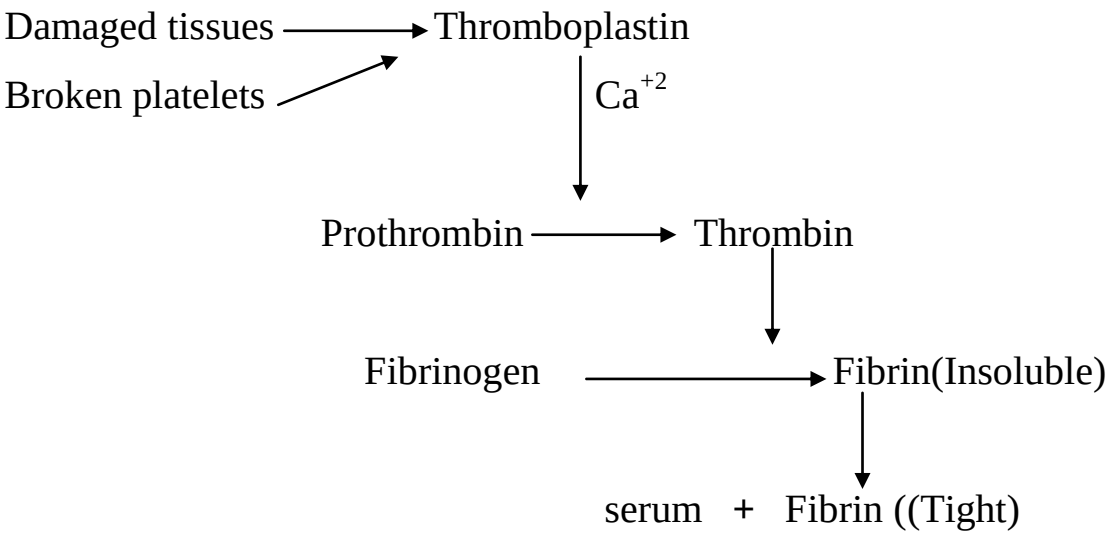
AB^+: Is the universal recipient which can receives blood from all other groups without agglutination because there is no agglutinin in the plasma .

Compatibility Test:

There is an important test must be done before blood transfusion process called (cross matching) and that occurs by centrifuging two samples of blood in different test tubes one for donor and other for recipient , then make mixing between R.B.C. of donor with plasma of recipient on slide , so if there any agglutination means the blood must be not given because presence of (sub groups) on R.B.C. membranes but it is very weak activity and not observed in ordinary test of blood grouping so compatibility test is very necessary in this process .

Mechanism of blood clotting (Coagulation)

Blood coagulation is protective device that prevent blood loss from an injured blood vessel.



Serum = plasma – fibrinogen

Blood disorder

Anaemia

It is a condition of deficiency of number of R.B.C. in the blood or the content of Hb inside the R.B.C. or both .

Classification of Anaemia :

A- According to etiology :

1- Aplastic anaemia : Due to decrease in number of R.B.C. produced by the bone marrow .

Aplastic anaemia : primary (cause unknown).

Secondary : - Drug(e.g chloramphenicol cytotoxic drugs).

-Exposure to X ray radiation

2- Heamorrhagic anaemia : Due to blood loss .

- Acute (accidents) Rx. : Blood transfusion .
- Chronic (e.g bleeding peptic ulcer) Rx. : Treat the cause .

3- Nutritional anaemia :

Iron ⟶ Iron deficiency anaemia .

Vit B12 ⟶ Megaloblastic anaemia .

Folic acid ↗

4- Pernicious anaemia : Due to deficiency of intrinsic factor secraeted from stomach . Rx. : Vit B12 ampules for life .

5- Haemolytic anaemia : Due to increase destruction of R.B.C.

- Heridetary factor (Sickle cell anaemia)
- Erythroblastosis foetalis incompatable blood transfusion .

B- According to morphology :

1- Normocytic Normochromic anaemia: Size of R.B.C. normal, Hb content is normal , But there is deficiency in number of R.B.C. e.g (Renal failure).

2- Microcytic hypochromic anaemia : Size of R.B.C smaller ,Hb content is less. e.g : Iron deficiency anaemia .

3- Macrocytic Normochromic or hyperchromic anaemia : size of R.B.C. larger , Hb content normal or more but there is decrease in number of R.B.C.

e.g : Megaloplastic anaemia due to decrease in vit B12 , Folic acid , Intrinsic factor.

4- Macrocytic hypochromic anaemia : size of R.B.C. larger , Hb content less ,e.g :Anaemia associated with twin pregnancy due to decrease in Fe & Vit B12.

Haemophilia :It is a hereditary disease due to deficiency of clotting factors (8 and 9) . This disease occurs in male only , the female carry the disease .In this disease the blood clot formation is delayed and increase of clotting time (more than 15 minutes) .

Thalassemia:

Thalassemia is a blood disorder passed down through families (inherited) in which the body makes an abnormal form or inadequate amount of hemoglobin. Hemoglobin is the protein in red blood cells that carries oxygen. The disorder results in large numbers of red blood cells being destroyed, which leads to anemia.

Leukemia is cancer of the body's blood-forming tissues, including the bone marrow and the lymphatic system.

Many types of leukemia exist. Some forms of leukemia are more common in children. Other forms of leukemia occur mostly in adults.

Leukemia usually involves the white blood cells. Your white blood cells are potent infection fighters — they normally grow and divide in an orderly way, as your body needs them. But in people with leukemia, the bone marrow produces abnormal white blood cells, which don't function properly.

Treatment for leukemia can be complex — depending on the type of leukemia and other factors. But there are strategies and resources that can help to make your treatment successful.

Lecture (3)

Cardio- Vascular System (The Circulatory System)

The C.V.S consist of :

1- Blood

2- Heart

3- Blood vessels - Arteries

- Veins

- Capillaries

The heart and blood vessels are the mechanism by which a constant circulation of the throughout the body is maintained .

The blood is pumped by the heart along the arteries to the capillaries and is returned by veins .

Functions of the Circulatory System :

1- To maintain a constant blood supply to the brain and vital centers at all times

2- To adjust the blood flow to other organs according to their requirements :

a- Blood supply to muscles is increased during exercise .

b- Blood supply to abdominal organs increase during digestion .

c- Blood supply to body surface (skin) is varied in order to regulate body temperature .

Heart : It is a hollow muscular organ lying in the thorax between the lungs and in relation to the upper surface of the diaphragm . It is situated behind the sternum and extend to the left for 9 cm .

It is conical in shape , the base is directed upwards and to the right and the apex directed downwards and to the left .

Heart chambers :

The heart is divided by a septum into right and left halves which do not communicate with each other .

Each half consists of two chambers , an upper thin walled (atrium) and a lower thick walled(ventricle) . The atria act as receiving chambers for the pump and the ventricles as distributers.

The opening between each atrium and ventricles is guarded by a valve which permits blood to flow only from the atrium to the ventricle and prevents any back flow in the opposite direction.

Structure of the heart :

Heart consists of three layers :

1- The pericardium (outer layer) .
2- The myocardium (middle layer) or the heart muscle ,this layer is thin in atria and thick in ventricles .
3-The endocardium (inner layer) .

Heart valves :

These are fibrous structure which permits the blood flow in one direction and prevents it's returned in the opposite direction .

1- Mitral valve (Bicuspid) :This valve is between the left atrium and left ventricle and permits the blood flow from left atrium to left ventricle and prevents it's return in the opposite direction .

2- Tricuspid valve This permits blood flow from right atrium to right ventricle

3- Aortic valve : Permits blood flow from left ventricle to aorta.

4- Pulmonary valve : Permits blood flow from right ventricle to pulmonary artery.

Heart sounds :

1- First heart sound (lub) : This is due to closure of mitral and tricuspid valves , so it occurs at beginning of ventricular systole .

2- Second heart sound (dup) : Due to closure of pulmonary and aortic valves , so it occurs at beginning of ventricular diastole .

3- Third heart sound : Due to flow of blood to the ventricle.

4- Fourth heart sound : Due to contraction of atria .

The 3 rd and 4 th heart sounds are not heard normally by stethoscope but may be recorded by phenocardiograph .

Abnormal heart sounds (Murmers) :

1- Functional murmers :abnormal heart sound due to rapid filling of ventricles but there is no structural changes in the valves , these murmers are always systolic .e.g : In pregnancy and anaemia .

2- Organic murmers : abnormal heart sounds due to structural changes of the heart or it,s valves , these are either systolic and diastolic according to the leasion . e,g : Stenosis and Incompitance .

Cardiac cycle :

Contraction X Relaxation in body muscle

Systole X Diastole in cardiac muscle

The two sides of the heart act together , the systole starts at atria then to the ventricle then diastole starts.

This systole and diastole of atria and ventricles is called (the cardiac cycle) and each cycle takes 0.8 seconds .

Systole 0.3 sec. Diastole 0.5 sec.

Heart as a pump :

The left ventricle pumps the blood to all the body tissues through the aorta . The right ventricle pumps the deoxygenated blood to lungs through the pulmonary artery .

Course of blood through the heart :

Blood from veins of head , neck and upper limbs enters the right atrium by the superior venacava and from rest of the body and lower limbs by the Inferior venacava .

Blood passes through the right atrioventricular opening in to the right ventricle this opening is guarded by the tricuspid valve .

Blood leaves the right ventricle by the pulmonary artery (Deoxygenated blood) it passes to the capillaries of the lungs and is collected up in the 4 pulmonary veins which pass to the left atrium (oxygenated blood) .

Blood then passes through the left atrioventricular opening which is guarded by the mitral valve , to the left ventricle ,then the blood leaves the left ventricle by the large main artery of the body (Aorta) .

Blood circulations:

1- Pulmonary circulation :

Right atrium → right ventricle → pulmonary artery ↓

Left atrium ← 4pulmonary veins ← veinules ← lungs

2- Systemic circulation :

Left atrium → left ventricle → Aorta → small arteries ↓

Right atrium ← Sup ← veinules ← capillaries ← arterioles

Inf venacava at tissue and cell body

The Electrocardiogram E.C.G.:

E.C.G.: It is a change in the electrical voltage which associates the spread of the cardiac impulse from the sino- atrial node to the atria ,then down the atrio-ventricular bundle and finally to the ventricles , this change can be recorded at distances remote from the heart .

The recording shows fluctuations throughout the cardiac cycle which are known as waves and complexes .

Types of leads :

1- Standard limb leads

Lead I Rt arm + Lt arm

Lead II Rt arm + Lt foot

Lead III Lt arm + Lt foot

2- Augmented unipolar leads :

avR Rt arm + zero electrode

avL Lt arm + zero electrode

avF Lt foot + zero electrode

3- Chest leads : These are 6 leads put on the chest : V1 , V2 ,V3, V4 ,V5 ,V6 .

The normal E.C.G.:

P- wave = Atrial systole .

Q.R.S complex = ventricular systole .

T-wave = ventricular diastole .

Changes in the E.C.G. may indicate heart disease as Ischemic heart disease and myocardial infraction .

Areas of the heart valves :

1- Closure of mitral valve is best heard at 5^{th} left intercostal space.

2- Closure of tricuspid valve is heard at the 6^{th} right cartilage .

3- Closure of aortic valve is heard at 2^{nd} right cartilage.

4-Pulmonary closure is heard at 2^{nd} left intercostal space .

Lecture (4)

Stroke volume :

The amount of blood which is pumped by each ventricle in every beat ,during rest it is 70 cm^3 .

Heart rate :

The number of heart beats in one minute , normally and during rest it is 70/min.

Increase in heart rate = Tachycardia - physiologically (exercise)

- pathologically (hyperthyroidism)

Decrease in heart rate = Bradycardia - physiological (athletic)

- pathological (hypothyroidism)

Cardiac out put : The amount of blood pumped by each ventricle in one minute ,normally and during rest it is 5Liters /min.

Cardiac out put = Stroke volume X Heart rate

= 70 X 70 = 4900 cm^3 = 5 L./min.

Conductive system of the heart :

The cardiac muscle has 2 characters :

1- Rhythmicity

2- Conductivity

The conductive system of the heart consists of :

1-Sino – Atrial node (S.A node) : in the right atrium .

2- Atrio – Ventricular node (A.V node)

3- Atrio – Ventricular bundle (bundle of His)

Rt bundle branch

Lt bundle branch

4- Purkinjie fibers

Normal sinus Rhythm: It is the normal cardiac impulse which originated from the S.A node and spread through the conductive system of the heart to reach the ventricular fibers .

Blood vessels :

Arteries	Veins
1- Carry blood from heart to body tissues	1- Carry blood from body tissues to the heart
2- Thick muscular wall	2- Thin muscular wall
3- Deep located except the radial artery	3- More superficial
4- Bright red colour	4- Dark red (blue)
5- Contain oxygenated blood except the pulmonary artery	5- Contain deoxygenated blood except the 4 pulmonary veins
6- Blood flow under high pressure	6- Blood flow under low pressure
7- Bleeding is pulstile and difficult to stop	7- Bleeding is slow ,continuer and easily to stop

Capillaries :

Small vessels which communicate the ending of arteries with the beginning of vein .It has thin walls through which the gas exchange , nutrients and waste products pass between the blood and body cells .

Characters of blood vessels : It has the ability contract and relax

1- Control the blood pressure (B.P.)

2- Regulation the amount of blood to body organs according to their demand.

So the vasodilatation will lead dilatation of the muscle in wall of blood vessels leading to dilation of the vessel ,and this will decrease the B.P.

Blood pressure : It is the force which is excorted by the blood on the walls of the blood vessels .

$$B.P = \frac{\text{Systolic B.P}}{\text{Diastole B.P}} = \frac{120}{80} \text{ mm.Hg}$$

Systolic B.P :

It is the upper limit of B.P inside the aorta ,and big arteries during ventricular systole . Normally at rest = 90- 140 mm.Hg

Diastole B.P :

It is the lower limit of B.P inside the aorta and big arteries during ventricular diastole . Normally at rest = 70- 90 mm.Hg

Abnormalities of B.P :

1- Hypertension:

increase of systolic B.P more than 140 mm.Hg and increase diastolic B.P more than 90 mm.Hg .

Types of Hypertension :

a-Essential hypertension : unknown cause .

b- Arteriosclerosis :

Due to presence of cholesterol on the walls of blood vessels so to lead to thickness of wall and decrease the cross sectional area which lead to increase in peripheral resistance and increase of B.P .

c- Renal hypertension : due to renal ischemia .

2- Hypotension :

Decrease of systolic B.P below 100 mm.Hg . and decrease of diastolic B.P below 70 mm.Hg .

Causes: Haemorrage , Diarrhea , sever vomiting ,sever burns .

Factors which determine B.P:

1- Cardiac out put :

It is the amount of blood which is pumped by each ventricle every minute .

Cardiac out put = Stroke volume X Heart rate

Increase in Heart rate
Increase in Stroke volume
Increase in Cardiac out put
→ Increase in B.P

2- Peripheral resistance :

It is the frietional resistance of the blood vessels against the blood flow .It depends on :

a- vascular wall :cross sectional area of blood vessels .

Increase cross sectional leads to decrease of B.P .

b- blood volume : decrease of blood volume leads to decrease of B.P .

c- blood viscosity : increase of blood viscosity leads to increase of peripheral resistance then increase of B.P.

Factors affecting the B.P.

1- Sex : B.P is higher in ♂ .

2- Age : B.P is higher in elderly .

3- Body wight .

4- Gravity .

5- Posture .

6- Excitement .

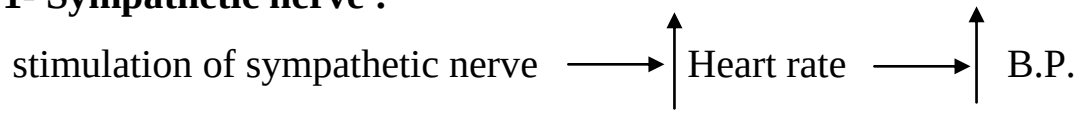
7- Muscular activity .

8- some drugs like Alcohol , adrenaline lead to increase B.P

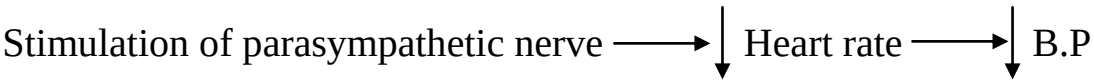
9-Some conditions :Bleeding and anesthesia lead to decrease B.P.

Control of B.P. :

1- Sympathetic nerve :



2- Parasympathetic nerve :



3- Baroreceptors :

These are present in the aortic arch and in the carotid sinus ,the baroreceptors are sensory receptors affected by the B.P. so in case of hypertension it stimulate the vasomotor center in brain in Medulla oblongata .

Measurement of B.P. :

The instrument which measure the B.P is called sphygmomanometer .

There are two method to measure B.P. :

1- Palpatory method : by the radial pulse ,this only record the systolic B.P.

2- Auscltatory method : by using medical stethoscope , this record systolic and diastolic B.P.

Blood flow :

Normal blood flow is silent and laminar ,the abnormal of blood flow is turbulent and noisy .

Lecture (5)

Lymphatic System

The lymphatic system is sometimes considered to be part of the immune system. It consists of a network of lymph vessels and ducts that collect excess fluid (called lymph) from extracellular spaces in tissues and transport the fluid to the bloodstream. The lymphatic system also includes many small collections of tissue, called lymph nodes, and an organ called the spleen, both of which remove pathogens and cellular debris from the lymph or blood. In addition, the thymus gland in the lymphatic system produces some types of white blood cells (lymphocytes) that fight infections.

spleen

The spleen is an organ in the upper far left part of the abdomen, to the left of the stomach. The spleen varies in size and shape between people, but it's commonly fist-shaped, purple, and about 4 inches long. Because the spleen is protected by the rib cage, you can't easily feel it unless it's abnormally enlarged.

The spleen plays multiple supporting roles in the body. It acts as a filter for blood as part of the immune system. Old red blood cells are recycled in the spleen, and platelets and white blood cells are stored there. The spleen also helps fight certain kinds of bacteria that cause pneumonia and meningitis.

Body fluids

Body fluids include blood, lymph, tissue fluid, milk and saliva. They are produced in the body, then circulated within it or secreted outside it. Several kinds of body fluids are collected and analysed to check the health status of human.

homeostasis

In biology, homeostasis is the state of study internal physical and chemical conditions maintained by living systems. This dynamic state of equilibrium is the condition of optimal functioning for the organism and includes many variables, such as body temperature and fluid balance, being kept within certain pre-set limits (homeostatic range). Other variables include the pH of extracellular fluid, the concentrations of sodium, potassium and calcium ions, as well as that of the blood sugar level, and these need to be regulated despite changes in the environment, diet, or level of activity. Each of these variables is controlled by one or more regulators or homeostatic mechanisms, which together maintain life.

Lecture (6)

Respiratory System

The respiratory system consists of :-

1- Nasal cavities (nose)

2- Pharynx

3- Larynx

4- Trachea

5 Bronchi

6- Bronchioles ┐ Lungs

7- Alveoli ┘

The lungs :

The lungs are a pair of conical shaped organs enveloped in membrane called pleura ,the lung occupy the greater part of the thoracic cavity ,each lung is divided in to lobes , the right lung has 3 lobes and the left lung has 2 lobes .

The lung consist of alveoli .

Function of respiratory system :

1- Absorption of oxygen from the air.

2- Excretion of Co_2 from the blood .

3- Regulation of blood pH 7.4

4-Production the voice .

Respirator muscles :

1- Intercostal muscles .

2- Diaphragm .

3- Accessory muscles : muscles of neck and shoulder .

The diaphragm : is a curved sheet of skeletal muscle which separates the thorax from the abdomen .

The functions of diaphragm:

1- It separates the thoracic cavity from the abdominal cavity .

2- It assists in breathing .

3- It helps expel substances from the abdominal cavity.

Respiratory system consists of 2 parts :

1- Upper conducting part called Dead space : It is the inspired air in the nasal cavities , pharynx , trachea and bronchi which not share in the gases exchange . It is 150 cm^3 .

2- Lower respiratory part : It is the real respiratory system where gases exchange take place , it is includes the ends of bronchioles and the alveoli.

Mechanism of respiration :

1- Inspiration :

Contraction of intercostal muscles and diaphragm ill lead to increase of thoracic cavity , so the air enter to lungs .

2- Expiration :

The diaphragm and intercostal muscles relax so the thoracic cavity return to normal size and expired air leave the lung to the outside .

Respiratory movement :

1- Thoracic (costal) .

2- Diaphragmatic (abdominal) .

Types of vital respiration :

1- External respiration :

Gas exchange in the alveoli .blood absorbs O_2 and excretes CO_2 in to the alveoli to out side .

2- Internal respiration :

Gas exchange in the body tissues and cells blood gives O_2 to the cells and takes Co_2 .

Respiratory rate : Number of inspiration and expiration in one minute .

Normally at rest in adult : 15-20 /min

in children : 20-40 /min

Factors affecting the respiratory system :

1- Age : fast in children .

2- Exercise .

3- Emotional factor .

4- Diseases : pneumonia ⟶ increase respiratory rate .

5- Level of Co2 in blood :

↑ Co_2 in blood ⟶ stimulation of respiratory center ⟶ Increase respiratory rate

6- Level of O2 in blood

↓ O_2 in blood ⟶ stimulation of respiratory center ⟶ Increase respiratory rate

7- Change of blood pH :

Acidosis ⟶ Increase respiratory rate

Alkalosis ⟶ Decrease respiratory rate

Lecture (7)

Spirometer

A spirometer is an apparatus for measuring the volume of air inspired and expired by the lungs. A spirometer measures ventilation, the movement of air into and out of the lungs. The spirogram will identify two different types of abnormal ventilation patterns, obstructive and restrictive. There are various types of spirometers which use a number of different methods for measurement (pressure transducers, ultrasonic, water gauge).

Respiratory volumes :

1- Tidal volume (T.V.):

The amount of air which pass in and out of the lungs during the ordinary quite breathing , it is about 400 ml.

2- Inspiration reserve volume (I.R.V.) :

The additional amount of air taken in by deep forced inspiration , it is 3.5 L.

3- Expiration reserve volume (E.R.V.):

The additional amount of air which is given out by deep forced expiration , it is 1.1 L.

4- Residual volume (R.V.) :

The amount of air which remains in the lungs after the deepest possible expiration ,it is 1.2L.

Lung capacities:

1- Total lung capacity (T.L.C) :

The total amount of air in the lungs .

T.L.C= T.V. +I.R.V +E.R.V +R.V = 6 L.

2- Inspiratory capacity (I.C)

The maximum amount of air which can be inspired .

I.C = T.V. + I.R.V

3- Vital capacity (V.C)

The maximum amount of air can be expired forcefully after a maximum inspiration .

V.C = T.V. +I.R.V +E.R.V

In ♂ = 4.5 L.

In ♀ = 3.5 L.

4- Functional residual capacity(F.R.C) :

The amount of air which remain in the lungs after a normal expiration .

F.R.C = E.R.V + R.V

Factors which affect the Vital capacity :

1- Sex

2- Age

3- Height

4- Size of body

5- Disease of lung :

Disease which affect the respiratory volumes and vital capacity :

1- Obstructive air disease like Asthma .

2- Constrictive disease like fibrosis .

Types of ventilation :

1- Pulmonary ventilation :

Pulmonary ventilation=Tidal volume X Respiratory rate

= 400 X (15-20)

= 6 - 8 L. /min

2- Alveolar ventilation :

Alveolar ventilation =(Tidal volume- Dead space) X Respiratory rate

= 400- 150 X (15-20)

= 3750 – 5000 cm3 /min

respiratory disorder:

Asthma:

Asthma is a condition in which your airways narrow and swell and produce extra mucus. This can make breathing difficult and trigger coughing, wheezing and shortness of breath.

Tuberculosis (TB)

Tuberculosis (TB) may be regarded in two categories: active disease or latent infection. The most common form of active TB is lung disease, but it may invade other organs, so-called "extrapulmonary TB."

Active TB: is an illness in which the TB bacteria are rapidly multiplying and invading different organs of the body. The typical symptoms of active TB variably include cough, phlegm, chest pain, weakness, weight loss, fever, chills and sweating at night. A person with active pulmonary TB disease may spread TB to others by airborne transmission of infectious particles coughed into the air.

Pneumonia : is an infection that inflames the air sacs in one or both lungs. The air sacs may fill with fluid or pus (purulent material), causing cough with phlegm or pus, fever, chills, and difficulty breathing. A variety of organisms, including bacteria, viruses and fungi, can cause pneumonia especially diplococcus pneumonae.

Lecture (8)

Nervous system

The nervous system is divided into :

1- Central nervous system

Consists of :

- Brain
- Spinal cord .

2- Peripheral nervous system

consists of :

- Cranial nerves(12 pairs)
- Spinal nerves (31 pairs)

3- Autonomic nervous system

consists of :

- Sympathetic nervous system .
- Parasympathetic nervous system .

The nervous system consist of collection of nerve cells (neurons) and nerve fibers .

Characters of neuron :

1- Irritability :

the ability to receive the sensory stimulation from the internal or external environment .

2- Conductivity :

the ability to conduct the neural stimulation to all the body tissues and organs which respond to it .

The neuron consists of :

1- Cell body .

2- Nucleus .

3- Nucleolus .

4- Cytoplasm.

5- Dendrites.

6- Axon .

7- Nerve endings .

8- Schwann cell.

9- Ranveir nodes .

10- Myelin sheath.

11- Synapse .

12- Nissl's granules.

Synapse :

It is the space present between the nerve endings of one neuron and the dendrites of other neuron , through this synapse the neural stimulus is transmitted by the chemical transmitters which is secreted from the vesicle present in the nerve endings .

Type of neurons (According to function):

1- Sensory neuron :

It transmits the neural stimulus from the receptor organs (organs of sensation) or other internal organs to the central nervous system .

2- Motor neuron :

It transmits the neural stimulus from the central nervous system to organs of response like muscles and glands.

3- Association neuron :

It transmits the nerve impulse from one neuron to other .

Types of neuron according to structure :

1- Unipolar neurons, which have only one process, classified as an axon and dendrites . Unipolar neurons are found as most of the body's sensory neurons, the axon carries the action potential in to the central nervous system.

2- Bipolar neurons with two processes, a dendrite and an axon , bipolar are found in the retina of the eye .

3- Multipolar neuron has many poles or processes, the dendrites and the axon. Multipolar neurons are found as motor neurons in the central nervous system .

Nerve fibers :

The nerve fibers is the axon of the neuron . It is long and ends at distance from the cell body .

Types of nerve fibers :

1- Sensory nerves :

Transmits the nerve impulse to the central nervous system.

2- Motor nerves :

Transmits the neural orders from central nervous system to the muscles or glands .

3- Mixed nerves :

Sensory and motor at same time .

Types of chemical transmitters :

1- Acetyle choline : secreted at the ends of the parasympathetic nerve fibers.

2- Nor adrenaline : It is chemical transmitter secreted at the ends of the sympathetic nerve fibers .

3- Serotonin : Chemical transmitters it's function is only inside the central nervous system .

Central nervous system :

It consist of : - (Brain - Spinal cord)

Brain :

Consist of :

1- Cerebrum .

2- Cerebellum .

3- Brain stem :

a- Mid brain

b- Pons

c- Medulla oblengata

the brain is the largest part of the nervous system and occupied a large space in skull . the brain is surrounded by meningies.

Meningies :

They are 3 layers surrounded the brain . It's function is nutrition and production of brain from external effecting .They are :

1- Pia matter (inner layer).

2- Arachnoid matter (middle layer).

3- Dura matter (outer layer) .

Between the pia and arachnoid layer there is a space called subarachnoid space which is filled by cerebro spinal fluid .

Cerebro spinal fluid (C.S.F.):

It is the fluid which fill the space of the brain and the subarachnoid space . It also present in the spinal cord canal , it is about 100 cm^3 it is aqueous fluid contains glucose , some salts and proteins . It's function nutrition and protection .

Cerebrum :

It is the largest part of the brain ,it consists of 2 parts (right and left) .the surface of brain is characterized by presence of guruses and suleuses .

Cerebral lobes :

1- Frontal lobe .

2- Parietal lobe .

3- Temporal lobe .

4- Occipital lobe .

Layers of cerebrum :

1- Cortex (outer layer) : It is gray in colour due to presence of neurons .

2- Medulla (inner layer) : It is white in colour due to presence of nerve fibers .

Functional areas of cerebral cortex :

1- Motor area :

In frontal lobe , it is concerned with the muscular voluntary movement of the body .

2- Sensory area :

In the parietal lobe , it receives the sensory impulse from skin like , touch , pain and heat .

3- Auditary area :

In the temporal lobe , it receives the nerve impulse of sound waves from the ear.

4- Olfactory area :

In the temporal lobe and receives the sensory stimulation from nose .

5- Visual area :

In the occipital lobe and receives the sensory stimulation from eye.

The cerebrum contains important areas like :

1- thalamus:

It is located in the center of cerebrum and it is important center in regulation of sensory stimulation .

2- Hypothalamus :

It is very small but very important due to presence of important centers which regulates the body temperature , hunger center and sleep center .

Functions of cerebrum :

1- It controls all voluntary functions of the body .

2- Contains all the sensory centers like taste , hearing , vision and smell .

3- Thinking , learning and memory .

Cerebellum :

It is located under the occipital lobe of the cerebrum , it is also composed of 2 layers :

1- Outer cortex (gray colour).

2- Inner medulla (white colour).

Functions of cerebellum :

1- Maintaining the balance of the body during movement .

2-Regulating muscle tone .

3-Co-ordinates movement in association with cerebral cortex.

4- Equilibrium .

Brain stem :

Consists of :

1- Mid brain

2- Pons

3- Medulla oblengata

Functions of brain stem :

1- Transmits the nerve impulse from the spinal cord to brain and the opposite direction .

2- Medulla oblengata contains the important vital centers of body :

a- The respiratory center ,

b- The cardiac center.

c- The vasomotor center .

spinal cord :

It is part of the (C.N.S) which begins as continuator of medulla oblengata . It is located in the spinal inside the vertebrae and ends at the first lumbar vertebra . It's length about 45 cm . The spinal cord has central canal called the central canal which contains the cerebro spinal fluid (C.S.F.) , the spinal cord is covered by menigies as the brain .

Layer of spinal cord :

1- Cortex (outer layer) white in colour due to presence of nerve fibers.

2- Medulla (inner layer) gray in colour due to presence of cell body .

Functions of spinal cord:

1- Center of reflex activities ,it is the function of the gray matter .

2- Transmits the nerve impulse from body to the brain and opposite .

The arch of reflex consists of :

1- Muscle 2- Tendon 3- Sensory nerve 4- Spinal cord 5- Motor nerve

Types of reflexes :

1- Knee reflex .

2- Biceps reflex.

3- Triceps reflex.

4- BaBaniski reflex.

Peripheral nervous system :

It consists of :

1- Cranial nerves .

2- Spinal nerves.

Cranial nerves : originate from the brain and they are of 3 types , sensory ,motor and mixed .

Names and functions of cranial nerves :

1- Olfactory nerve

Sensory – smelling .

2- Optic nerve

Sensory – vision .

3- Oculomotor nerve

Motor – movement of eye ball , pupil , upper eye lid .

4- Trochlear nerve

Motor – movement of eye ball .

5- Trigeminal nerve

Mixed nerve – sensation and movement of muscle of mastication .

6- Abducens nerve

Motor nerve – circular movement of eye.

7- Fascial nerve

Mixed nerve – taste movement of muscle of face ,lips and eye lids .

8- Auditery nerve

Sensory nerve – hearing and equilibrium of body.

9- Glosopharynged nerve

Mixed (sensory ,motor and secretory) taste ,swallowing and secreation of saliva.

10- Vagus nerve

Mixed (sensory ,motor and secretory) swallowing , sensation in pharynx ,secreation of gastric ulcer .

11- Accessory nerve

Motor nerve – movement of head and shoulder .

12- Hypoglossal nerve

Motor – movement of tongue.

Spinal nerve :

These are 31 pairs originate from the spinal cord .

8 Pairs cervical nerves .

12 Pairs thoracic nerves .

5 Pairs lumber nerves .

5 Pairs sacral nerves.

1 pairs coccygeal nerves .

All of the spinal nerves are mixed (sensory & motor) .

Function of spinal nerves :

The spinal nerves are mixed nerves so it transmit the nerve impulse from the spinal cord to the body parts and in the opposite direction .

Lecture (9)

Autonomic nerves system :

Some peripheral nerves collected together to perform special function which is involuntary like the movement of internal viscera.

The autonomic nerves system consists of :

1- Sympathetic nerves system :

The nerves originate from thoraco – lumber region of spinal cord, it contains chains of neural ganglia .

Type of chemical transmitter in the sympathetic nerves system is called Noradrenalin which is secreated in special condition as in fight or phobia or escape .

Functions or effects of sympathetic nervous system:

1-Dilate the pupil.

2- Inhibit the lacrimal glands secretion .

3- Decrease the secretion of saliva.

4- Increase the heart rate.

5- Increase the cardiac out put and blood pressure .

6- Dilate the respiratory passage.

7- Decrease the gastric and pancreatic juice .

8- Decrease the intestinal movement .

9- Increase sweating .

10- Erection of hair of body and head.

Parasympathetic nerve system :

It consists of some cranial nerves and some of the spinal nerve .The chemical transmitters is Acetyl choline .

Functions or effects of parasympathetic nerve system:

This system acts especially in case of rest as during sleep .

1-Constricts the pupil of eye .

2- Stimulate the lacrimal glands secretion .

3- Increase the secretion of saliva.

4- Decrease the heart rate.

5- Decrease the cardiac out put and blood pressure .

6- Constricts the respiratory passage.

7- Increase the gastric and pancreatic juice .

8- Increase the intestinal movement .

9- Plays important role in urination and deification .

Lecture (10)

Digestive system

Digestive system consists of :

1- Mouth (Tongue –Teeth)

2- Pharynx

3- Oesoohagus(Esophagus)

4- Stomach

5- Small intestine

6- Large intestine

7- Rectum

8- Accessory glands (Salivary glands , Liver , Pancreas)

Functions of digestive system :

1- Ingestion (mastication and swallowing)

By the mouth . pharynx and oesophagus .

2- Digestion (In stomach and small intestine)

Number of chemical processes performed by enzymes secreted by the glands which convert the complicated foodstuffs in to simple form which can be absorbed .

3- Absorption : (mainly in small intestine).

4- Egestion : The excretion of food residue (faeces) to outside by large intestine

Mouth : contains

1- Lips

2- Tongue

3- Teeth

4- Saliva

Tongue : muscular organ which contains the taste buds and helps in swallowing and speech.

Functions of mouth :

1- Intake of food .

2- Mastication by teeth .

3-Swallowing .

4- Help in speech .

Salivary glands :

1- Parotid glands.

2- Submandibular glands.

3- Sublingual glands .

The salivary glands secrete saliva through their ducts into the buccal cavity .

Saliva : colourless alkaline fluid which is secreted by the salivary glands , amount 1L./day.

Saliva consist of :

1- Water 90%

2- Mucin

3- (Ca)salts

4- Salivary amylase enzyme .

Decrease saliva (dry mouth) :

Causes : 1- Mouth breathing.

2- Drugs (Atropine) .

Increase saliva :

Causes 1- Intake of food.

2- Smell or slight of food.

3- Special types of food.

Functions of saliva :

1- Saliva amylase enzyme digestion of carbohydrate .

2- Moistening of food by mucin so helps in swallowing the bolus.

3- Deposition of Ca salts on the teeth.

4- Moistening of mouth helps in speech.

5- Solvent of some foods and drugs .

6- Removes the reminant of food from teeth.

Pharynx :

Expanded part of the digestive tract about 13 cm. long .

Function : Swallowing of bolus to the oesophagus .

Oesophagus :

Muscular tube 25 cm. long ,it expends from pharynx to cardiac orifice .

Function : pushs the bolus to stomach by it's peristaltic movement .

Stomach :

Dilated potion of alimentary canal ,it lies in the upper part of abdomen .It consists of :

1- Cardiac orifice.

2- Fundus.

3- Body .

4- Pyloric antrum.

5- Pyloric orifice .

The stomach secreats the :

Gastric juice : Acidic colourless fluid about 2 L. /day .

It consists of :

1- Water 90%

2- Mucin.

3- HCL.

4- Pepsin enzyme.

Factors affecting the secretion of gastric juice :

1- Neural factor :

Stimulation of vagus nerve ⟶ Increase gastric juice .

2- Hormonal factor :

Secretion of gastrin hormone ⟶ Increase gastric juice .

Function of stomach :

1- Acts as reservoir of food .

2- Breaks the food in to chyme and mix it with gastric juice .

3- Secretion of gastric juice which contains :

HCL :

a- neutralized the alkaline saliva and acidifies food .

b- antimicrobial agent.

c- aids the action of pepsin .

pepsin enzyme :Digestion of proteins into peptones .

Mucin :products the mucous membrane of stomach from the action of pepsin and HCL (prevent gastric ulcer).

4- Secretion of intrinsic factor which is important for the absorption of vit B12 from small intestine .

Small intestine :

Extend from pyloric sphincter of stomach to the first part of intestine (caecum) , it is about 6 meters long ,it consists of 3 parts :

1- Duodenum

In duodenum opens the bile duct and pancreatic duct .

2- Jejunum.

3- Ileum.

Functions of small intestine :

1- Secretion of intestinal juice (3L./day) which is composed of water , mucin and enzymes .

2- Digestion of foodstuffs by enzymes :

- Erypsin enzyme digests the proteins .

Polypeptide $\xrightarrow{\text{Erypsin}}$ Amino acid

- Complete the digestion of carbohydrates

Maltose $\xrightarrow{\text{Maltase}}$ glucose

Lactose $\xrightarrow{\text{Lactase}}$ glucose + galactose

Sucrose $\xrightarrow{\text{Sucrase}}$ glucose + fructose

3- Secretion of mucin which protects the mucous membrane from the action of acidic chyme and prevent the duodenal ulcer .

4- Absorption: It is the transport of simple digested food from cavity of small intestine into the blood (glucose and amino acids) or in to lymph (fatty acid and glycerin) . Absorption is the function of intestinal villi .

5- Pushing of reiminant of food to the large intestine by it's peristaltic movement.

Large intestine :

It is 1.5 meters long .It consists of :

1- Caecum and appendix .

2- Ascending colon .

3- Transverse colon .

4- Descending colon.

5- Sigmoid colon .

6- Rectum .

7- Anal canal .

Function of large intestine :

1- Slight absorption (water , some salts and drugs).

2- Secretion of mucin which lubricates the faeces so helps in it's passage through the anus.

3- Some bacteria in large intestine live as normal flora and provide the body with vit B and vit K .

4- Egestion of waste products to outside by daefecation by it's peristaltic movement .

5- Bacterial decomposition of cellulose .

Lecture (11)

Accessory of Digest system:

Pancreas :

It is abig gland lies transverly across the posterior abdominal wall at the level of 2^{nd} and 3^{rd} lumber vertebrae behind the stomach.

The pancreas consists of head ,body and tail .The head lies in the C- shaped curve of the duodenum .

The pancreatic duct opens with the bile duct in the duodenum by one opening .

Functions of pancreas :

The pancreas has 2 different secretions:

1- Internal secretion (Hormone)directly into blood so pancreas is an endocrine gland:

a- Insulin hormone from beta cells of Islets of langerhans .

insulin is absorbed directly in to blood , the function of insulin is to enable the tissues to use sugar .

normal level of glucose in blood = 80 – 120 mg/100ml of blood .

so if there is increase of glucose level in blood more than normal limit then more Insulin secreted from pancreas to decrease the glucose level.

Deficiency of Insulin ⟶ Diabetes Mellitus

Diabetes Mellitus:

It is a disease caused by deficiency of Insulin hormone from Beta cells of pancreas .

Characterizes by :

1- Polyurea,

2- Polydepsia.

3- Polyphagia .

4- Increase glucose level in blood.

5- Glucosurea .

b- Glucagon hormone secreted from alpha cells of langerhans of pancreas ,It has opposite function of Insulin so it increase the level of glucose in blood by converting the liver glycogen into glucose .

2- External secretion

The pancreatic juice : It is an alkaline fluid leaves the gland by the pancreatic duct which opens in duodenum .

Normal amount = 3/4 L./day.

The pancreatic juice consist of :

- Enzymes
- NaHCo3

The pancreatic enzymes are :

1- Pancreatic Amylase which convert all starchs (carbohydrate)in to Maltose.

2- Lipase which convert fats in to fatty acids.

3- Trypsin which convert peptones into amino acids .

Liver :

The largest organ in the body . It lies in the right hypochondrium under the diaphragm . It consists of right big lobe and left small lobe .

Blood supply :

1- Hepatic artery .

2- Portal vein .

The liver secreted bile which is carried by the common bile duct and stored in the gall bladder , the bile duct opens in to duodenum .

Functions of liver :

1- Secretion of bile .

2- Storage of glycogen.

3- Formation of urea.

4- Production of plasma proteins (Albumin and Globulin).

5- Destruction of fats.

6- Storage of vit B12 and Iron.

7- Destruction of toxic substances.

8- Production of heparin.

9- Production of clotting factors .

10- Formation of R.B.C. in embryo.

Bile : It is an alkaline secretion of the liver , its colour is yellow to green , it consists of :

1- Water 90%. 2- Mucin 3- Bile pigment. 4- Bile salts.

Functions of bile salts:

1- Assist the action of pancreatic enzymes especially Lipase .

b- Help the absorption of fat from intestine .

Metabolism

Metabolism : Series of changes involving the building up and breaking down of substance for use in the body .

Metabolism includes:

1- Anabolism : Building up of fresh tissues from the nutritive materials (food).

2- Catabolism : Chemical changes involving the breaking down of worn out tissues and their removal .

Diet consists of :

1- Organic compounds :

a- Carbohydrates .

b- Fats.

c-Proteins .

2- Non – organic compounds .

a- Water .

b- Salts.

3- Vitamins.

Factors affecting metabolism :

1- Muscular work ⟶ Increase metabolism.

2-The basal metabolism depends on the surface area of body .

↑ Surface of body ⟶ ↑ Metabolism

3- Age

In children metabolism is greater than adult .

4- Fever ⟶ ↑ Metabolism

5- Thyroid gland

Hyperthyroidism ⟶ increase metabolism.

Hypothyroidism ⟶ decrease metabolism.

Carbohydrate metabolism:

Carbohydrates consists of carbon , hydrogen and oxygen.

1- All starches and sugars are converted in to glucose by action of enzymes :

a- Cooked starch —salivary amylase→ maltose

b- All starch —pancreatic amylase→ maltose

c- Maltose —maltase→ glucose

2- Glucose is absorbed by stomach and small intestine and carried by portal vein to the liver where it is stored as liver glycogen .

3- When required glycogen is reconverted in to glucose .

4- Oxidation of glucose in to water + Co2 + heat + energy .

5- Normal fasting blood sugar 80-120 mg/ 100 ml. blood .

Fat metabolism :

Fats contain :carbon + hydrogen +O2 .

1- Fats —lipase→ Fatty acids + glycerol

2- In presence of bile salts these are absorbed from small intestine and recombined into fats.

3- Lymph carry them to thoracic duct then to blood which take them to fat stores of the body .

4- On need they are carried to liver .

5- In starvation and diabetes mellitus : Incomplete oxidation of fat to Acetones and Ketones .

Protein metabolism:

Consist of Nitrogen + S + P + H2 + O2

1- Protein $\xrightarrow{\text{pepsin}}$ peptones

2- Peptones $\xrightarrow{\text{Erypsin \&Trypsin}}$ Amino acid .

3- Absorption of amino acid in small intestine carried to liver.

4- Formation of urea in the liver .

5- The remainder used for repair and body building .

Lecture (12)

Urinary system

The urinary system is one of the four excretory system of the body .

Organs of urinary system :

1-Kidneys

2- Ureters .

3- Urinary bladder .

4- Urethra

Kidneys :

Pair of organs , the right kidney is slightly lower in position than left kidney . Kidney is flattened bean shaped organ .

In adult it is 12 cm. length ,6 cm. wide , 3 cm. thickness . the two kidneys lie in the abdominal cavity under the diaphragm on the two sides of the vertebra coloumn. Almost vertically on the posterior abdominal wall .

Each kidney is surrounded by an outer membrane called the kidney capsule .

Kidney has 2 surfaces an outer lateral convex and the other is inner medial concave surface called the hilum, through which the renal artery enters and the renal vein and ureter leave the kidney.

The adrenals (suprarenal glands) are situated on the upper pole of each kidney .

Each kidney consists of :

1- Cortex (outer layer) : light pale in colour ,it looks granulates .

2- Medulla (inner layer) : dark in colour consist of pyramids .

3- Pelvis of kidney : It is the beginning of the ureter .

Blood supply of kidney:

Kidneys are supplied with blood from the renal artery which is a branch of of the abdominal aorta . the renal artery divides in to smaller arteries called the afferent arteriole which enters the malpigian body forming network of capillaries called glomerulus .

Blood leaves the glomerulus by efferent arteriole which divides in to capillaries around the tubule . blood then collect from these capillaries to form small venules . which are collected to gather to form the renal vein which leaves the kidney and open in the inferior venacava.

Each kidney consist of the million nephrones which are a tiny coiled tube .

Structure of nephron :

1- Malpigian body - glomerulus - bowman's capsule

2- Proximal convoluted tubule .

3- Loop of henle .

4- Distal convoluted tubule .

5- Collecting duct .

Function of kidney :

1- Formation of urine .

2- Excreation of waste products from metabolic process , eg : urea , excess salts and toxins .

3- Regulation of acid –base balance to maintain blood pH 7.4 .

4- Regulation of Electrolytes balance .

5- Production of erythropoietin .

6- Changing the inactive vit D to active form .

7- Regulation of water and fluid balance .

8- Secreation of hormones like Renin prostaglandin .

Formation of urine :

It is 4 steps :

1- Glmerulus filtration .

2- Tubular reabsorption .

3- Tubular secreation

4- Concentration of urine .

1- Glmerulus filtration :

Simple physical process occurs in the glomerulus , the substances filtered under pressure . it is not selective .

Filtered substances are :

Water , soluble salts , glucose , amino acid , urea , uric acid , creatinine and drug .

Non filtered substances are :

R.B.C. and plasma proteins .

2- Tubular reabsorption:

Urine is formed in a rate 120 ml./min. but the daily urine out put is 1-1.5 L.

So most of water which is filtered in the previous step is absorped again in proximal convoluted tubuler .

All of the glucose which is filtered is reabsorbed again from the body need . other nutrient like Amino acids and minerals are reabsorbed according to the body need .

3- Tubular secreation:

This occurs in the convoluted tubules and it is an active vital process , it is a selective process . Excess of H^+ is secreated in the urine to keep the blood pH constant (7.4) .

Abnormal substances like pencilline is also secreated from the tubule in to the urine .

4- Concentration of urine :

In the distal convoluted tubule the excess of water which is filtered in first step will return the blood circulation under the effect of Anti diuretic hormone (A.D.H) from the posterior lobe of the pituitary gland . decrease of A.D.H causes diabetes insipidus .

Normal constituents of urine :

1- Excess water .

2- Excess electrolytes like Na^+ , K^+ , Mg^+ , Ca^+ .

3- Excess acids and alkaline .

4- Metabolic waste products : include urea , uric acid and creatinine .

Abnormal constituents of urine :

1- Glucose : In diabetes mellitus .

2- Proteins (Albumin) : called proteinurea in diseases of kidney like glomerulonephritis .

3- Blood (R.B.C.) : in kidney diseases like glomerulonephritis .

4- Stones :

Increase concentration of some salts in the blood so it will accumulate and form stones like (Ca) phosphate or oxalate . this stone may be formed in the kidney or it will pass through the ureter or in the bladder .

If this small it may pass through urine to outside , but some times it is large and cause pain (Renal colic) or it may cause urinary obstruction so may need surgical interference .

5- Bile : in case of Jaundice .

6- Ketone and Acetone : in case of diabetes mellitus , fasting , starvation .

7- Chorionic gonado trophic hormone : in first few weeks of pregnancy .

Renal failure :

Failure of the kidney to form urine.

1- So lead to retention of water (oedema).

2- Retention of excess minerals and salts .

3- Uremia : increase of urea in blood more than upper normal limit 40mg/100ml.

4- Changes in Acid – Base balance and disturbance of blood pH .

5- Anuria : decrease amount of urine.

6- Hypertension .

7- Anaemia .

8- Albuminurea .

Rx. Of renal failure :

1- Restriction of protein in diet.

2- Artificial kidney .

3- Kidney transplantation .

Lecture (13)

The female reproductive system

It consists of :

1- Uterus.

2- Ovaries .

3- Fallopian .

4- Vagina.

Uterus :

The uterus is a hollow pear shaped organ situated in the pelvis between the bladder in front and the rectum behind .

In adult it is about 8 cm in length , 5 cm in width , 2.5 cm in thickness.

Structure :

The uterine wall consists of 3 layers :

1- Peritoneum (outer).

2-Myometrium (middle thick layer consist of involuntary muscle .

3- Endometrium (inner).

Functions of uterus :

1- To receive the fertilized ovum and to nourish the developing fetus during pregnancy .

2- To expel the fetus at end of pregnancy by uterine contractions.

Ovary :

There are two ovaries right and left situated in the pelvis on the two sides of the uterus .

Functions of ovary :

1- To produce the mature ova.

2- Acts as endocrine gland in producing the female sex hormones :-

a- Estrogen hormone.

b- Progesterone hormone .

Functions of estrogen hormone :

1- Development of female sex organs.

2- Production of secondary sexual characters .

Functions of progesterone hormone :

It prepares the uterus to receive the fertilized ova and to prefect the fetus during pregnancy .

Fallopian tubes :

Two in number about 10 cm in length .

1- It's function is to collect the ova discharged from the ovary and transfer it towards the uterus cavity.

2- Fertilization of the ovum by spermatozoa usually occurs in the tube .

The male reproductive system

Testis :

Two glandular organs oval in shape .

Functions :

1- Production of sperms.

2- Acts as endocrine gland in production of the male sexual hormones Androgen and Testosterone hormones which act in the development of the secondary male sexual characters.

Prostate :

It is a gland situated below the base of the bladder . It is anterior to the rectum . It surrounds the first part of the urethra .

Enlargement of the gland is common in elderly men and cause obstruction to urine outlet from the bladder and need surgical operation .

Functions of prostate :

It secrets 20% of the semen which contains the sperms.

Lecture (14)

Endocrine glands

Also called ductless gland because it's secretion which is called hormones reach the blood directly .

The endocrine glands are :

1- Pituitary gland .

2-Thyroid gland .

3- Parathyroid glands.

4- Adrenal glands.

Other endocrine glands are organs which have other function in addition to hormonal secreation :

Sex glands , pancreas , stomach , kidney , hypothalamus , thymus gland and placenta .

Hormone : It is the chemical messenger secreted by a ductless glands (endocrine glands) and carried by blood to affect the activity of other distant organ .

The organ or tissue affected by the hormone is called the target tissue .

The hormone is secreted in it's normal amount to perform it's normal function ,any change in it's amount if decreased or increased will lead to disease .

Chemical structure of hormones:

1- Protein in nature : e.g. : Insulin hormone .

2- Steroid hormones which consist of lipid . e.g. : sex hormones and hormones of adrenal cortex.

Control of endocrine gland activity :

1- Nervous control .

2- Blood control :

a- Metabolic regulation : like amount of Insulin hormone secreation depends on the amount of glucose level in the blood .

b- Reciprocal regulation .

pituitary gland :

It is single gland about 1 cm in diameter ,situated at the base of the brain in bony cavity called pituitary fossa.

The pituitary gland consists of 2 lobes : anterior and posterior .

The pituitary gland called master gland because it controls the activity of many other endocrine glands.

The hormone which secreted from anterior lobe of pituitary gland:

1- Human growth hormone :

Hyposecreation of this hormone during childhood leads to condition called Dwarfism .

Hypersecreation during childhood lead to Gigantism .

Hypersecreation of the hormone after puberty will leads to disease condition called Acromegaly in which deformities of hands ,feet and bone of face and jaws.

2- Thyroid stimulating hormone (T.S.H):

This stimulates the growth and activity of thyroid gland and secreation of thyroxin hormone .

3- **Adreno cortico trophic hormone (A.C.T.H) :**

This hormone stimulates the adrenal cortex to secreate it's hormone :

a- Mineralo corticoid .

b- Gluco corticoid .

4- Gonado trophic hormone :

This is important for development of sex glands and organs and the secretion of sex hormones :

a- The follicle stimulating hormone (F.S.H)

In female it's stimulates the ovary to secreate oestrogen ,in male it stimulates the production of spermatozoa .

b- Luteinizing hormone (L.H)

In female it stimulates production of progesterone .in male it stimulates production of testosterone .

c- Prolactin hormone

This hormone helps the secreation of milk from the breast .

The hormone which secreted from posterior lobe of pituitary gland:

1- Antidiuretic hormone :

It concentrates the urine by increasing the absorption of water in the distal convoluted tubule and collecting duct .

Decrease of the A.D.H leads to disease called Diabetes insipidus .

2- Oxytocin

The functions of this hormone :

a- Stimulates the contraction of uterus muscles in pregnant woman during labour .

b- Stimulates the lactating ducts of breast to eject milk during lactation .

Thyroid gland:

Thyroid gland is situated in the lower part of the neck .It consist of 2 lobes joined together by the isthmus .

Thyroid gland secreats the hormone called thyroxin which contains large quantity of Iodine which is absorbed from food . secreation of thyroxin hormone is regulated by the thyroid stimulating hormone (T.S.H) .

Functions of thyroxin hormone :

1- It controls and increases the general metabolism of the body .

2- It affects the irritability of the nervous system .

3- Keeps the hair and skin in normal condition .

4- It affects the body growth and mental development in infancy .

5- Storage of Iodine .

Hyperthyroidism :

It means hypersecretion of thyroxin from the thyroid gland .It is generally associated with enlargement of gland called Goiter .

The disease produced is known thyrotoxcosis or called exophthalmic goiter .

This disease is characterized by protrusion of the eye balls , rapid pulse , increased sweating and increase in metabolism .

Hypothyroidism :

Is mean hyposecretion of thyroxin .

In adult lead to disease called Myxoedema ,in this disease the patient becomes dull slow speech and movement , increase weight due to decrease metabolism .

Skin is dry and thick .

In infant hypothyroidism lead to disease called cretinism ,dwarfism with failure of mental development .

Ovaries :

There are two ovaries right and left situated in the pelvis on the two sides of the uterus .

Functions of ovary :

1- To produce the mature ova.

2- Acts as endocrine gland in producing the female sex hormones :-

a- Estrogen hormone.

b- Progesterone hormone .

Testis :

Two glandular organs oval in shape .

Functions :

1- Production of sperms.

2- Acts as endocrine gland in production of the male sexual hormones Androgen and Testosterone hormones which act in the development of the secondary male sexual characters.

Lecture (15)

Body temperature

Body temperature : It is a balance state between the heat production and loss from the body .

Heat is produced by :

1- Metabolic reaction.

2- Muscle contraction .

3- Environment .

Heat is lost from the body through:

1- skin by :

Sweating , conduction , convection ,radiation .

2- Respiratory system.

3- Urinary system .

4- Digestive system .

Regulation of body temperature :

The body temperature is regulated by a special center located in the brain called hypothalamus .

Factors affecting of body temperature :

1- Age : it is more in children than adult .

2- Exercise : increase in exercise .

3- Take the food increase the body temperature.

4- Hormones : hypothyroidism causes decrease in body temperature and hyperthyroidism causes increase in body temperature .

Measurement of body temperature :

The body temperature is measured by clinical thermometer which is graduated from 35C – 42 C .

Normal body temperature : 36.2 C – 37.5c .

Area for measuring the body temperature :

1- Mouth .

2- Axilla .

3- Groin .

4-Rectum .

Hypothermia :when the body temperature is below 35C .

- Physiology in starvation

- Pathology in hypothyroidism .

Hyperpyrexia : increase in body temperature .

- Physiologically as in take the food .exercise .

- Pathologically in hyperthyroidism .

Drugs which affecting of body temperature :

It is called (Antipyretic) which include Aspirin and Paracetamol .

There are 2 systems to measure the body temperature :

1- Centigrade system .(C)

2- Fahrenheit system .(F)

To convert C to F =

$$F = \frac{9}{5} \times C + 32$$

To convert F to C =

$$C = (F-32) \times \frac{5}{9}$$

Muscular structure and function:

A muscle is a group of muscle tissues which contract together to produce a force. A muscle consists of fibers of muscle cells surrounded by

protective tissue, bundled together many more fibers, all surrounded in a thick protective tissue. A muscle uses ATP to contract and shorten, producing a force on the objects it is connected to. There are several types of muscle, which act on various parts of the body.

Structure of Muscle

A muscle consists of many muscle tissues bundled together and surrounded by epimysium, a tough connective tissue similar to cartilage. The epimysium surrounds bundles of nerve cells that run in long fibers, called *fascicles*. These fascicles are surrounded by their own protective layer, the perimysium. This layer allows nerves and blood to flow to the individual fibers. Each fiber is then wrapped in an endomysium, another protective layer. As seen in the image below, a muscle is arranged in a basic pattern of bundled fibers separated by protective layers.

Function of Muscle

Whether it is the largest muscle in your body or the tiny muscle controlling the movement of your eye, every muscle functions in a similar manner. A signal is sent from the brain along a bundle of nerves. The electronic and chemical message is passed quickly from nerve cell to nerve cell and finally arrives at the motor end plate. This interface between the muscle and nerve cells releases a chemical signal, acetylcholine, which tells the muscle fiber to contract. This message is distributed to all the cells in the fiber connected to the nerve.

Types of Muscle

Skeletal Muscle

When you think of a muscle, most people generally think of a skeletal muscle. The biceps, triceps, and quadriceps are all common names for muscles that body builders tend to focus on. In fact, these general muscles are often composed of many small muscles that attach to different places to give a joint its full range of motion. Skeletal muscle is a *striated muscle*. This means that each muscle fiber has *striations*, or linear marks, which can be seen when this muscle is put under a microscope. The striations correspond to the *sarcomeres* present in striated muscles, which are highly organized bundles of muscle cells which can contract quickly in concert.

Skeletal muscle is controlled via the *somatic nervous system*, also known as the voluntary nervous system. Point your finger to the ceiling. This is your somatic nervous system in action, controlling your skeletal muscles.

Cardiac Muscle

Cardiac muscle, while similar to skeletal muscle in some ways, is connected to the *autonomous nervous system*. This system controls vital organs such as the heart and lungs and allows us to not have to focus on pumping our heart each time it needs to beat. While there is a certain amount of conscience control we have over the autonomous nervous system, it will always kick in when we are unconscious. For instance, you can hold your breath if you like but you do not have to remember to breathe all the time. Cardiac muscle surround the chambers of the heart and is used to pump blood through the body.

Cardiac muscle is similar to skeletal muscle in that it is striated. Unlike skeletal muscle, cardiac muscle fibers are arranged in a branching pattern instead of a linear pattern. Both skeletal muscle and cardiac muscle need to contract quickly and often, which is why the striations can be seen.

Smooth Muscle

Unlike skeletal and cardiac muscle, smooth muscle is not striated. This is because the individual muscle cells are not perfectly aligned into sarcomeres. Instead, they are displaced throughout the fibers. This gives smooth muscle the ability to contract for longer, although the contraction happens more slowly. Consider the muscle that contracts the sphincter on your bladder. This muscle may need to stay clamped shut for hours at a time and only gets a minute of relief some times. Many other smooth muscles operate in the same manner.

Like cardiac muscle, smooth muscle is mostly controlled by the autonomous nervous system. The many muscles that line your digestive tract work together to move food through the digestive system. Muscles attach to your hair follicles that all your hairs to stand up when it's cold. Smooth muscle is almost everywhere in your body and aids in everything from circulation to digestion.

Skin structure:

The skin is composed of two major layers: a superficial epidermis and a deeper dermis. The epidermis consists of several layers The topmost layer consists of dead cells that shed periodically and is progressively replaced by cells formed from the basal layer. The dermis connects the epidermis to the hypodermis, and provides strength and elasticity due to the presence of collagen and elastin fibers. The hypodermis, deep to the dermis of skin, is the connective tissue that

connects the dermis to underlying structures; it also harbors adipose tissue for fat storage and protection.

Skin function :

1- protection

The primary function of the skin is to act as a barrier. The skin provides protection from: mechanical impacts and pressure, variations in temperature, micro-organisms, radiation and chemicals.

2- regulation

The skin regulates several aspects of physiology, including: body temperature via sweat and hair, and changes in peripheral circulation and fluid balance via sweat. It also acts as a reservoir for the synthesis of Vitamin D.

3- sensation

The skin contains an extensive network of nerve cells that detect and relay changes in the environment. There are separate receptors for heat, cold, touch, and pain. Damage to these nerve cells is known as neuropathy, which results in a loss of sensation in the affected areas. Patients with neuropathy may not feel pain when they suffer injury, increasing the risk of severe wounding or the worsening of an existing wound.