

Human Physiology

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قسم صحة المجتمع / المعهد التقني بالموصل

Target population

For students of first class

Community Health dept.

MOSUL TECHNICAL INSTITUTE

Objectives

- 1 – The student is able to know how the body organs work and perform their activities**
- 2 – The student is able to know the structure and the situation of the organs inside the body**
- 3 – The student is able to done more clinical examination that related with the physiology**

Theoretical topics

1st week

Physiology

definition

BLOOD

function, properties composition, blood plasma, blood serum

THE TEXT •

Physiology

Is the science that deal with the *structure and function* of the living body organs.

Living body (human) consist of *many systems*

Every system consist of *many organs*, the organ consist of *certain type of tissues*, and the tissue consist of *specialized cells*.

Blood

Properties

- Classified as **connective tissue**, but it's cells are not fixed.
- **Red viscid** fluid.
- Contain colorless fluid called **plasma**.
- Composed of **RBC** (erythrocytes), **WBC** (leucocytes) and **platelets** (thrombocytes).
- Is about 1/12 of body weight.
- Volume **in adult about 5litres**, but in new born about 300ml.

Blood

Function :

- 1- **Transportation** : transport oxygen, nutrition, hormone to the all body tissues. Convey CO₂ to lung and urea to the kidney.
- 2- Help in **maintain a constant body temperature** – by convey heat produced by liver and muscles.
- 3- **Body defense** – by lymphocytes and granulocytes.
- 4- **Maintain a constant internal PH** at 7.4 .
- 5- Help in **maintain osmotic pressure** .

BLOOD

Content :

blood composed of :

1- Plasma: It is about 55% of the blood volume , which composed of :

1- Water about 90% of a plasma volume.

2- Protein :

a- albumin.

b- clotting factors (fibrinogen).

3- Antibodies.

4- Nutrients as :

- 1- Carbohydrate (as glucose).
- 2- Amino acids – product of protein

digestion.

3- Lipids.

potassium, phosphate, calcium).

4- Mineral salts (as sodium, chloride,

5- Metabolic materials as : enzymes, vitamins , hormones , uric acid , lactic acid .

Note : plasma without fibrinogen called "**serum**".

BLOOD

Content :

2- Cells :

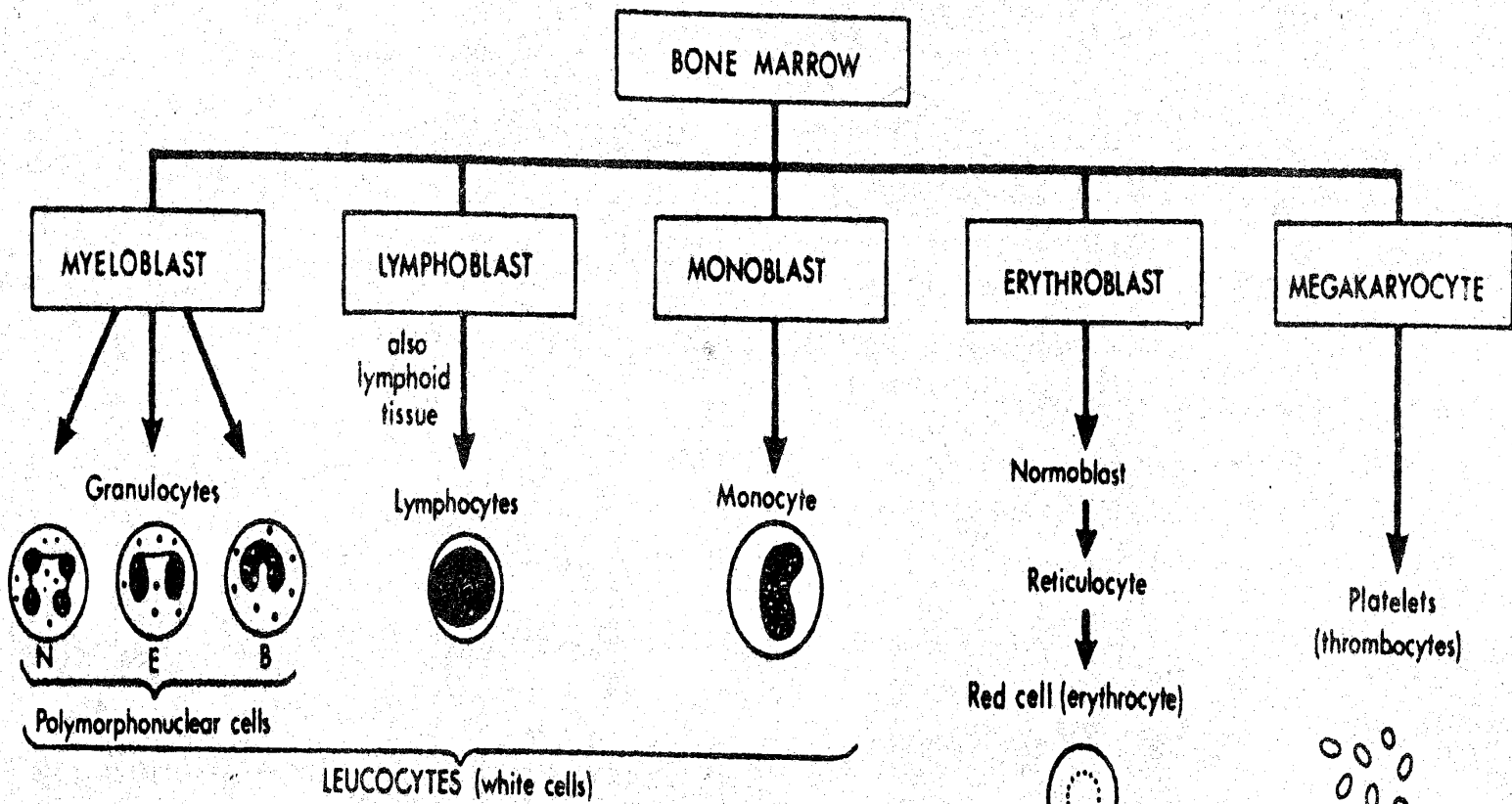
It is about 45% of the blood volume and perform different functions , which are : **RBC** , **WBC** , and **platelets**

Origin of blood cells :

RBC, WBC and platelet are formed from stem cells of red bone marrow , which can develop into different specialized cells including blood cells

Also **lymphocytes** develop in **lymphoid tissues**, and **reticulo-endothelial tissue** of (spleen, liver, lymph nodes) also the **reticulo-endothelial tissue** can produce the **monocytes**

illustrate that in diagram next page



| LEUCOPENIA | | | | |
|------------------------|---------------|-------------|---------------|------------------|
| LACK = AGRANULOCYTOSIS | — | — | ANAEMIA. | THROMBOCYTOPENIA |
| EXCESS = | LEUCOCYTOSIS | | POLYCYTHAEMIA | |
| Neutrophilia | Lymphocytosis | Monocytosis | | |
| Basophilia | | | | |
| Eosinophilia | | | | |

Quiz /1: Circle the correct answer

1- The plasma contains metabolic material , like

a – albumin b – lactic acid c – amino acid d – hormone e – antibodies

2- Blood is about (a – 1/10 ,b – 2/12 , c – 1/12) of body weight

check your answers in key answer page 167

2nd week

Red blood cell (RBC or Erythrocyte)

properties (**shape, number, function**)

production

degradation

Red blood cells (RBC)

- 1- Formed in the bone marrow of ribs, sternum and vertebrae.**
- 2- Biconcave disc shaped.**
- 3- Mature cells without nucleus.**
- 4- It is cytoplasm filled with pigment (Hemoglobin).**
- 5- Span life about 100-120 days.**
- 6- Broken down in the liver or spleen, It's iron and protein being recovered for further use.**
- 7- Main function is to transport O₂ and CO₂ .**
- 8- It is thickness 2 μ and diameter 7 μ , with a central area thinner than edges.**
- 9- Count in male 5.5 million / mm³, in female 4.5 million / mm³ .**

RBC Formation :

About 1% of red cells in the body have to be replaced each day, and the new cell formation need certain items in the diet, such as :

1- Iron : additional to that present , about 5mg iron / day will be required for a man , and 10mg iron / day for women (due to loosen with the blood in menstrual period)

2- Protein : to supply amino acid .

3- Folic acid and vitamin B12: (B12 absorbed in the intestine depend on (intrinsic factor)

Deficiency of any of these materials in the diet cause ***anemia***

But

Polycythemia

is a disease characterized by a surplus of RBC

Types of anemia :

Anemia caused by low O₂ transport capacity

1- Pernicious anemia (megaloblastic or macrocytic anemia) : Is made by a deficiency of B12 and folic acid . Here the red blood cell are irregular in size , and in general are too big , and there is a shortage of RC .

2- Iron deficiency anemia : If iron intake is not sufficient for the body's need. The red blood cells become very pale in color due to the shortage of hemoglobin . Here red cells are smaller than normal one . Also this type called (hypochromic anemia) .

3- Aplastic anemia : This type was due to an over – dose of ionizing radiation (X-ray). Also this type may caused by some drugs like benzene derivatives . caused by inability of BM to produce RC .

4- Hemolytic anemia : Are different types , They are a hereditary , Have a common character which is the cells are very fragile , So that they rupture easily as they go through the capillaries , So the life span of red

cell is so short .These types are :

Hereditary spherocytosis

Sickle cells anemia

Thalassemia

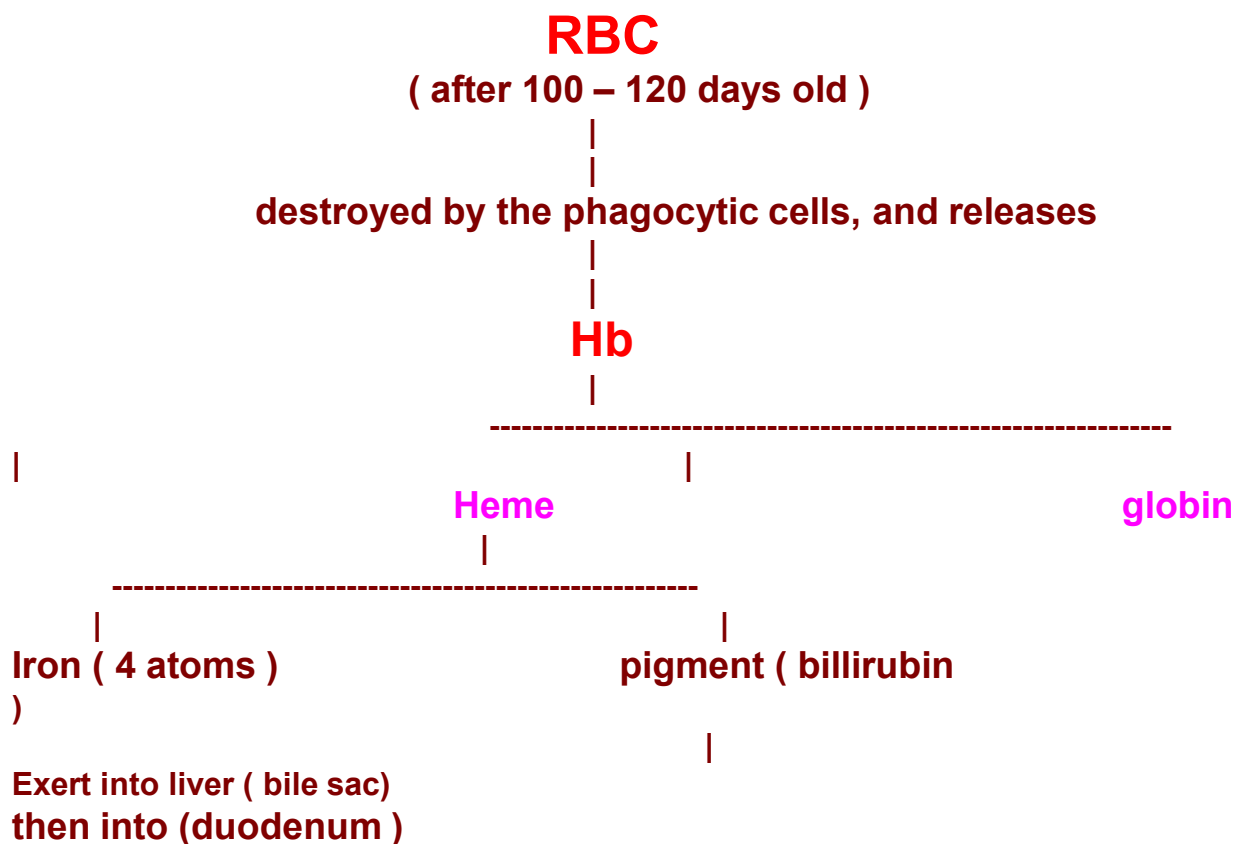
Erythroblastosis fetalis

Erythropoietin :

Is a substance released by the kidney in response to a sustained shortage of oxygen in the body, which induce the red bone marrow to produce RBC , as in **anoxia**.

Red cell break down : after 100 – 120 days old of red cells are taken up and destroyed by a series of **phagocytic cells**, which is found in **bone marrow , spleen , liver and all parts of the body**

The diagram below illustrate that :



Quiz No: 2 : Answer with true or false

- 1 – Lymphocytes develops in bone marrow only
- 2 – Mature RBC has small nucleus
- 3 – Main function of RBC is to produce antibodies
- 4 – RBC cytoplasm filled with pigment called hemoglobin
- 5 – Polycythemia is a disease characterized by a surplus of RBC in the blood
- 6 – Deficiency of Vit. B12 and Folic acid caused hypochromic anemia

check your answers in key answer page 167

The 3rd week

Leukocyte

Type

Shape

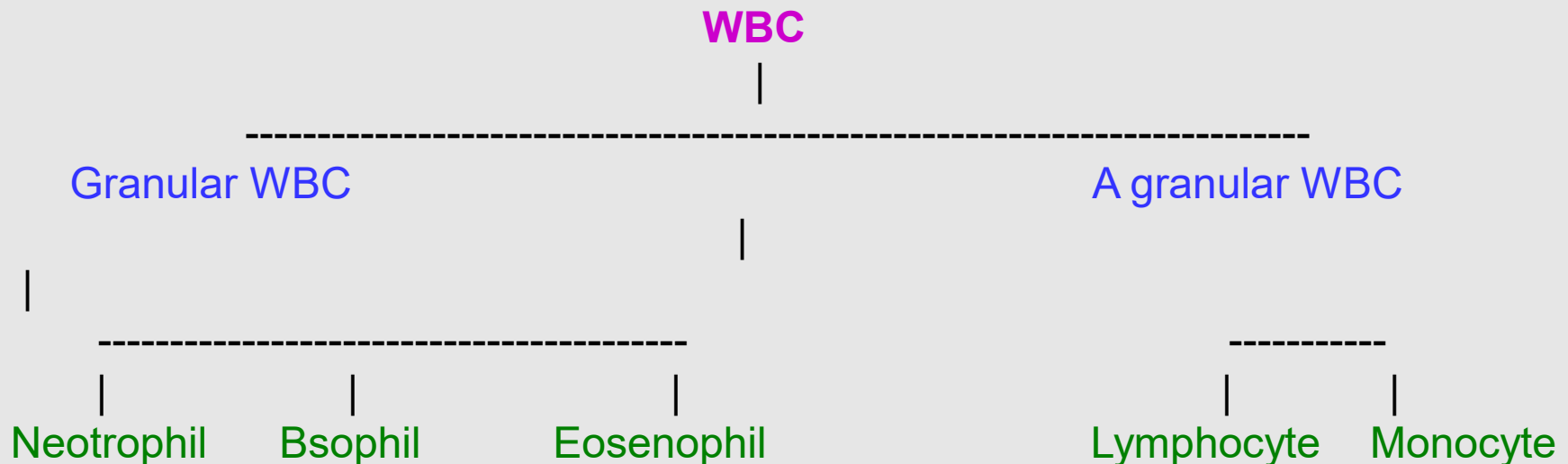
Number

Function

White blood cell (WBC or leucocyte)

- 1- are several kinds , differ in structure and origin.
- 2- all have a large nucleus.
- 3- concern with body defense .
- 4- it is count from 4000 – 11000 in cubic millimeter.
- 5- life span from 6 hr. to several days .

TYPES



Granulocyte :

Divided in to 3 types – all are phagocytic

(*Neutrophil , Basophil , Eosinophil*)

Neutrophils :

- 1 - It is number are **65%** of total number of WBC.
- 2 - Consider as body's **first line of defense** ,seek out and kill bacteria.
- 3 - Half life is **6 hour's** .
- 4 - Many of neurophil leave the circulation and enters the tissues , by squeezing themselves through the pores of the capillaries wall by a **process called diapedesis** and reach infected area , since an agents was produced by the interact between bacterial products and plasma factors (**chemotaxis**) .

Basophils :

- 1 - it is numbers are 1% of WBC number.
- 2 - contain histamine and heparin.
- 3 - also phagocytic .

Eosinophils :

- 1 - it is numbers are 4% of total number of WBC.
- 2 - also phagocytic .
- 3 - increase in patients with allergic disease .

A granulocytes :

divided into two types – about **30%** of total number of WBC.

Monocytes :

1 - about **5%** of WBC .

2 - larger than granulocytes.

3 - have **kidney –shaped nucleus**.

4 - are **phagocytic cell** , able to engulf bacteria and foreign particles , by follow the neutrophil to the infected area . **after 24hours of entering the circulation** they enter the tissues to become tissue macrophages , here called the "**reticuloendothelial system** " . Tissue macrophages including the **kupffer cells** of the liver and **alveolar macrophages** of the lung.

5 - are migrate in response to **chemostatic stimuli** ,and engulf and kill bacteria .

Lymphocytes :

- 1 - besides bone marrow also formed in lymphoid tissue , thymus, spleen.
- 2 - smaller than granules , have very large spherical nucleus.
- 3 - enter the circulation via thoracic duct .
- 4 - do not act as phagocytic , instead they act as antibody which react with foreign body called antigens and destroy them .
- 5 - play a key role in immunity .

Quiz No: 3 : Circle the correct answer

1 – The count of WBC in cubic millimeter of blood is about ;

a – 8000 – 12000

b – 400 – 1100

c – 4000 – 11000

2 – The behavior of lymphocyte in body defense is

a - act as phagocyte

b – act as antibodies

check your answers in key answer page 167

4th week

Platelets

Number

Function

Coagulation of blood

Anticoagulant

Platelets :

Are small cellular fragments rather than complete cells

Function: It was important in **coagulation of blood** .

Number: Between **250.000 – 400.000** in cubic millimeter .

Homeostasis :

It is mean a **prevention of blood loss**. When blood vessel is rapture, then the homeostasis is began ,and it is achieved by several different mechanism including :

1-Vascular spasm (vasoconstriction)

2- Formation of the plug

3- Blood coagulation: (clot formation)

1- Vascular spasm (vasoconstriction) :

Immediately after blood vessel is **cut or ruptured** , the traumatized vessel causes the wall of the vessel to **contract**; then reduce the flow of the blood. The vasoconstriction of injury blood vessel is due to the liberation of **serotonin and other vasoconstrictors** from platelets

2- Formation of the plug :

When the blood vessel is damaged , the endothelium is disrupted and collagen is exposed .Collagen attract platelets ,and adhere to it , then a loose plug of aggregated platelets is formed by the help of **serotonin and ADP**.

3- Blood coagulation: (clot formation) :

After plug was formed , the clot begins to develop in 5 to 20 seconds if the trauma of the vascular wall has been severe ,and in 1 to 20 minutes if the trauma has been minor.

Clotting Process :

Blood coagulation take place in three essential steps:

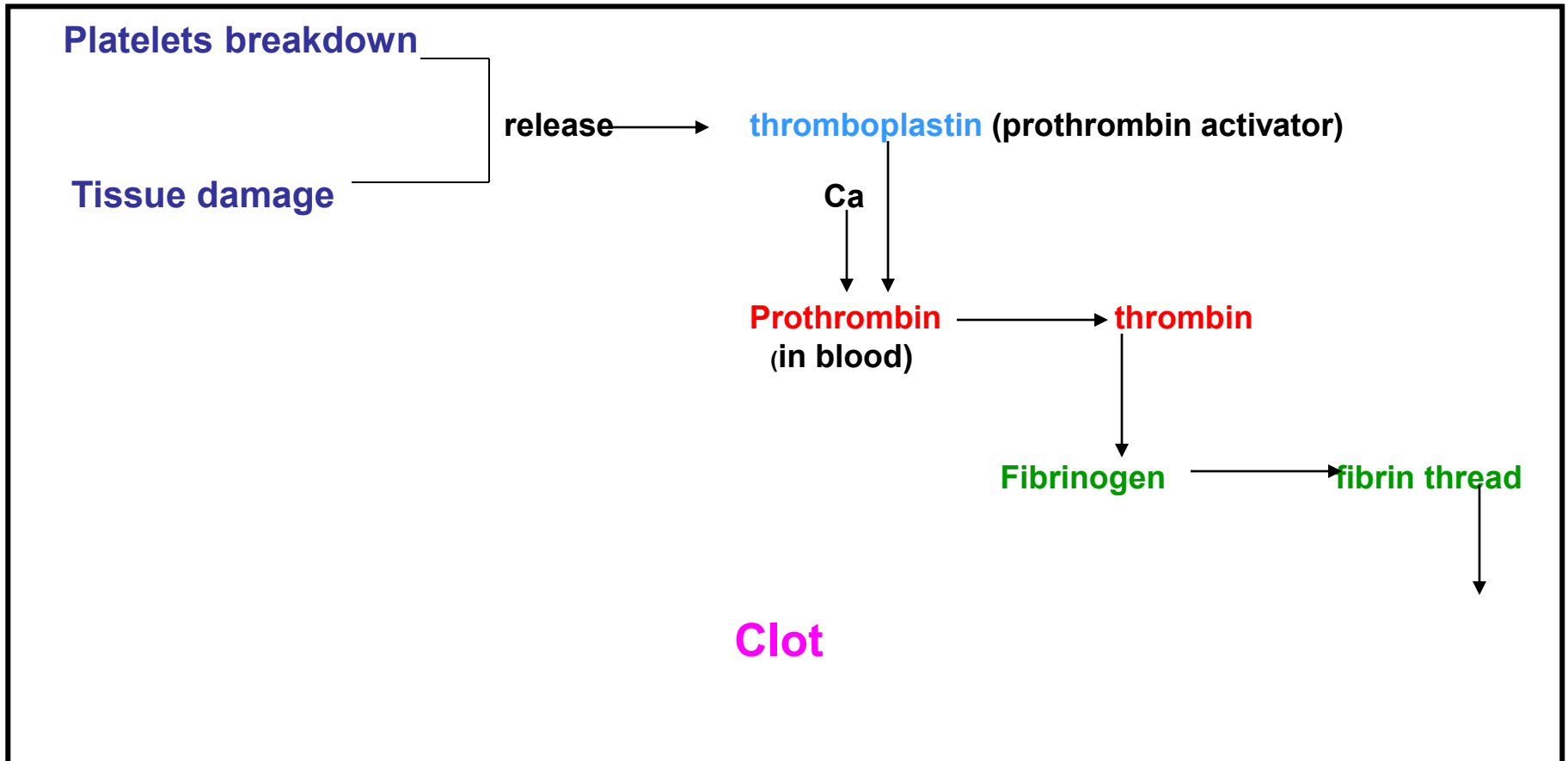
First : A substance called **prothrombin activator** (thromboplastin) is formed in response to rupture of the vessel .

Second : The prothrombin activator catalyzes the conversion of **Prothrombin** present in the blood into **thrombin**.

Third : The thrombin acts as an enzyme to convert **fibrinogen** present in the blood into **fibrin** threads that enmesh platelets , blood cells ,and plasma to form the **clot** it self ,

as following

Clotting Process



platelets diseases

Thrombocytopenia :

- 1- Mean the presence of a **very low quantity of platelets** in the circulatory system .
- 2- Persons with thrombocytopenia have a **tendency to bleed** as do hemophilia , except that the bleeding is usually **from many small capillaries** rather than larger vessels , as in hemophilia .
- 3- As a result , a **small hemorrhages occur through out all the body tissues** . The skin of such person displays many small **purplish blotches**.
- 4- Ordinarily ,bleeding does not occur until the **number of platelets in the blood falls below a number value 50,000/mm³**.

Other disease

Hemophilia :

- 1- Is a **bleeding tendency** that occurs almost in males .
- 2- In 85% of cases it is caused by deficiency of clotting factor VIII . called **hemophilia "A" or " Classic hemophilia "** . In 15% of the cases caused by deficiency of clotting factor IX .
- 3- Both factor (VIII , IX) are transmitted genetically by the female chromosome .
- 4- If one of female X chromosomes is deficient , she will be a **hemophilia carrier**, were transmits :
 - 1- The disease to the ***half of her male*** off springs .
 - 2- The carrier state to ***half of her female*** off springs .

5th week

Hemoglobin

Function

Normal value

Composition

Hemoglobin :

It is a pigment , which is **bright red** in color when **combined with oxygen** , and **dark blue** in color when there is **no oxygen present** .

NORMAL VALUE

The blood of a normal person contain approximately **15 grams** of hemoglobin ***in each 100 ml of blood*** , and each gram of hemoglobin combine with a maximum of about **1.34ml** of oxygen .

COMPOSITION

There are **4 separate iron atoms and globin molecule** in each hemoglobin, each of these combined with one molecule of oxygen . Important feature of hemoglobin molecules is it's ability to combine loosely and reversibly with oxygen.

Red cell break down :

After 100 – 120 days old of red cells are taken up by a series of **phagocytic cells**, which is found in bone **marrow** , **spleen** , **liver** and all parts of the body , then Hb is converted by these cells into a yellow pigment **billirubin** , which passes via blood and exerted into the bile and to the duodenum, and the iron returns for farther RBC formation.

See a diagram in page 13

Quiz / 4 :Define the following:

a – Platelet

B – Hemophilia

C - Hemoglobin

check your answers in key answer page 168

6th week

BLOOD GROUPS

TYPES

RH factor

Blood groups (types) :

- 1 - **Membrane** of each red cell contain **one or two or non** of a **variety of antigens** (called agglutenogens).
- 2 - Important types of agglutinogens are **A and B** .
- 3 - According to that, the individuals divided into **4 blood groups A, B, AB, O**
- 4 - There are A and B antigens in many tissues other than blood , like salivary gland , saliva , pancreas , kidney , liver , lungs , testis , semen , and amniotic fluid
- 5 - **Agglutinogens A and B are glycoproteins** (M.W. 8000 or more) that differ in composition by only one sugar residue .
- 6 - **Antibody** who against agglutinogen (**antigen**) called **agglutinin** , Present in the plasma of the blood .
- 7 - **Agglutinin (antibody)** occur :
 - 1- **naturally** (inherited).
 - 2- **by exposure to the RBCs** of another individual via :
 - a - blood transfusion.
 - b - during pregnancy.

Blood groups

Universal recipients:- is a blood group can receive all other blood types, like blood group **AB** .

Universal donor : - is a blood type can be given to all other blood types, like blood group **O** .

Rhesus group (Rh factor):

In addition to the 6 antigens of the ABO system ,there is another substance called **antigen- D** (agglutenogen)

Peoples who **have antigen-D** on their red cells membrane are said to be **Rhesus positive (Rh+)** are about 85% . The remaining 15% **have no antigen D** on their red cells membrane and said to be **Rhesus negative (Rh -)**.

Neither the Rh+ nor the Rh- people have any anti- antigen D naturally occurring in their plasma , but anti- antigen D will develop in Rh- person only , if that person is giving a Rh+ transfusion. The anti- antigen D which is formed will persist through out life , and person will not be able to have Rh+ blood. The Rh+ patients do not have anti- antigen D in their plasma , they can not make anti- D and they can have a transfusion of their Rh- or Rh+ blood.

When a man of Rh+ married a woman of Rh- , and when the wife become pregnant , it's Rh- blood may become sensitized by a proteins from her Rh+ fetus (this factor have been inherited from the father) .If these proteins enter the mother's circulation before or during child birth . During subsequent pregnancy with Rh+ fetus ,some of the anti-Rh antibodies may pass from the mother's blood into the blood of her fetus ,and cause destruction of fetus's red cells . This condition is called "erythroblastosis fetalis** " or hemolytic disease of the new born.**

7th week

CARDIOVASCULAR SYSTEM

HEART

structure

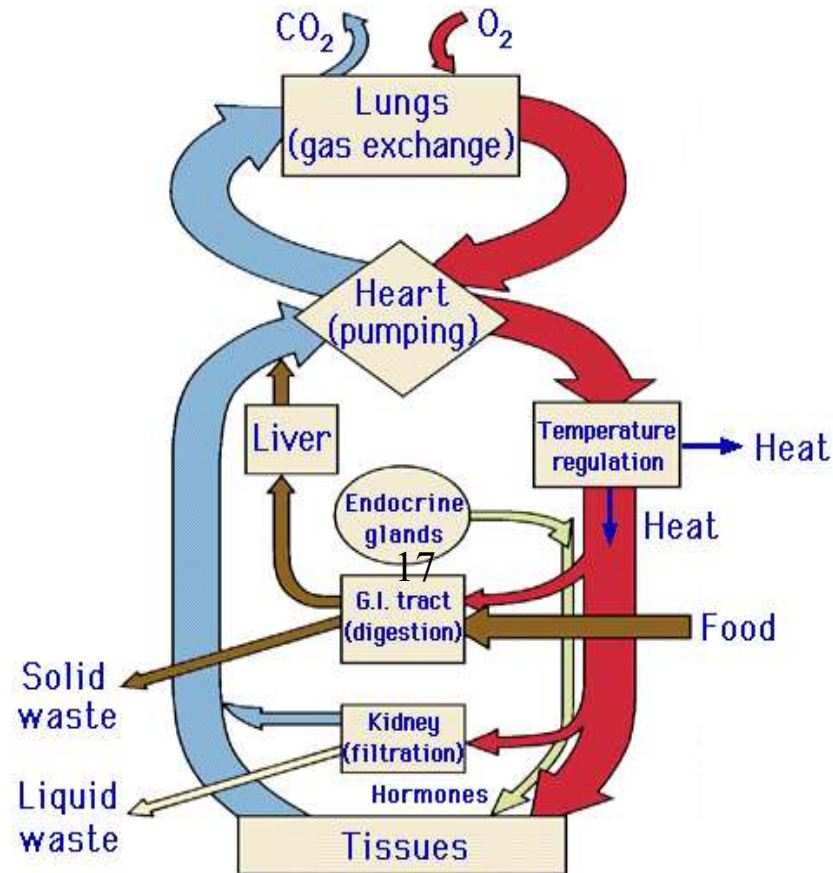
function

cardiac valve

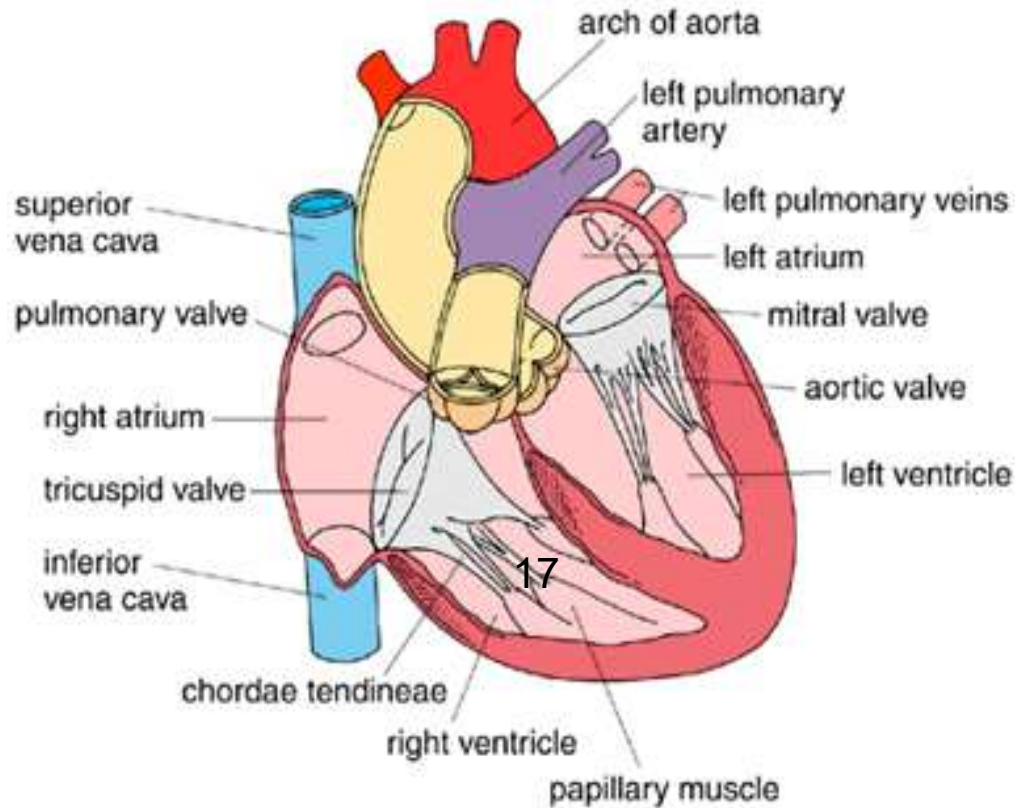
cardiac cycle

heart sounds

CARDIOVASCULAR SYSTEM



- 1 - It is a closed system consist of heart and blood vessels .
- 2 - Filled with circulating blood .
- 3 - Transport body useful things (O_2 and nutrient) , and un useful things (Co_2 and other waste products)
- 4 - Transport hormones from their production to their targets.
- 5 - Distributes the heat for all body.



The Heart:

- 1 - It is a **pump** which **circulates the blood** around the body .
- 2 - In fact , it is tow pumps , the left side pumps blood coming from lungs to the tissues ,and pumps the blood which has been returned from the tissue to the lungs.
- 3 - Each side of heart consist of two chambers, the **atrium and ventricle**.
- 4 - There are a **valves** between each atrium and ventricle, and at the opening of large vessels .

Cardiac cycle

Cardiac cycle : It is a sequence of one **systole** followed by one **diastole** , and it last 0.8 of a second.

Ventricular systole : It is a contraction phase of a ventricular chamber of the heart at rest, which last **0.3 second**.

Ventricular diastole : It is a relaxation phase of a ventricular chamber of the heart at rest, and last **0.5 second**.

Cardiac Output

Heart Rate: Is the number of beat / minute , which is normally equal 70 beats/min

Bradycardia : is a relatively slow heart rate less than 60 beat/min.

Tachycardia : refers to a heart rate over 100 beat/min

Stroke Volume: At each beat, each ventricle pumps out about 70 ml blood . (Normal person)

Cardiac Output: It is the volume of the blood pumped out by each ventricle / minute. May be represented by the equation:

$$\text{C.O.} = \text{H.R.} \times \text{S.V.} = 70 \text{ beat/min} \times 70\text{ml/beat} = 4500 \text{ ml/min.}$$

In exercise, the cardiac output is greater than at rest , since the exercise increase the heart rate and stroke volume

Control of the heart rate:

The heart rate can be influenced by :

1- The nervous system :

Stimulation from the sympathetic nervous system increases the heart rate . Stimulation from the parasympathetic nervous system decreases the heart rate.

2- Factors in the internal environment

3- Hormones , ions and drugs in the blood

Heart valves :

Heart valves : Are structures which allow the blood to flow in one direction only, which are passive structures, they do not contain any muscle tissue

Each ventricle has a valve at its inlet and its outlet ,are:

Inlet valves: named atero-ventricular valves. On the right side the mitral valve, and on the left side the tricuspid valve.

Outlet valves: Situated at beginning of large vessels, each have three semilunar structures. On the right side the pulmonary valve. On the left side, the aortic valve. Located at beginning of large vessels.

See picture in page 32

Heart sounds

Heard by

STETHOSCOPE

Recorded by

phonocardiogram

Heart sounds:-

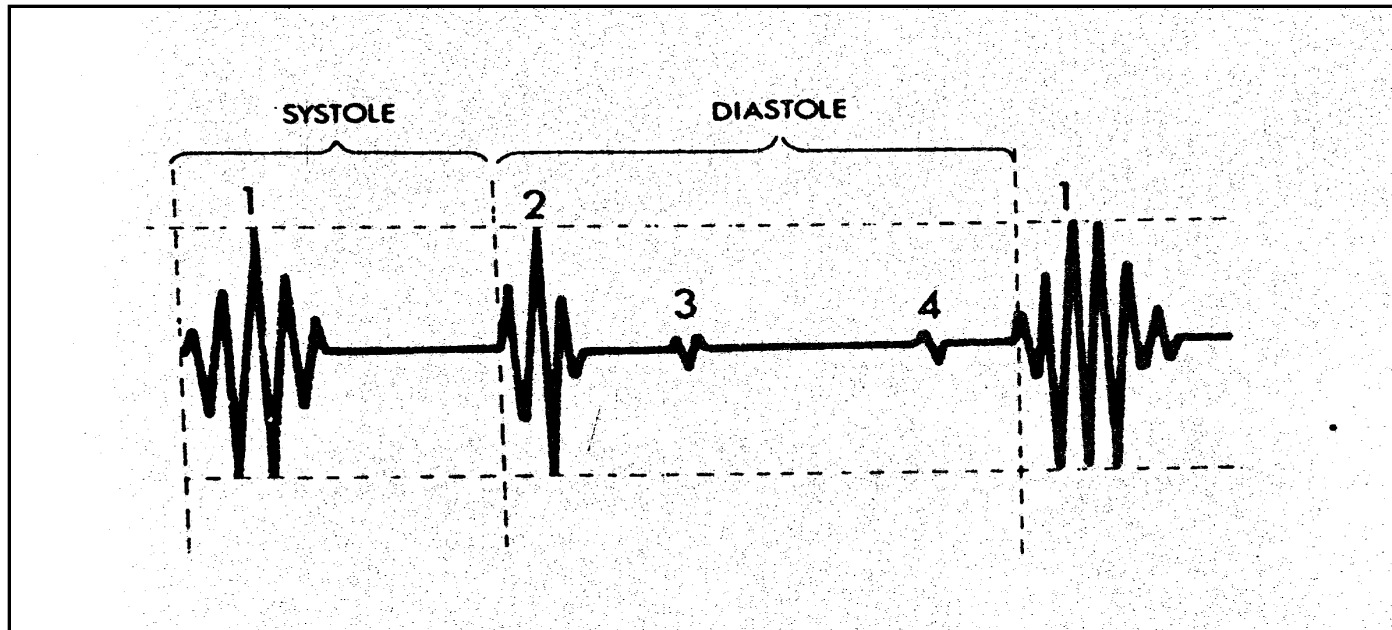
- 1- The **closure** of the **mitral** and **tricuspid** valves is associated with a sound can heard by stethoscope, and termed the "first heart sound" and heard like the word "**lub**" and this sound marks the **onset of ventricular systole** .
- 2- The closure of the semilunar valves (**aortic** and **pulmonary**) causes the second heart sound, which is like the word "**dub**". This marks the end of ventricular systole and the **start of ventricular diastole**.
- 3- Since the interval period of time between the first heart sound and second heart sound is shorter than the interval period of time between the second heart sound and the first heart sound. Here the beating of the heart has characteristic rhythm (**lub-dub-pause-lub-dub-pause.**)

Phonocardiography :

An instrument using a microphone attached to the chest, which recording heart sounds, called a phonocardiogram .

The first (1) and second (2) heart sounds is a record of the a closure of the heart valves . The third (3) heart sound which corresponds to a rushing of the blood into the ventricles during diastole .

The fourth (4) heart sound which corresponds to the atrial systole.



Valve areas on the chest can be heard the valves sound :

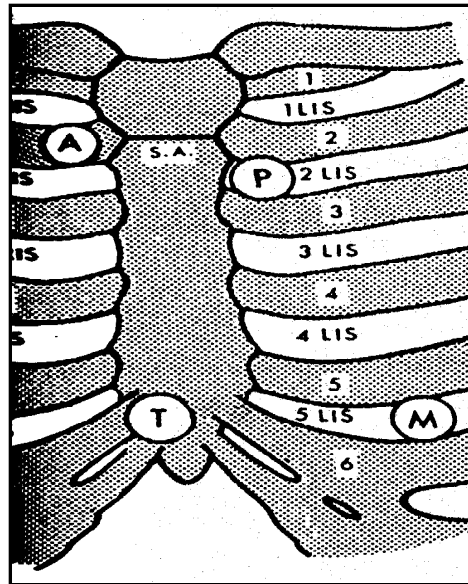
The heart sounds are heard best where there is no lung tissues between the heart and the chest wall , because the lung was poor conductor of sound. The sound of :

Pulmonary valve is heard best in the region of the second left intercostals space

Aortic valve is heard best under the beginning of the second right rib

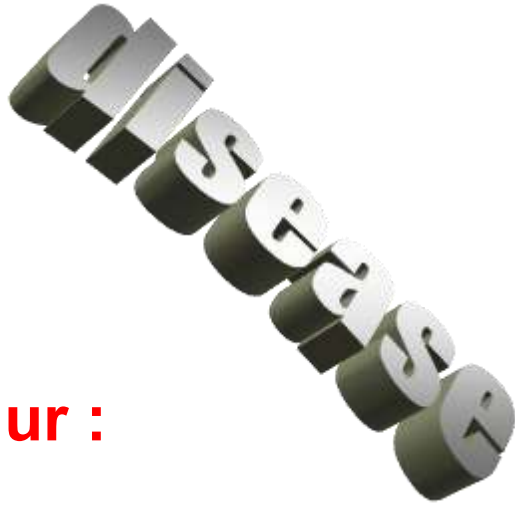
Mitral valve is heard best in the region of the fifth intercostals space of median left side

Tricuspid valve is heard best at the lower boarder of the sternum



A : aortic valve , **P**: pulmonary valve , **T**: tricuspid valve , **M**: mitral valve

Heart sounds



Murmur :

1- **Abnormal heart sound usually due to a faulty action of the heart valves (valve fail to close tightly) and blood leaks back (or can not open completely) make a noise sound during passing of blood through narrow opening.**

2- **Also may be caused by a narrowing of valve opening (**stenosis**) and this state called incompetence or regurgitation .**

3- **Also the abnormal sound may be caused by a congenital defects , disease , and physiological variations.**

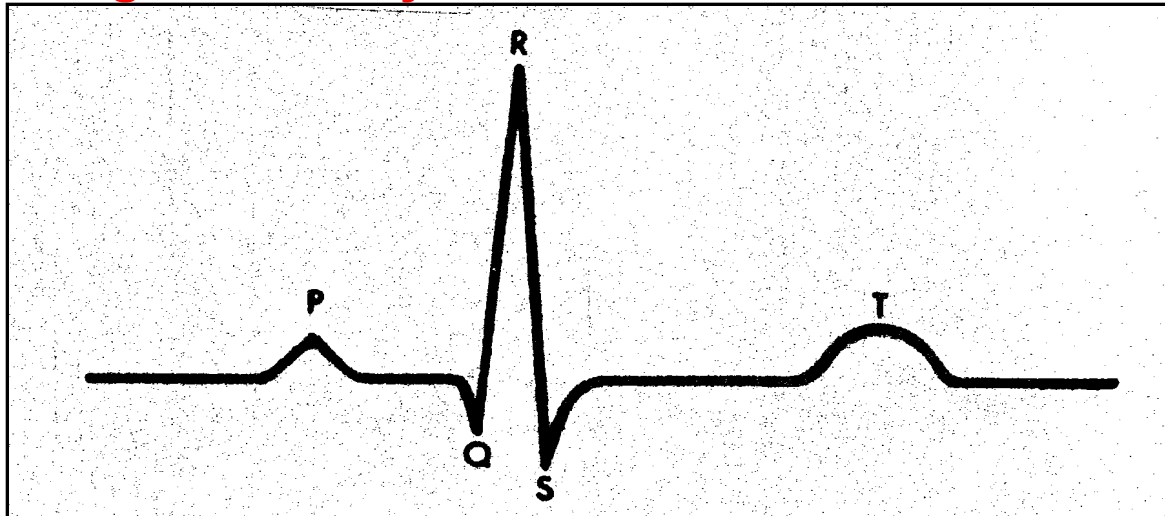
8th week

ELECTROCARDIOGRAPH

ECG

Electro cardiograph (ECG) :

- 1- Is an instrument used for making records of the changes in the electric currents produced by the contracting heart muscle .
- 2- This electric activity is picked up by electrodes placed on the surface of the skin and appears as a WAVES on the ECG tracing paper .
- 3- P wave : represents the activity of the atria.
QRS and T waves : represents the activity of the ventricles.
- 4- Changes in the waves and the intervals between them are used to diagnose heart damage and arrhythmias.



Origin and spread of the cardiac excitation :

- 1- Normally the heart is beats in an orderly sequence .
- 2- The structures that make up the **conducting system** are :

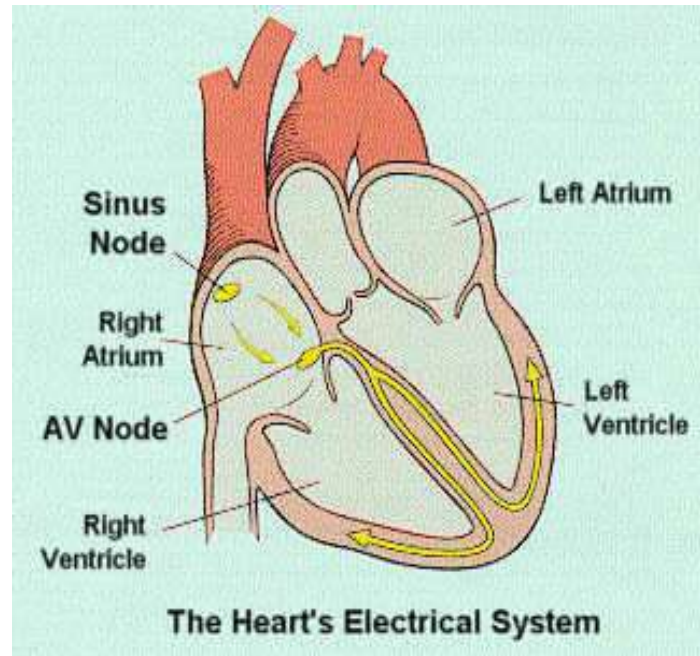
The **senio-atrial node (SA node)**.

Internal atrial path way.

The **atrioventricular node (AV node)**located at the posterior portion of the septum.

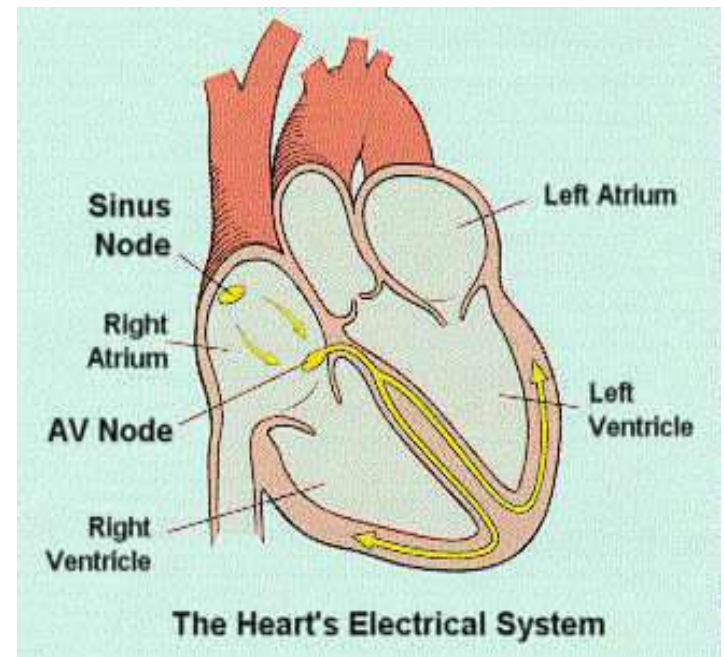
The **bundle of his** and it's branches .

The **purkinje system** .



The order in which the impulses travel is as follows :

- 1- The **SA node** generate the electric impulse that begins the heart beat.
- 2- The excitation wave travels throughout the muscle of each atrium (inter nodal atrial pathway) causing it to contract .
- 3- Then AV node stimulated .At this time the filling of the ventricles with blood is complete .
- 4- Then excitation wave travels rapidly through the bundle of His and it's branches and purkinje fibers, causing the ventricular walls to contracts practically at once , and pushing the blood through vessels.



Quiz / 5 : Circle the correct answer

- a – A and B antigens presents in the red cell membrane .
- b – Blood group O is an universal recipient blood type .
- c – Erythroblastosis fetalis is a hemolytic disease of the new born.
- d – Cardiovascular system was an open system like digestive system .
- e – The measurement unit of the cardiac out put is ml/hr.
- f – Ventricular systolic last about 0.3 second.
- g – Murmur is abnormal heart sound due to a faulty action of the heart valves .
- h – Changes in the waves and the intervals between them in ECG are used to diagnose heart damage and arrhythmias

check your answers in key answer page 168

11th week

Blood Pressure

Normal value

Factors effecting

Blood Pressure

Is the force of the blood exert against arterial walls. It is measured in millimeter of mercury (mmHg) using the **sphygmomanometer**, and composed of :

Systolic blood pressure :- Is the maximum pressure in the aorta and arteries occur during the heart muscle contraction, the average normal value is around 120 mmHg

Diastolic blood pressure :- Is the minimum pressure in the aorta and arteries occur during the heart muscle relaxation, the average normal value is around 80 mmHg

Control of blood pressure by :

Sympathetic nerves : it's stimulation lead to increase heart rate and then to increase the blood pressure .

Parasympathetic nerves : it's stimulation lead to decrease heart rate and then to decrease the blood pressure .

Baro-receptors : which sense the changing in blood pressure.

Factors determine the blood pressure : In order to have B.P. there must be :

Cardiac out put (C.O): increase C.O. lead to increase B.P.

C.O.=stroke volume × heart rate .

Peripheral resistance : is a resistance to blood flow in systemic circulation , which is produce by :

Vascular wall : decrease of the cross section of the vessel lead to increase of the blood pressure (vasoconstriction) , and vice versa

Blood volume : the decrease of the blood volume (as in bleeding) lead to decrease of the blood pressure

Blood viscosity : Increase of the viscosity of the (as in polycythemia) lead to increase of the blood pressure

Factors affecting the blood pressure :

- 1) **Sex** : blood pressure is higher in male
- 2) **Age** : blood pressure is higher in elderly
- 3) **Body weight** : higher weight leads to higher blood pressure
- 4) **Gravity** : the pressure in the legs is higher than the pressure in the head
- 5) **Posture** : pressure at lying is higher than sitting , and this is higher than at standing .
- 6) **Excitement.**
- 7) **Muscular activity** : Blood pressure was high
- 8) **Rest and sleep** : Blood pressure is less
- 9) **Some drugs** : alcohol , adrenaline increase Blood pressure
- 10) **Some condition** : as bleeding and anesthesia decrease Blood pressure

Abnormalities of Blood pressure :

- 1) **Hypertension** : It is an increase of the blood pressure , where are :
- a) Systolic blood pressure – was more than 150 mmHg .
 - b) Diastolic blood pressure – was more than 90 mmHg .

There are three types of high blood pressure , which are :

- 1- Artrio sclerosis – due to presence of cholesterol and Ca salt in the wall of blood vessels.
- 2- Renal hypertension – due to renal ischemia .
- 3- Essential hypertension – cause unknown .

- 2) **Hypotension** : It is a decrease in blood pressure , where are :
- a) Systolic blood pressure below 100 mmHg .
 - b) Diastolic blood pressure below 70 mmHg .

The cause of hypotension may be due to :

- 1- Hemorrhage.
- 2- Diarrhea.
- 3- Sever vomiting.
- 4- Sever burns.

12th week

Respiratory system

Function

Structure

Expiration

Inspiration

Respiratory rate

Respiratory muscles

Respiratory system

function of respiratory system:-

- 1- absorption of O₂ from the air**
- 2- excretion of CO₂ from the blood**
- 3- regulation of blood PH**
- 4- production of voice (larynx)**

It is two parts

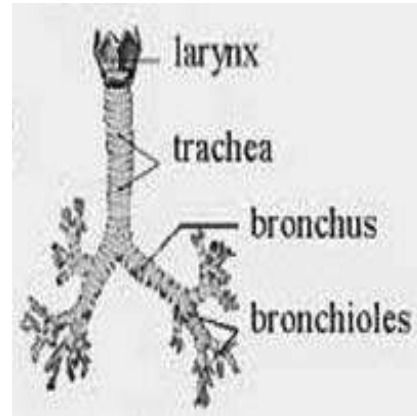
A) Conducting parts

B) Respiratory parts

Respiratory system

Conducting parts

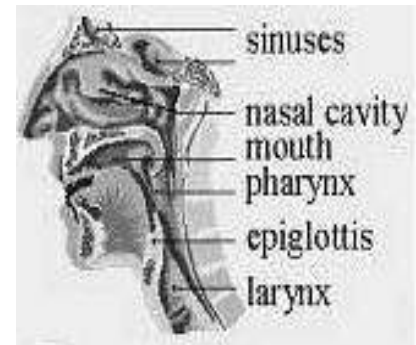
Are **air passages** , like **nasal cavity** , **larynx** , **trachea** , **bronchus** and **bronchioles** .



1-Nose: made of **cartilage and bone** and is designed to **warm, moisten, and filter air** as it comes into the system

Nasal cavity :contain

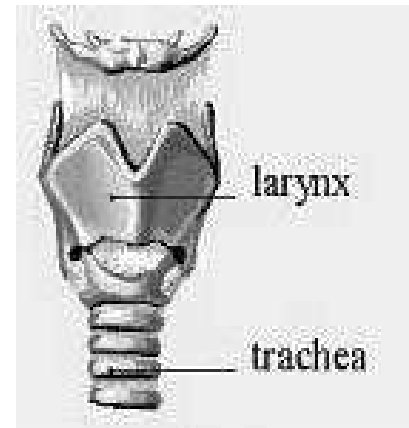
- 1- Hairs :-act as a filter for dust from inspired air .
- 2- Mucous membrane :
 - 1) Trapping the foreign bodies .
 - 2) Moistened inspired air before reaching the lung .
- 3- Dense net of **blood vessels** :- to warming the inspired air .



2-Pharynx – (throat) conducts food and air; exchanges air with Eustachian tube to equalize pressure

3-Larynx – (voice box) connects the pharynx and the trachea; made of cartilage; contains vocal cords

4-Epiglottis – flap of tissue that covers trachea; ensures food travels down the esophagus



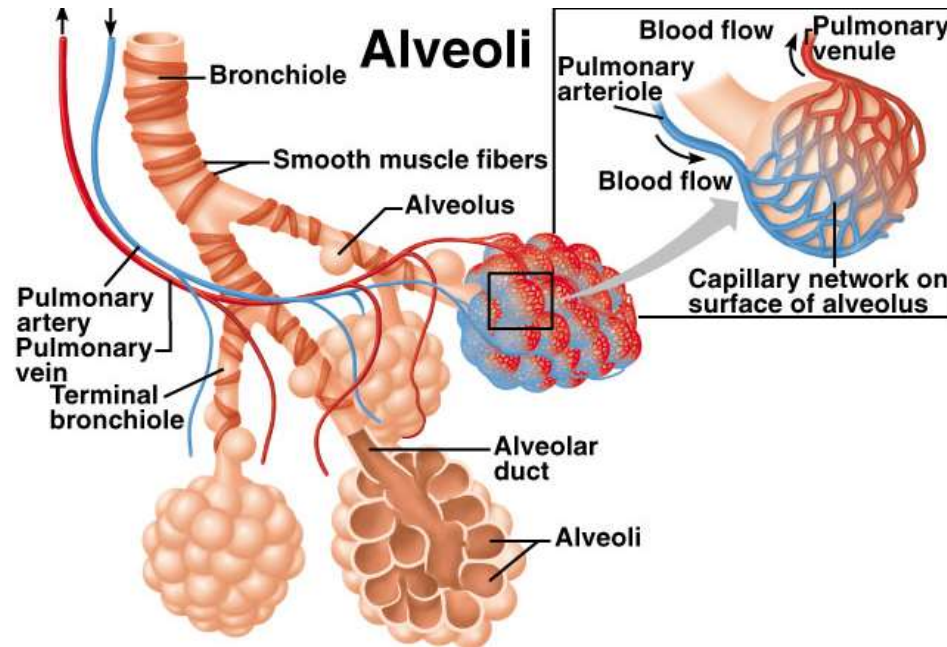
Respiratory system

Respiratory parts

:

are a sites for gas exchange between alveolar air and blood , like respiratory bronchioles and alveoli .

Alveoli – cup shaped structures at the end of the bronchioles that resemble bunches of grapes; are in direct contact with capillaries (gas exchange); covered with **SURFACTANT** that keep them from collapsing



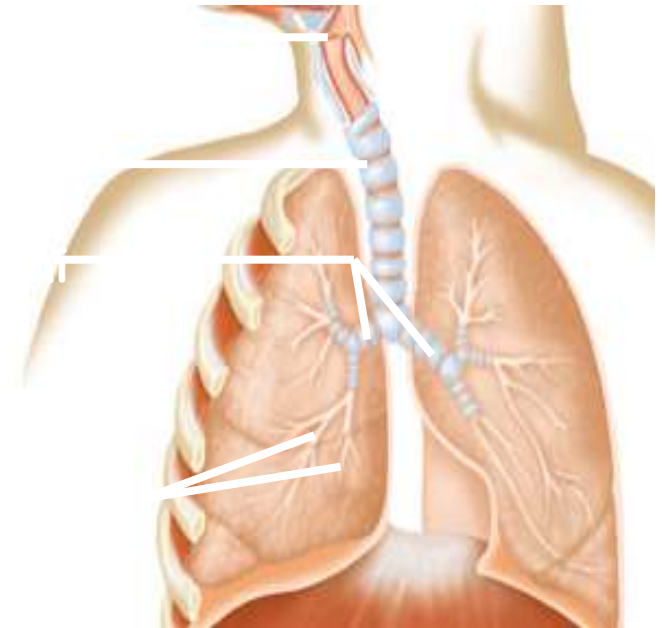
Respiratory system

The Lungs:

are a pair of conical shaped organs, with a millions of alveoli, for this, it is a spongy. Each lung was enveloped in a serous membrane called pleura. The pleura was of two layers

- **visceral layer**, covering the lungs directly

- **parietal layer**, lies anterior of the chest wall and the upper surface of the diaphragm. there is a serous fluid between these layers for lubrication.



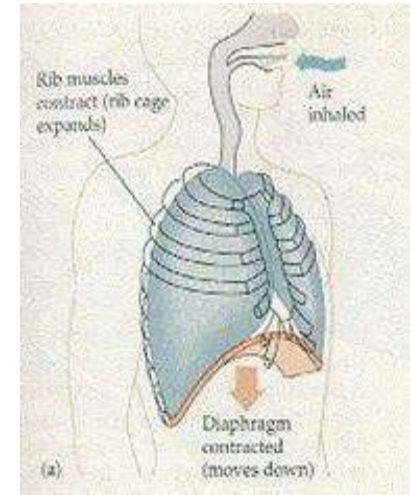
Respiratory system

Respiration is achieved by :

A: Inspiration (also called Inhalation) :Is the drawing of the air into the lungs and is brought about by contraction of the:

Respiratory muscles

- 1) Inter costal muscles.
- 2) Diaphragm muscle.



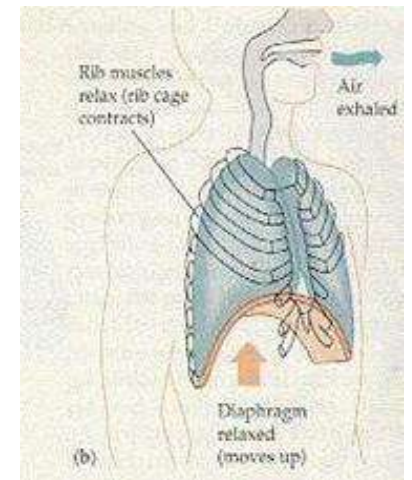
B: Expiration (also called Exhalation)

Is the expulsion of the air from the lungs, is brought about by the relaxation of the :

Respiratory muscles

- 1) Inter costal muscles
- 2) Diaphragm muscle
- 3) Accessory muscles (found in the cervical region) .

These muscles are employed in forced expiration



Respiratory system

Respiratory rate : It is the **number** of inspiration and expiration in **one minute** , its

normal at rest

= **15 – 20 / minute** in **adult**

= **20 – 40 / minute** in **children**

= **more than 40 /min** in **infant**

13th week

Respiratory system

Respiratory capacities

Pulmonary Ventilation

Respiratory system

Respiratory capacities :

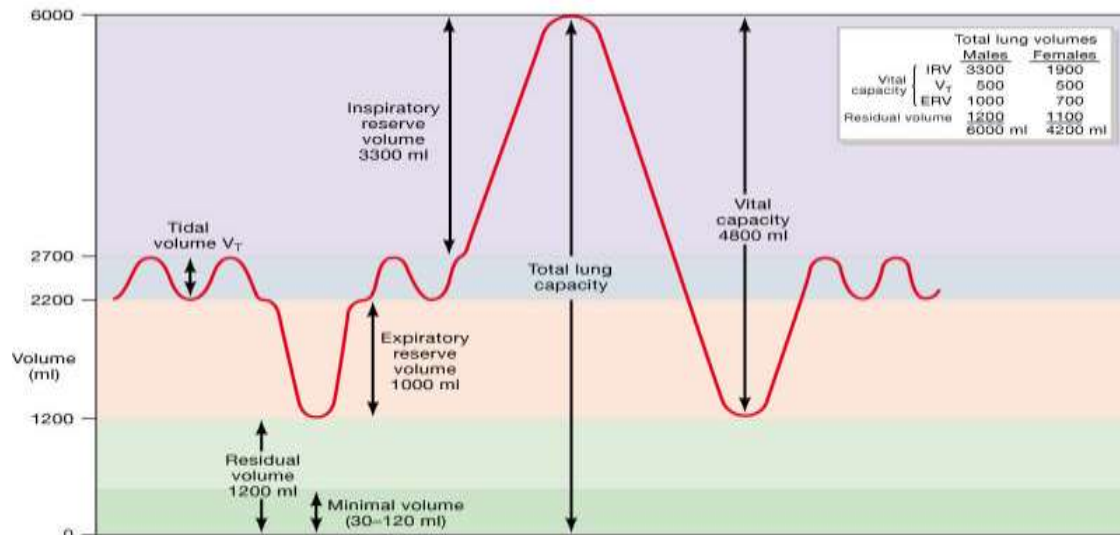
Vital Capacity : is the volume of air that inspired or expired in forced breathing, which is about 4800cc.

Residual Volume: is the residual volume represents the air that can not be removed from the lungs even by forceful expiration, it is about 1200cc.

Total Lung Capacity : is the total volume of the air that can be contained in the lungs after maximum inhalation which is 6000cc.

Tidal volume : Is the volume of air that inspired , and expired in normal breathing , which is about 400 cc.

Dead space air : It is the inspired air in the conducting parts of the respiratory system , which not share in the gases exchange , it is 150 cc.



Respiratory system

Types of ventilation :-

1- Pulmonary Ventilation (P.V.)

$$\begin{aligned} \text{P.V.} &= \text{Tidal volume} \times \text{respiratory rate} \\ &= 400 \times (15 \text{ or } 20) = 6000 \text{ or } 8000 \text{ cm}^3/\text{min} = 6 \text{ or } 8 \text{ L /min} \end{aligned}$$

2- Alveolar Ventilation (A.V.)

$$\begin{aligned} \text{A.V.} &= (\text{Tidal volume} - \text{Dead space}) \times \text{respiratory rate} \\ &= (400 - 150) \times (15 \text{ or } 20) \\ &= 250 \times 15 \text{ or } 20 \\ &= 3750 \text{ or } 5000 \text{ cm}^3/\text{min} \end{aligned}$$

Note :

The elastic recoil of the lungs and chest walls returns the chest to the resting respiratory level

At the end of quiet expiration , the lungs still contain about 3 litres of alveolar air , but only 420 ml of this , is oxygen (14 % of 3 litres) , since the body requires 250 ml of oxygen every minute for metabolism

Respiratory system

percentage of air components:

| air content | in alveolar air | room air |
|--------------------------------------|------------------------|-----------------|
| oxygen(O₂) 21% | 14% | |
| carbondioxide(CO₂) | 5.5 - 6% | 0.05% |
| nitrogen(N₂) | 80% | 79% |

14th week

Respiratory system

Gas exchange

It's regulation and control

Gas Transport

Respiratory system

Gas exchange : -

Occurs in a millions of alveoli (which provide a respiratory surface between 60 – 100 m²) where the O₂ dissolves in a surfactant fluid inside the alveoli , then O₂ diffuses across the two cells thickness separating the blood and alveolar air , and the dissolved O₂ combined rapidly with the blood hemoglobin , and CO₂ being released from blood plasma .

Factors affecting gases transport by blood :-

1- Partial blood pressure of the gas (or tension): the gas move from an area of high pressure to area of low pressure

A – In lung :

| Gas | gas P. in alveolar air | gas P in capillaries(blood come from tissue) |
|---------|------------------------------|--|
| PO_2 | 100 mmHg | 40 mmHg |
| | ----- O_2 transfer -----> | |
| PCO_2 | 40 mmHg | 46 mmHg |
| | ----- CO_2 transfer -----< | |

B – In tissue :

| Gas | gas P in capillaries (blood come from lung) | gas P. in tissue |
|---------|--|------------------|
| PO_2 | 100 mmHg | 40 mmHg |
| | -----> | |
| PCO_2 | 40 mmHg | 46 mmHg |
| | -----< | |

2- Content of the gas in blood:

the quantity of gases in blood depend on the amount of Hb.

| <u>Content</u> | <u>in artery</u> | <u>in vein</u> |
|----------------|--------------------|--------------------|
| O_2 | 19 ml/100 ml blood | 14 ml/100 ml blood |
| CO_2 | 48 ml/100 ml blood | 52 ml/100 ml blood |

Respiratory system

Gas Transport :-

Arterial blood is 97% saturated with oxygen . while venous blood is about 70% saturated with oxygen . this 27% difference represents the oxygen that has been taken up by the cells. O₂ and CO₂ can transport to all body organs and tissues by different items in the blood.

1- O₂ was transport by:

- 1- combine with hemoglobin (almost of O₂).
- 2- very small quantity carried by plasma.

2- CO₂ was transport by:

- 1- 10% is dissolved in plasma.
- 2- 70% transport as ion (bicarbonate ion).
- 3- 20% is combined with the protein portion of Hb

and the protein in the plasma.

Respiratory system

Control and regulation of respiration :

respiration regulated by:

1-Respiratory control center - found in medulla and pons (in brain)

Medulla stimulates inspiratory muscles (diaphragm & external intercostal muscles)

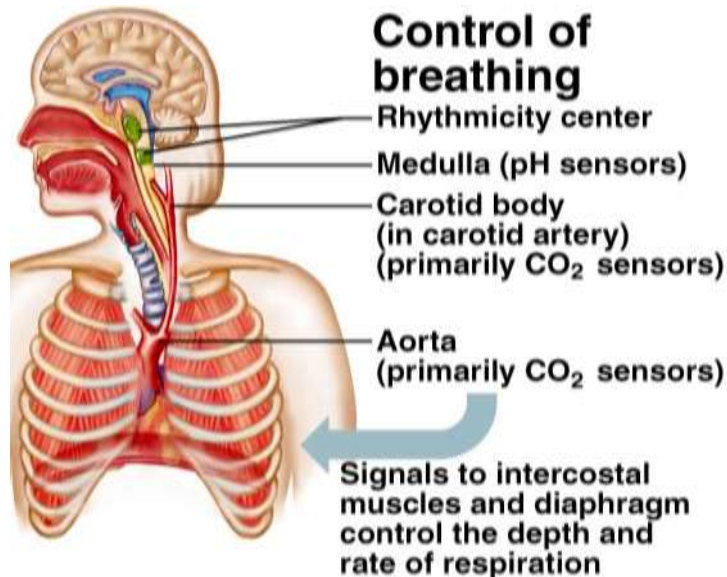
2-chemically Control - by changing of CO₂ quantity

The most important factor affecting the

↑ in arterial CO₂ causes ↑ in acidity of

↑ in CSF acidity is detected by pH sensors

↑ rate and depth of breathing



Respiratory system

Factors affecting respiratory rate:-

- 1- **age:** faster in children .
- 2- **exercise:** lead to increase the respiratory rate.
- 3- **emotional disturbance:** like hysteria which lead to increase the respiratory rate.
- 4- **diseases:**
 - a- pneumonia- lead to increase respiratory rate.
 - b- drugs poisoning – lead to decrease respiratory rate.
- 5- **high center in brain affect during speaking and singing.**
- 6- **level of CO₂ in blood :**
 - if increase CO₂ in blood -----increase respiratory rat.
 - If decrease CO₂ in blood -----decrease respiratory rate.
- 7- **level of O₂ in blood:**
 - if decrease O₂ in blood ----- increase respiratory rate.
- 8- **change of blood pH:**
 - if blood become Acidosis----- lead to increase respiratory rate.
 - If blood become alkalosis ----- lead to decrease respiratory rate.

Respiratory system

diseases

Respiratory System Disorders :-

Asthma – muscles of bronchioles constrict, lead to a drastically reducing ventilation

Emphysema – destruction of alveoli

Tuberculosis – highly contagious bacterial infection

Lung cancer – 90% of lung cancer victims have a history of smoking

Quiz / 6 : Define the following :

a – blood pressure

b – alveoli

c – tidal volume

d - asthma

check your answers in key answer page 169

15th week

Urinary system

Structure

Function

Urinary system

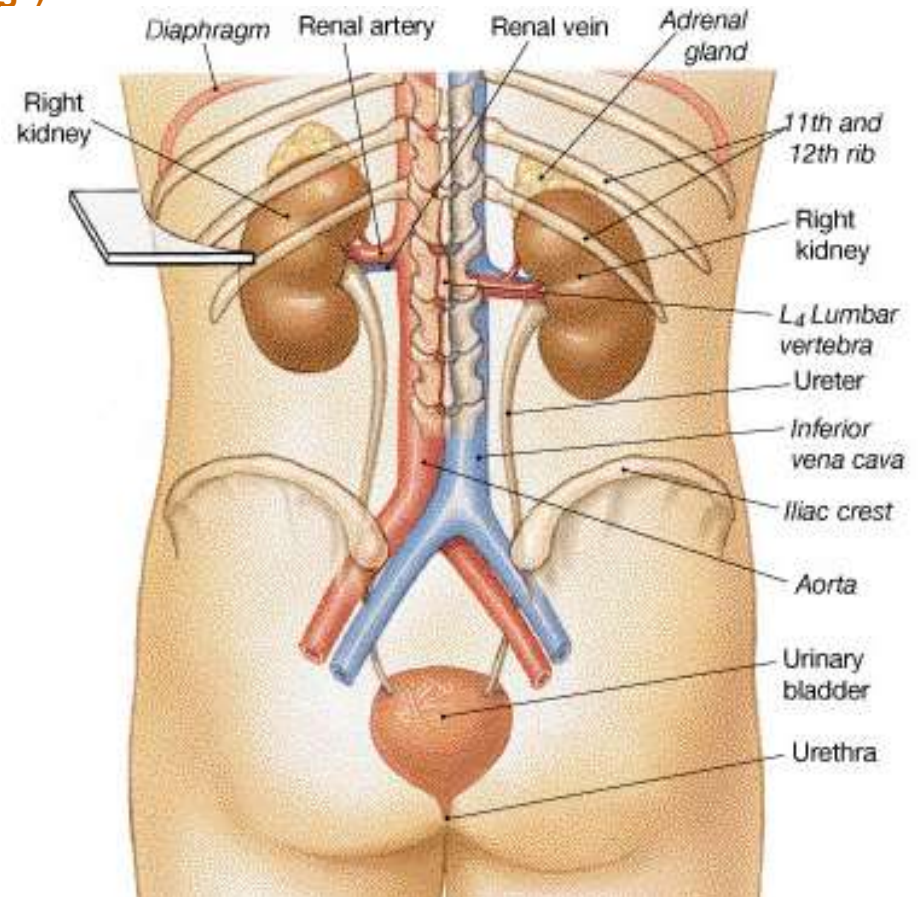
Also called **excretory system** , because is to **remove** the waste product from the blood and eliminate them form the body . Is consist of :-

Two Kidneys .

Two ureters .

Urinary bladder .

Urethra (male 20cm , female 4cm long)



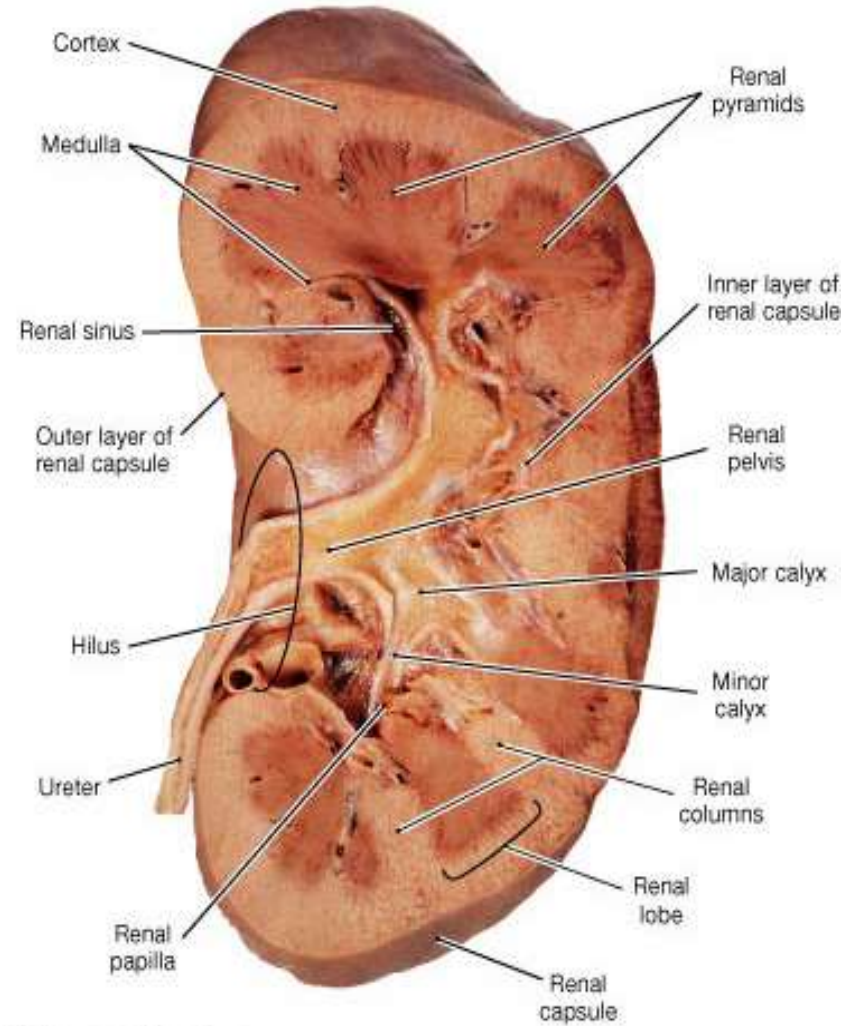
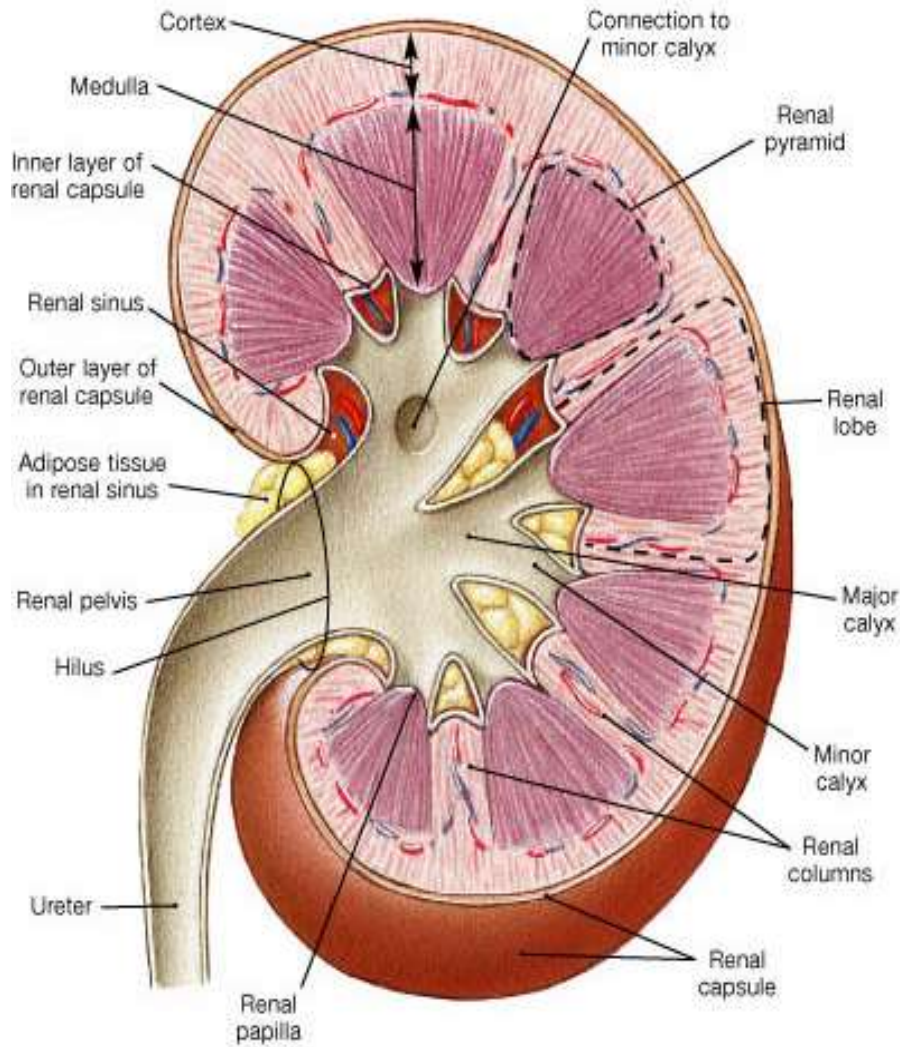
Urinary system

Kidneys :-

- 1) a pair of organs .
- 2) situated on the posterior abdominal wall , lie between the 12th thoracic and 3rd lumbar vertebra .
- 3) are been shaped , reddish brown in color .
- 4) it is size of 11.25cm long , 5-7.5cm width , 3cm thickness .
- 5) each contain a million of **nephrons** .
- 6) each have internal structures , as :-
 - a) Cortex .
 - b) Medulla .
 - c) Minor calyces .
 - d) Major calyces .
 - f) Renal pelvis .

See after

Kidney



(a) Frontal section of left kidney, anterior view

Urinary system

Kidney Function :-

- 1) Keep the body in **homeostasis** :- by controlling composition and volume of the fluid by removing and restring the selected amount of water and solutes .
- 2) Help to control blood pH (by acid – base balancing) .
- 3) Help to control electrolyte composition of body fluid .
- 4) Help to control blood pressure , by production renin (hormone) that activates the renin – angiotension path way

5 general functions:

1, Maintain water balance by excretion and reabsorption of water.

2, Excretion of waste products:

urea, ammonia, uric acid, creatinin, H⁺, drugs (antibiotics) and toxins...

3, Maintain blood pH balance by

a, excreting waste products: organic acids and organic bases

b, excreting H⁺ directly

c, reabsorb HCO₃⁻ to blood

4. Regulating electrolyte metabolism by

controlling excretion and reabsorption of ions.

Ca⁺⁺, Na⁺ and K⁺ ions can be excreted or

reabsorbed by the tubular system of the kidneys.

5, Synthesis of hormones: erythropoitin and renin, ...

Urethral sphincters •

Internal: involuntary sphincter of smooth muscle –

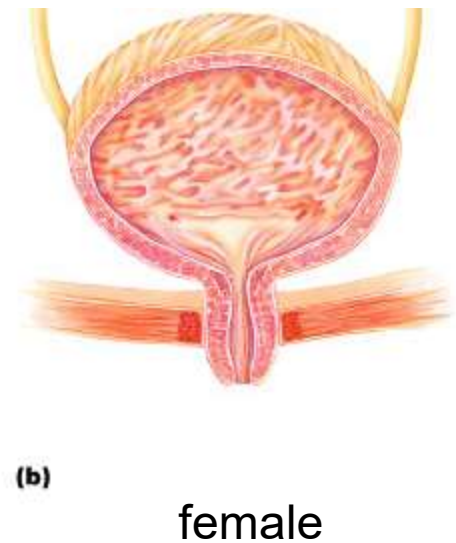
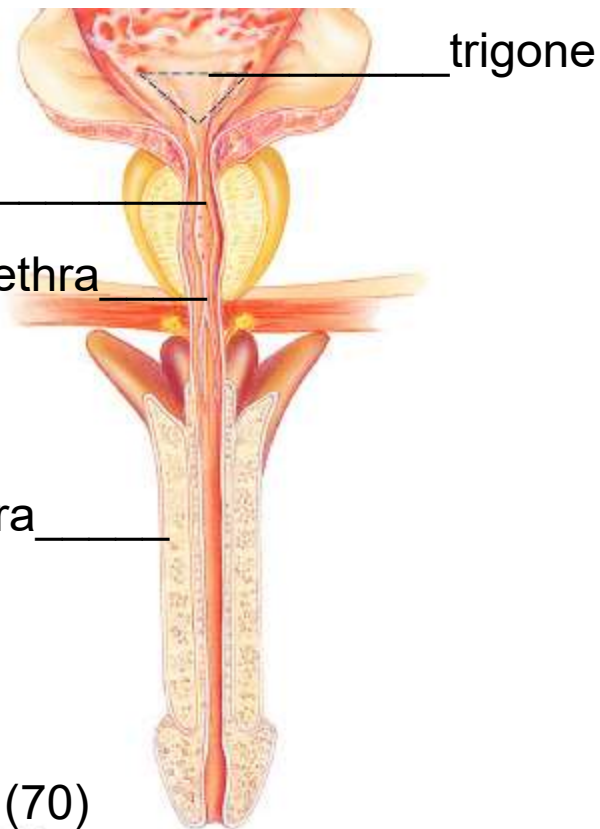
External: skeletal muscle inhibits urination voluntarily –
until proper time (levator ani muscle also helps
voluntary constriction)

**Males: urethra has
three regions (see
right)**

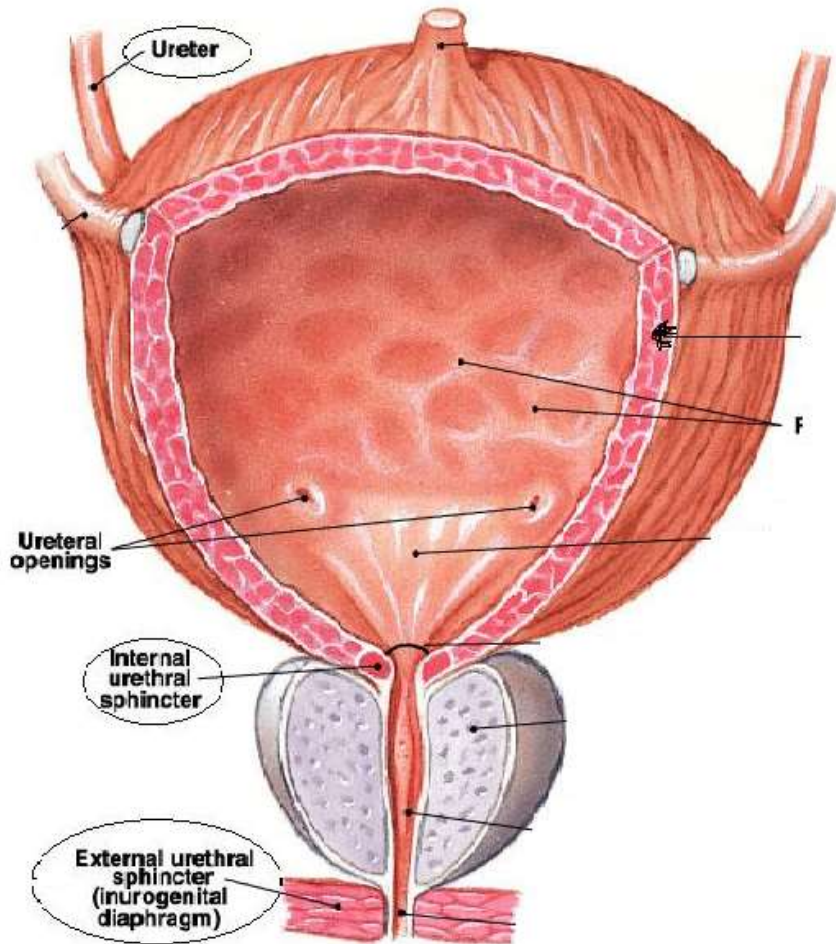
1. Prostatic urethra _____

2. Membranous urethra _____

3. Spongy or penile urethra _____



Bladder- structure of



- 3 layers
 - Outer layer
 - Loose connective tissue
 - Middle layer
 - Smooth muscle and elastic fibres
 - Inner layer
 - Lined with transitional epithelium

(71) •

16th week

Urinary system

Nephron

The urine

Urine formation

Urinary system

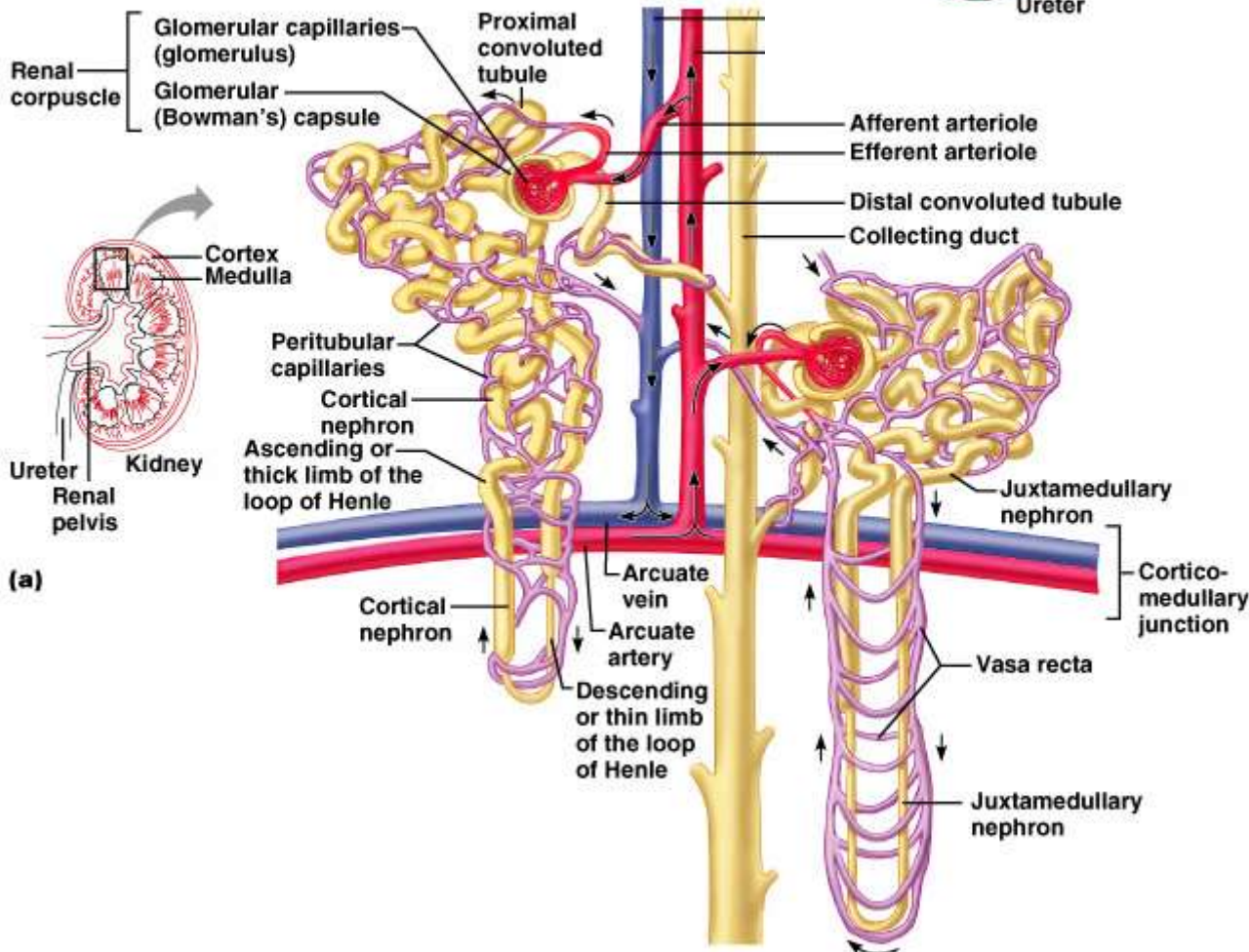
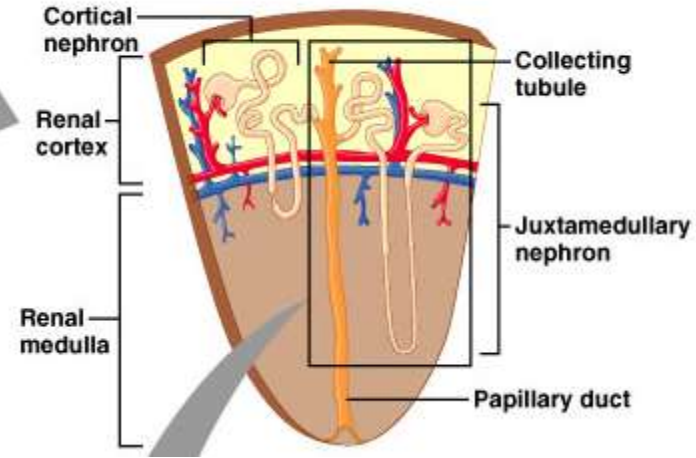
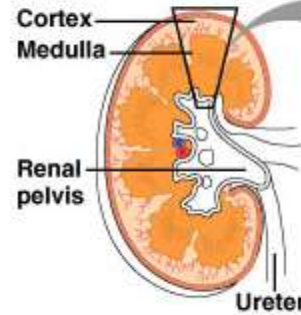
Nephron :-

Is a **coiled tube** with a bulb of one end . This bulb called Bowman's capsule , which surrounds a cluster of capillaries called glomerulus . A small blood vessel called the **afferent arteriole** supplies the glomerulus with blood ; another small vessel called the **efferent arteriole** carries blood from the glomerulus .

Nephron consist of :-

- 1) Bowman's capsule
- 2) Glomerulus
- 3) Proximal convoluted tubule
- 4) Loop of Henel's
- 5) Distal convoluted tubule
- 6) Collecting tubule

Classes of nephrons



Cortical nephrons •

85% of all –
nephrons

Almost entirely –
within cortex

Juxtamedullary
nephrons •

Renal corpuscles –
near cortex-
medulla junction

(73) •

Nephron

Urineriferous tubule (anatomical unit for forming urine)
Nephron

Renal corpuscle (in cortex)
Glomerulus (tuft of capillaries)
Glomerular (Bowman's) capsule

Tubular section
Proximal convoluted tubule
Loop of Henle
Distal convoluted tubule

Collecting duct

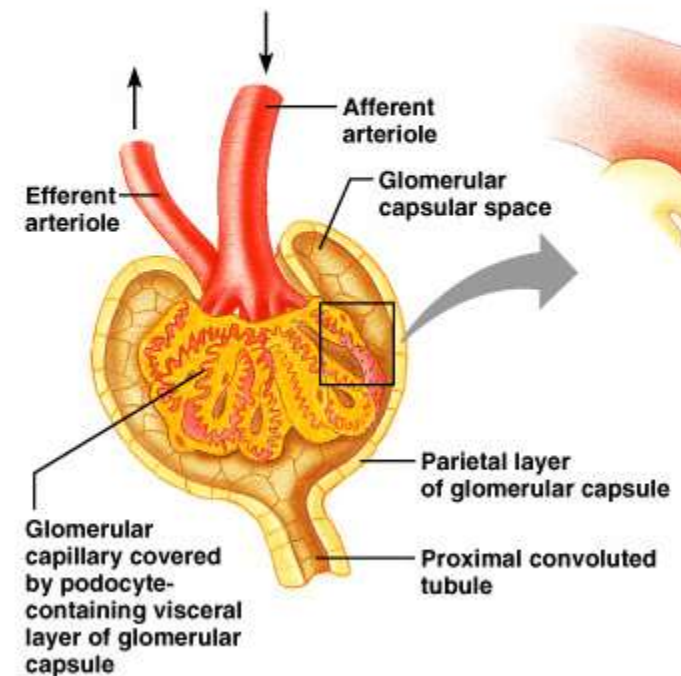
- Renal corpuscle
- Tubular section

Renal corpuscle: only in cortex •

Tuft of capillaries called —
glomerulus

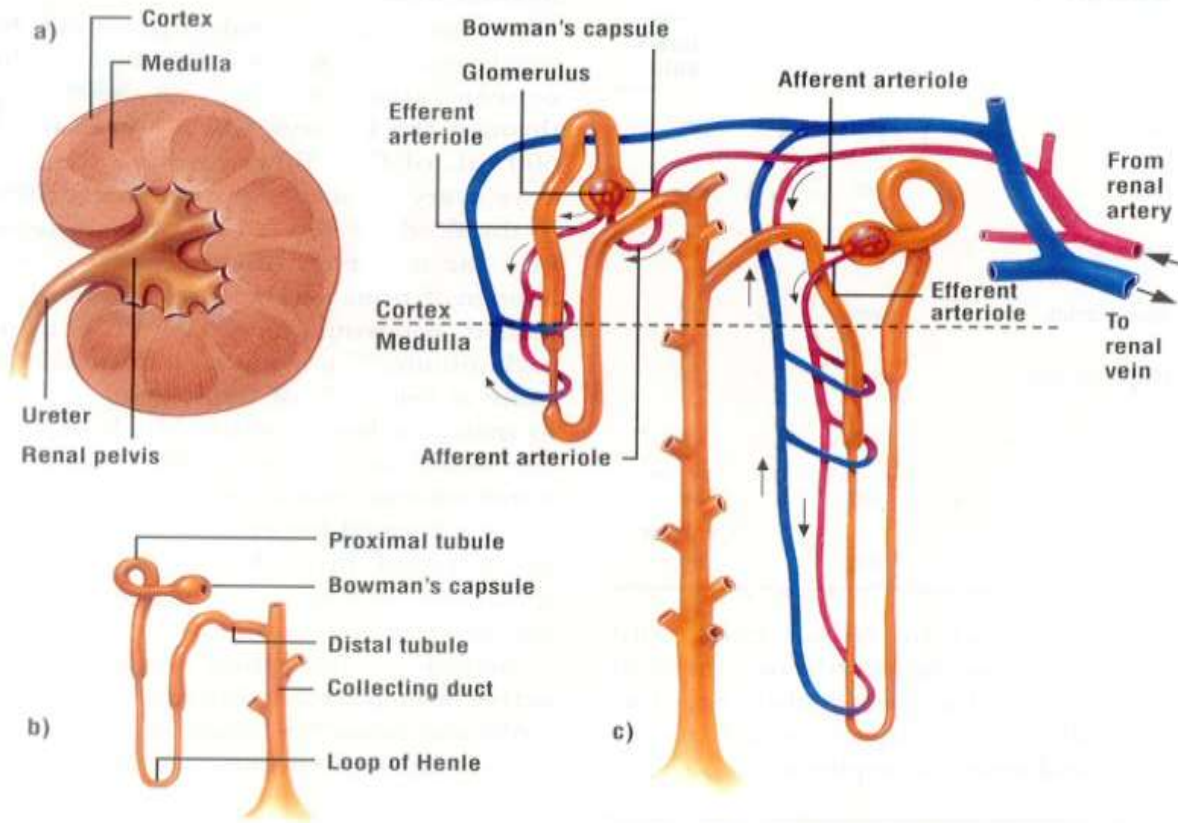
Surrounded by cup-shaped, —
hollow **glomerular (Bowman's) capsule**

(74) —



Nephron consist of :-

- 1) Bowman's capsule
- 2) Glomerulus
- 3) Proximal convoluted tubule
- 4) Loop of Henle's
- 5) Distal convoluted tubule
- 6) Collecting tubule



The collecting ducts

- The most important role is to conserve body fluids
- When the body must conserve water, the posterior pituitary gland secretes ADH (antidiuretic hormone)
- ADH increases the permeability of the collecting tubules and distal tubules to water so more is reabsorbed
- This decreases the total volume of urine
- Alcohol inhibits the release of ADH, so less water is reabsorbed producing copious amounts of dilute urine (can cause dehydration) Why do hypertension patients need low Na diet?
- High NaCl can increase blood osmolarity
- which increases ADH release

Urinary system

The urine:-

Is yellowish liquid, about **95% water and 5% dissolved solids and gases**. The amount of these dissolved substances is indicated by "specific gravity" .

Urine contain:-

- 1- surplus water
- 2- surplus electrolytes
- 3- surplus acid and alkalis
- 4- metabolic waste product

including :-

A- urea:- is a nitrogen portion of amino acids convert to ammonia then to urea.

B- uric acid:- is a nitrogen of nucleic acid and purines appear as a form of uric acid.

C- creatinine:- a rise from muscles creatine, when appear in urine this resembles that the body lost the nitrogen.

5- metabolic content of some drugs.

6- chorionic gonadotrophin:- is a hormone appear in case of a pregnant female, which is used in examination of pregnancy.

7- abnormal constituents:- if present in urine indicate there is a disturbance,

including :-

A- glucose:- the reason is the diabetes mellitus.

B- keton bodies :- the reason is the ketosis.

C- plasma albumin:- the reason is kidney disease.

D- red cells:- the reason is kidney disease.

E galactose:- the reason is galactosaemia.

8- yellow pigment:- including bile compounds.

Urinary system

Urine formation :- Urine is formed by three processes :-

- 1) Glomerular filtration
- 2) Tubular reabsorption
- 3) Tubular secretion



Urinary system

1- Glomerular Filtration :-The wall of glomerular capillaries acts as a sieve which permit the free flow of water and soluble material through them , and are impermeable to blood cells and large protein molecules .
But the filtration is entirely non – selective what ever the body's requirements

Large molecules (not filtered)

Small molecule (filtered)

Blood cells , Plasma protein

Water , inorganic salt , glucose , amino acid ,

Waste products (urea , uric acid creatinine)

2- Tubular Secretion :- Another substances are added to the glomerular filtrate by active transport from blood vessels that surround the tubules , Like surplus acid and alkalis , also pencyllin lost from the body by this mechanism .

3- Tubular Reabsorption :- Capillary network surrounding the renal tubules allows re-absorption of a substances according to the body's needs from the filtrate like glucose . The re-absorption is selective

Hormonal control- •

Parathyroid hormone, calcitonin »

Anti diuretic hormone »

Aldosterone »

Urinary system

Water Filtration :-

- 1- all nephrons filter 120ml of water per minute (this is called glomerular filtration rate– GFR)
- 2- of the 120ml , about 119ml of water are reabsorbed , and only 1ml . passes to the collecting tubes .
- 3- 1ml / min . reach to 1500ml / day secrete to outside .
- 4- glomerular filtration of water about 170 liter / day , and the total body water 45 liter ,
this mean that body water are filtered about 4 time / day .

Water Re-absorption :- Of filter water :

- 1- as said , about 119ml water / minute reabsorbed , this equal about 168.5 liter / day .
- 2- 7/ 8 of NaCl is reabsorbed by active transport in the proximal tubules . so 7/ 8 of water is reabsorbed passively with sodium (Na) .
- 3- 1/8 of water reabsorbed in distal tubules by the affect of the anti diuretic hormone (ADH).

Uric acid is a metabolic product of protein and RNA metabolism. •

Over production or poor excretion of uric acid in the kidneys can cause elevated blood levels of uric acid. •

Some uric acid can precipitate in joints to cause pain and joint deformation – gout. •

Creatinine is a waste product from skeletal muscle metabolism. •

To evaluate a person's kidney clearance function, blood and urine levels of creatinin levels can be tested and compared. •

If the blood creatinin is higher than normal and urine creatinin is low, the person's kidney function would be bad. •

The excretion of H⁺ in urine helps to maintain blood pH balance and also can acidify urine. •

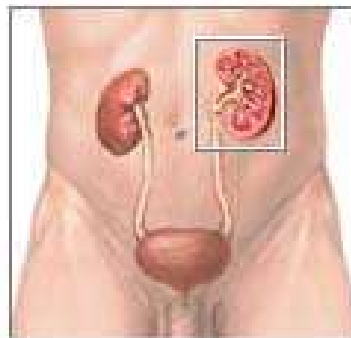
The acidic urine can eliminate bacteria growth in the urinary system. •

Infection can be eliminated by frequent urination. •

Urinary system

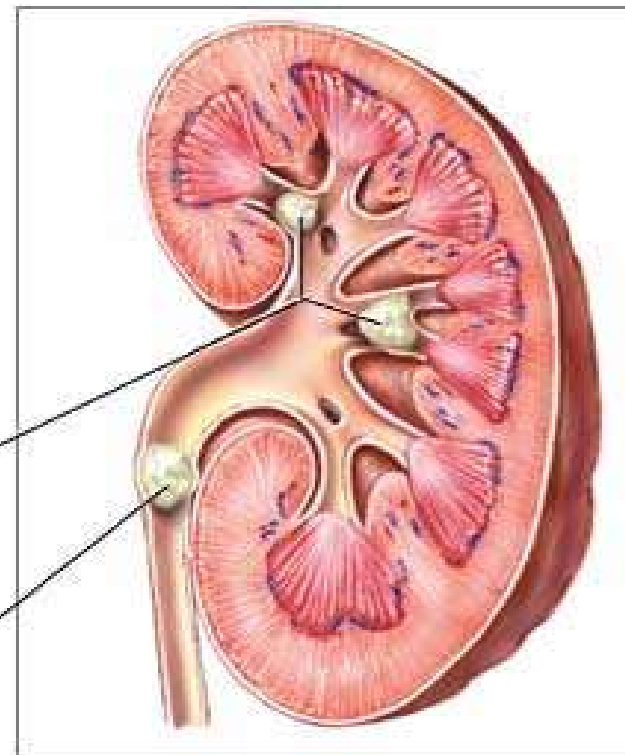
Nephrolithiasis

Occurs when urine becomes too concentrated and substances crystallize. Symptoms arise when stones begin to move down ureter causing intense pain.



Kidney stones in the minor and major calyces of the kidney

Kidney stone in the ureter



ADAM.

Urination:- (Micturition)

Is the process of expelling urine from the bladder, and take place as follows:-

- 1- as bladder fills, a stretch receptors send impulses to a center in the lower part of spinal cord .**
- 2- from spinal cord, a motor impulses are send out to the bladder musculature and the bladder is emptied. (This is a spinal reflex)**
- 3- at the time of urination can be voluntary controlled unless the bladder becomes too full.**

Normally, messages are also relayed to the brain. The descending impulse can either

- inhibit or stimulate the spinal reflex depending on the situation.

Urinary bladder can hold 600 ml of urine. The stretch receptors will be stimulated when there is more than 150 ml of fluid.

-

Micturition center of brain: pons

In infant this emptying is automatic (a reflex action).

17th week

Digestive System

structure

Salivary glands

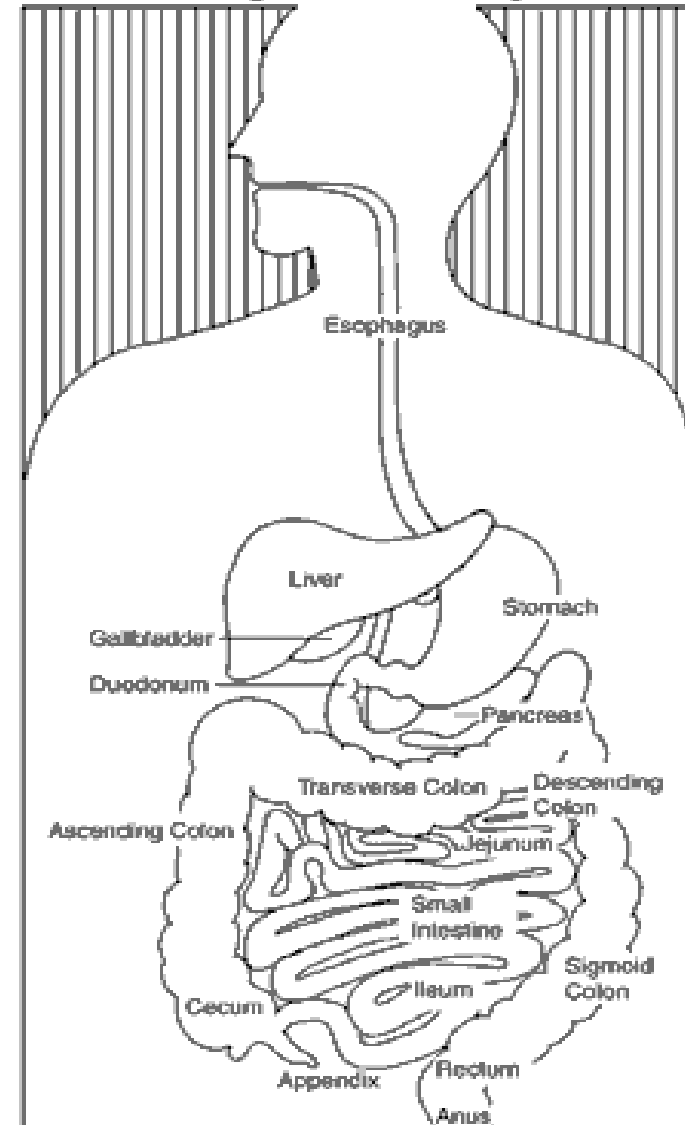
Pancreas

Digestive system

Consist of :-

- 1-Mouth
- 2-Pharynx
- 3-Oesophagus
- 4-Stomach
- 5-Small intestine
- 6-Large intestine
- 7-Anal canal and anus
- 8-Accessory glands (liver, pancreas, salivary glands)

The Digestive System



Function of Dig. System :-

1-Ingestion:-*mastication* and *swallowing*.

2-Digestion:-*perform by enzyme*, which convert the complicated food stuffs into simple forms which can be absorbed.

3-Absorption:-*mainly take place in small intestine*.

4-Egestion:-*excretion* of food residue (*as faeces*) to outside

Digestive system

Mouth:- consist of :

(lips, teeth, tongue, salivary glands)

Function of mouth:-

a- **Mastication:-** break down of the food by the help of teeth.

b- **Swallowing:-** push the food by the help of tongue.

c- **Help in speech:-** by the help of tongue and lips.

d- **Protect the teeth.**

e- **Moistening of the food:-** by the help of the salivary gland.

Teeth:-

Temporary 20,

Permanent 32(incisors 8, canines 4, premolars 8, molars 12).

Digestive system

Salivary glands

are pairs:- 1-parotid glands

2-submandibular glands

3-sublingual glands

Secrete saliva:- which colorless, alkaline fluid, consist of water 90%, mucin, Ca salts, amylase(enzyme).

Function of saliva:-

1-digestion of carbohydrate by amylase

(starch -----salivary amylase-----→maltose)

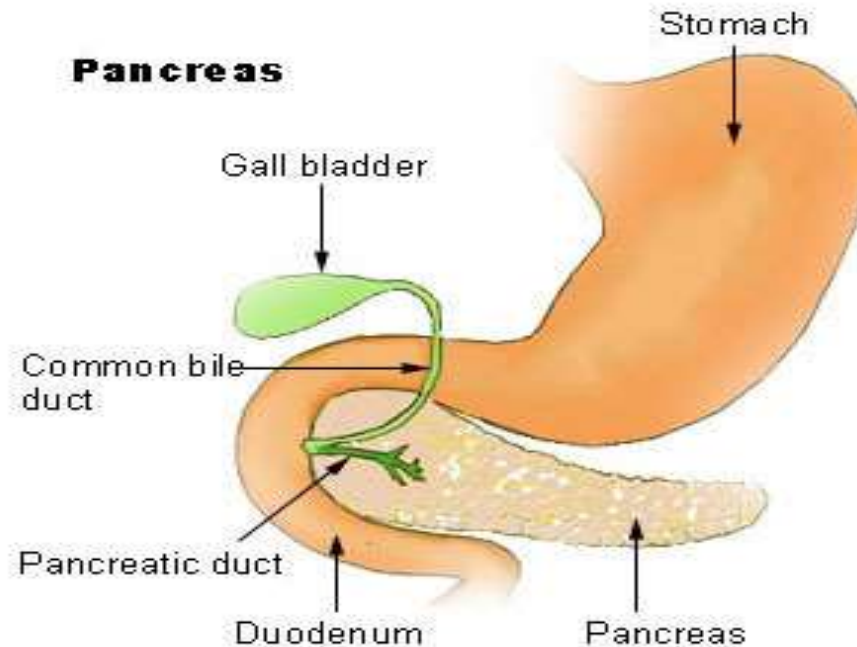
2-moistening of the food by mucin.

3-deposition of Ca salts on the teeth.

4-solvent of some foods and drugs.

Pancreas:-

Big gland, lies in the left posterior abdominal wall, connect with duodenum by pancreatic duct :



Function :- Secret two different secretion :-

Internal secretion :- are two hormones, secrete directly into blood so that the pancreas consider as endocrine gland

1-Insulin :- enable the tissue to use sugar (glucose).
normal level of glucose 80 – 120 mg/100ml

blood. Deficiency of insulin cause diabetes mellitus.

2-Glucagon :- has opposite action of insulin, so it increase glucose level in blood by convert liver glycogen into glucose.

External secretion (pancreatic juice) :- amount 3/4 liter/day.

Pancreatic juice :

1-NaHCO₃

2-Enzymes: **1-pancreatic amylase** – convert starch into maltose.

2-pancreatic lipase – convert fat into fatty acid +glycerin.

3-trypsin – convert proteins into amino acid.

18th week

19th week

Stage of Digestion

Digestive system

Pharynx:- it is a common passage of digestive and respiratory systems.
It is expanded tube of 13cm long.

esophagus:-

a-It is a muscular tube of 25cm long.

b-It push the bolus toward the stomach by peristalsis movement.

Stomach:-

a-Includes 4 region :-

1-cardia 2-fundus 3-body 4-pyloric

b-**Secrete** gastric juice:-

which is **acidic**, colorless fluid, about two liter

per a day consist of:-

1- water 90%

3-HCL

2- mucin

4-enzyme (pepsin)

Digestive system

Function of the stomach:-

- 1- act as **reservoir** of food.
- 2 -**break down** the food stuff into chyme.
- 3- **secretion** of **intrinsic factor**:-aid in absorption of Vit.B12.
- 4- slight **absorption** of:-water, glucose, alcohol and some drugs.
- 5 -**secretes gastric juice**, which the main component are:-
 - A-HCL:- it's function**
 - a-neutralize the alkaline saliva.
 - b-acts as antimicrobial agent.
 - c-aids the action of pepsin in protein digestion.
 - B-Pepsin:- Digest protein**
Protein ---pepsin--→peptones.
 - C-Mucin:- protect the mucous membrane of the stomach from action of pepsin and HCL (prevent gastric ulcer).**

Factors affecting secretion of gastric juice:-

1- Neural factor:- stimulate the vagus nerve, lead to increase gastric juice.

2- Hormonal factor:- secretion of gastrin hormone lead to increase gastric juice

Digestive system

Small intestine:-

It is a tube of about 6 meters in length, which consist of :-

- a- Duodenum (12 inch long), open in it a bile duct and pancreatic duct.
- b- Jejunum.
- c- Ileum.

Function of S. Intes. :-

a-Secretion of intestinal juice (about 3 liters/day), composed of :-

1- water

2- mucin:- protect the mucous membrane from the action of chyme and prevent the duodenal ulcer.

3- enzyme:- like erepsin , which digest protein.

b-Digestion of food stuffs by enzyme

1-polypeptide (protein) ----**erepsin**----→ amino acids.

2-complete the digestion of carbohydrates :-

Maltose ----**maltase**-----→ glucose.

Lactose ----**lactase**-----→ glucose + galactose.

Sucarose ----**sucarase**-----→ glucose + fructose.

c-Absorption

absorbed of the simples digested food using **villi** :-

a-into the blood (like glucose and amino acids).

b-into the lymph (like fatty acids and glycerin)

d-Pushing the remaining food to large intestine by **peristalsis movement**

Digestive system

Large intestine:-

Is 1.5 meter long. consist of :-

- 1-caecum and appendix.
- 2-ascendiny colon.
- 3-transuerse colon.
- 4-descending colon.
- 5-sigmoid colon.
- 6-rectum.
- 7-anal canal and anus

Function :-

1-slight absorption of :-

a-water

b-some salts

c-drugs

2-secretes mucin:-for lubrication of the faces for smooth passage.

3-egestion (excretion) of waste product to outside by defecation.

4-excretion of calcium, iron and drugs residue.

5-bacteria live in large intestine help in :-

a-providing the body with Vit. B. and Vit. K.

b-decomposition of cellulose.

Digestive system

liver:-

Largest brown organ, weight 1275 – 1550 g.

Function :-

- 1 - **secrete** bile
- 2 - **storage** of :- A- glycogen.
B- vit. B12 and iron.
- 3 - **formation** of urea
- 4 - **production** of :- A- heat.
B- heparin.
C- RBC in embryo.
D- clotting factors (prothrombin + fibrinogen).
E- plasma protein (albumin + globulin).
- 5 - **destruction** of :- A-toxic substance and some drugs.
B- fat.
C- old RBC.

Bile:-

Produce by liver, store in gall bladder, is alkaline secretion, it's color is yellow to green.

Bile consist of :-

- 1- water
- 2- mucin
- 3- cholesterol
- 4- bile pigments (bilirubin and biliverdin)
- 5- bile salts :-help in ***digestion of fats***

Quiz 7 : circle the correct answer

- a – The kidney help to control blood pressure , by production renin that activates the renin – angiotension path way.
- b – Nephron is an uncoiled tube with a bulbs at two end .
- c – Chorionic gonadotrophin , is a hormone appear in the urine in case there is a kidney disease
- d – Main function of the mouth is the mastication , moistening , and swallowing the food .
- e – Saliva is alkaline fluid that help in protein digestion .
- f – In the body the heat is gained by metabolic processes and external factors (like hot food) only .
- g – Each gram of protein was eating gives 4 calories

check your answers in key answer page 169

20th week

Body temperature

definition

Heat gain and heat loss

Regulation

Factors affecting

Body temperature

Definition

Is a result of balanced heat that produced by many chemical activities and heat loss from the body. Normal body temperature = 36.2 – 37.8

To keep the body temperature constant, there must be a balance between the **heat gain** and **heat loss**.

The heat is gained by :-

- 1- Metabolic processes.
- 2- Muscular activity :- a-voluntary (as exercise)
b-involuntary (as shivering)
- 3- External factors (as hot food)

The heat is loss by :-

- 1- Skin :- a- sweating
b- radiating
c- convection
d- conduction
- 2- Respiratory system.
- 3- Urinary system.
- 4- Defecation

Body temperature

Regulation :-

In brain, the **hypothalamus** (is a **heat regulation center**) regulation the **diameter of the blood vessels** (**increase or decrease**)of the skin, so **effect the blood flow**, and so affects on body temperature. All this mechanism mediated by the sympathetic nerve, as following :-

In cold :- sympathetic nerve cause vasoconstriction, which cause low flow of skin blood which lead to a low heat loss.

In hot :- sympathetic nerve cause vasodilatation, which cause high flow of skin blood and high heat loss.

Factors affecting the body temperature :-

1- **Age** :-child have more temperature than old person, due to increase metabolism.

2- **Food intake.**

3- **Muscular activity** :- a- in exercise increase the body temperature.
b- in sleep decrease the body temperature.

4- **Thyroid hormone** :- a- hyper thyroidism – increase body temperature.
b- hypo thyroidism – decrease body temperature.

5- **Durinal normal change** of body temperature at 4a.m – lowest normal limit body temperature.

6- after **ovulation** (in female) increase body temp.

Body temperature measured by medical thermometer from

- 1- Mouth.
- 2- Axilla.
- 3- Rectum.

Hypothermia :- it means a fall of body temperature below the normal limit (less than 35 c).

Hyperthermia (hyperpyrexia) :-is a rise of the body temperature above the normal limit.

21th week

Metabolism

Definition

Type

Vitamins

Metabolism

Is a complex processes where by the food is converted into heat and energy and used for growth and the repair of the tissues these processes are :-

1-Catabolism

2-Anabolism

1-Catabolism :- is a break down of food for yield energy in a series of reaction called cellular respiration.

Cellular respiration are :-

1- An aerobic respiration – occur without oxygen, occur in cytoplasm to yield little energy.

2- Aerobic respiration (oxidation) – reaction used O₂ occur in mitochondria and yield much energy (in form of ATP)

2-Anabolism :- is the conversion of the food into a substance (amino acid) needed for cellular activities , growth and repair of the tissues.

10 of 20 amino acid needed for build proteins can be manufactured by metabolic reaction, other 10 amino acids can not be made by the body, and therefore must be taken with the diet.

Metabolism

Calories :-

Is the amount of heat required to raise the temperature of one liter of water by one degree centigrade.

Basal metabolic rate (BMR) :-

Is the calories required under basal condition (a complete physical rest 12 - 18 hours after a meal) for all normal body activities.

Calories number in diet :-

| | |
|--------------|-----------------------|
| Carbohydrate | 1 gm gives 4 calories |
| Protein | 1 gm gives 4 calories |
| Fat | 1 gm gives 9 calories |

Thus atypical diet might consist of :-for a day

| | |
|--------------|------------------------|
| Carbohydrate | 375 gm = 1500 calories |
| Protein | 100 gm = 400 calories |
| Fat | 100 gm = 900 calories |
| (105) | |

Metabolism

Vitamins

Organic substances needed in very small quantity, used in cell metabolism, are part of the enzymes or other essential substance.

| Vit. | Solubility | Source | deficiency caused |
|-----------------------------------|----------------------|---|---|
| Vit. A | Fat soluble | milk, butter cream, carrot green vegetable | 1-change in epithelium. 2-lead to night blind ness 3-degenerate of lacrimal glands, salivary glands, sweat glands |
| Vit. B1 (Thiamine) | Water soluble | creals, yeast. | 1-lead to beriberi (disorder of carbohydrate metabolism) 2-disorder of sensory and motor nerves 3-oedema and cardiac failure |
| Vit. B2 (Riboflavin) | Water soluble | flour, milk, meat | 1-inflamation of tongue 2-dermatitis 3-neuritis leads to defective |
| Nicotinic acid | Water soluble | liver, yeast, kidney | 1-give rise to pellagra (dermatitis) 2-diarrhoea 3-brain is affected leading to dementia |

| | | | |
|---|----------------------|---|--|
| <p>B12 (cyanocobalamin) and folic acid Grouped together because they are essential for red cell formation.</p> | <p>Water soluble</p> | <p>by the help of intrinsic factor in the stomach</p> | <p>Is due to a failure of intestinal absorption 1-lead to macrocytic anemia 2-lead to Vit.B12 neuropathy, this take the form of sub acute combined degeneration of the spinal cord (sense and motor nerve</p> |
| <p>Vit. C. is probably involved in the formation of collagen and the cement substances between cells.</p> | <p>Water soluble</p> | <p>lemon, orange, grapefruit, black currants, leafy green, vegetable, straw berries</p> | <p>1-lead to scurvy (gum bleeding and joint) 2-lead to slow wound healing</p> |
| <p>Vit.D.)</p> | <p>Fat soluble</p> | <p>butter, cream egg yolk , fish liver oil, made by sun light</p> | <p>1-lead to rickets.(a bone disease of child hood</p> |
| <p>Vit.K.</p> | <p>Water soluble</p> | <p>green vegetable but, synthesized by bacteria in colon</p> | <p>1-blood clotting is retarded</p> |

22th week

23th week

Nervous System (NS)

Structure

Function

Central nervous system

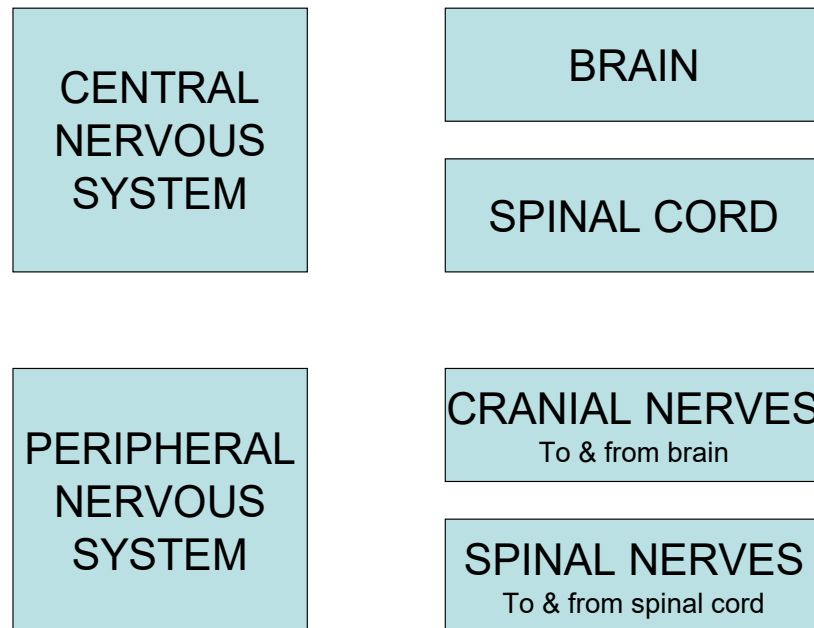
Peripheral nervous system

Nervous System (NS)

Nervous System (NS):

The nervous system **regulates** most body systems using direct connections called nerves. It **enables you to sense and respond to stimuli**

Anatomical divisions



Nervous System (NS)

The basic function are:

- 1 - Receive sensory input internal or external
- 2 - Integrate the input
- 3 - Responding to internal and external stimuli

Is divided into :-

1) Central nervous system:

a- Brain

b- spinal cord

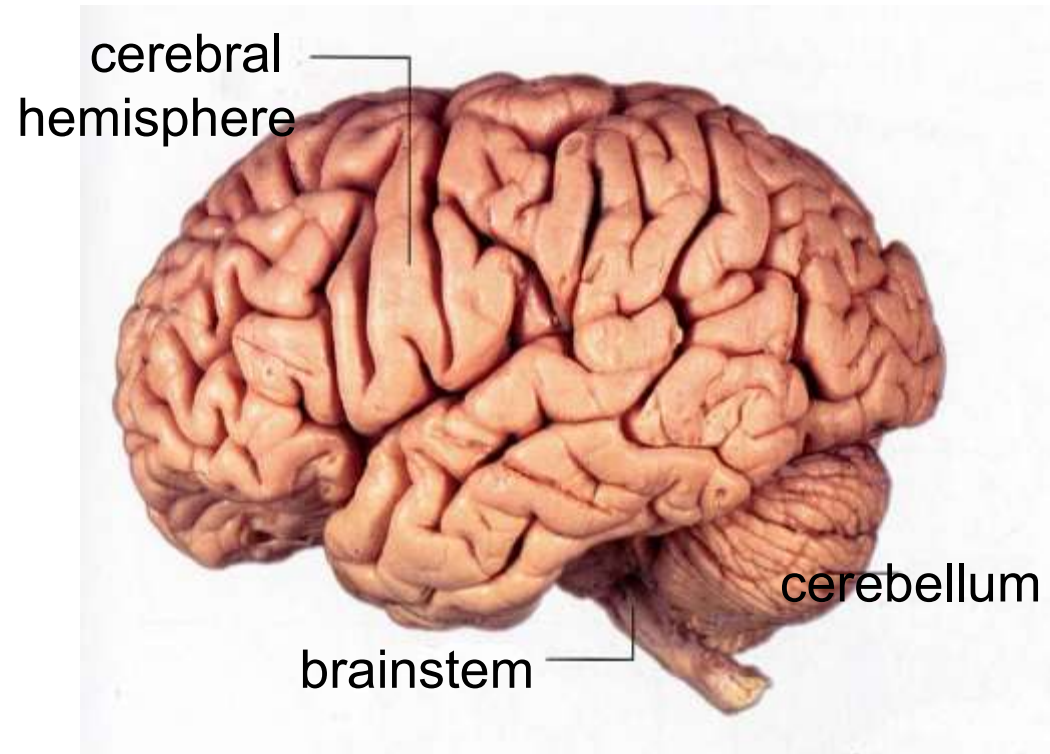
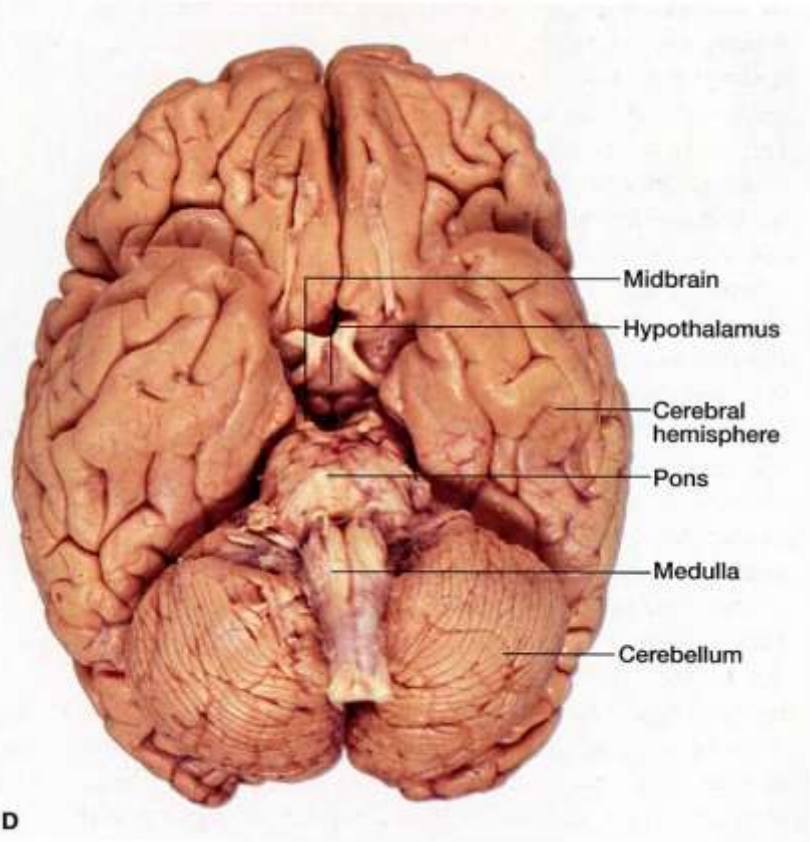
The Brain does almost all processing 3 areas :

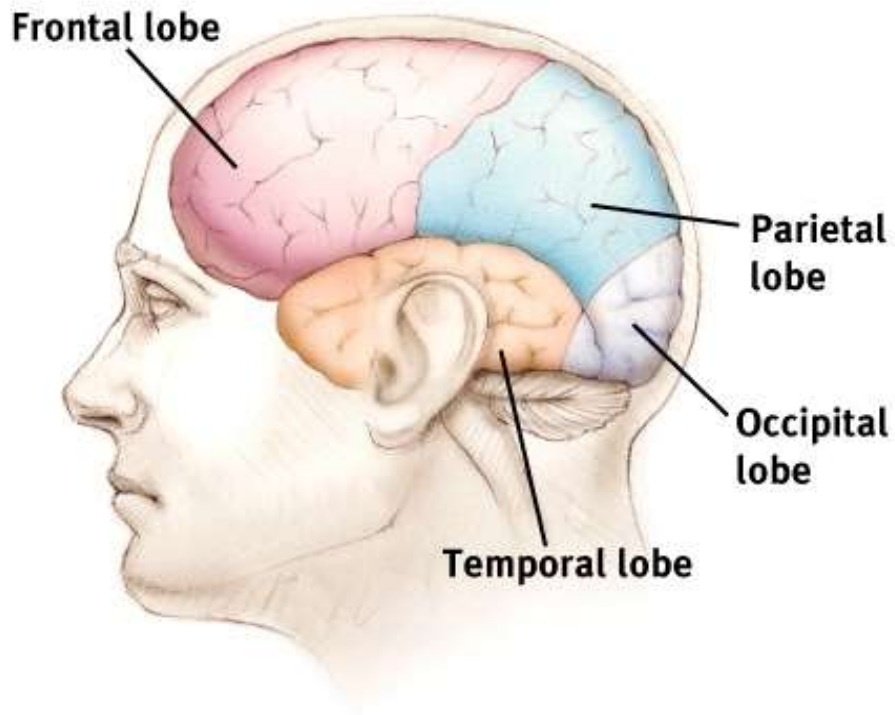
The Brainstem - controls many basic functions

The Lymbic System - control motivation and very important in memory

The Cerebral Cortex - complex processing of information .

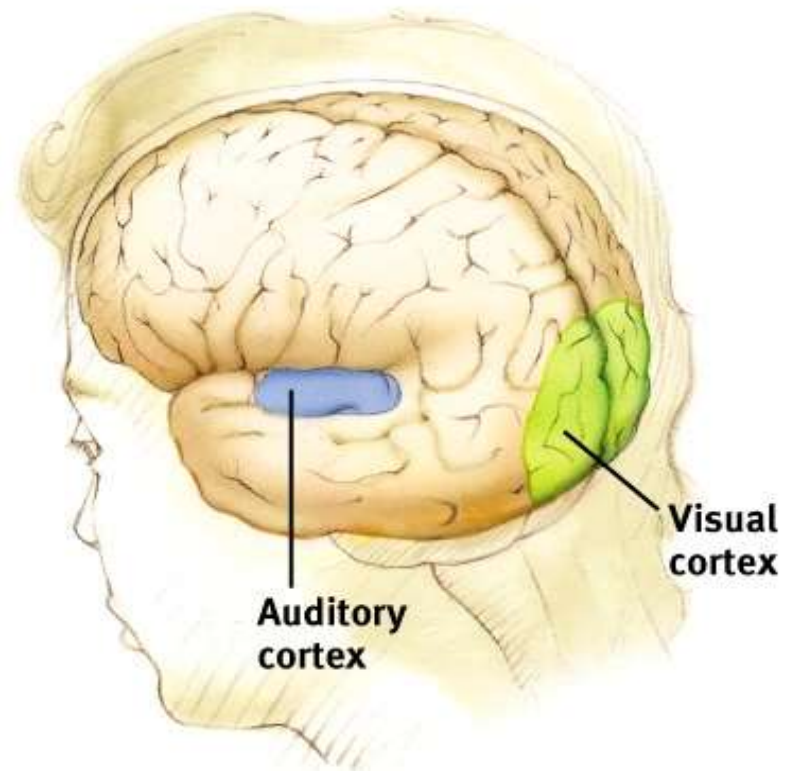
The Brain





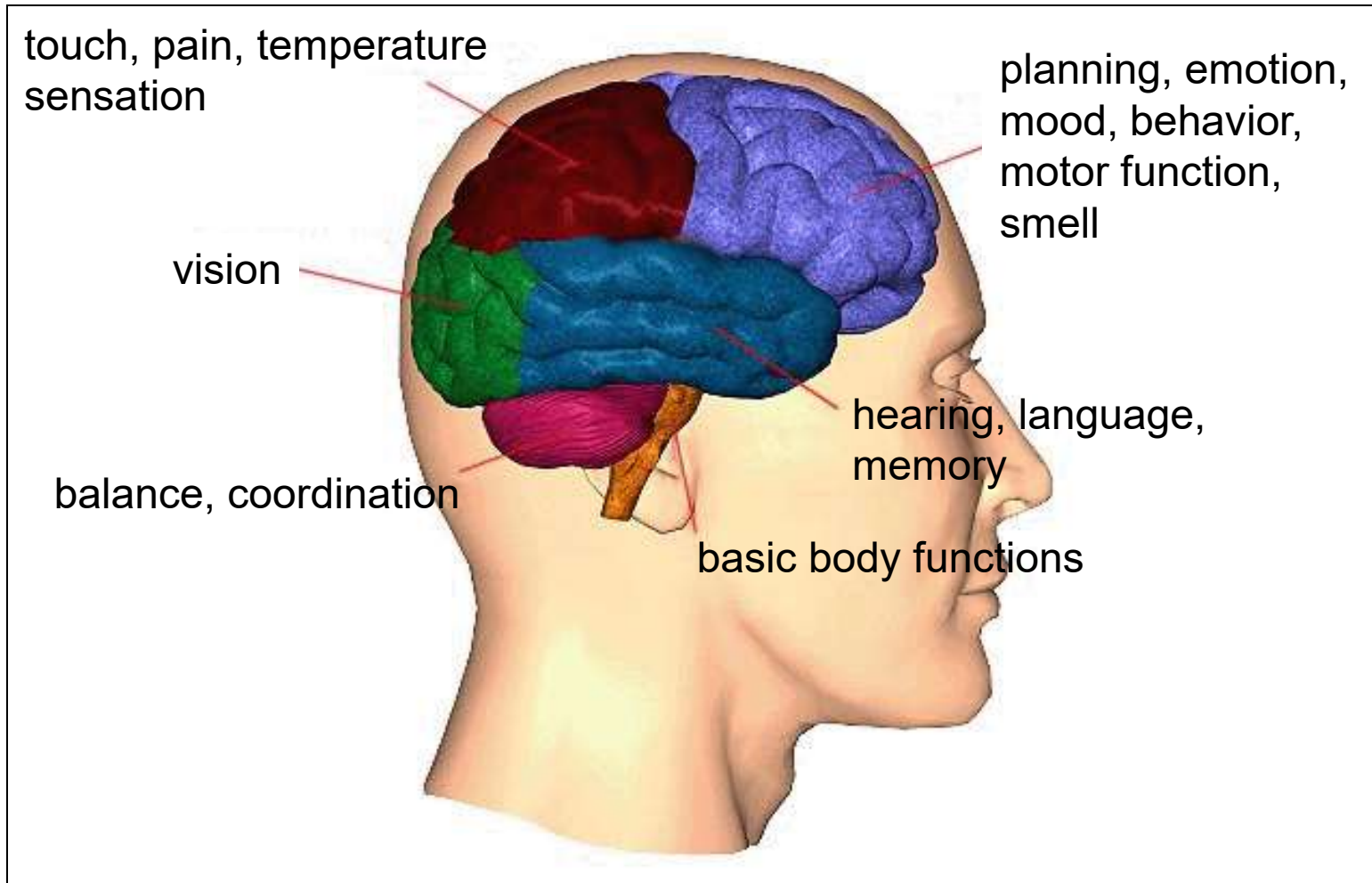
**The Cerebral Cortex -
Basic Divisions**

**Cerebral Cortex Functional Divisions -
Hearing and Vision**



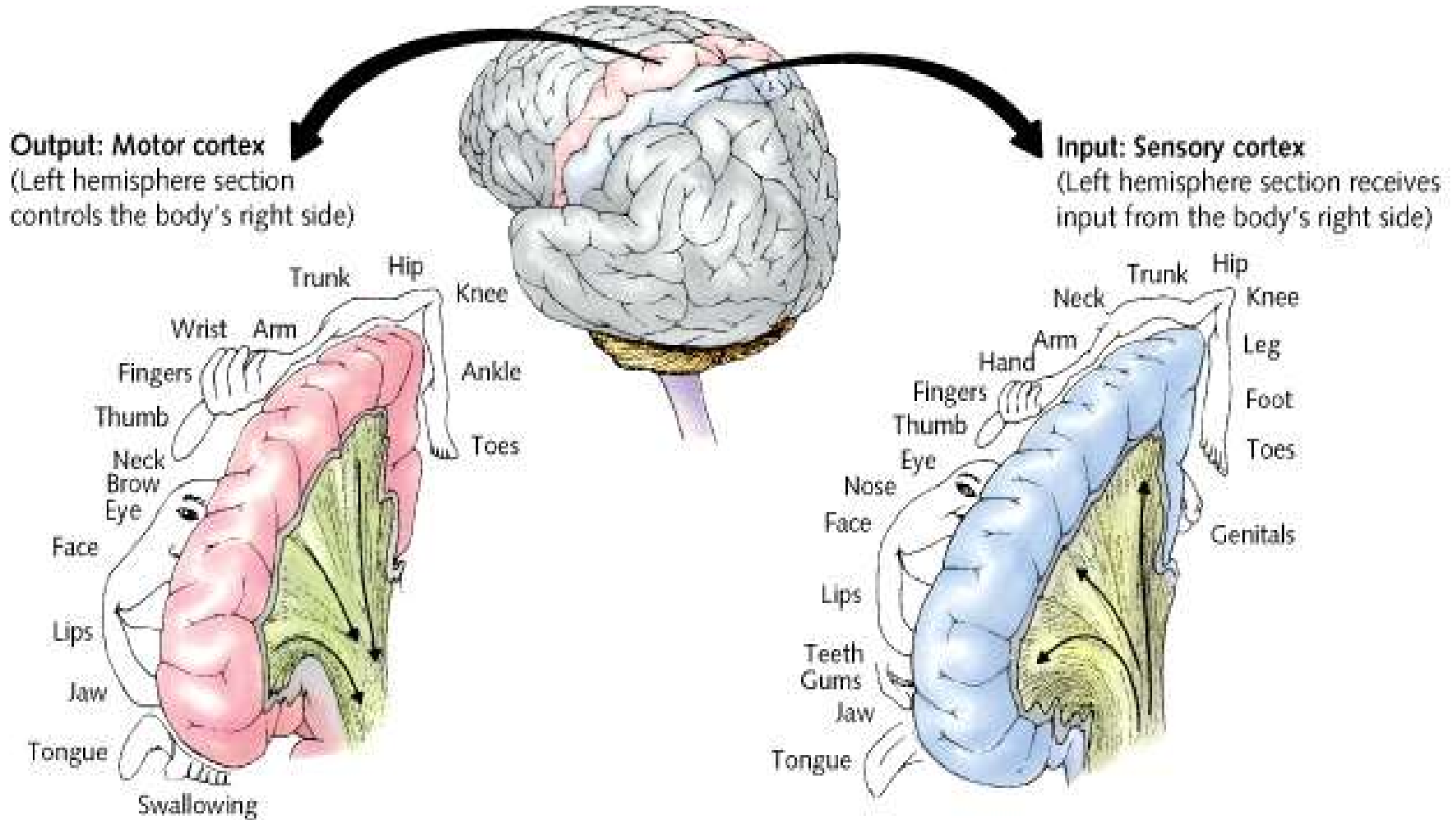
Brain

Lobes



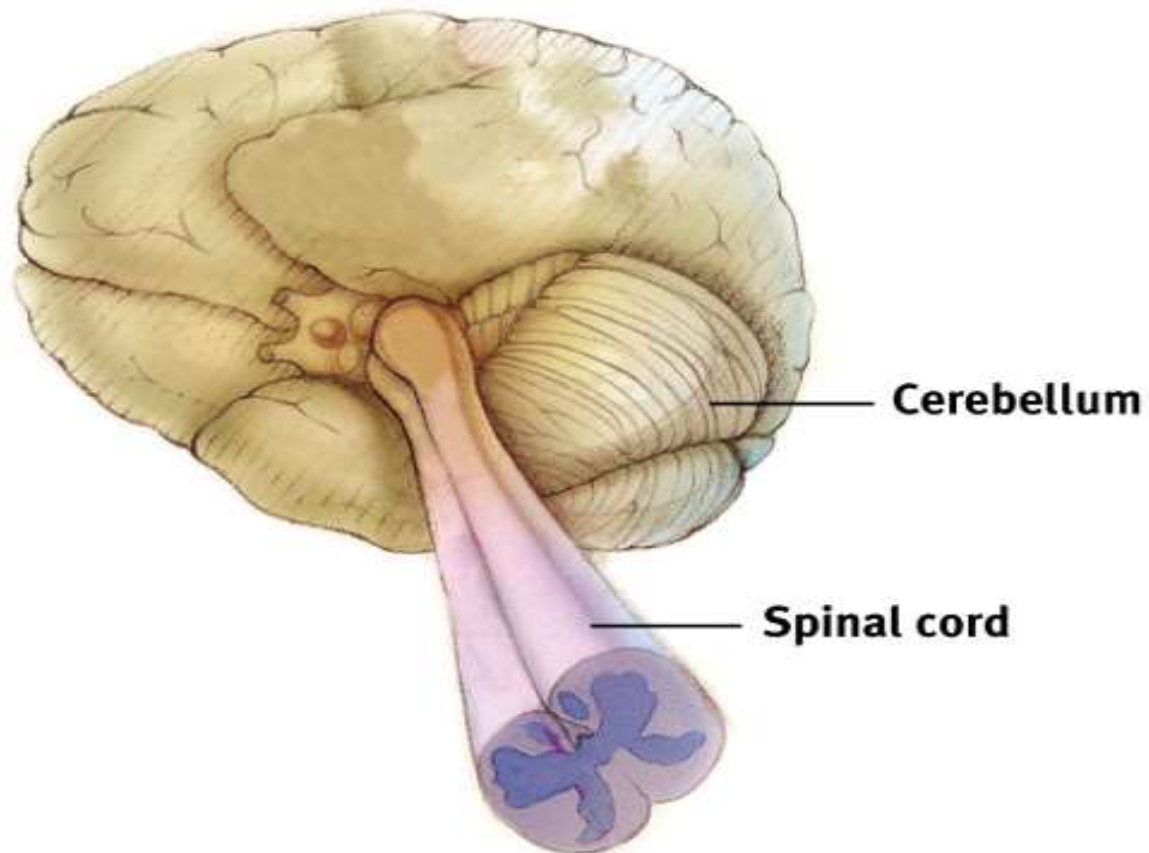
Brain

Cerebral Cortex Functional Divisions - Movement and Sense of Touch

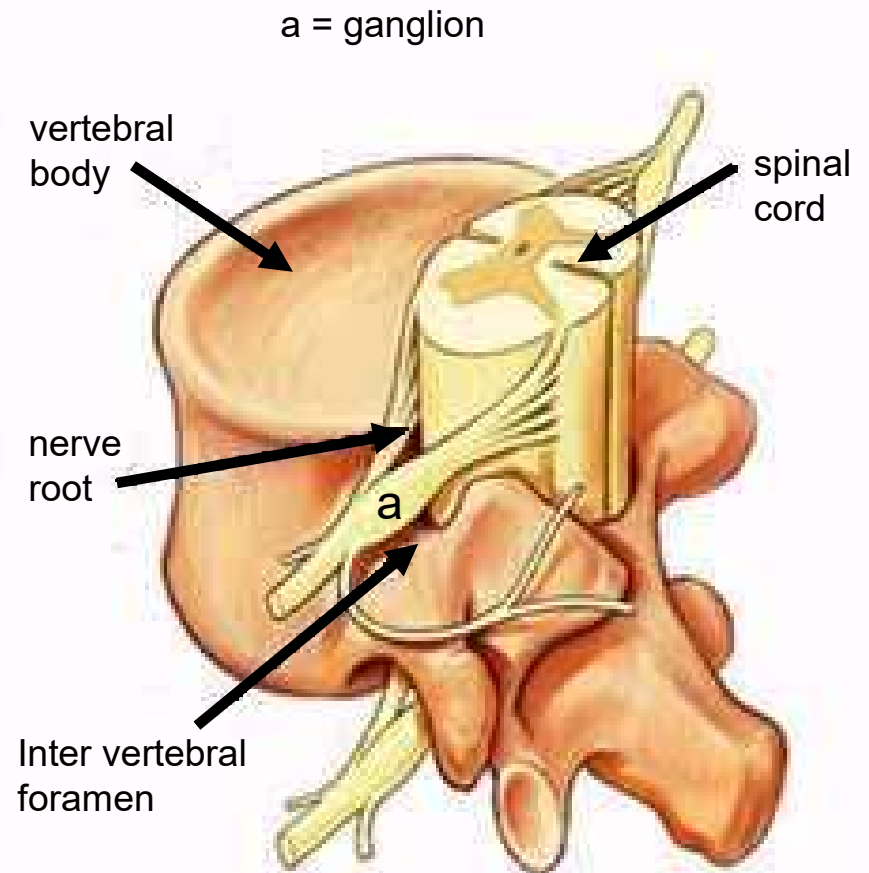
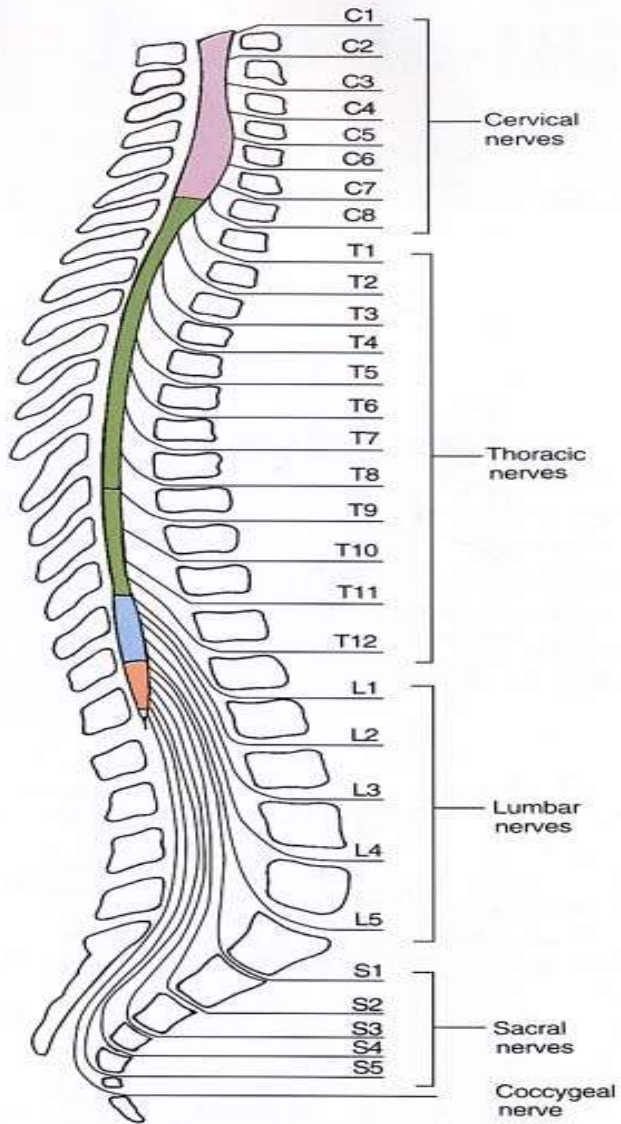


spinal cord

Spinal Cord carries information and controls some reflexes

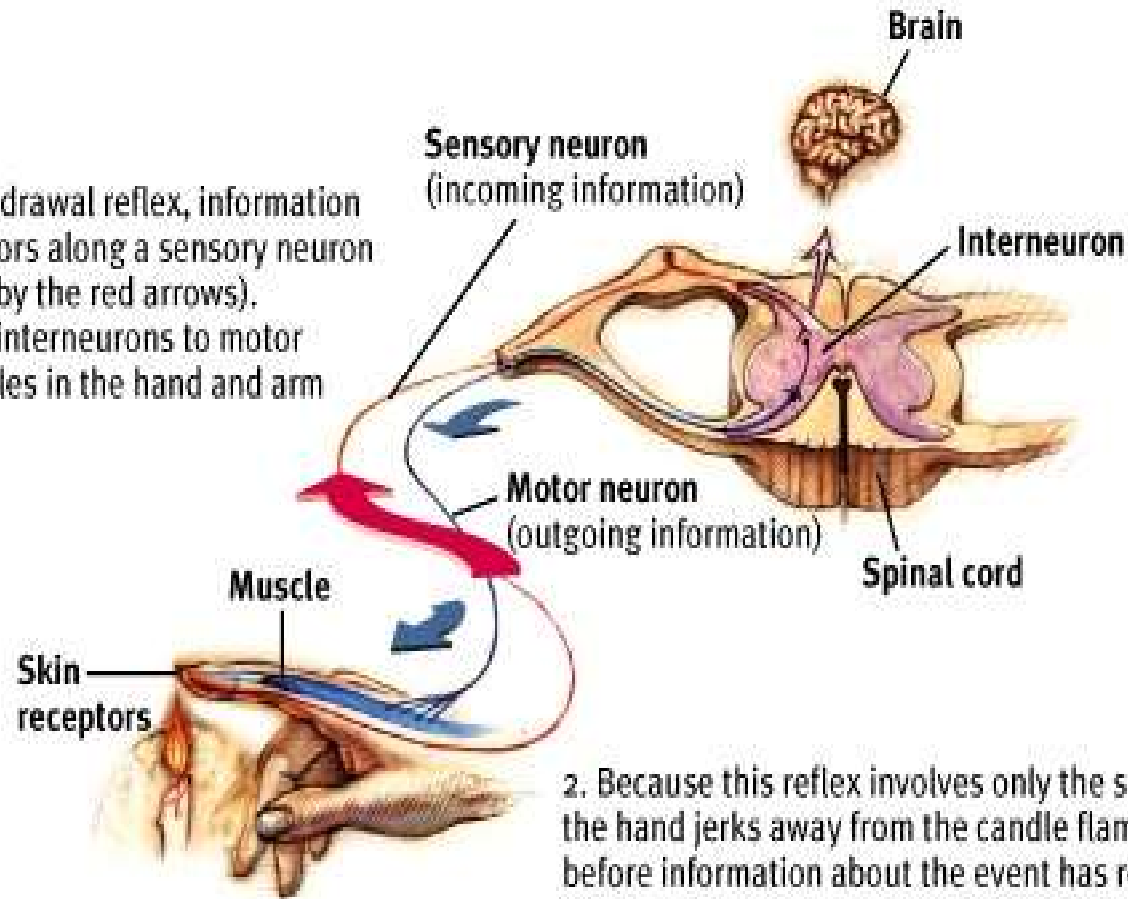


Spinal Cord



How the Spinal Cord Controls Reflexes

1. In this simple hand-withdrawal reflex, information is carried from skin receptors along a sensory neuron to the spinal cord (shown by the red arrows). From here it is passed via interneurons to motor neurons that lead to muscles in the hand and arm (blue arrows).



2. Because this reflex involves only the spinal cord, the hand jerks away from the candle flame even before information about the event has reached the brain, causing the experience of pain.

2) Peripheral nervous system : Is divided into the **somatic** and **autonomic** components.

The somatic controls voluntary movements (i.e. skeletal muscles)

The autonomic controls involuntary responses (i.e. stress, rest)

PNS :- include of nerves, which are:

A- cranial nerves -----12 pairs

B- spinal nerves -----31 pairs

1-cervical nerves --- ----8 pairs

2-thoracic nerves ----- 12 pairs

3- lumbar nerves ----- 5 pairs

4-sacral nerves ----- 5 pairs

5-coccygeal nerves --- 1 pairs

3) Autonomic nervous system :-

The autonomic nervous system is activated mainly by centers located in the **spinal cord, brain stem and hypothalamus**

Composed of sympathetic and parasympathetic nervous system

The sympathetic and parasympathetic nerve endings secrete one of the two synaptic **transmitter** substances, **acetylcholine** or **norepinephrine**. Those fibers that secrete acetylcholine are said to be cholinergic. Those that secrete norepinephrine are said to be adrenergic.

The parasympathetic and sympathetic nerves **act reciprocally** to each other.

As example :- sympathetic stimulation contracts meridional fibers of the iris and, therefore, dilates the pupil, while parasympathetic stimulation contracts the circular muscle of the iris to constrict the pupil.

Nervous System

3) Autonomic nervous system :-

composed neural ganglia and nerves fiber

consist of :-

A-Sympathetic nervous system :-

is a nerves originates from thoraco – lumber region of spinal cord, which contain ganglia .The chemo-transmitter used here is " **Nor adrenaline** " .

Function :- (Adrenergic) = (Acetylcholine)

1-Dilate – pupil, respiratory passage

2-Increase – heart rate, cardiac output, sweating

3-Decrease – secretion of saliva - gastric and pancreatic juice, blood pressure , intestinal movement

4-Erection hairs of body and head

5- "Fight or Flight"

B-Parasympathetic nervous system :-

is consist of some cranial nerves and some spinal sacral nerves, the chemical transmitter used is **Acetylcholine**.

Function :- (Cholinergic) = (Norepinephrine)

1- Constricts – pupil, respiratory passage

2- Decrease – heart rate, cardiac output, blood pressure

3- Increase – intestinal movement, gastric and pancreatic juice secretion, salivary secretion

4-Stimulate the lacrimal glands

5-play important role in urination and defecation

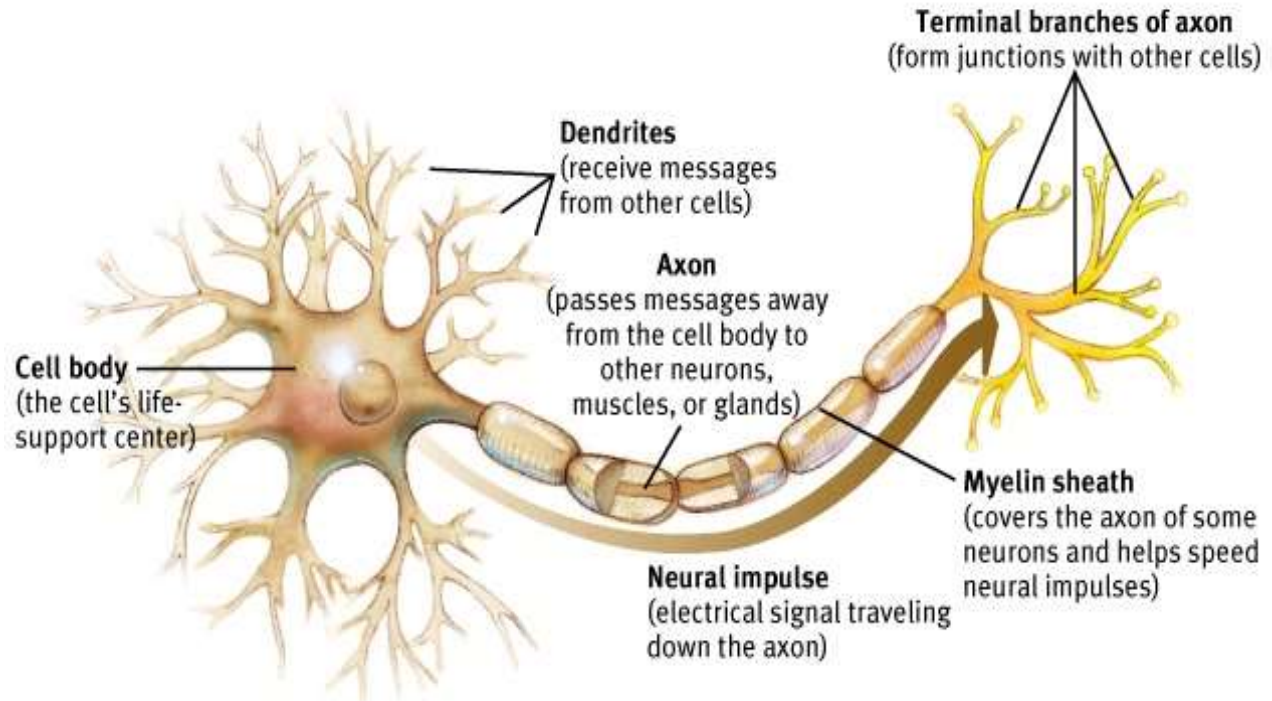
6- "Rest and Digest"

Nervous System

The neuron:- It is a cell (nerve cell), like other cells contain nuclear and cytoplasm and other organelles, but with special name like sarcoplasm and sarcolema.

Three types of neurons (FUNCTIONAL TYPE):-

- 1-Sensory neurons :** Long dendrite, short axon and carry messages from sensory receptors to the central nervous system
- 2-Motor neuron :** Long axon, short dendrite and transmit messages from the central nervous system to the muscles (or to glands)
- 3-Interneuron :** found only in the central nervous system where they connect neuron to neuron



Nervous System

Characters of neuron :-

- 1-Irreversibility – receive sensory stimulus from internal or external environment
- 2-Conductivity

Pre & Postganglionic Neurons

Preganglionic fibers pass between CNS and ganglia

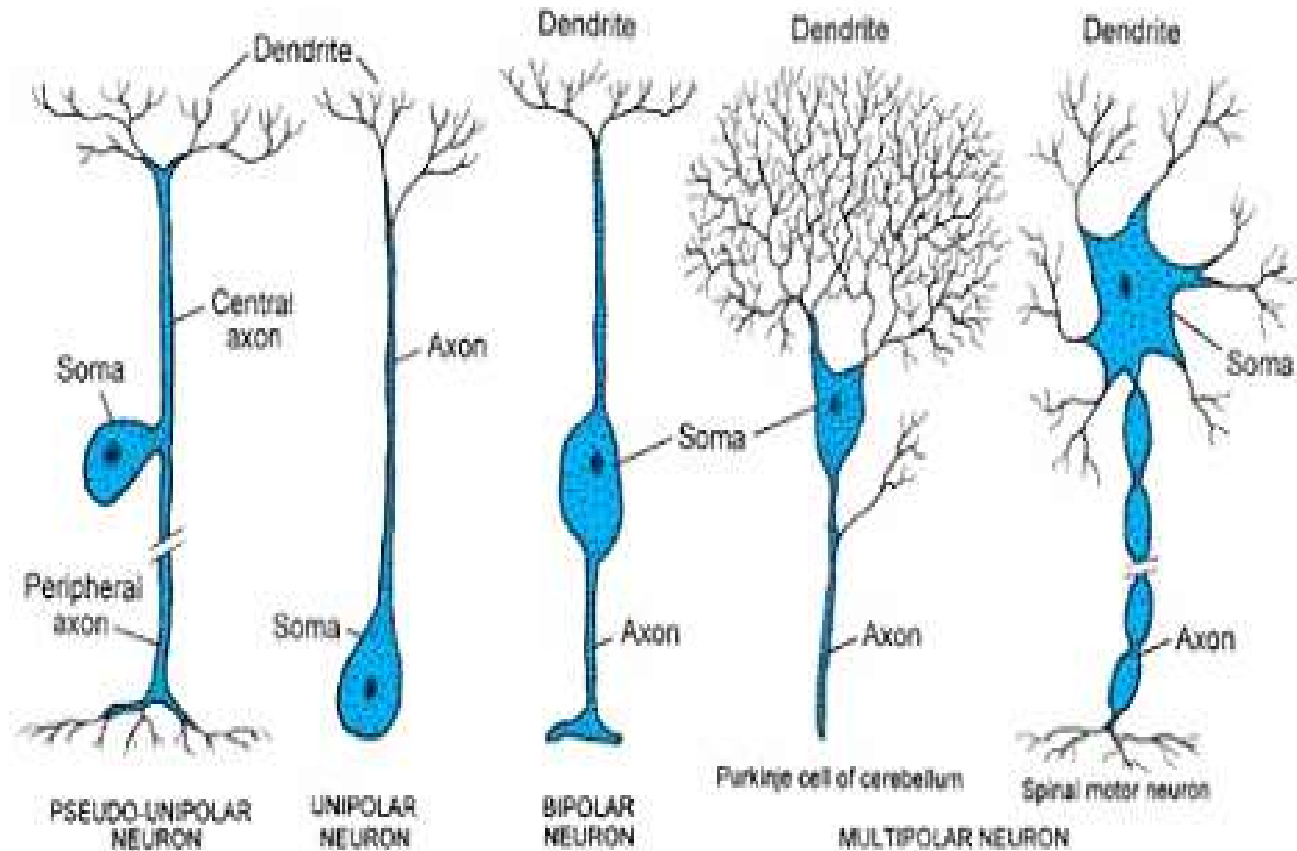
Postganglionic fibers pass between ganglia and effector organ

Type of chemical transmitters :-

- 1-Acetylcholine :- secreted at the end of parasympathetic nerve fibers
- 2-Noradrenaline :- secreted at the end of sympathetic nerve fibers
- 3-Serotonin :- function only inside the central system

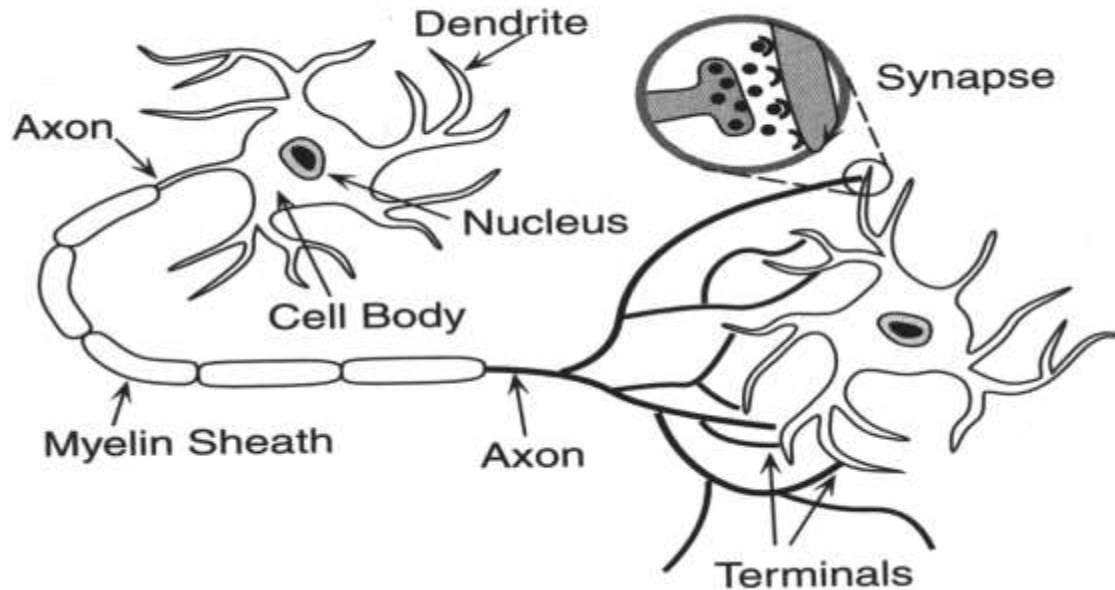
Nervous System

ANATOMICAL TYPE OF NEURONS



Nervous System

Synapse :- Is the space present between the nerve ending of one neuron and the dendrite of other neuron. Through this space the neural stimulus is transmitted by the chemical transmit which is secreted from the vesicles present in the nerve ending .When arrival of the action potential causes some of the vesicles to move to the end of the axon and discharge their content into the synaptic cleft, then bind to receptor molecules on the next cell, prompting transmission of the message along the cell membrane



24th week

Ear and Eye Physiology

structure

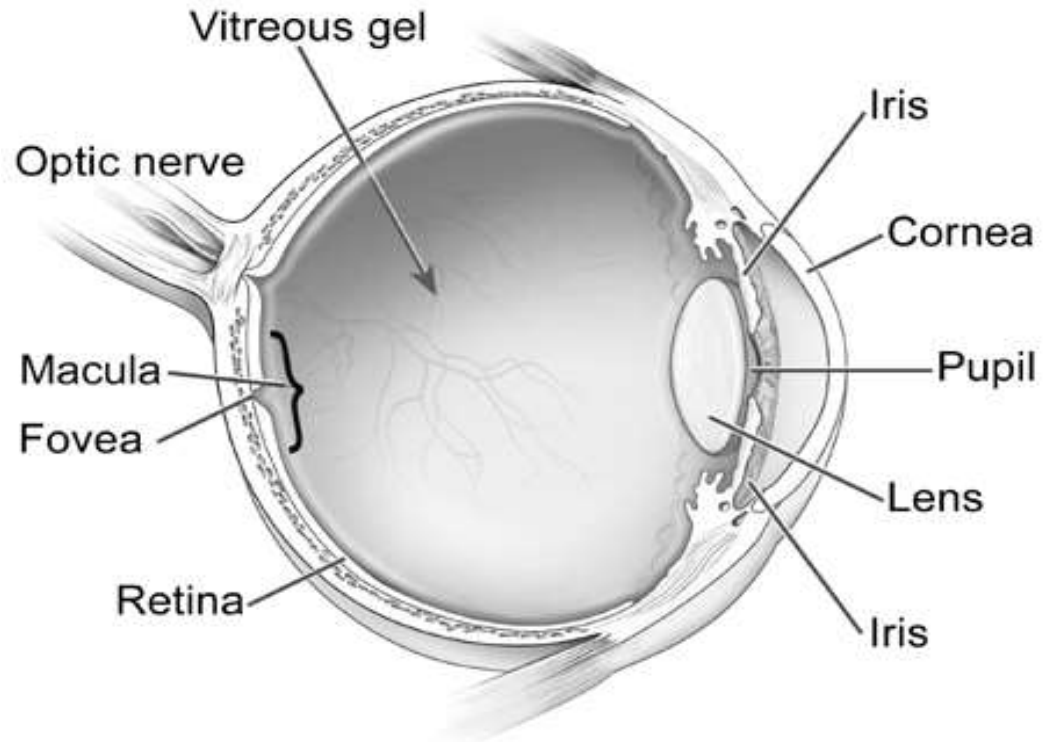
function

The eye

The Eye's Essential Components

The ability to see is dependent on the actions of several structures in and around the eye ball. The essential components of the eye's optical system include:

Retina
Iris
Lens
Pupil
Cornea
Optic Nerve
Vitreous gel
Aqueous humor



(125)

The eye

CORNEA

The cornea is a transparent tissue in the front part of the eye. It is a curved spherical structure that is responsible for focusing the light onto the inside of the eye.

IRIS

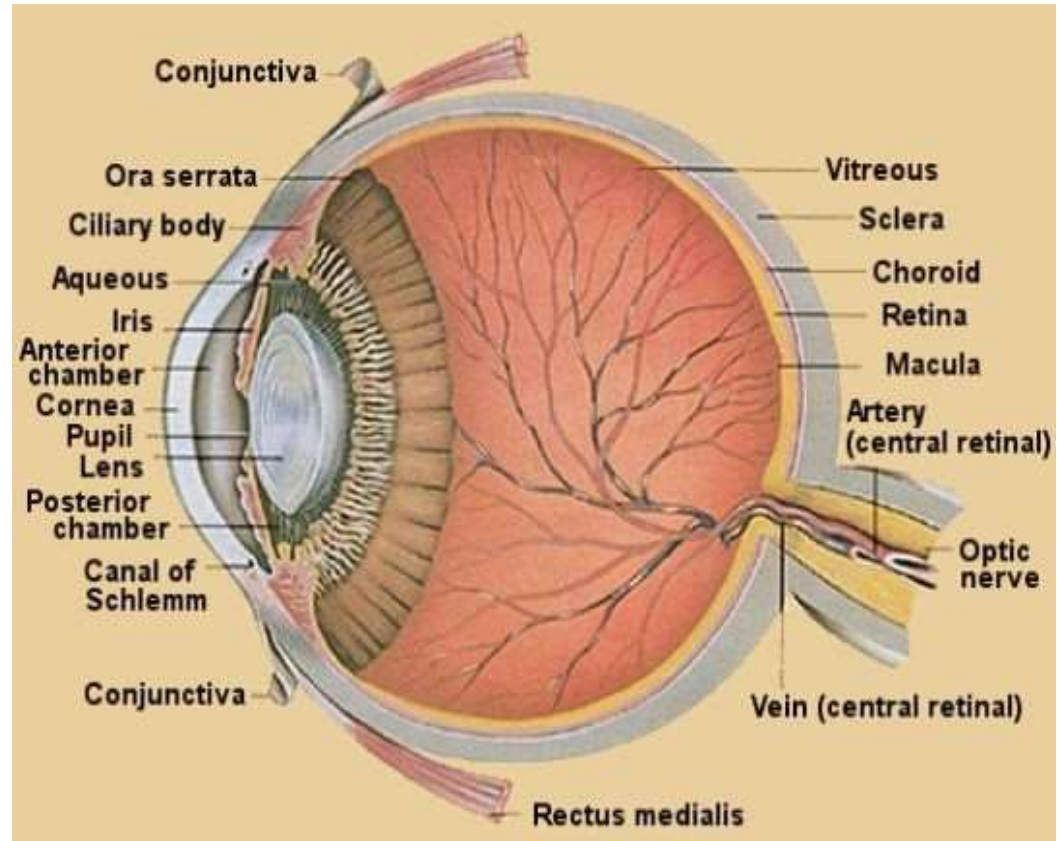
The iris is the colored part of the eye. It opens up in dark rooms and at night to let more light into the eye. Conversely, in bright lights the iris constricts to decrease the amount of light that enters the back of the eye.

PUPIL

The pupil is the black spot in the center of the iris. Actually, the pupil is the name given to the opening in the iris through which light passes.

LENS

This is located just behind the iris. The lens is responsible for helping to fine adjust the focus of the eye. The lens changes shape to allow clear vision both in the distance and for reading.



The eye

VITREOUS HUMOR

The vitreous is a clear jelly-like material which fills the inside of the eyeball. Light passes through the vitreous on its way to being focused onto the retina

RETINA

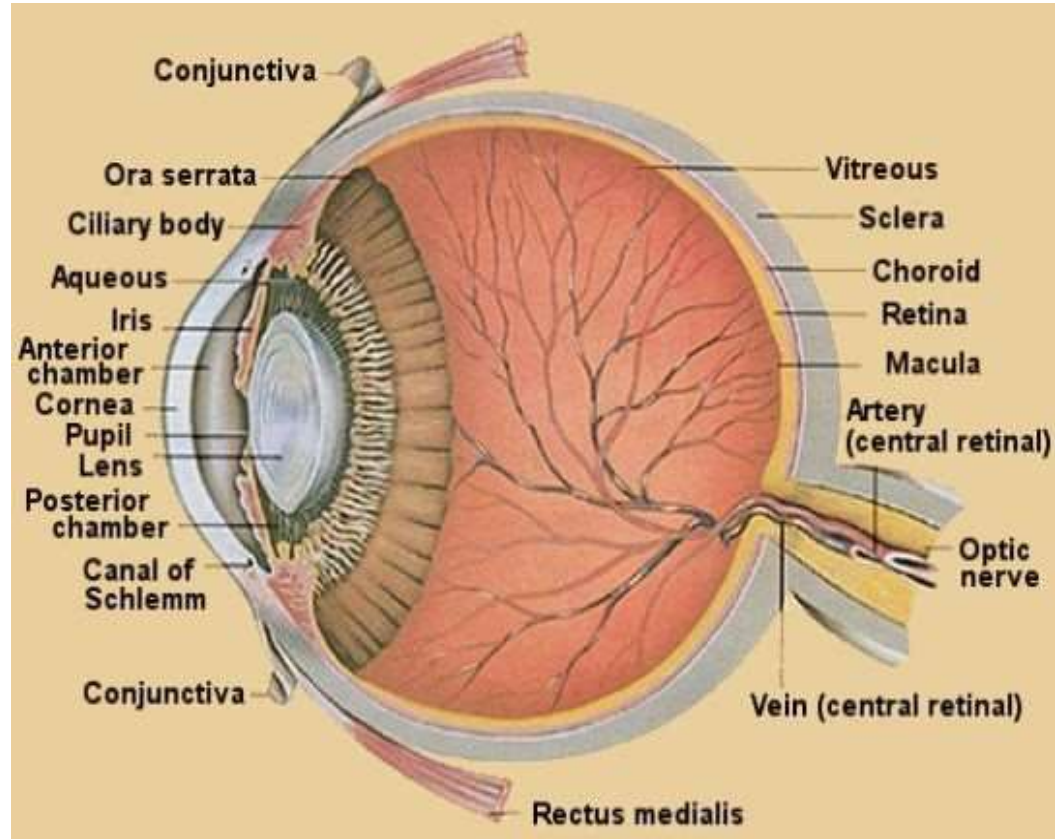
The retina is a thin film of tissue (like film in a camera) where images are brought into focus. The retina lines the inside surface of the eyeball. The retina is connected to the brain where the visual signals are processed. The retina contains millions of specialized photoreceptor cells.

Rods ◊ dim light

Cones ◊ bright light

CILIARY MUSCLES

In a healthy eye, the lens can change its shape (accommodate) to provide clear vision at various distances. If an object is close, the ciliary muscles of the eye contract and the lens becomes rounder. To see a distant object, the same muscles relax and the lens flattens.



The eye

MACULA & FOVEA

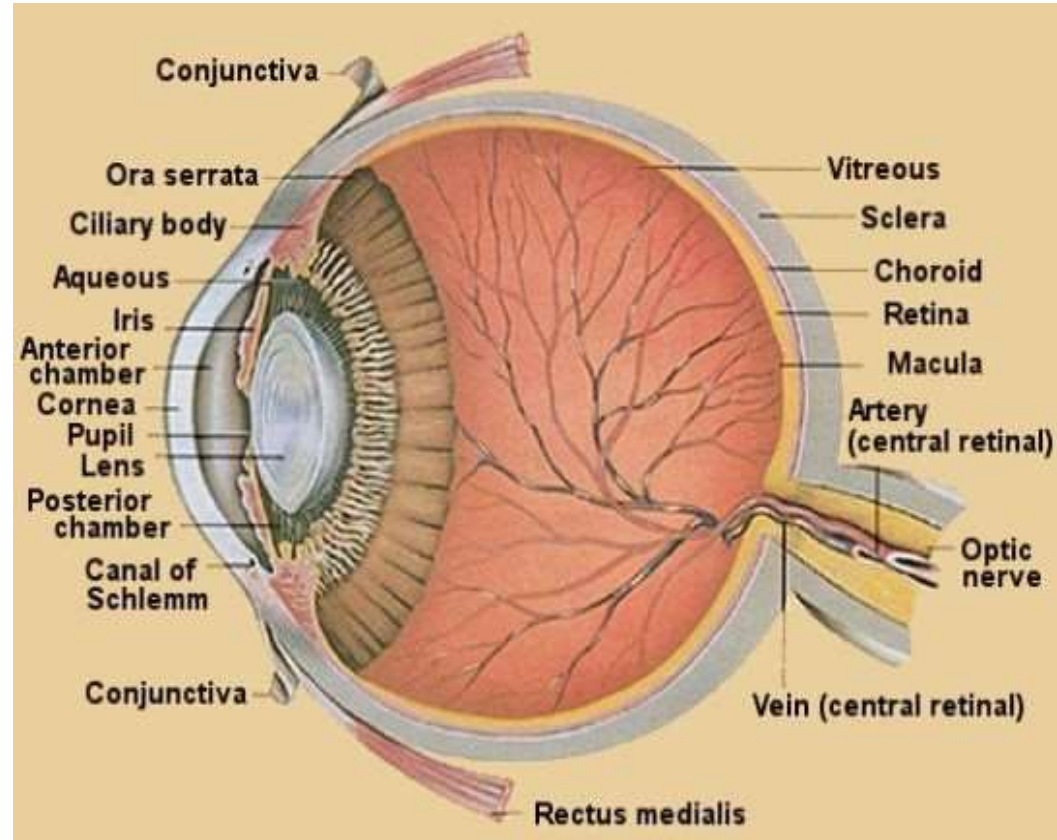
The macula, located in the center of the retina, is where most of the cone cells are located. The fovea, a small depression in the center of the macula, has the highest concentration of cone cells. The macula is responsible for central vision, seeing color, and distinguishing fine detail.

CONJUNCTIVA

The conjunctiva is the thin, transparent, mucous membrane that lines the eyelids and covers the front surface of the eyeballs. The section that lines the eyelids appears red in color because it contains many blood vessels. The section that covers the cornea appears white because of the sclera behind it.

Ciliary Body

A structure located behind the iris (rarely visible) which produces aqueous fluid that fills the front part of the eye and thus maintains the eye pressure. It also allows focusing of the lens.



The eye

Sclera

The white, tough wall of the eye. Few diseases affect this layer. It is covered by the episclera and conjunctiva, and eye muscles are connected to this.

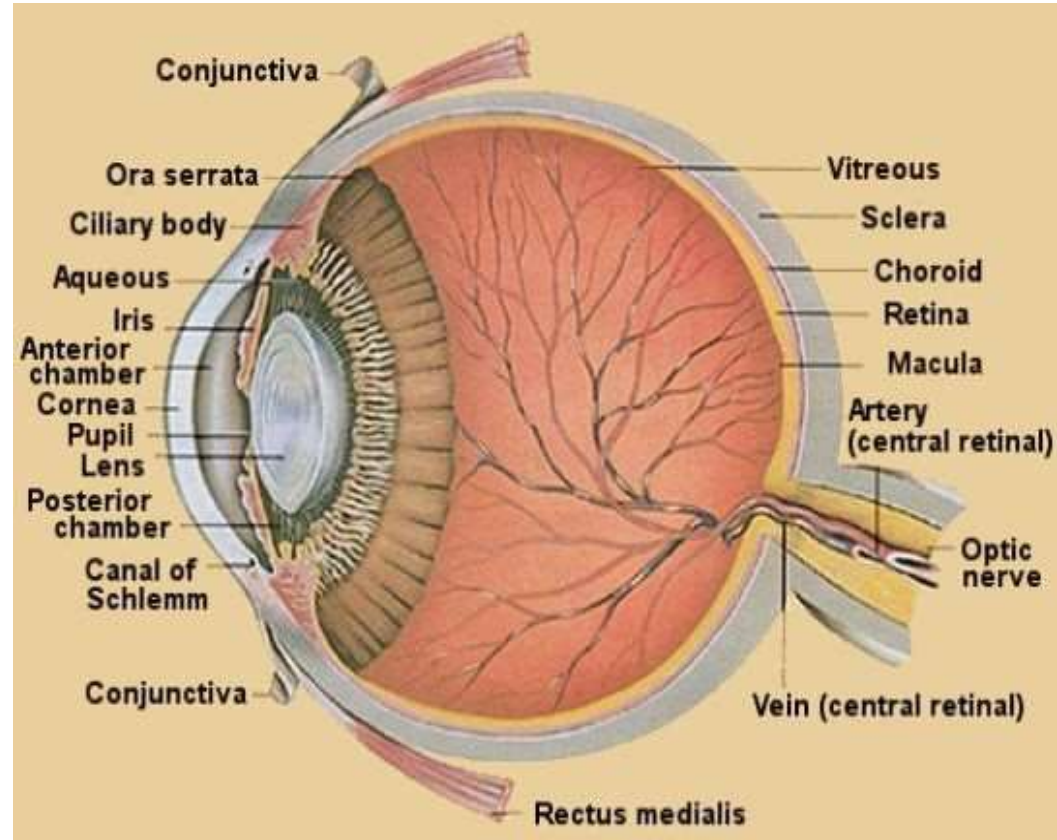
AQUEOUS HUMOR

Aqueous humor is nutritive watery fluid produced by the ciliary body through the ciliary body processes and secreted into the posterior chamber (i.e., space between the iris and the lens). It maintains pressure and provides nutrients to the lens and cornea.

EYE LID & EYE LASHES

Eye lids: The eyelids are moveable folds of skin that protect the front surface of the eyes. They close the eyes and blink, which moistens the surface of the eyes and removes debris.

Eye lashes: The eyelashes (also called cilia) are hairs that grow at the edge of the eyelids and remove minute particles of debris away from the surface of the eyes



The eye

OPTIC NERVE & VISUAL PROCESSING

The optic nerve, located behind the retina, transmits signals from the photoreceptor cells to the brain. Each eye transmits signals of a slightly different image, and the images are inverted. Once they reach the brain, they are corrected and combined into one image.

This complex process of analyzing data transmitted through the optic nerve is called visual processing.

EYE MOVEMENT

EXTRAOCULAR MUSCLES:

The stabilization of eye movement is accomplished by six Extra-ocular muscles that attach to each eyeball and perform their horizontal and vertical movements and rotation. These muscles are controlled by impulses from the cranial nerves that tell the muscles to contract or to relax. When certain muscles contract and others relax, the eye moves.

25th week

Physiology of the Ear

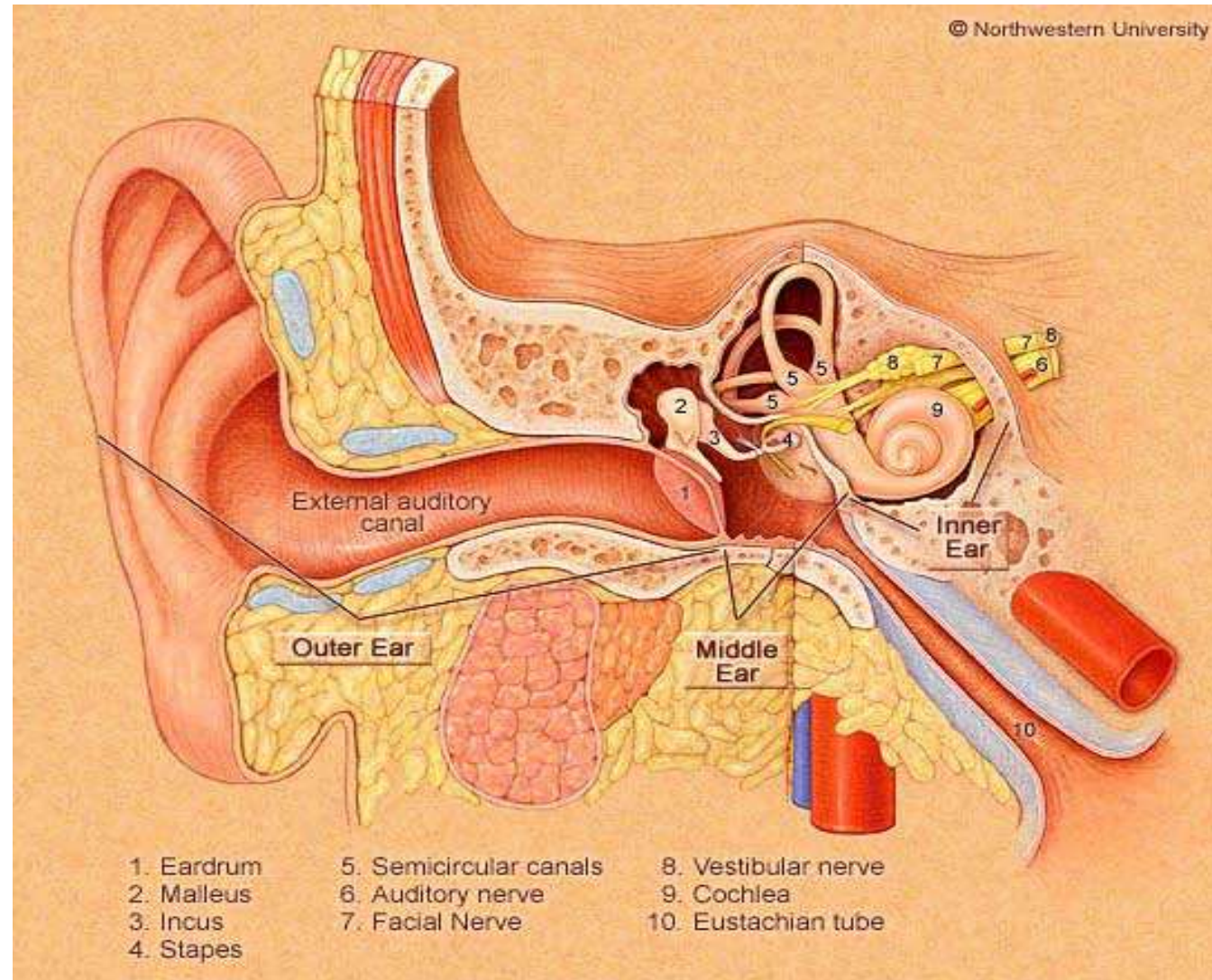
Structure

Function

The ear

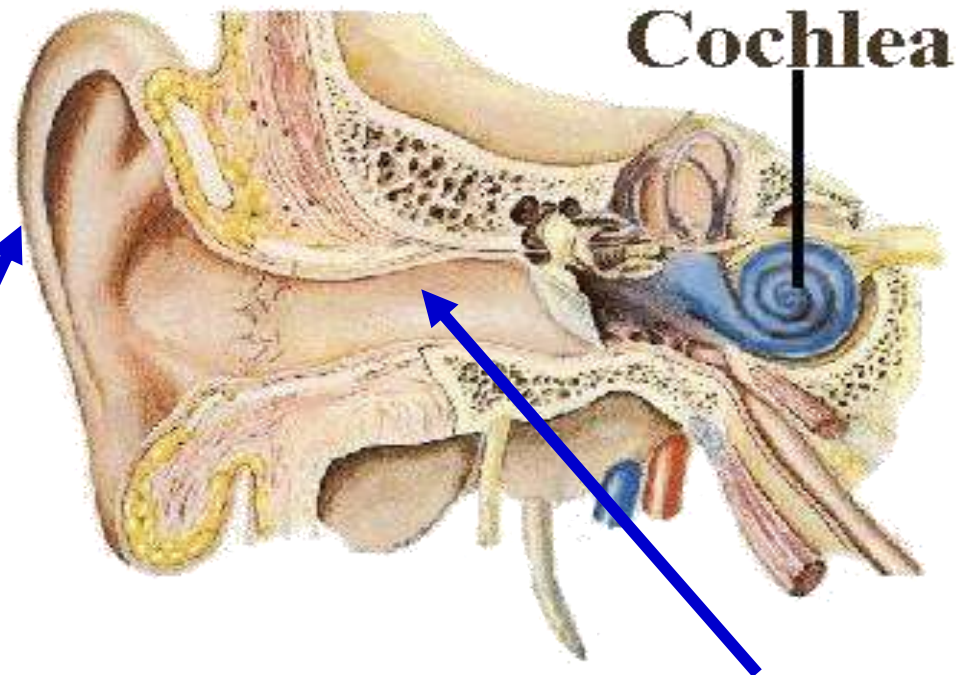
The ear is divided into three parts :

- 1 -Outer ear
- 2 -Middle ear
- 3 -Inner ear



The ear

The Outer Ear Consists of:



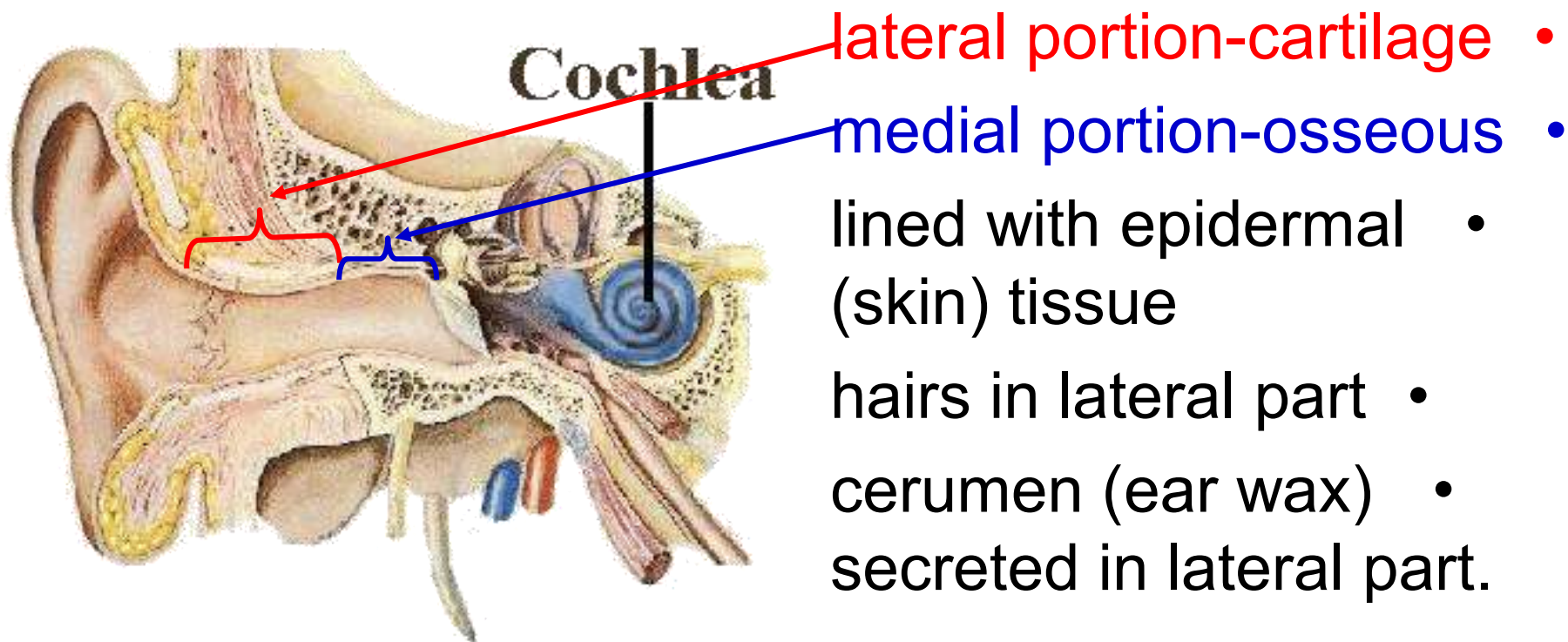
The Pinna - •
cartilaginous, highly
variable in
appearance, some
landmarks.

External Auditory •
Canal (or external
auditory meatus) -
2.5 cm tube.

(132)

The ear

External Auditory Canal



- lateral portion-cartilage
- medial portion-osseous
- lined with epidermal (skin) tissue
- hairs in lateral part
- cerumen (ear wax) secreted in lateral part.

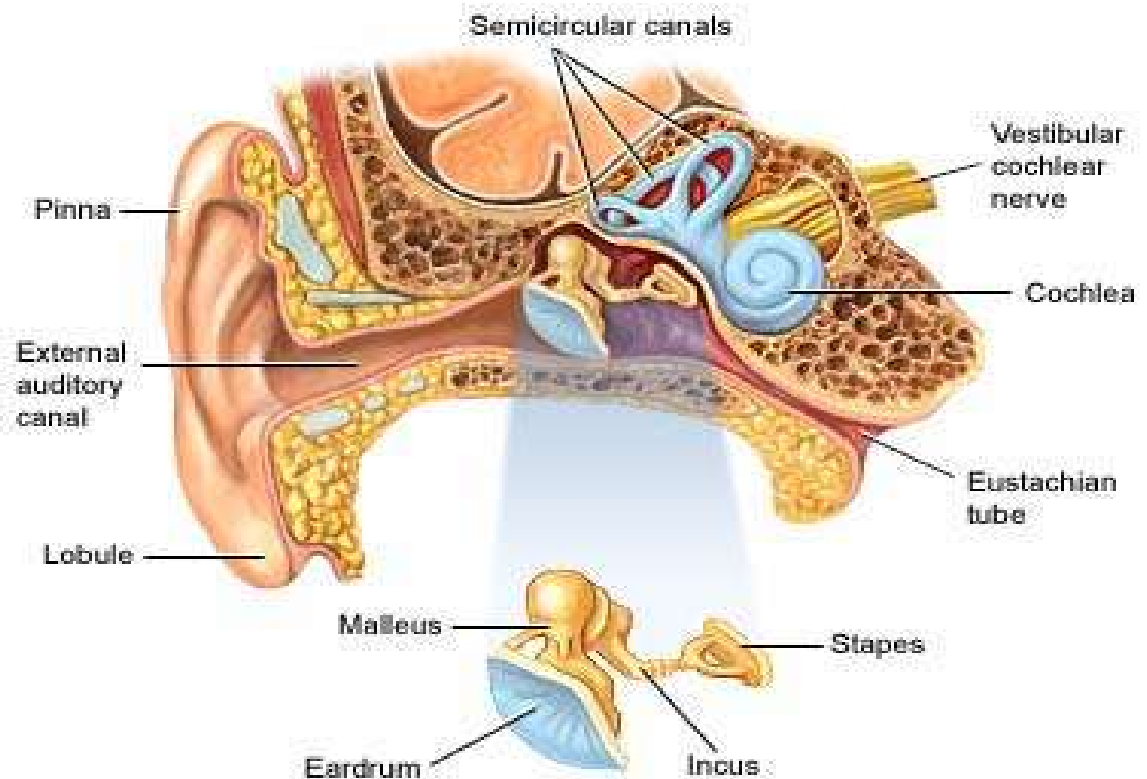
The ear

Outer Ear Functions

- Amplification / Filtering •
- Protection •
- Localization •

Middle Ear Structures

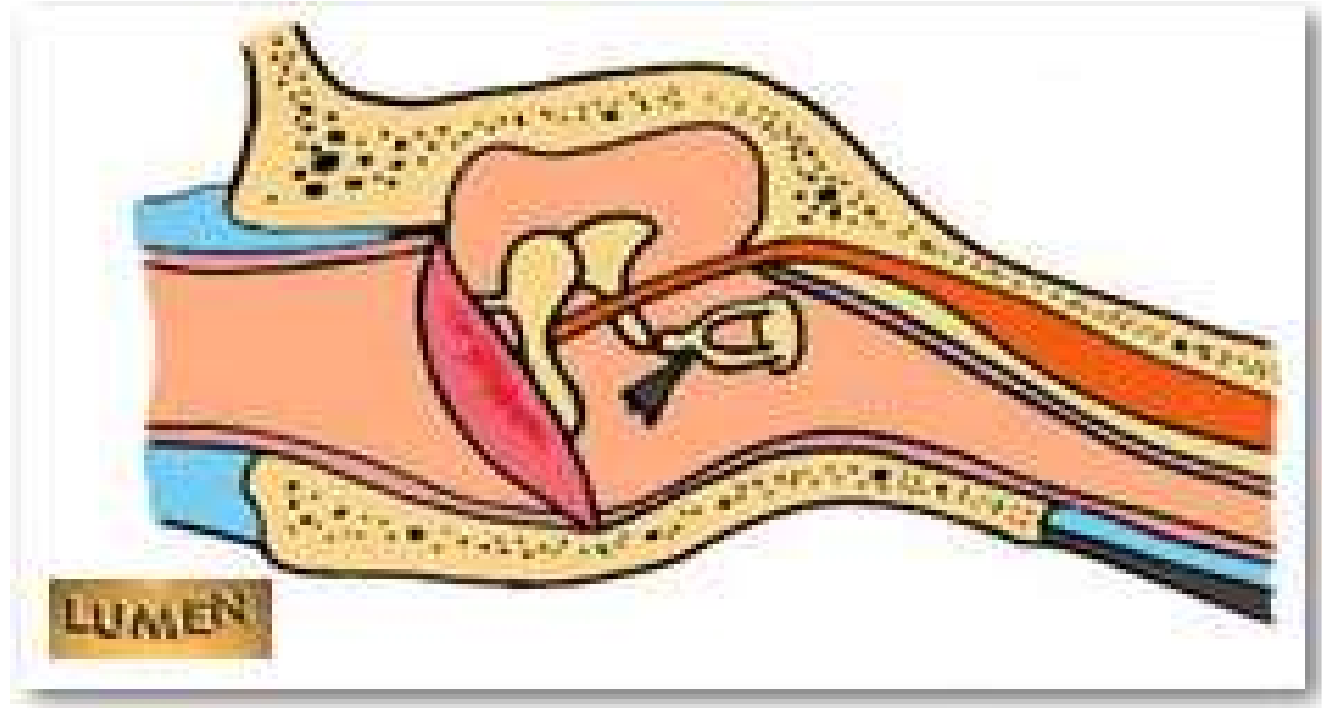
- 1- Malleus I
- 2- Incus I--Ossicles
- 3- Stapes I
- 4- Tympanic Membrane (Eardrum)
- 5- Round Window
- 6- Eustachian Tube



The ear

Middle Ear Muscles

1. The Stapedius Attaches to Stapes, Contracts in Response to Loud sounds, chewing, speaking; Facial (VIIth cranial) nerve
2. The Tensor Tympani Helps open Eustachian tube



Middle Ear Functions:

Impedance Matching , Filtering , Acoustic Reflex

The ear

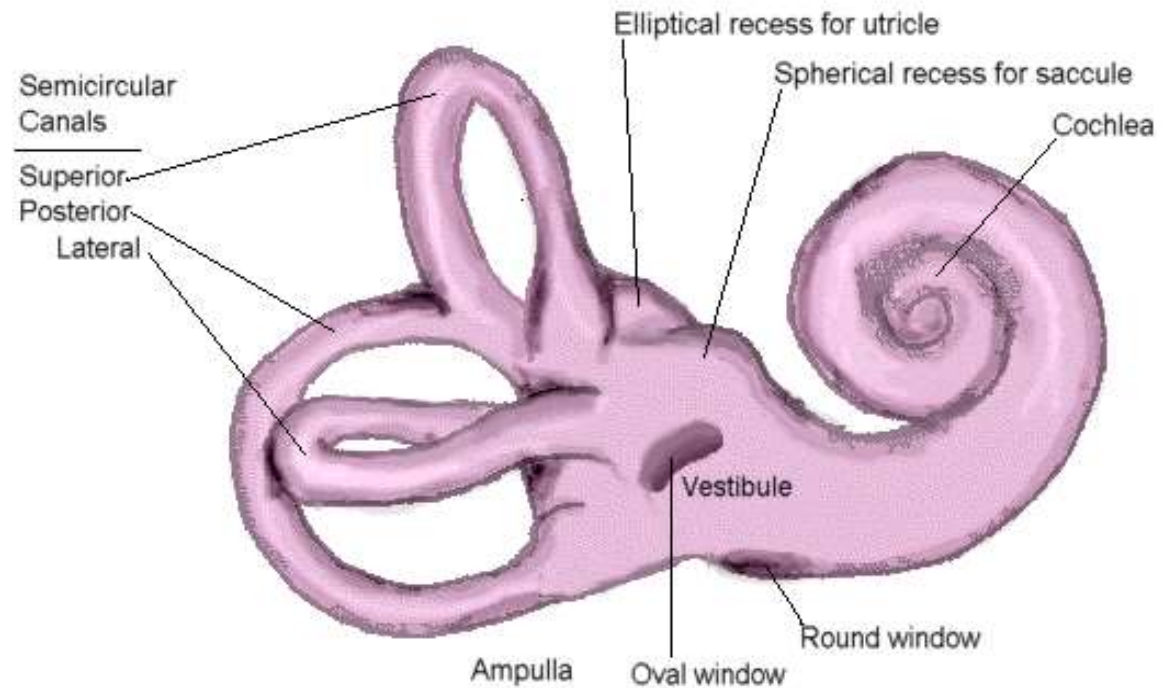
INNER EAR

Two Halves: •

Vestibular--transduces motion and pull of gravity •

Cochlear--transduces sound energy •

(Both use Hair Cells) •



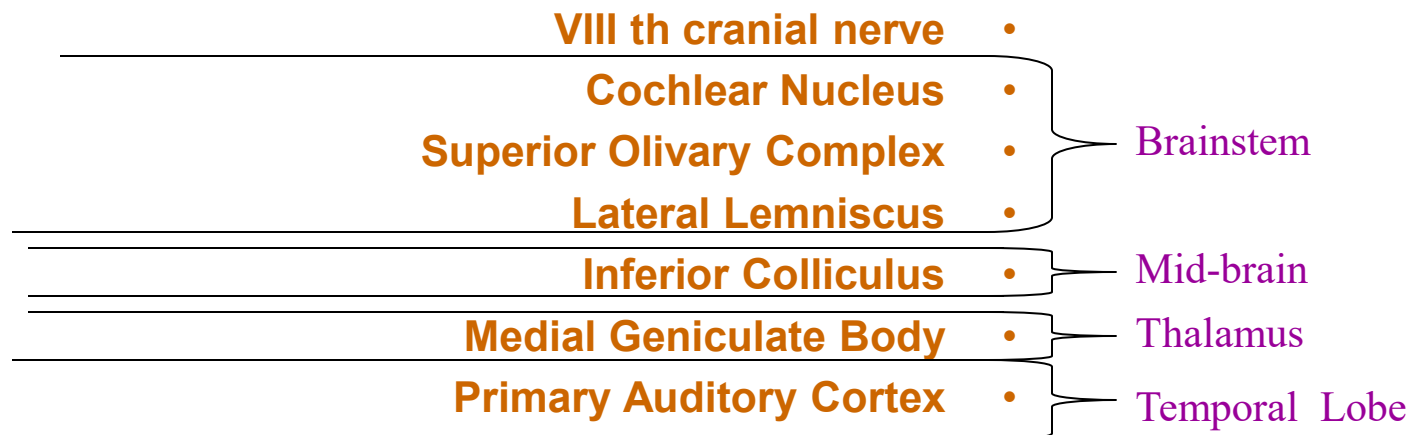
(136)

The ear

Cochlear Functions

- Transduction- Converting acoustical-mechanical energy into electro-chemical energy.
- Frequency Analysis-Breaking sound up into its component frequencies
- Bekesy's Traveling Wave
- Active Tuning from OHCs

Major Components of the Central Auditory Nervous System



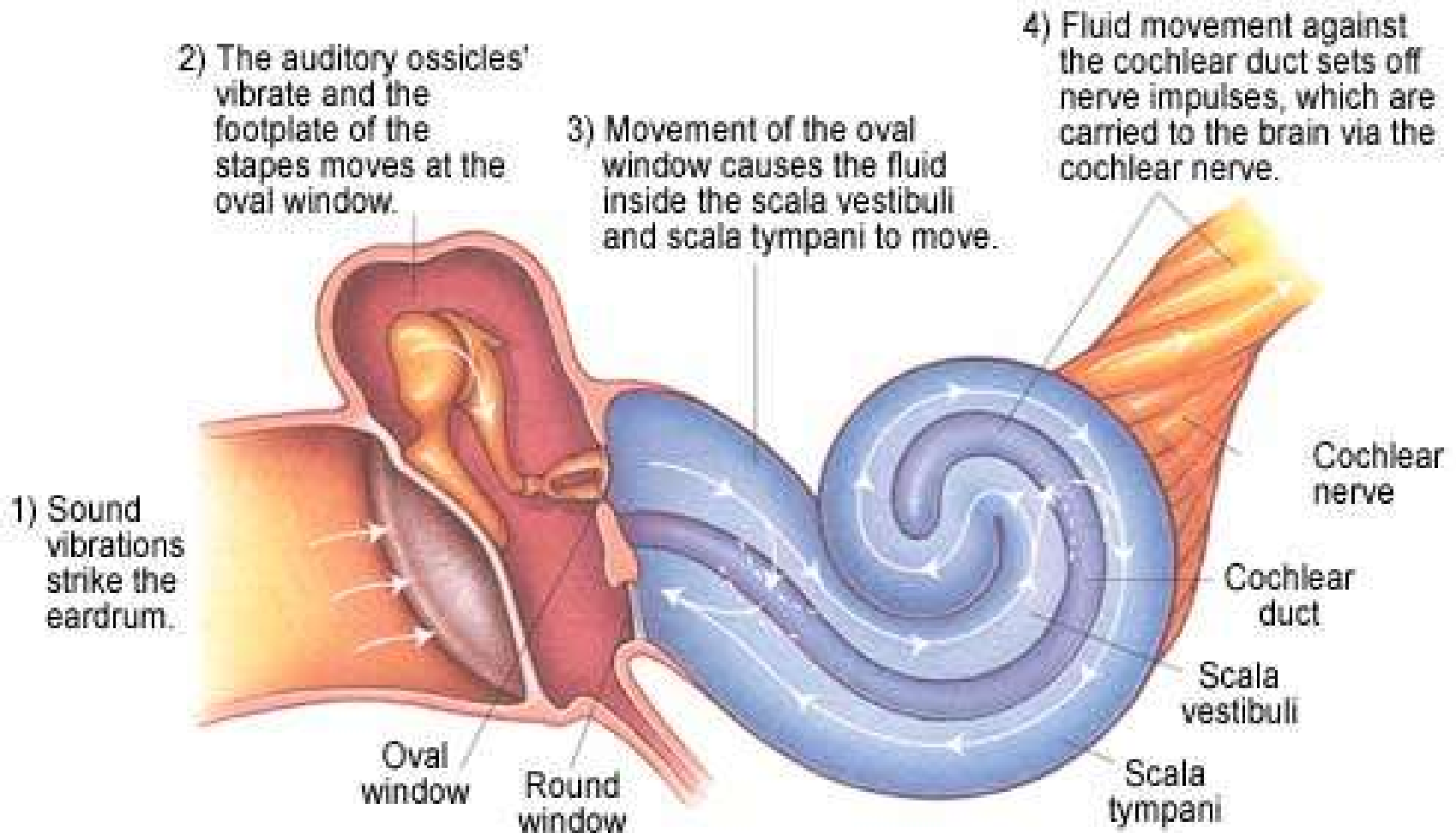
The ear

Cortical Processing

- Pattern Recognition** •
- Duration Discrimination** •
- Localization of Sounds** •
- Selective Attention** •

With one ear plugged, blind people are more accurate than sighted people at locating a sound source

The ear



26th week

Muscular system

Type

Property

Structure

function

muscular system

MUSCLE

It is a **Cell (fiber) responsible for contraction and relaxation** , approximately 40 per cent of the body is skeletal muscles and 10 per cent is smooth and cardiac muscles.

There are three types of muscles :

1 - skeletal muscles : **joined with the bones** (responsible for body movement), also found in the upper portion of the esophagus ,tongue, long cylindrical cell (fiber), voluntary control.

2 - smooth muscles : found in **internal body organs except heart**, involuntary control ,spindle shape cells

3 - cardiac muscles : found in the **heart** ,involuntary control , short bifurcate cylindrical cell

muscular system

Muscle fiber :

In most muscles , the fibers extend the entire length of the muscle (except 2 per cent) each is innervated by only one nerve end located near the middle of the fiber .

Each muscle fiber composed of :

a - sarcolemma : cell membrane

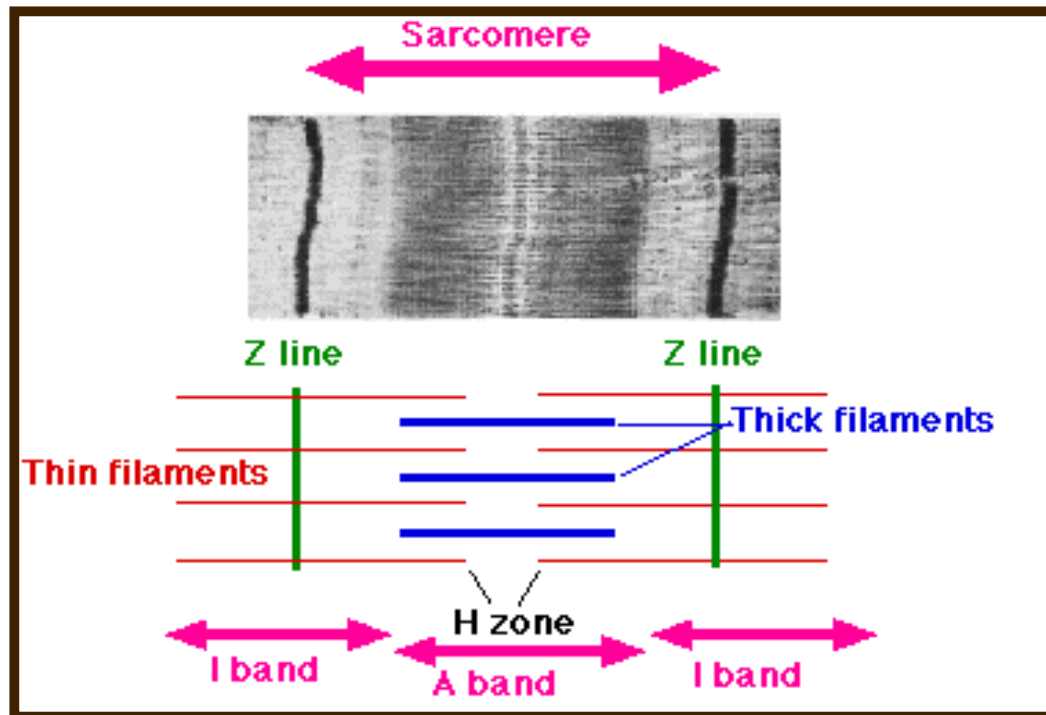
b – sarcoplasm : cell cytoplasm

c – several thousand myofibrils , mitochondria , endoplasmic reticulum , nucleus and other cell inclusions .

muscular system

Myofibril Anatomy :

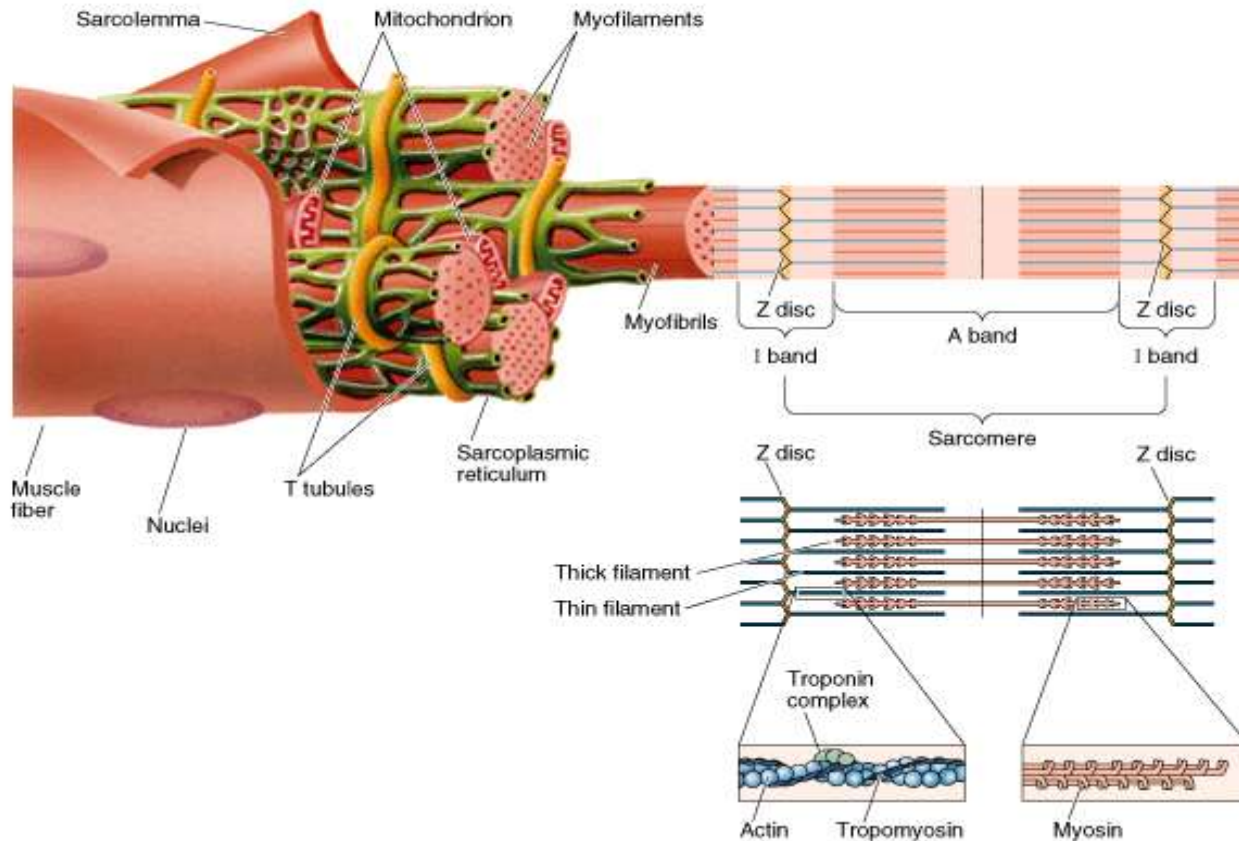
Myofibril have alternate light and dark bands . The light bands which contain only *actin* filaments , are called I bands because they are mainly *isotropic* to polarized light . The dark bands , which contain the *myosin* filaments , are called A bands because they are *anisotropic* to polarized light . The actin filaments are attached to so-called **Z disc** . The Z disc composed of several filamentous proteins different from actin and myosin filaments . The portion of myofibril that lies between two successive Z discs is called a **sarcomere** , and the length of sarcomere is about 2 microns . The myofibril contains several thousand sarcomeres.



muscular system

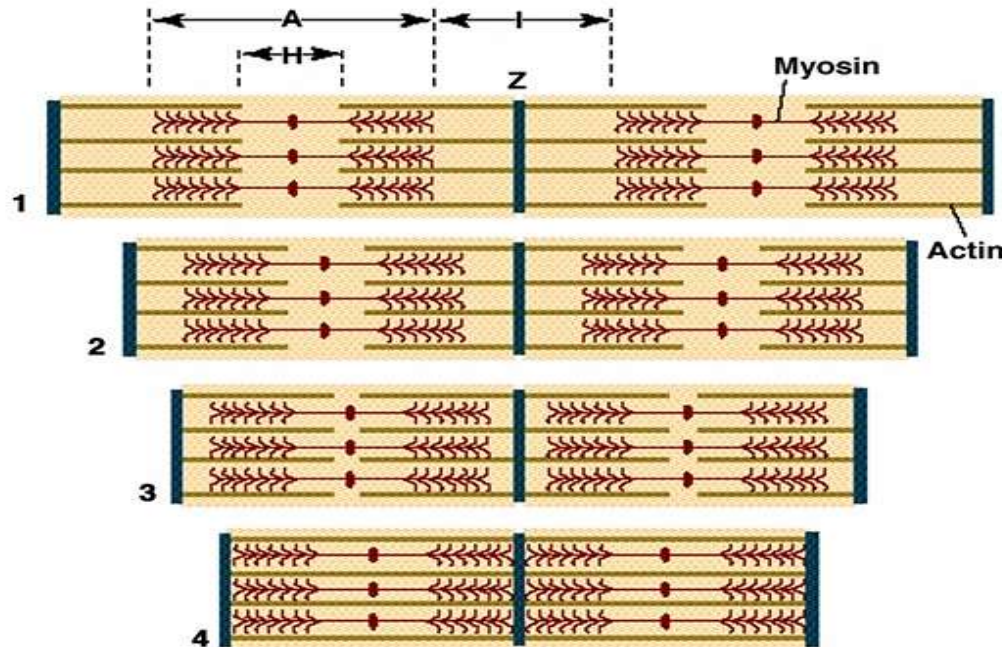
Myofibril : Each muscle fiber (cell) contains several hundred to several thousand myofibrils , Each myofibril in turn has lying side - by - side about 1500 myosin filaments and 3000 actin filaments , which are large polymerized protein molecules responsible for muscle contraction . The myofibrils are bathed in sarcoplasm inside the muscle fiber, where the sarcoplasm contains large quantities of potassium , magnesium , phosphate , protein enzymes , mitochondria (for ATP need for contraction) and sarcoplasmic reticulum (important in control of muscle contraction)

► Organization of a Muscle Fiber



muscular system

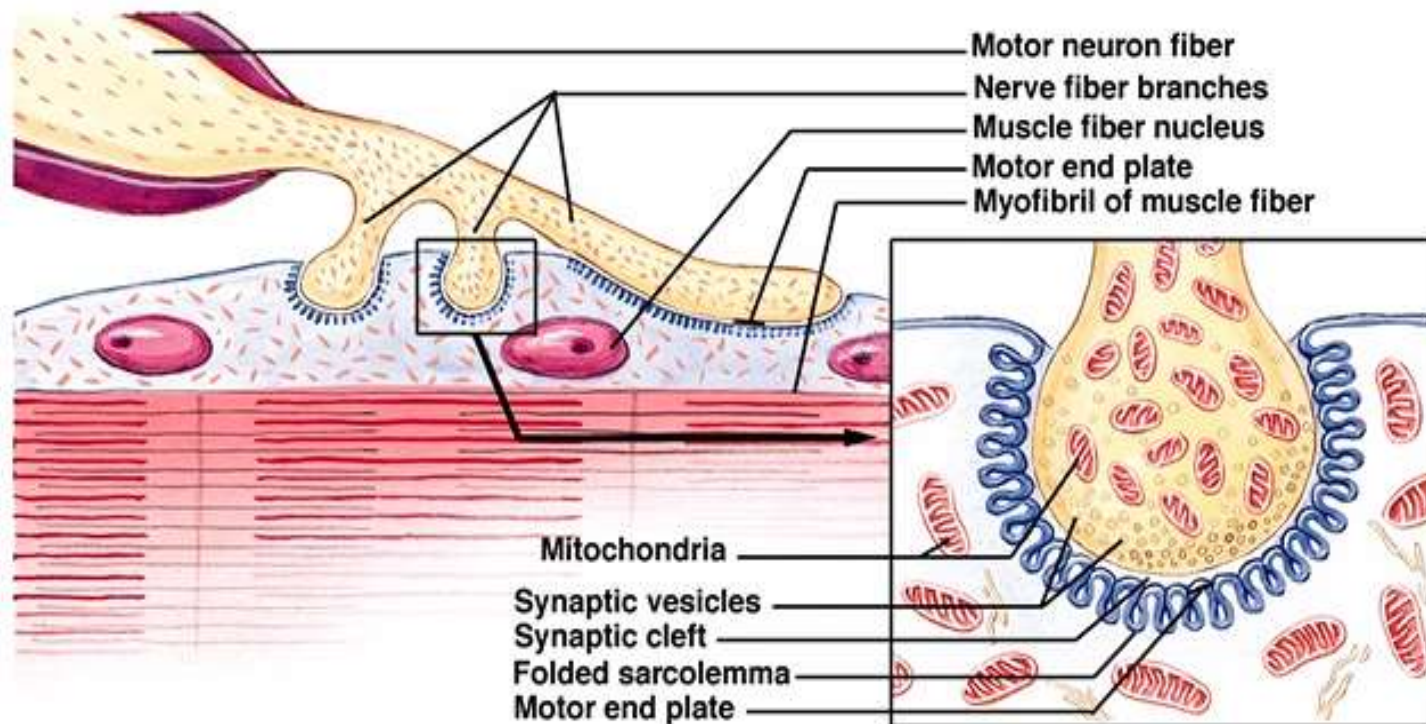
Muscle contraction : occur by a sliding filament mechanism , by pulling the actin filament in word among the myosin filament , so that they now over lap each other , where this caused by mechanical , chemical , or electrostatic forces generated by the interaction of the cross- bridge of the myosin filaments with the actin filaments . The figure below illustrates the contraction of muscle fiber and shows the over lapping of actin and myosin filaments



Under resting condition , the sliding forces between the actin and myosin filaments are inhibited , but when an action potential travels over the muscle fiber membrane , this causes the release of the large quantities of calcium ions into the sarcoplasm surrounding the myofibril . The calcium ions activate the forces between the filaments and contraction begins. But energy is also needed for the contractile process to proceed. This energy is derived from ATP which is degraded to ADP to give the energy required

muscular system

Muscle innervation: Nerve ending makes a junction called the *neuromuscular junction* with the muscle fiber at the fiber mid point , so that the action potential in the fiber travels in both directions . This neuromuscular junction is bridged by the release of very small amounts of *acetylcholine* every time a nerve impulse arrives . This acetylcholine passes across the gap and is taken up by receptors on the motor end-plate , of the muscle fiber , the acetylcholine **alter** the membrane permeability of the motor end- plate , so that the **sodium rushes** in producing a change in **voltage** . The depolarization spreads from the motor end-plate to the whole of the muscle fiber , then **calcium ions are released** and the muscle then **contracts** .



Quiz /8 : List the main functions of the following :

a – Nervous system

b – Lymbic system

c – Spinal cord

d – Cornea

e – Lens

f – Outer ear

g – Skeletal muscles

check your answers in key answer page 170-171

27th week

28th week

The Endocrine System

types

Function

Endocrine Glands

A glands which secrete their products into the blood are ductless glands

The products secreted by these glands are called Hormones travel by blood to a target cells far away from gland

Chemical Classification of Hormones

Steroid Hormones: •

Secretes by endocrine glands: –

- Adrenal cortex •
- Ovaries •
- Testes •
- placenta –

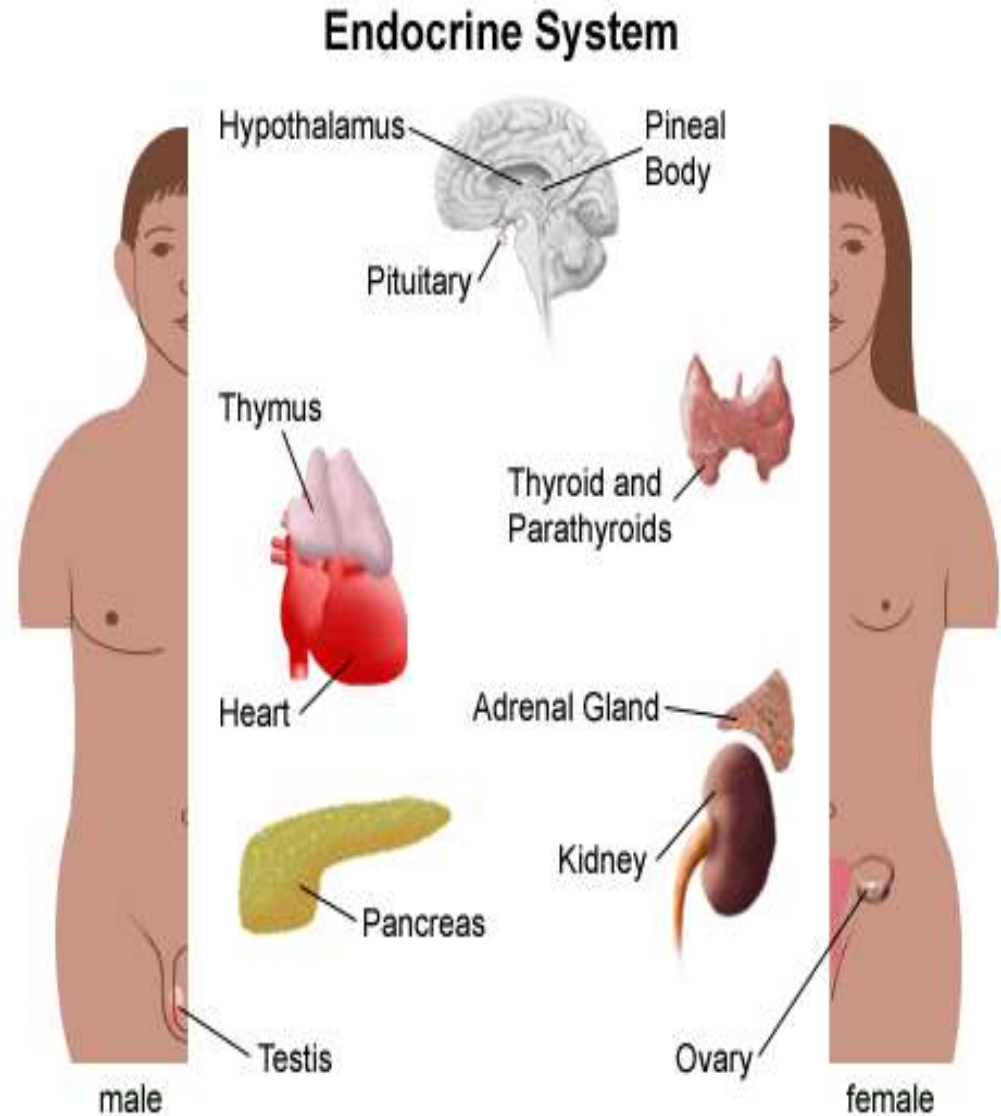
Non steroid Hormones:

Secretes by endocrine glands

- Thyroid gland
- Parathyroid gland
- Adrenal medulla
- Pituitary gland
- pancreas

Endocrine Glands

- Hypothalamus •
- pineal body •
- Pituitary •
- Thyroid •
- Parathyroid •
- Pancreas •
- Adrenal •
- Gonads (testis ,ovary) •



Hypothalamus

Location- Base of brain •
case

Functions- Regulation of Primitive or •
Basal activities such as sex drive and
water balance

Pineal body •

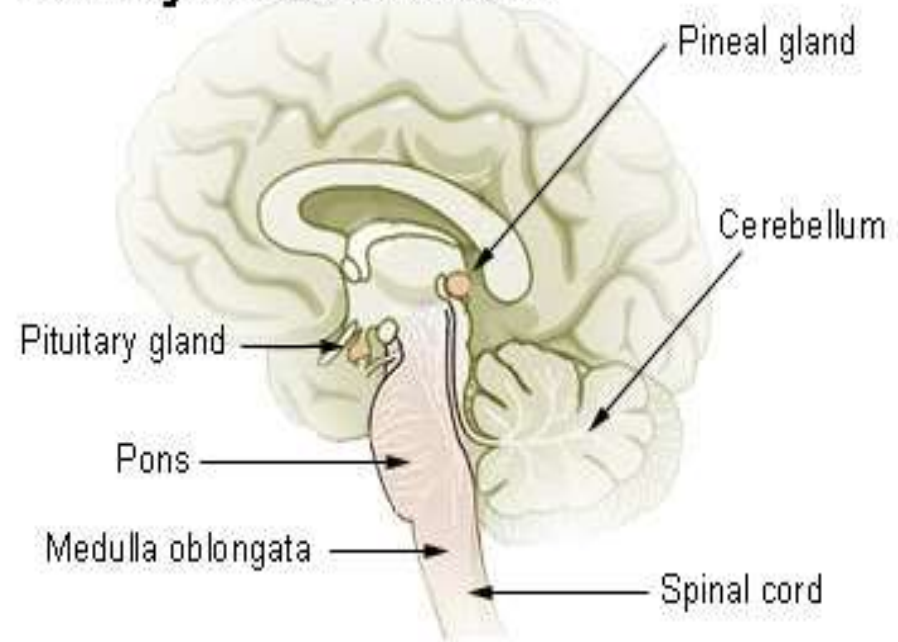
The pineal body is located below the corpus callosum, a part of the brain. It produces the hormone melatonin and secretes it directly into the cerebrospinal fluid, which takes it into the blood. •

Melatonin affects reproductive development and daily physiologic cycles. •

Pituitary •

The pituitary gland or hypophysis is located at the base of the brain. No larger than a pea.

Pituitary and Pineal Glands



The pituitary gland itself consists of three sections:

- 1-The anterior lobe •
- 2-The intermediate lobe •
- 3-The posterior lobe •

Anterior lobe: •

- Growth hormone •
- Prolactin - to stimulate milk production after giving birth •
- ACTH (adrenocorticotrophic hormone) - to stimulate the adrenal glands •
- TSH (thyroid-stimulating hormone) - to stimulate the thyroid gland •
- LH (luteinizing hormone) - to stimulate the ovaries or testes •
- FSH (follicle-stimulating hormone) - to stimulate the ovaries and testes •

Intermediate lobe:

Melanocyte-stimulating hormone - to control skin pigmentation

Posterior lobe:

- ADH (antidiuretic hormone) - to increase absorption of water into the blood by the kidneys
- Oxytocin - to contract the uterus during childbirth and stimulate milk production

Thyroid and parathyroid

The thyroid gland and parathyroid glands are located in front of the neck, below the larynx (voice box).

The thyroid

plays an important role in the body's metabolism. Both the thyroid and parathyroid glands also play a role in the regulation of the body's calcium balance.

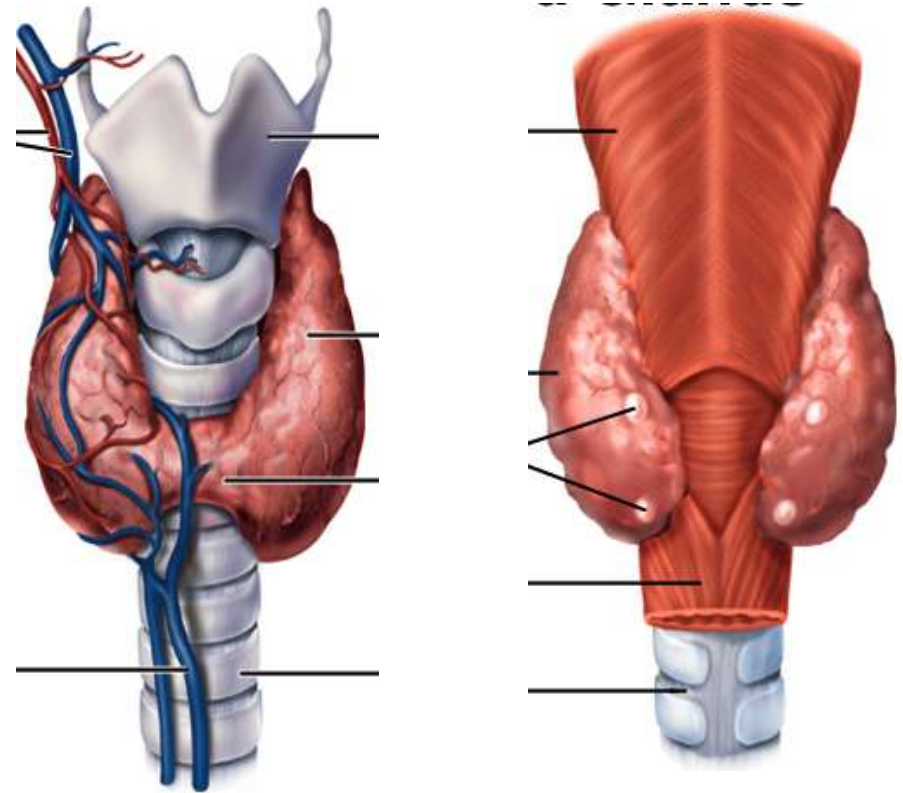
The thyroid secretes two major hormones called thyroxine (T4) and tri-iodothyronine (T3).

The thyroid also secretes a hormone called calcitonin, important in keeping calcium levels in the body normal

Parathyroid Glands

Parathyroid hormone is the most important regulator of blood calcium levels

Hypoparathyroidism, or insufficient secretion of parathyroid hormone, leads to increased nerve excitability



The adrenal gland

The adrenal, or suprarenal gland is paired with one gland located near the upper portion of each kidney. Each gland is divided into an outer cortex and an inner medulla

Chemically, all the cortical hormones are steroid.

Mineralocorticoids

are secreted by the outermost region of the adrenal cortex. The principal mineralocorticoid is aldosterone, which acts to conserve sodium ions and water in the body.

Glucocorticoids

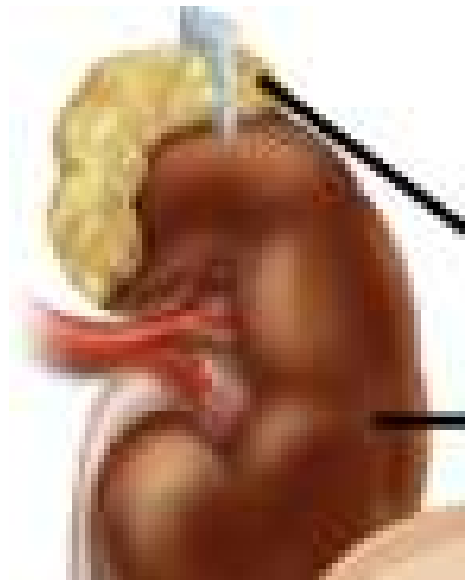
are secreted by the middle region of the adrenal cortex. The principal glucocorticoid is cortisol, which increases blood glucose levels

Gonadocorticoids, or sex hormones

Male hormones, **androgens**, and female hormones, **estrogens**

The adrenal medulla :

secretes two hormones, **epinephrine** and **norepinephrine**. These two hormones are secreted in response to stimulation by sympathetic nerve, particularly during stressful situations.



The Thymus

The thymus is located in the lower part of the neck, and the front part of the upper chest. After puberty it is mostly replaced by fat.

The thymus secretes thymosin hormone which is important in the development and maintenance of a normal immune system.

The Pancreas

The endocrine pancreas is separate from the exocrine pancreas.

The endocrine pancreas is made up of small clumps of cells within the pancreas, called pancreatic islets, or the islets of Langerhans

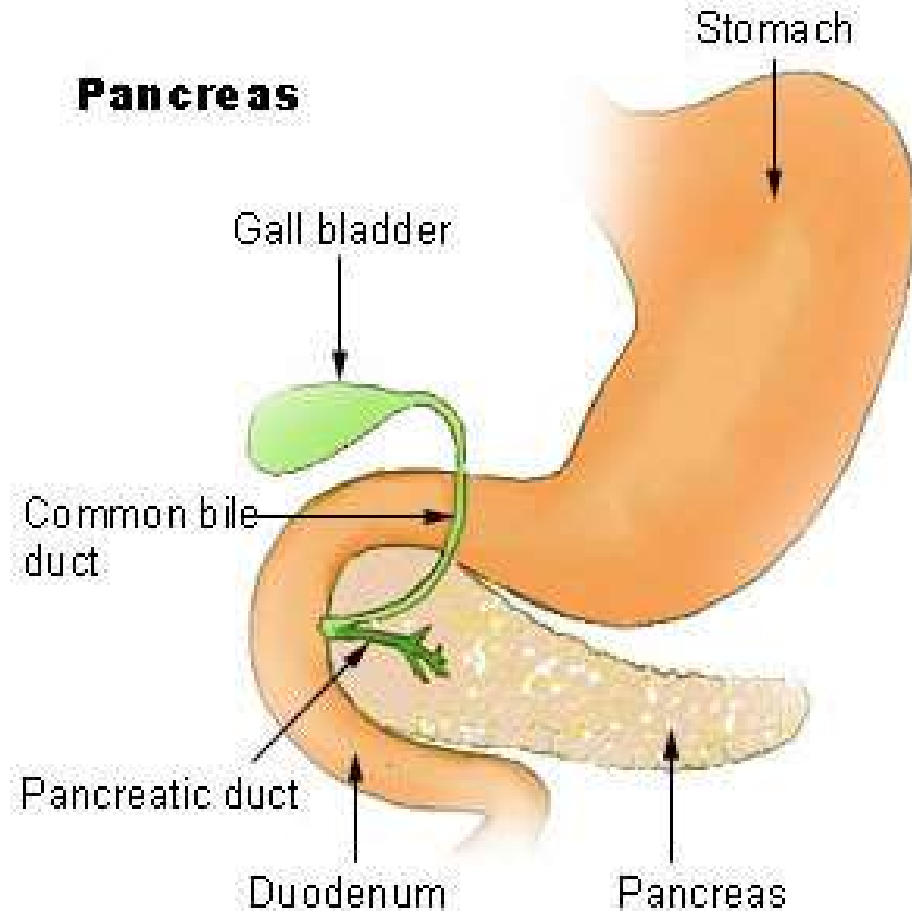
Secretes two important hormones :

Glucagon:

Secretion of glucagon is controlled by the level of blood sugar, being released when levels are too low.

This greatly increases the output of sugar from the liver and returns blood sugar levels to normal

Insulin is released in periods when there is a lot of sugar available, like after a meal. A lack of insulin means the body has to use fat for metabolism rather than sugar and can lead to a condition known as ketoacidosis



Testes

Male sex hormones, as a group, are called androgens.
The principal androgen is **testosterone**

This steroid hormone is responsible for:

- Increased skeletal and muscular growth
- Enlargement of the larynx accompanied by voice changes
- Growth and distribution of body hair
- Increased male sexual drive

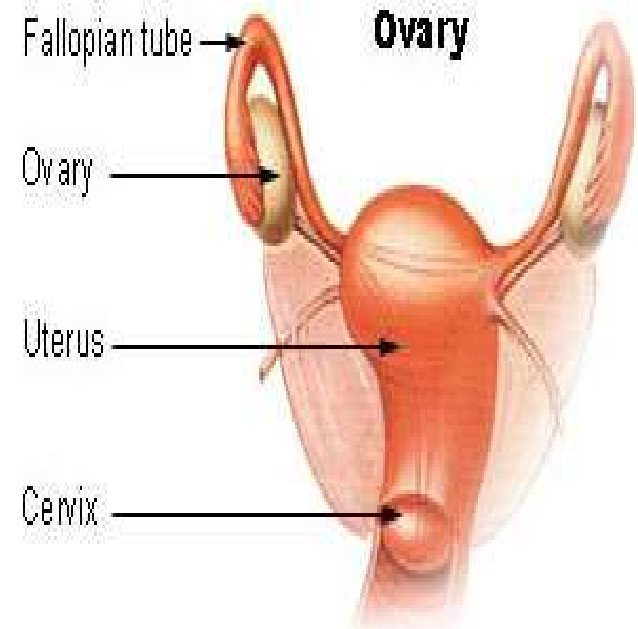
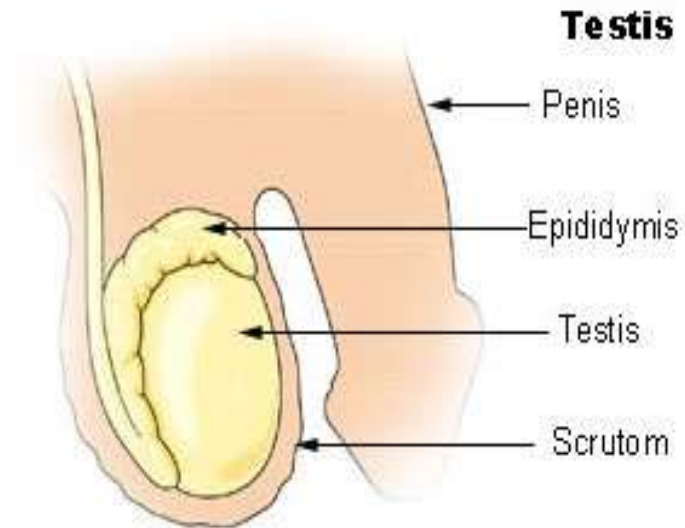
Ovaries

Two groups of female sex hormones are produced in the ovaries, the **estrogens** and **progesterone**

At the onset of puberty, estrogens promotes:

- The development of the breasts
- Distribution of fat evidenced in the hips, legs, and breast
- Maturation of reproductive organs such as the uterus and vagina

Progesterone causes the uterine lining to thicken in preparation for pregnancy. Together, progesterone and estrogens are responsible for the changes that occur in the uterus during the female menstrual Cycle



Other hormonal activity

In addition to the major endocrine glands, other organs have some hormonal activity as part of their function. These include the stomach, small intestines, heart, and placenta

Stomach

The lining of the stomach, the gastric mucosa, produces a hormone, called gastrin, in response to the presence of food in the stomach.

This hormone stimulates the production of hydrochloric acid and the enzyme pepsin, which are used in the digestion of food

Small intestine

The mucosa of the small intestine secretes the hormones secretin and cholecystokinin

Secretin stimulates the pancreas to produce a bicarbonate-rich fluid that neutralizes the stomach acid. Cholecystokinin stimulates contraction of the gallbladder, which releases bile

It also stimulates the pancreas to secrete digestive enzyme

The heart

Also acts as an endocrine organ in addition to its major role of pumping blood. Special cells in the wall of the atria, produce a hormone called atrial natriuretic hormone, or atriopeptin.

The placenta

The placenta develops in the pregnant female as a source of nourishment and gas exchange for the developing fetus. It also serves as a temporary endocrine gland.

One of the hormones it secretes is human chorionic gonadotropine, which signals the mother's ovaries to secrete hormones to maintain the uterine lining so that it does not degenerate and slough off in menstruation

29th week

Reproductive System

(male & female)

structure

function

Male Reproductive System

1 -Scrotum – sac of skin that holds testes. Hangs below body to keep testes cool. Sperm cannot be produced if body is too warm. Testes move into scrotum just before birth.

2 -Testis/testes – male gonads. Made up of small, coiled tubes – seminiferous tubules. 300-600 per testis. Immature sperm made here.

Secrete testosterone

3 -Epididymis – storage area in upper rear of testis. Immature sperm move here to mature – takes 18 hours.

4 -Vas deferens – tube that leads upwards from each testis into lower part of abdomen from epididymis.

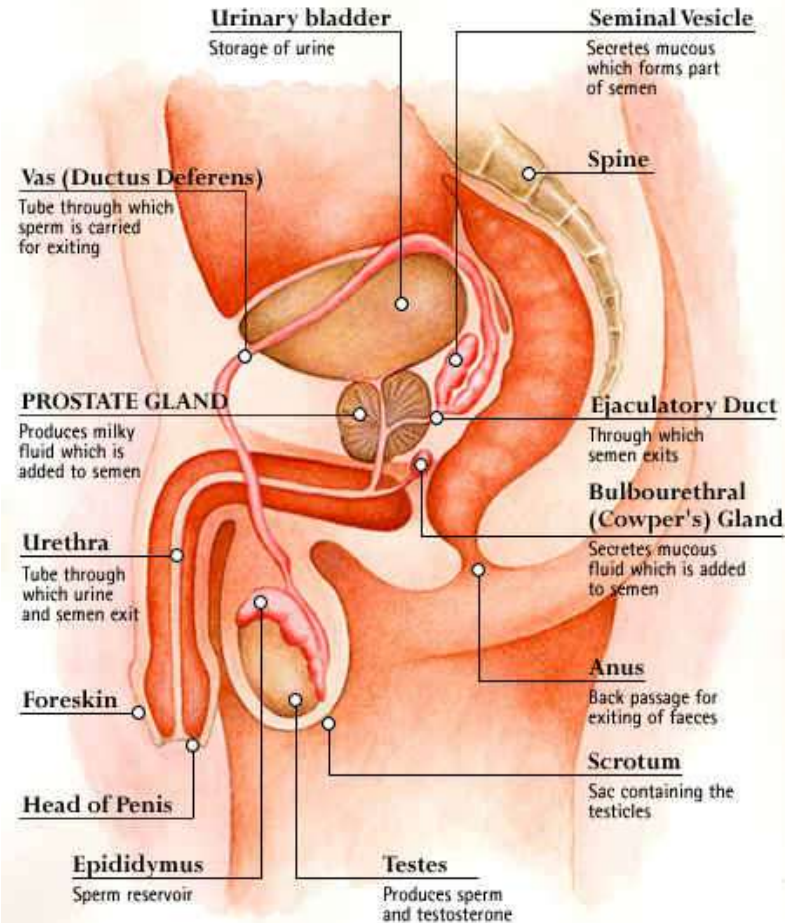
5 -Cowper's gland – produces fluids that nourish sperm and protect them from the acidity of female. Combination of sperm and fluids - semen

6 -Seminal vesicles – same job as Cowper's gland

7 -Prostate gland – same job as Cowper's gland and seminal vesicles

8 -Urethra – passageway for excretion of urine and for sperm to leave body. Vas deferens empties into urethra

9 -Penis – male reproductive organ. Facilitates internal fertilization



Male Reproductive System

Ejaculation – muscular contractions force semen through urethra. Before, during and after ejaculation reflex actions keep outlet of bladder closed

Hormones of male reproductive system

1 -Luteinizing Hormone (LH) – stimulates testes to produce testosterone

2 -Testosterone – stimulates development of sperm. Once there is a large number of sperm, puberty is complete.

Female Reproductive System

1 - Ovary – female gonads: 2 ovaries 4 cm long, 2 cm wide

1 - Secrete estrogen

2 - Produces egg

Follicles – each ovary contains 200,000 egg sacs called Follicles. In each follicle is an immature egg.

All the eggs are present at birth. During the woman's lifetime 500 eggs mature. When an egg matures, follicle moves to surface of ovary.

Follicle breaks & releases the egg – ovulation

Egg can be fertilized for about 24 hours after ovulation

2 - Oviduct (fallopian tube) – Each ovary is near but not connected to oviduct. Tube with funnel-like opening. Cilia line it to create a current that draws the egg into the tube. **Egg is fertilized in the oviduct**

3- Uterus – thick, muscular, pear-shaped organ. Once egg is fertilized it finishes its development in uterus attached to uterine wall

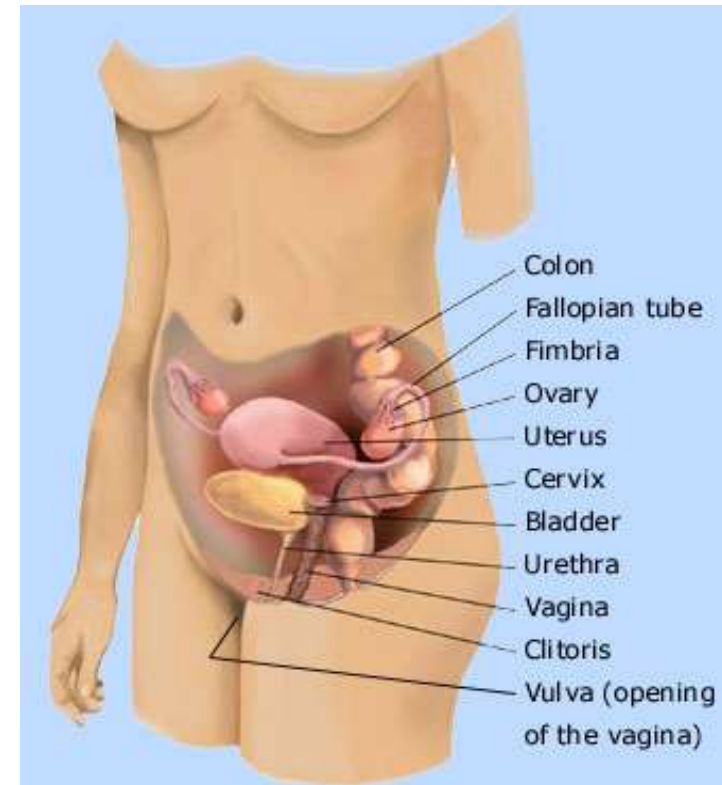
4 - Vagina (birth canal) – leads to outside of body

5 - Cervix – narrow neck of uterus

What is the menstrual cycle? : Cycle during which an egg develops and is released from the ovary and the uterus is prepared to receive a fertilized egg

Menarche: first menstrual period – usually occurs between 11 and 12

Menopause: time when a woman stops menstruating, usually between 45 & 55 and is no longer able to conceive.



Post test

Q: ANSWER THE FOLLOING :

- 1- What are the benefits of the nasal cavity ?
- 2- CO₂ is transported in the blood by :
- 3- Mention the kidney functions .
- 4- After injury, the haemostasis is achieved by several mechanisms including :
- 5- Cardiac muscle has properties , such as :
- 6- On using the following instruments we hear certain heart sounds. What heart activities do these sounds represent ?
 - a- By the stethoscope :
 - 1- sound like the word – Lub – represent
 - 2- sound like the word – Dub – represent

Continue

b- By the Phenocardiograph :

- 1- The second heart sound – represent
- 2- The third heart sound – represent
- 3- The fourth heart sound – represent

7- Murmur , an abnormal heart sound usually due to:

8- The heart rates are controlled and influenced by the :

9- What are the type of high blood pressure (hypertension)? And mention the reason of each of them :

10- Write down the formula by which you can calculate the alveolar ventilation , and how much is it's value in a man with respiratory rate 12 beat/min , and mention the unit of the measurement .

11- Respiration is controlled and regulated by :

Continue

12- If the following materials appear in urine, What do they indicate ?

Chorionic gonadotrophin , Glucose ,Red cell

13- Agglutinin (antibody) may be produced by exposure to RBCs of another individual , via :

14- Premature beat (extra – systolic) may occur in normal person due to :

15- Mention the types of chemical transmitters (neurotransmitters) and the side release of each of them :

16- The causes of haemophilia are the deficiency of :

17- The type of neurons are :

18- The oxidation of the nutrient inside the cell (cellular respiration) will yield :

19- Deficiency of Vitamin C will lead to diseases, these diseases are :

(160)

Continue

- 20- Urine is formed by processes which are :
- 21- What are the functions of HCL in stomach ?
- 22- List five of the liver function .
- 23- Heat is lost from the body by :

the answer at the page 162-166

THE ANSWER

1-

- 1- act as filter for dust from inspired air by hairs .
- 2- trapping the foreign bodies by mucous membrane .
- 3- moistened inspired air by mucous membrane .
- 4- warming inspired air by blood vessels .

2-

- 1- 10% is dissolved in plasma .
- 2- 70% transport as ion (bicarbonate ion) .
- 3- 20% is combined with the protein of the Hb and the protein in the plasma .

3-

- 1- keep the body in homeostasis .
- 2- help to control blood pH (by acid – base balancing) .
- 3- help to control electrolytes composition of body fluid .
- 4- help to control blood pressure .

4-

- 1- vascular spasm (vasoconstriction) .
- 2- formation of the plug .
- 3- blood coagulation (clot formation) .

5-

- 1- rhythmicity .
- 2- conduction .

6-

- a- 1- closure of the mitral and tricuspid valves (on set of ventricular systole) .
 - 2- closure of the semi lunar valve (start of ventricular diastole) .
- b- 1- closure of the heart valve .
 - 2- rushing of the blood in to the ventricles during diastole .
 - 3- the a trial systole .

7- faulty action of the heart valves .

- a- valve fail to close tightly and the blood leak back .
- b- valve can not open completely, where make noise sound during passing .

8-

- 1- nervous system .
- 2- factors in the internal environment .
- 3- hormones, ions and drugs in the blood .

9-

- 1- arthrosclerosis – due to presence of cholesterol and Ca salt in the wall of blood vessels .
- 2- renal hypertension – due to renal ischemia .
- 3- essential hypertension – cause unknown .

10- $A.V = (\text{Tidal volume} - \text{dead space}) \times \text{respiratory rate}$
 $(400 - 150) \times 12 = 250 \times 12 = 3000 \text{ cm}^3/\text{min} .$

11-

- 1- respiratory control center in medulla and pons .
- 2- chemically control – by changing of CO_2 quantity .

12-

- 1- pregnancy .
- 2- diabetes mellitus .
- 3- kidney disease .

13-

- 1- blood transfusion .
- 2- during pregnancy .

14- initiated by caffeine , nicotine or psychological stresses .

15-

- 1- acetylcholine – parasympathetic N.V.
- 2- noradrenalin – sympathetic N.V.
- 3- serotonin – in brain .

16- clotting factors VIII and TX .

17- sensory neurons , motor neurons , inter neurons .

18- heat , energy , CO₂ and H₂O .

19-

- 1- lead to scurvy (gum bleeding and joint) .
- 2- lead to slow wound healing .

20-

- 1- glomerular filtration .
- 2- tubular secretion .
- 3- tubular re-absorption .

21-

- 1- neutralize the alkaline saline .
- 2- acts as antimicrobial agent .
- 3- aids the action of pepsin in protein digestion .

22-

- 1- secrete bile .
- 2- storage of glycogen , Vit.B₁₂ and iron .
- 3- formation of urea .
- 4- production of heat , heparin , RBC in embryo and clotting factors .
- 5- destruction of toxic substances of drugs , fat and old RBC .

23-

- 1- skin (sweating , radiation , convection and conduction) .
- 2- respiratory system .
- 3- urinary system .
- 4- defecation .

Quizzes answer

Quiz/1 :

a- Lactic acid , hormone .

b- 1/12 .

Quiz/2 :

a- false

b- false

c- true

d- false

e- true

f- false

Quiz/3 :

a- 4000 – 11000

b- act as antibody

Quiz/4 :

a- platelets : Are small cellular fragment in blood coagulation of blood, normal number between 250000 – 400000 in cubiemillimeter .

b- hemoplilia : Is a bleeding tendency disease, that occurs in almost in males, it's hereditary disease transmitted genetically by the female chromosome.

c- hemoglobin : It's a bright red pigment when combined with oxygen and darle blue in color when there is no oxygen present, if concern with oxygen transport, normal value about 15 grams in 100 ml of blood .

Quiz/5 : a , c , f , g , h .

Quiz/6 :

a- Blood pressure : Is the force of the blood exert against arterial walls.

it's measured in millimetre of mercury (mmHg)

using the sphygmomanometer, and composed of systolic blood pressure and diastolic blood pressure .

b- Alveoli : Cup chapped structure at the end of the bronchioles that resemble bunches of grapes ; are indirect contact with capillaries (gas exchange) ; cone red with surfactant that keep them from collapsing .

c- Tidal volume : Is the volume of air that inspired, and expired in normal breathing, which as about 400 cc .

d- Asthma : Muscles of bronchioles constrict drastically lead to reducing ventilation .

Quiz/7 : a , d , g .

Quiz/8 :

a- Nervous system :

1- Receive sensory input internal or external .

2- Integrate the input .

3- Responding to internal and external stimuli

b- Lymbic system :

Control motivation and uery important in memory .

c- Spinal cord :

Carries information and controls some reflexes .

d- Eovnea :

Is responsible for focusing the light outo the inside of the eye .

e- Lens :

Is responsible for helping to fine adjust the focus of the eye .

f- Outer ear :

Amplification and filtering the sound, protection other part of the ear and localization .

g- Skeletal muscle :
responsible for body movement .

