JRG College of Pharmacy

JRG COLLEGE OF PHARMACY

UNIVERSITY SOLVED QUESTION WITH ANSWER

Year : 2023-2024

Subject : HAP

Subject Code : BP101T

Subject In-Charge : TEJASWINI KUMARI DASH

KIRANMAYEE BHATRA

Registration No:

Total Number of Page: (01)

1st Semester (Regular) Examination: 2023-24

Course: B.Pharm
SUB_CODE: 23PBP101

SUBJECT NAME: Human Anatomy and Physiology - I
BRANCH:
Max Time: 3 Hours
Max Marks: 75

Sitting: 1st 10.00 AM to 1.00 PM

Medium of Writing: English
Q. Code: A001

The figures in the right-hand margin indicate marks.

Q 1 Objective Type (Answer All) (10 x 02 Marks)

a) What is Mitosis?
b) Define homeostasis?
c) Describe the general functions of epithelial tissue.
d) What is the composition of the bone?
e) Describe the layers of the skin.
f) Explain the clinical significance of Rh factor.
g) Explain how hemoglobin is formed.
h) What is cardiac output?
i) What is normal blood pressure?
j) Explain the general functions of nose.

Q 2 Short Answer Questions (Answer any Seven out of Nine) (7 x 05 Marks)

a) Write a note on the transport across the cell membrane.
b) Describe the structure and functions of muscular tissue.
c) Write a note on the salient features and functions of axial skeletal system.
d) Write a note on the physiology of neuromuscular junction.
e) Write a note on the types of joints and their articulation.
f) Explain the mechanisms of coagulation of blood.
g) Write a note on the functions of Reticulo Endothelial System.
h) Write a note on the disorders of the eye.
i) Describe the structure and functions of veins.

Part- B (Answer Any Two)

Q 3 Long Answer Question (2 X 5 Marks)

a) Write a note on the conduction system of the heart.
b) Describe the origin and functions of cranial nerves.

Q 4 Long Answer Question (2 X 5 Marks)

a) Write a note on the classification of tissues and their functions.
b) Write a note on the composition and functions of blood.

Q 5 Long Answer Question (1 X 10 Marks)

Write a note on the structure and functions of parasympathetic nervous system.

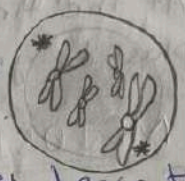
MITOSIS

Cell nucleus is replicated & divided into two identical nuclei containing genetically identical material.

Foure phases

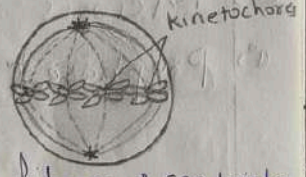
(i) prophase (ii) Metaphase (iii) Anaphase (iv) Telophase

(i) Prophase



- Chromosomal material condenses & seen to be composed of two chromatid & Centromere.
- Nuclear envelope breaks up. Spindle fibres begin to form & extends from centrioles.
- centrioles slowly migrate to opposite side of cell.

(ii) Metaphase



- Chromosomes move & lined up along equatorial plate.
- Chromosomes moves with the help of spindle fibres & centrioles.
- The spindle fibres are attached to kinetochores.

(iii) Anaphase

- Chromosomes splits & pulled apart by spindle fibres causing sister chromatids & create two daughter chromosomes.
- Further the daughter cell get migrate towards opposite poles.
- They have identical set of chromosomes & also identical parent cell.

(iv) Telophase

- New nuclei begin to form around new set of Chromosomes.
- spindle fibre disappears.
- Chromosomes back into their loose form.

⇒ It is derive from a Greek word Homeo means Same, stasis means standing.

⇒ Thus, Homeostasis is defined as a state of dynamic equilibrium that maintains a constant internal Physiological environment of body, Constant with respect to the changing external environmental condition.

⇒ It involves exchange the material bet^n the cell, good metabolism, integration of diff^n activites of the body & reacting towards the changes occuring in the body's internal environment.

(i) EPITHELIAL TISSUE Superficial

Epithelium or Epithelia covers the external body surface & inner lining of internal organs, vessels, tubes, glands

The cells in the epithelium are closed packed & arranged in one or more lyers.

A thin sheet of connective tissue, known as basement membrane, separates the epithelium from the underlinening tissue.

Characterstics

(i) Polarity - Having one free surface (Apical surface) & one attached surface

(i) cellular nature :- cells in epithelium feet closely together side by side & sometimes atop eachother & held together by specialised junc. supported by connective tissue. (Attachment to a layer of connective tissue at basal surface forms a layer called basement membrane.

(ii) A-vascular :- Typically lacks its own blood supply.

(iii) Re-generation :- Can regenerate if properly nourished.

(iv) absence of nerves (except for a few axons in deeper layers)

Composition of bone

- Bone is made up of organic part (about 30%) mainly type 1 collagen & proteins that give flexibility.
- Inorganic part (70%) :- mainly calcium phosphate provides hardness

LAYERS OF SKIN

Epidermis :- Outermost layer which having no blood vesseles providing a water prove barrier and creating our skin.

LAYERS OF EPIDERMIS

(i) Stratum ~~epidermis~~ Cornium : barrier to env

Dead Karatinised cell that act as a barrier to environmental factors.

(ii) Stratum lucidum

Found only in thick skin areas like Palms, sole of

(iii) Stratum Granulosum

Water prove barrier

(iv) Stratum Spinosum

Strenth & flexibility

(v) Stratum Basale

Deepest layer where new skin cells are produce through mitosis, it helps the formation of fingerp & it also contain melanosite which helps to produ Skin Pigmentation.

Dermis

To contain connective tissue, hair follicle, sweat gland & sensesory receptor.

Sebacious gland :- production of sebum

Antipersiperent

LAYERS of DERMIS

PEPILLARY

⇒ Made upof lose connective tissue.

⇒ Capilaries, limph vesseles, sensesory neurons.

RETICULAR

⇒ dense Connective tissue

⇒ Hair follicles, sweat gland, sebacious gland.

HYPODERMIS (subcutaneous layer)

⇒ Helps to store fats.

⇒ Attached to the bone & muscle

Clinical significance of Rh-factor

- Important in blood transfusion compatibility and Pregnancy.
- If Rh-negative mother carries an Rh-positive fetus it may cause hemolytic disease of new born.

RBC (Red blood cells)

- 99% of all blood cells are erythrocytes
- Bi-concave disc, flexible with no nucelus & intra-cellular organells. leaving more space for haemoglobin. Diameter → 7 µm

Func:- gas trasport mainly of oxygen & also carried CO_2

Life span & developent of Erythrocytes

Erythroblast (nucleated cells)
↓ in red bone marrow (bone marrow)

Dietary Vit. B12 & folic acid promote maturation

Dietary iron used to make Haemoglobin

- Reduces in size
- Produce Haemoglobin
- loses nucleus

↓

Reticulocyte (mature in circulation in 7 day)

↓

mature erythrocytes (lives for 120 days)

↓

Haemolysis

Iron content Recycled

Bilirubin secreted into the Bile

- As they have no nucleus should need to be continuely replaced by new cells from Red bone marrow
- The life span in the circulation is about 120 days
- The process of development of RBC from stem cells takes about 7 days is called erythropoiesis
- vitamin B_{12} & folic acid are required for Red blood cell synthesis

Stages in development of RBC :

Day-1

proerythroblast

Day-2

Basophilic-erythroblast

Day-3

Polychromatophilic erythroblast

Day-4

Normoblast → ejection of nucleus

Day-5-7

Reticulocyte enters blood circulation

↓

mature Red Blood cells

CARDIAC OUTPUT

- It is defined as it is the amount of blood flowing from the heart [from left ventricle into aorta per min.] or in one heartbeat.

Cardiac Output = Stroke Volume x Heart Rate

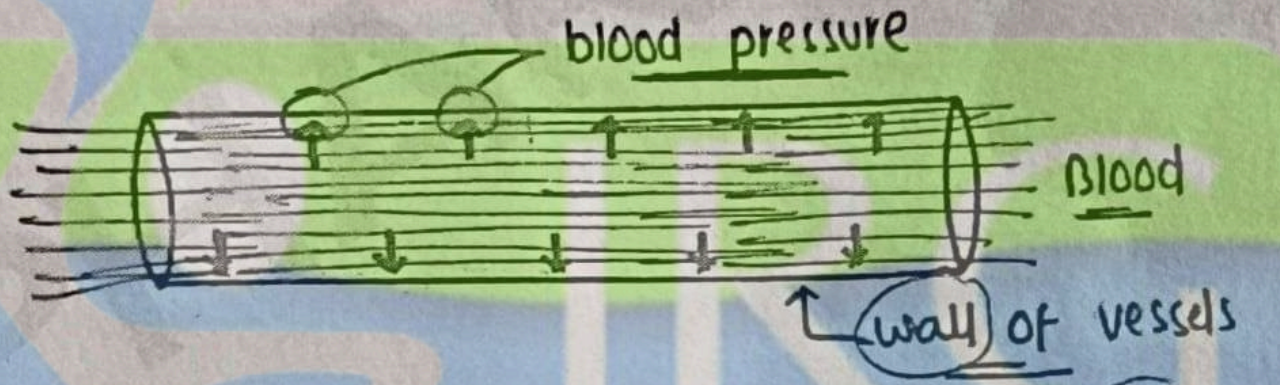
= 70 ml x 72 /min = 5040 ml/min

= about (5) litre / minute.

where, stroke volume = volume of blood pumped by heart / heartbeat.

BLOOD PRESSURE

- It is the pressure exerted by the blood to the inner wall of blood vessels.
- It mainly depends on the diameter of blood vessels.



- Average / Normal blood pressure → 120/80 (systol / diastol)
- Low BP → less than 90/60 ⟷
- High BP → more than 140/90

General fun' of nose

- It helps in breathing by filtering,
- warming and humidifying the inhaled air.
- Also functions in the sense of smell & voice resonance.

Transport across membranes

There are two types of transport mechanisms found in the cell membranes :-

(1) Active transport
(2) Passive transport

- Active transport having two mechanisms

(i) primary active transport :- involves the transport of substance against the conc. gradients by utilising the energy by the hydrolysis of ATP.

(ii) secondary active transport :- Generally occurs when the ion channels are formated with the help of a carrier protein.

- Passive transport having two mechanisms

(i) Passive diffusion :- Transport of substances against their concerntration gradient & electrical gradient & this difusion is not dependent of energy.

(ii) Facilated diffusion :- transport of substance along their concerntration & electrical gardient & also not dependent of energy.

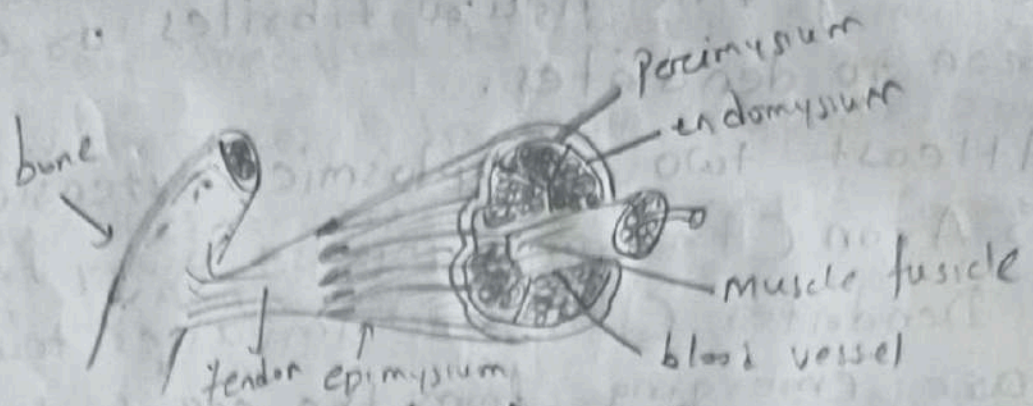
* Exocytosis :- By which the contains of the cells are released outside of the cells. *Endocytosis Reverse mechanism of endocytosis. Includes three mechanism.

- Phagocytosis :- Foregin Particeles are surrended by the plasma membrane forms the phagosomes & fuse with lysosomes & hydrolytic enzymes which

digest the foreign material inside the cell. Thus called cellular eating.

Pinocytosis :- known as cellular drinking which digest the liquid substances as phagocytosis.

The foreign material binds with specific receptor protein, which is digested by the cell.



Muscular tissue

Muscular tissue is formed by agrigation of muscle cells or fibres & can be classified as

(i) skeletal muscle
(ii) smooth muscle (visceral)
(iii) Cardiac muscle

Skeletal muscle

- These are cylindrical shaped, multi-nuclicated cell, having a group of muscle fibriles.
- These are generally join to bones by collagen fibre bunddle called as tendons.
- Skeletal muscles are voluntery in nature & are supplied by cerbrospiral nerves through somatic nervous system.

Characterstics Feature

- Length of the muscle fibres varies from several mm to inches & weldth varies of 10-100mm.
- ends of the fibres are tapered.
- ending of a motor neurons (synaptic boll) creats a narrow space bet^n ending of a skeletal muscle fibres synaps.
- The fibres are arranged in a bunddle within whole muscle & are known as fascicles.
- Around each individual muscle fibre there is a connective tissue layer known as Endomysium. which is covered by a another connective tissue layer known as Perimysium.
- Perimysium wraps the muscle of buddle fibres in the form of fascicles.
- Around each fascicles the perimysium is continues with a external sheath known as Epimysium, which is wrapping the whole muscle.
- Below the connective tissues, blood vesseles are present & within the endomysium a reach network of capillaries are also present.

Smooth muscle

- These are thin & spindle shaped which Consist of actin (thin) & myosin (thick) fillament sliding over each other
- In order to help the cell contraction

Characterstic feature

- They occurs in the organs of visceral organ in walls of hollow organ & blood vesseles.
- They are unstriated muscle fibre having a single nuclie & controlled by autonomic nervous system. Thus involuntary in nature.
- Calcium binds to a protein Calmodulin rather than binding troponin.

Calcium + Calmodulin protein activates the myosin fillaments, which in turn attach with the actin fillament, to start the procers of contraction, in smooth muscle.

Cardiac Muscle

- These are cross, striated involuntary muscle found in myocardium of heart & extend upto the basal membrone of the large blood vessels to join the inner surface of heart
- The extend of each of these cells is about 100mm in length & 15mm in daimeter in cr
- A very fine highly vascular connective tissue is sandwich bet^ the two Cardiac cell is known as Endomysium.
- A single rounded nuclie is present centrally in each muscle fibre.

More no of mitochondria & less Number of myofibrils are contained in the sacroplasm of these cell

Func of muscular tissue

- Allows the movements of joints & bones.
- help in the production of large amount of heat As well as maintain the fluid balance of whole body.
- maintain the posture of body & supports the veseral organs forming a protective layer around diffⁿ organ, tissues & blood vesseles.
- help to expresses the feelings, thoughts. which are proposed by the brain.

- Dependent on skeletal muscle contraction & breathing movements to push back blood to heart.

Axial skeletal system

- The axial skeleton form central axis of body & protects/ supports vital organs.
- It consist 80 bones.
- Major parts are:- Skull (22 bones), Hyoid bone (1 bone), Auditory ossicles (6 bones), vertebral column (26 bones), Thoracic cage (25 bones)
- Bones are arrange symmetrically along body's longitudinal axis.

Functions:-

Protection

Protects vital organs like brain, spinal cord, heart & lungs.

Supports

Provide central framework that support head neck & trunk.

Movement

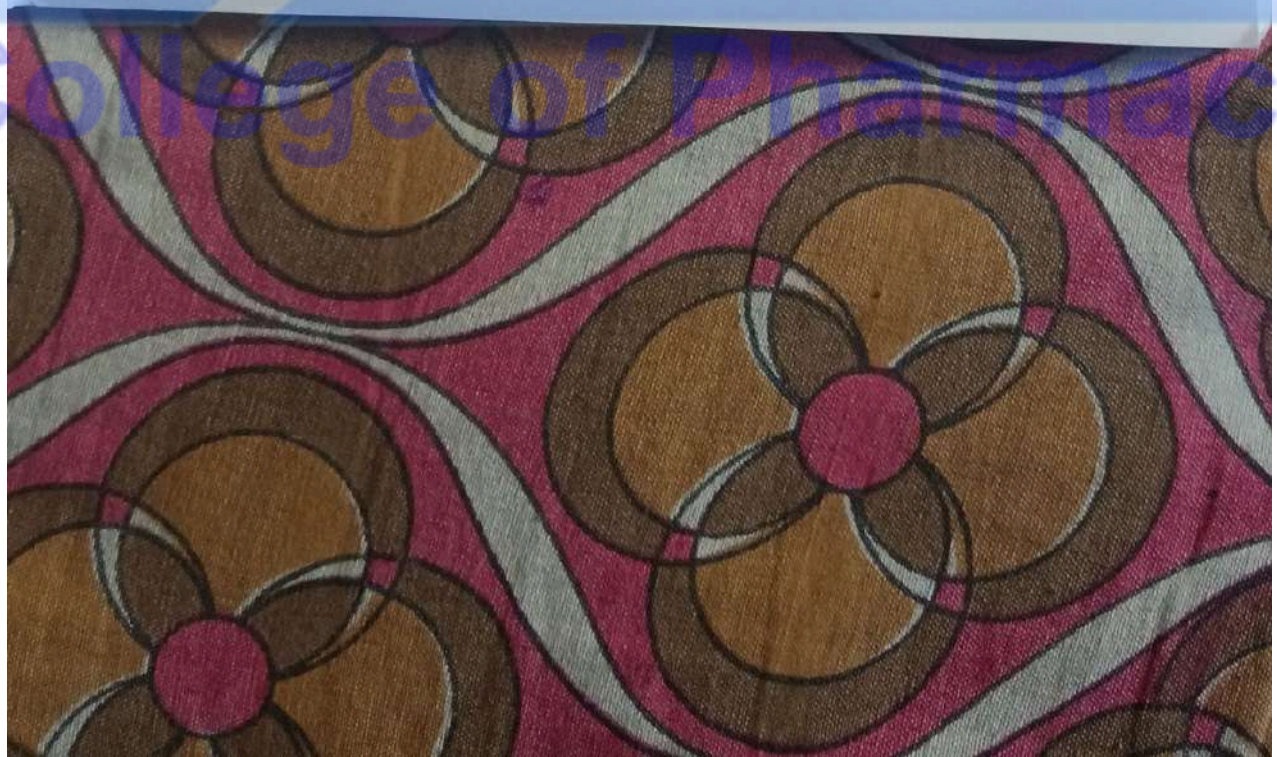
Though less mobile than appendicul system, allows bending, twisting & respiratory movements.

Sound transmission

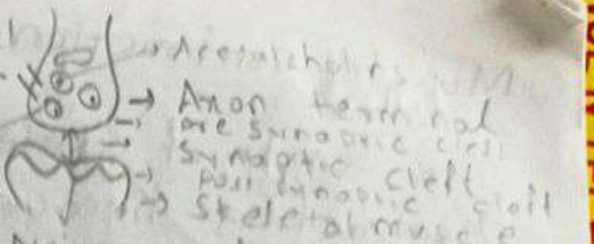
Auditory ossicles in ear transmit sound vibrations.

Hematopoiesis

Bone marrow in axial bone produce blood cells.



Neuromuscular Junction



- The junction between neuron cells and skeletal muscles is called neuromuscular junction.
- In this junction the end part of the neuron is connected to the skeletal muscle fibres.
- The axon terminal in the neuron is known as Pre-synaptic cleft.
- The axon terminal contain acetyl choline packed inside the vessicles.
- It also contains calcium channels which allows the movements of calcium.
- Arrival of motor neuron action potential depolarised the membrane of terminal bottom.
- Activation & opening of voltage getted calcium Channel leds to Calcium influx in axon terminal.
- movement of Ach to inner surface of pre-synaptic membrane
- Vesicles fuse to the membrane and release Ach into synaptic cleft by exo-cytosis
- Ach diffuse across synaptic cleft & bind to the Ach receptor on the motor end plate.
- Binding of Ach cause Sodium ion influx & Potassium ion efflux. & generate action Potential
- Spread of action potential to the muscle fibre & Contraction will occur. & that Communication occurs bet^ neuron & muscle is called Neuro muscular transmitic

ATP hydrolysis

- Mysoin head include an ATP binding site [ATP → ADP + Ph]
- This conversion gives energy to the myosin head

Attachment of mysoin to Actin to form cross bridge.

Energized mysoin head attacked with the actin an myosin binding site,
Now this attachment is reffered as cross-bridge.

Power stroke

- Once the cross bridge are formed, the power stroke occurs.
- In power stroke the cross bridge rotates towards the centre of sacromere.
- The power stroke generates a force which slide the thin filament over thick filament

Detachment of myosin from Actin

- Once the contraction ends, the ATP again binds on the ATP binding site an myosin head & myosin get detaches from the actin.
- This process is cyclic.

Changes during muscle Contraction

- The resting pH of muscle is alkaline and during contraction due to dephosphorilation of ATP to ADP the pH become acidic.

Joints

on the basis of structure

- Fibrous Joint
- Cortilagenous Joint slightly
- Synovial Joint (freely movable)

A joint is the connection bet^n two bones in which one bone is attach with the other bone

Arthrology is the science concerned with the study of anatomy fun^c, disfunction, & treatment of joints.

Arthrology is also called as Arthrologia & Syncosteology

Joint pain → Arthalgia

Muscle pain → Mylgia

Joints is a point of contact bet^n two bones, bet^n bones & Cartilage or bet^n bone & teeth.

Hyoid bone in neck, only one bone doesn't articulate with any of the bone.

Classification:

on the basis of structure

- Fibrous (Immovable)
- Cortilagenous (slightly movable)
- Synovial (Freely movable)

Fibrous Joint

- which have very less degree of movement.
- It is a fixed joint, where collagenous fibre, connective tissue, connects to bone.
- Ex→ Sutures, syndemosis - betⁿ tibia & fabula, Gomiphosis

Cartilaginous

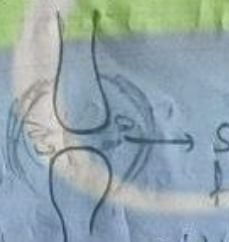
which have some degree of movement, in this bones are connected with eachother, with the help of cartilage. (Hylaine, Fibrocartilage)

Ex→ Ribs & vertibral coloumn.

Synovial joint

Freely moveable

= The exclusive characterstic of synovial joint is the presence of a space called synovial cavity betⁿ articulating bones.



- All synovial joints are di-arthrosis

- In this bones are connected eachother with the help of synovial fluid which is filled inside the synovial cavity

Types of synovial Cavity

- Gliding joint
- Hinge joint
- Pivot joint
- Condyloid joint
- Saddle joint
- Ball-and-socket joint

⑤ Describe the mechanism of blood coagulation ?

Ans :) Blood coagulation (clotting) : is a complex physiological process that prevents excessive bleeding when blood vessels are injured.

•) It occurs when :-

① Trauma or injury to vascular wall.
② Trauma blood.
③ When WBC came contact to collagen damaged endothelial cell or other element.
④ It involves a series of biochemical rea n.

•) It summarised under 3 main steps :-

① Formation of prothrombin : -

↳ Formed by two mechanism extrinsic and intrinsic pathway.

a) Extrinsic pathway :-

•) It is the site of trauma is outside the blood vessel, prothrombin formation occur.

i) Release of tissue thromboplastin :-

↳ The damaged tissue release tissue thromboplastin (factor III).

ii) Activation of factor X :-

↳ Thromboplastin (factor III) combines with stable factor (factor VII) to form tissue thromboplastin (factor VII complex).

↳ Then it activates, stuart factor (Factor X) forming activated factor X.

iii) Formation of Prothrombin Activator Complex :-

↳ The activated factor X along with labile factor (factor V) & Ca^{2+} (factor IV) forms complex called prothrombin activator.

b) Intrinsic pathway

↳ In case injury to blood tissue of blood to collagen occure.

↳ The steps of intrinsic pathway can summarised by:

① injury to blood activates plasma factor XII & simultaneously platelets are also activated to release phospholipids.

② Factor XI activated to XI.a by activated factor XII.

③ Factor IX activated to IX.a by activatd factor IX in presence Ca^{+2}.

④ Factor X is activated to Xa by activated factor IX in presence of activated factor XIII Ca^{+2} & phospholipids.

⑤ The activated factor X along with phospholipids activates factor V & Ca+ forms a complex called Prothrombin.

Functions of Reticulo endothelial system.

Reticulo Endothelial System also called Monocular phagocy
- It system is a network of specialized cell, spread throughout the body.

Functions are:-

- Phagocytosis.
  Engulf & destroy Microbes, worn out cells, cellular debris & foreign particles.
- Immunity:-
  Present antigens to lymphocytes, helps in activation of immune response.
- Blood cell turnover:
  Remove & recycle aged or damaged RBCs & platelet

- Iron & haemoglobin metabolism

Recycle iron from destroyed RBCs for new haemoglobin synthesis.

- Detoxification

Help clear toxins, foreign substances & circulating immune complexes from blood.

- Storage function

Act as a reservoir for iron, lipids & other metabolites.

a) Structure

DISORDERS OF EYE

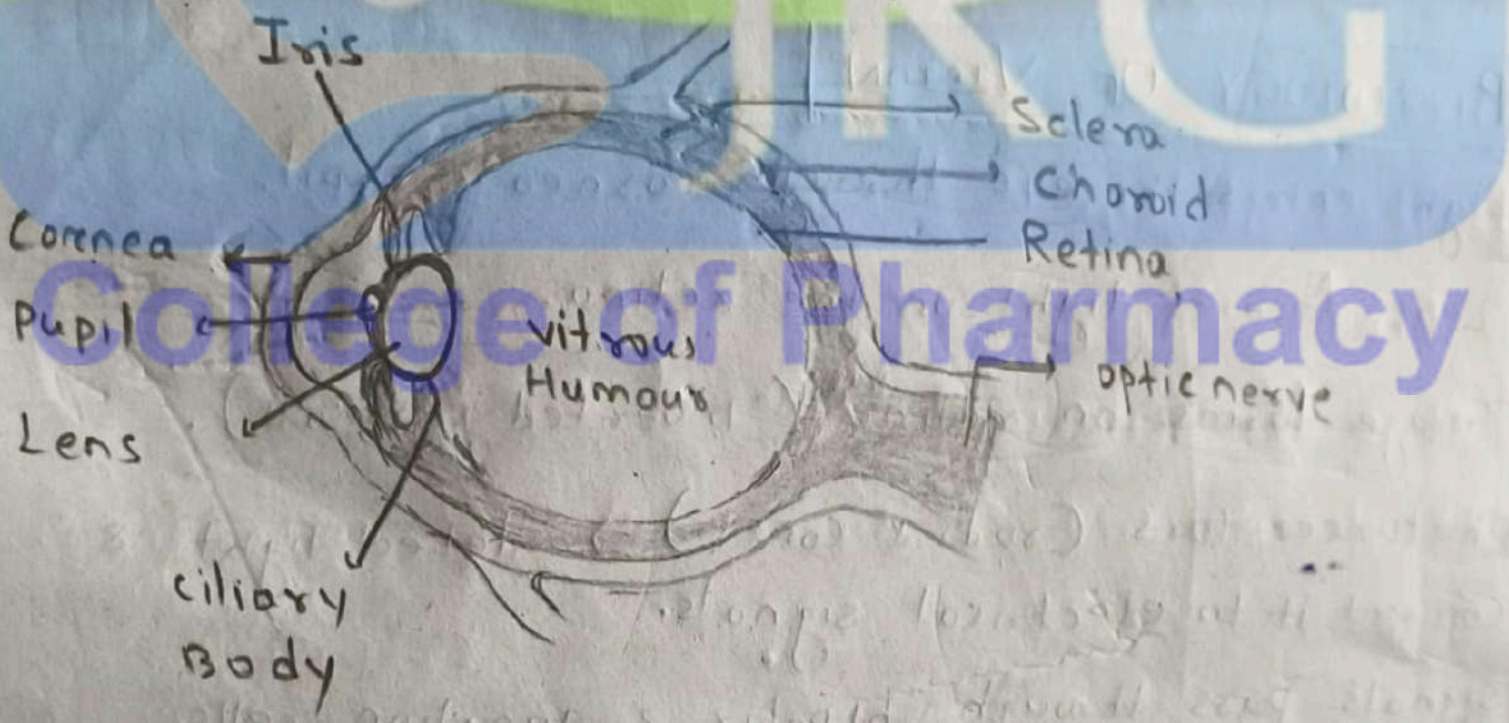
Myopia :- Difficulty in seeing the distant object.

Hypermetropia :- Difficulty in seeing the near object.

Glaucoma :- Increased intraocular pressure due to excess production of aqueous humour.

Color Blindness :- Defect in retina, can't see one or more colours.

Night Blindness :- Not possible to see in dimlight



- Iron & haemoglobin metabolism

Recycle iron from destroyed RBCs for new haemoglobin synthesis.

- Detoxification

Help clear toxins, foreign substances & circulating immune complexes from blood.

- Storage function

Act as a reservoir for iron, lipids & other metabolites.

a) Structure

Veins are blood vessels which carry blood towards heart.

Three layers (Tunics)

Tunica intima (inner layer)

Thin endothelium lining with valves to prevent back flow

Tunica media (Middle layer)

Thin layer of smooth muscles.

Tunica externa (outer layer)

Thick layer of connective tissue which provide supports.

valves

Present in most veins to prevent back flow & ensure one way flow towards the heart.

wider lumen

Veins have a larger internal diameter compare to back arteries, which allow to hold more blood.

Thin walls

due to blood pressure in veins is low, their wall are thinner & less muscular than arteries.

Functions

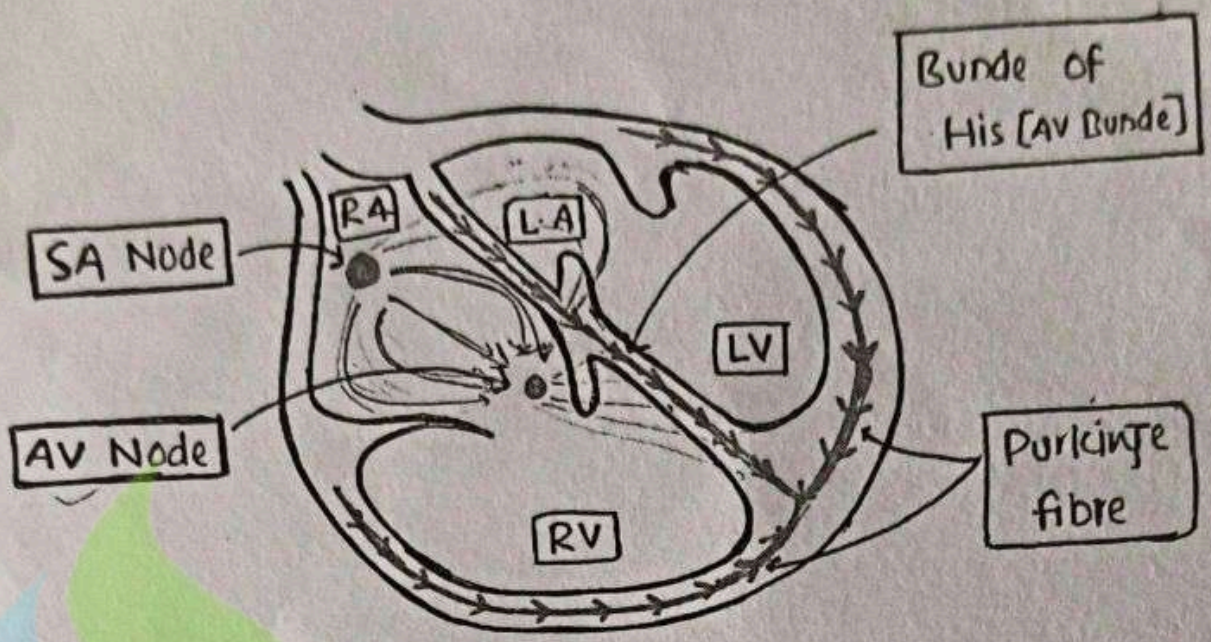
- vein carry deoxygenated blood from tissue back to heart.
- vein hodld about 60-70% of tot al blood volume act as blood reservoir.
- valve ensure that blood flow only toward heart preventing pooling due to gravity.
- veins rely on skeletal muscle contraction & breathing movements to push back blood to heart.

CONDUCTION SYSTEM OF HEART

- Heart is made up with a myocardiac muscle (tissue) also known as cardia cells.
- These cells have ability to generate electrical impulse itself known as Auto rythmicity and are responsible for pumping action of heart-
- They itself generate action potential / electric impulse [current to pump heart].
- It consists of four major element →
  - (i) SA Node
  - (ii) AV Node
  - (iii) Bundle of His
  - (iv) Purkinje fibres

(i) SA Node → It is Sino Atrial Node. It is the natural pacemaker of the heart.

- It generate action potential (electric impulse) responsible for the pumping action of heart.
- It located in the wall of right atrium near the superior vena cava.



(ii) AV Node → It is Atrioventricular Node. It is the second pacemaker of the heart.

- It located in the bottom of right atrium.
- It collects impulse from SA node and transfer to bundle of His.

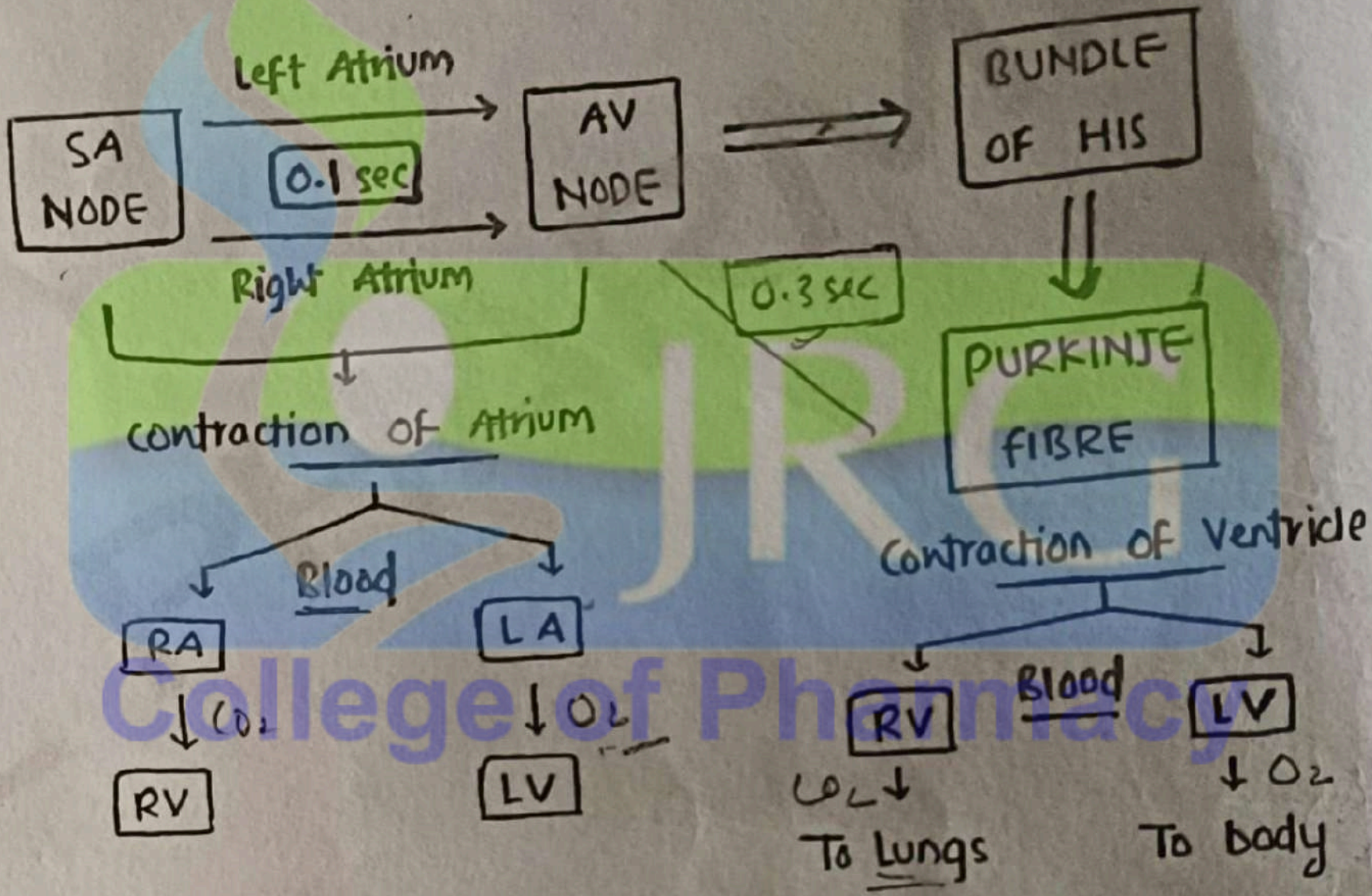
(iii) Bundle of His → Also known as AV bundle. It located b/w the atria & ventricular.

- It receives impulse from AV node and transfer to purkinje fibre.

(iv) Purkinje fibre → It is located at the end of AV bundle at the base of heart

- These are network of small bundle of conducting fibres and get impulse from Bundle of His.

- It is responsible for the contraction of ventricles.



Cranial Nerves

→ These are those nerves which originated from the brain and brainstem and extend throughout the body on both sides.

→ cranial nerves carry information from the brain to the other parts of the body. mainly to the head and neck.

→ these nerves are present in paired.

-> They are mainly responsible for Balancing smell, vision, hearing & movement of muscle.

-) Twelve pairs (12) of cranial nerves are present in humans

1) Olfactory
2) Optic
3) Occulomotor
4) Trochlear (pathetic)
5) Trifacial (Trigeminal)
6) Abducens
7) Facial (portio dura)
8) Auditory (portio mollis)
9) Glosso-pharyngeal
10) Vagus (pneumogastric)
11) Accessory (spinal accessory)
12) Hypoglossal

No	TYPE	LOCATION	Functions
1	sensory	cribriform plate	smell
2	sensory	optic foramen	vision
3	motor	superior orbital fissure	Eye movement
4	motor	" "	Eye movement
5	mixed	" "	facial sensation
6	motor	" "	Eye movement
7	mixed	Internal auditory canal	facial expression
8	sensory	" "	Hearing and balance
9	mixed	Jugular foramen	oral sensation & taste
10	mixed	" "	Vagus nerve
11	motor	"	Shoulder elevation & head turning
12	motor	Hypoglossal	Tongue movement

a) PNS

The human nervous system is a complex network that coordinates all body activities. It devided into two main parts :-

1. Central nervous system (CNS) :-
   Including brain & spinal cord.
2. peripheral nervous system (PNS)
   Including all nerves & ganglia outside the CNS.

Definition

- The peripheral nervous system (PNS) is the part of the nervous system that lies outside the brain & spinal cord.
- It consist of nerves & ganglia that connect the central nervous system to sensory organs, muscles & glands.

The PNS is divided into following major components:

1. Somatic nervous system (SNS)

Func - Controls voluntary movements.

Composed of:

- Sensory Neurons: Carry information from sensory organs (skin, eyes, ear etc) to CNS.
- Motor Neurons: Transmit commands from CNS to skeletal muscles

involved action such as walking, writing, talking etc

2. Autonomic Nervous system

Func: Controls involuntary activities of body.

Regulates func such as heartbeat, digestion, respiration & glandular secretion.

→ Further subdivided into three parts.

Sympathetic nervous system

→ Activates the body during stress or emergency.

→ known as "fight or flight" system.

Parasympathetic nervous system

→ promotes relaxation & recovery

→ known as "rest & digest" system

Enteric Nervous system

→ Sometimes reffered as 2nd brain.

→ Controls motility, secretion & blood flow in gastrointestinal tract.

Structure of PNS

1. Nerves
   - Bundles of axon carry signals to & from the CNS.
   - → Types
     - Cranial nerves : 12 pairs that emerge from the brain
     - Spinal nerves : 31 pairs that emerge from spinal cord.
2. Ganglia
   - cluster of neuron cell bodies that ~~emerge from the spinal~~ located outside the CNS.
   - Act as relay stations for nerve signals.

Function of PNS

1. Transmission of sensory information
   - → sensory neurons in PNS detects change in internal & external environment.
   - → These neurons carry information from sensory receptors (like skin, eyes, ears, nose etc) to CNS.
   - → Ex → Touch, temp., pain, pressure from skin
     - → vision, hearing, taste, smell
2. Transmission of Motor Commands
   - → motor neurons transmit signals from the CNS to the muscles and glands.
   - → Responsible of muscle contraction.
   - → Divided into
     - Somatic motor neurons
     - Autonomic motor neurons

3) Regulation of involuntary fun°
Heartbeat, Blood pressure, Breating, digestion, body temp.
There are automatic, don't require conscious control.

4) Voluntary control of movement
Commands are sent from the brain to muscle to perform physical activities like writing, walking or speaking.

5) Homeostasis maintenance
- Balance activity bet° sympathetic & parasymapthetic systems.
- Eg. When stressed, heart rate increases & after relaxing, heart rate slows.

6) Control of special senses
Through cranial nerves, the PNS play a role in special senses like - vision, hearing & balance, smell, Taste.

Clinical importance

- Damage to PNS can cause condition like
  - Peripheral neuropathy
  - Paralysis
  - Loss of sensation.