

Basic Human Anatomy, Physiology & Medical Terminology



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Visualization of Anatomy

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Medical Terminology:

DEFINITION:

Medical terminology is a vocabulary for accurately describing the human body and associated components, conditions, processes and process in a science-based manner.

- Although medical terminology may seem complex, many medical terms can be broken into component parts, which makes them easier to understand.
- Many of these terms are derived from Latin or Greek words, but some include the names of physicians.
- Prefixes are word parts that appear at the beginning of a word and modify its meaning; suffixes are found at the end of words. By learning what various prefixes and suffixes mean, it is possible to decipher the meaning of a word quickly.

OBJECTIVE:

There are three objectives to keep in mind as you study medical terminology.

1. Analyze words by dividing them into component parts:-
2. Relate the medical terms to the structure and function of human body:-
 - a. Medical terms explained in their proper context will be easier to remember.
 - b. Eg: hepatitis-means inflammation of liver. (Hepat:-Liver and itis:-inflammation)
3. Be aware of spelling and pronunciation problems:-
 - a. Some medical terms are pronounced alike but are spelled differently and also have different meanings.
 - b. Eg:-ilium and ileum
 - i. They have identical pronunciations but
 1. ILLIUM –means a part of hip bone and
 2. ILEUM –means part of the small intestine.

WORD ANALYSIS:

It means dividing the word into its component parts.

The component parts are:-

- 1. Word root:**
 - a. The **word root** is a term derived from a source language such as Greek or Latin and usually describes a body part.
 - b. The word root is the foundation of the word. All medical terms have one or more roots.
 - c. Eg:- The root “**Hemat**” means “**blood**.”
- 2. Prefix:**
 - a. The **prefix** can be added in front of the term to modify the word root by giving additional information about the location of an organ, the number of parts, or time involved.
 - b. Eg: Subgastric--here “Sub” is prefix which means “under”

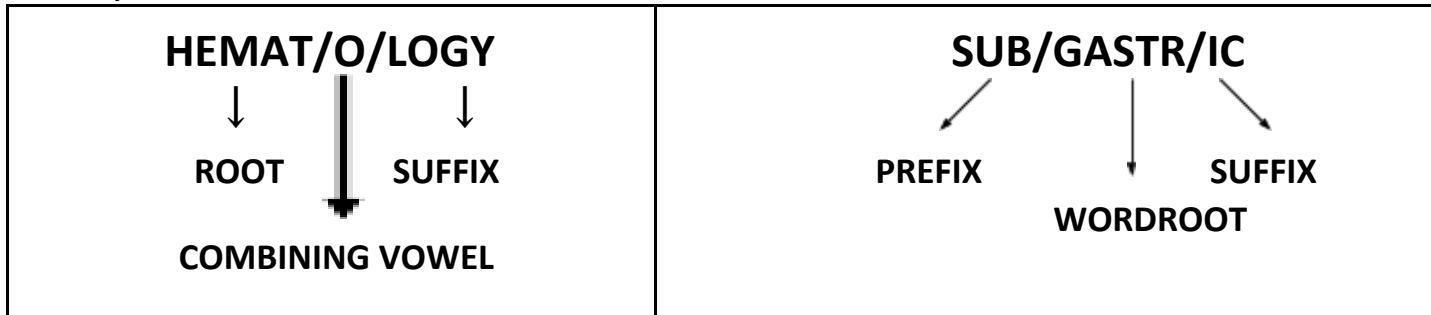
3. Suffix:

- a. **Suffixes** are attached to the end of a word root to add meaning such as condition, disease process, or procedure.
- b. Eg:- The suffix “**-logy**” means “**study of**”.

4. Combining vowel:

- a. (Usually O) It links the root to the suffix or one root to another root.

Example



List of few commonly used medical terms to start:

Prefix/Suffix	Example
-ic	of or pertaining to
a = an absence of	a/vir/emia (no virus in the blood)
alg(ia) = pain	neur/algia (nerve pain)
anti = attacks	anti/retroviral (attacks retroviruses)
contra = against	contra/ceptive (against conception)
cyt(e,o) = cell(s)	macro/cyte (big cell)
dys = abnormal	dys/plasia (abnormal growth)
emia = in the blood	tox/emia (toxins in the blood)
endo = inside	endo/scopy (examining the inside)
erythr(o) = red	erythro/cyte (red blood cell)

gastr(o) = stomach	gastr/itis (stomach inflammation)
gen(esis) = origin, new	oste/o/genesis (formation of new bone)
glyc(o) = glucose (sugar)	hyper/glyc/emia (high blood sugar)
hem(ato) = blood	hemato/logy (study of the blood)
hepat(o) = liver	hepat/itis (liver inflammation)
hyper = high, elevated	hyper/lipid/emia (high blood lipid levels)
intra = within	intra/muscular (in the muscle)
itis = inflammation	pancreat/itis (inflammation of the pancreas)
leuk(o) = white	leuko/penia (deficiency of white blood cells)
lip(o) = fat	lipo/dys/trophy (abnormal fat development)
lysis = break up	cyto/lysis (breaking up cells)
mal = bad, poor	mal/nutrition (poor nutrition)
mega(lo) = large	mega/dose (large dose)
my(o) = muscle	my/algia (muscle pain)
osteo = bone	osteo/pathy (bone disease)
penia = deficiency	osteo/penia (deficiency in the bones)
peri = around	peri/oral (around the mouth)

Surgical Procedures

Suffix	Meaning	Example
-centesis	puncture a cavity to remove fluid	amniocentesis
-ectomy	surgical removal (excision)	appendectomy
-ostomy	a new permanent opening	colostomy
-otomy	cutting into (incision)	tracheotomy
-orrhaphy	surgical repair/suture	herniorrhaphy
-opexy	surgical fixation	nephropexy
-oplasty	surgical repair	rhinoplasty
-otripsy	crushing, destroying	lithotripsy

Numbers

Prefix	Meaning	Example
mono-, uni-	one	monocyte, unilateral
bi-	two	bilateral
tri-	three	triad
quadr-	four	quadriplegia
hex-, sex-	six	hexose
diplo-	double	diplopia

Directions and Positions

Prefix	Meaning	Example	Word	Meaning
ab-	away from	abduction	anterior or ventral	at or near the front surface of the body
ad-	toward	adduction	posterior or dorsal	at or near the back surface of the body
ecto, exo-	outside	ectopic, exocrine	superior	above
endo-	within	endoscope	inferior	below
epi-	upon	epigastric	lateral	side
infra-	below, under	infrastructure	distal	farthest from center
ipsi-	same	ipsilateral	proximal	nearest to center
meso-	middle	mesopexy	medial	middle
meta-	after, beyond, transformation	metastasis	prone	face down or palm down
peri-	surrounding	pericardium	sagittal	vertical body plane, divides the body into equal right and left sides
retro-	behind, back	retroversion	transverse	horizontal body plane, divides the body into top and bottom sections
trans-	across, through	transvaginal	coronal	vertical body plane, divides the body into front and back sections

Conditions

Prefix	Meaning	Example	Suffix	Meaning	Example
ambi-	both	ambidextrous	-algia	pain	neuralgia
aniso-	unequal	anisocoria	-asthenia	weakness	myasthenia
dys-	bad, painful, difficult	dysphoria	-emia	blood	anemia
eu-	good, normal	euthanasia	-iasis	condition of	amebiasis
hetero-	different	heterogeneous	-itis	inflammation	appendicitis
homo-	same	homogeneous	-lysis	destruction, break down	hemolysis
hyper-	excessive, above	hypergastric	-lytic	destroy, break down	hemolytic
hypo-	deficient, below	hypogastric	-oid	like	lipoid
iso-	equal, same	isotonic	-oma	tumor	carcinoma
mal-	bad, poor	malaise	-opathy	disease of	arthropathy
megalo-	large	megalocardia	-orrhagia	hemorrhage	menorrhagia
			-orrhea	flow or discharge	amenorrhea
			-osis	abnormal condition of	tuberculosis
			-paresis	weakness	hemiparesis
			-plasia	growth	hyperplasia
			-plegia	paralysis	paraplegia
			-pnea	breathing	apnea

What is Anatomy?

Anatomy is the science that studies the structure of the body.

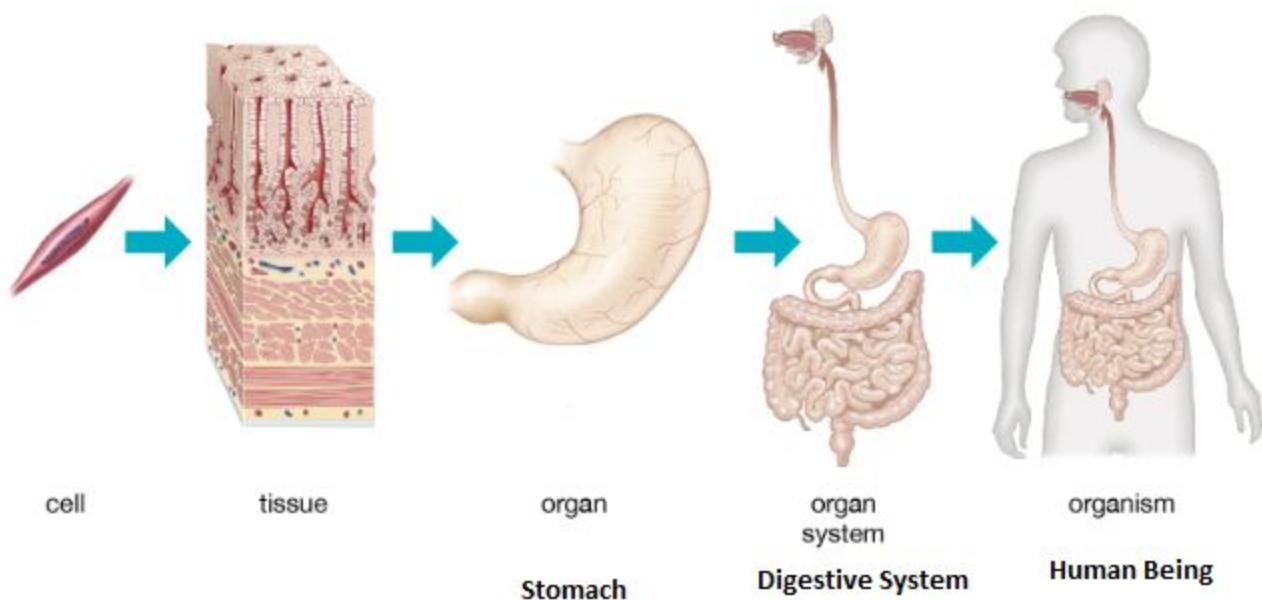
What is Physiology?

Physiology is the scientific study of functions and mechanisms in a living system. As a sub-discipline of biology, physiology focuses on how organisms, organ systems, individual organs, cells, and biomolecules carry out the chemical and physical functions in a living system

Introduction to the Human Body

Human beings are arguably the most complex **organisms** on this planet. Imagine billions of microscopic parts, each with its own identity, working together in an organized manner for the benefit of the total being. The human body is a single structure but it is made up of billions of smaller structures of four major kinds:

Levels of organization

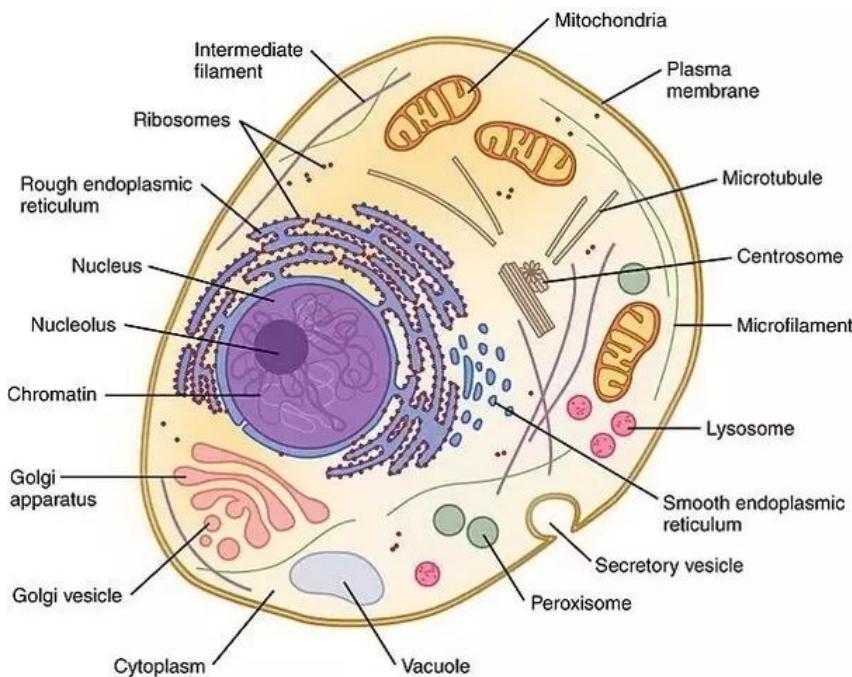


Cells

Cells have long been recognized as the **simplest units of living matter** that can maintain life and reproduce themselves. The human body, which is made up of numerous cells, begins as a single, newly fertilized cell.

A cell consists of three parts:

1. Cell membrane (Plasma Membrane)
 2. Cytoplasm
 3. Nucleus
- Within the cytoplasm lie intricate arrangements of fine fibers and hundreds or even thousands of minuscule but distinct structures called **organelles** (Ex: Mitochondria (Powerhouse of Cell, Ribosomes (Protein produced) etc)
 - **Nucleus:** The cell nucleus contains the majority of the cell's **genetic material** in the form of multiple linear **DNA** molecules organized into structures called **chromosomes**.
 - Humans have 22 pairs of chromosomes + two sex chromosomes (XX-Female and XY-Male chromosomes). **46 chromosomes in total**

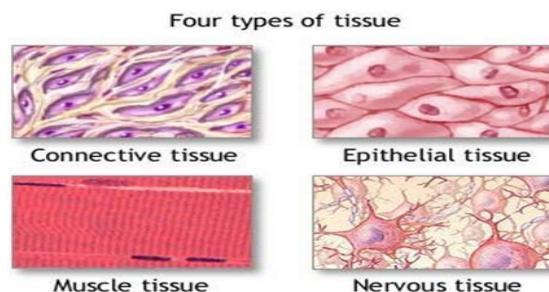


Tissues

Tissues are somewhat more complex units than cells. By definition, a tissue is an **organization of many similar cells** with varying amounts and kinds of non-living, intercellular substance between them.

Body Tissues

- **Tissue:** a collection of cells that are similar in structure and that work together to perform a particular function
- 4 Types of Tissues:
 - Muscle
 - Nervous
 - Epithelial
 - Connective



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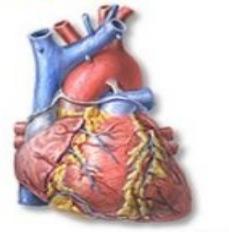
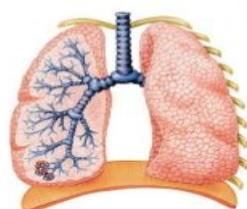
Organs

Organs are more complex units than tissues. An organ is an organization of several different kinds of tissues so arranged that together they can perform a special function. For example, the stomach is an organization of muscle, connective, epithelial, and nervous tissues. Muscle and connective tissues form its wall, epithelial and connective tissues form its lining, and nervous tissue extends throughout both its wall and its lining.

Organs

- Two or more tissues working together form an organ
- Organs are more complex than tissues.
- Examples of Organs

- Heart
- Stomach
- Lungs



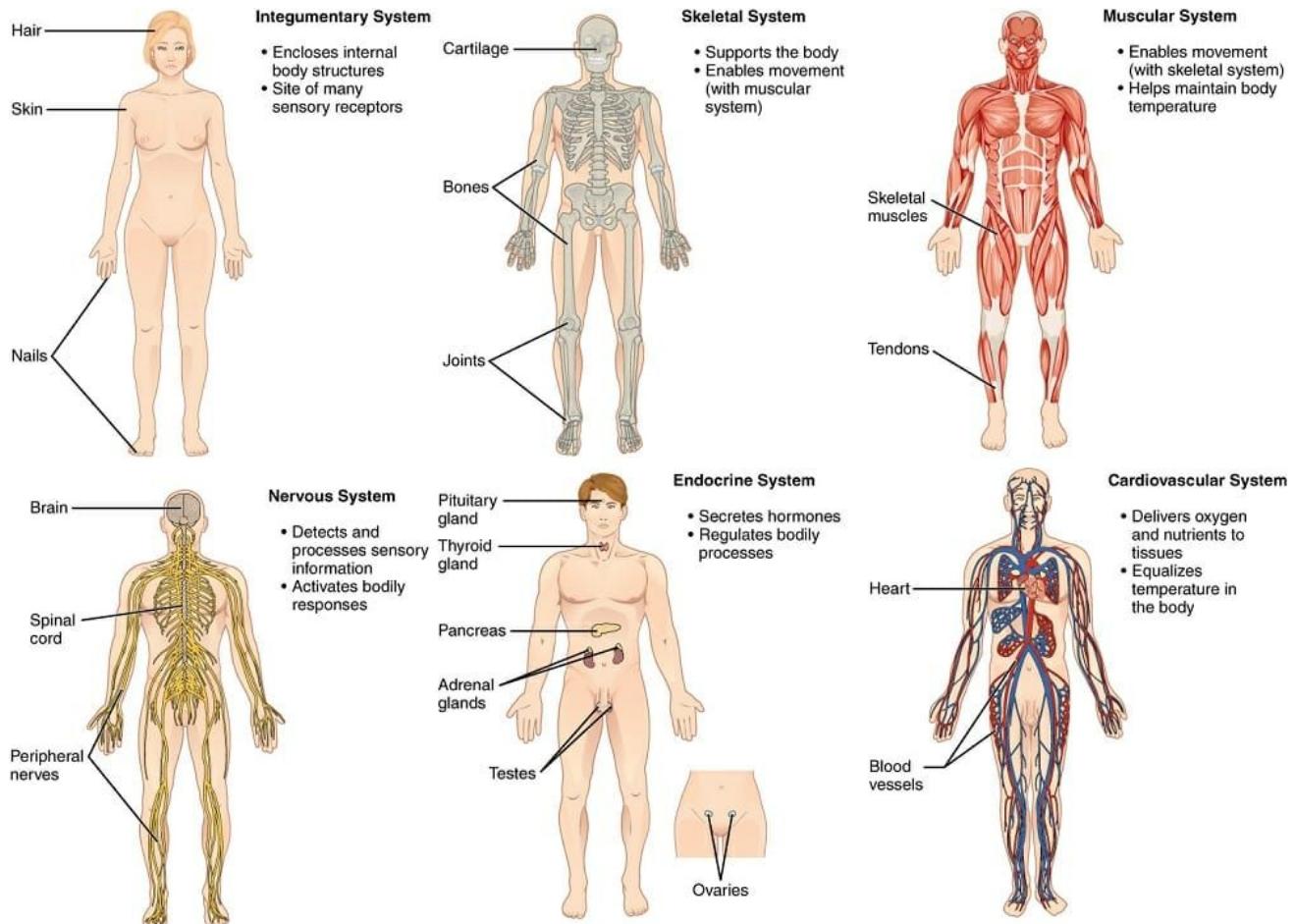
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Systems

Systems are the most complex of the component units of the human body. A system is an organization of varying numbers and kinds of organs so arranged that together they can perform complex functions for the body.

Major systems compose the human body:

1. Skeletal
2. Muscular
3. Nervous
4. Endocrine
5. Cardiovascular
6. Lymphatic
7. Respiratory
8. Digestive
9. Urinary
10. Reproductive
 - o Male
 - o Female
 - o Obstetrics
11. Blood and basic immunology
12. Integumentary (Skin, Hair, Nail)
13. Sensory system (Ear, Nose, Eye)



Medical Terminology Introduction and Colour

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
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Introduction		-ac, -acal	pertaining to	Greek (-akos)	cardiac, hydrophobic, pharmacomaniacal
Introduction		-al	pertaining to	Latin -alis	abdominal
Colour		alb-	Denoting a white or pale color	Latin <i>albus</i> , white	Albino
Introduction		allo-	Denoting something as different, or as an addition	Greek (allos), another, other	Alloantigen, allopathy
Introduction		ante-	Describing something as positioned in front of another thing	Latin (ἀντε), before, in front of	antepartum
Introduction		anti-	Describing something as 'against' or 'opposed to' another	Greek (anti), against	Antibody, antipsychotic
Introduction	Disease process	apo-	separated from, derived from	Greek	Apoptosis
Introduction		arch(i,e,o)	first, primitive		archinephron : first formed kidney
Introduction		-ary	pertaining to	Latin -arius	biliary tract
Introduction		-ation	process	Latin	
Introduction		aut(o)-	self	Greek	Autoimmune
Introduction		aux(o)-	increase; growth		auxocardia : enlargement of the heart
Introduction		bio-	life	Greek	Biology
Colour		chlor(o)-	Denoting a green color	Greek (chloros), green, yellow-green	Chlorophyll
Colour		chrom(ato)-	color	Greek	Hemachromatosis
Introduction		co-	with, together, in association	Latin	
Introduction		com-	with, together	Latin	
Introduction		contra	against	Latin	Contraindicate
Introduction		cor-	with, together	Latin	
Introduction		cry(o)-	cold	Greek	Cryoablation
Colour		cyan(o)-	Denotes a blue color	Greek (κύανος, κυάνεος), blue	Cyanopsia
Introduction		cyt(o)-	cell	Greek	Cytokine
Introduction		-cyte	cell	Greek	Leukocyte
Introduction	Disease process	dis-	separation, taking apart	Latin	Dissection
Introduction		-eal	pertaining to	Latin	
Colour, Blood		erythr(o)-	Denotes a red color	Greek (erythros), red	Erythrocyte

Colour		glauc(o)-	Denoting a grey, bluish-grey color	Greek (glaúkos), grey, bluish-grey	Glaucoma
Introduction		iatr(o)-	Of or pertaining to medicine, or a physician	Greek (iātrós), healer, physician	Iatrochemistry
Introduction		-iatry	Denotes a field in medicine of a certain body component	Greek (iātrós), healer, physician	Podiatry, Psychiatry
Introduction		-ic	pertaining to	Greek (-ikos)	Hepatic artery
Introduction		idio-	self, one's own	Greek idios, "one's own"	Idiopathic
Introduction		iso-	Denoting something as being 'equal'	Greek (íisos), equal	Isotonic
Introduction		-ist	one who specializes in	Greek (-istes)	Pathologist
Introduction		-ite	the nature of, resembling	Greek	Hermaphrodite
Introduction		-ium	structure, tissue		pericardium
Introduction		karyo-	nucleus	Greek - "nut"	Eukaryote
Introduction		kin(e)-, kin(o), kinesi(o)-	movement	Greek	Kinesthesia
Colour, Blood		leuc(o)-, leuk(o)-	Denoting a white color	Greek (leukos), white, bright	Leukocyte
colour		melan(o)-	black color	Greek (melas, melano-), black; dark	Melanin
colour		polio-	Denoting a grey color	Greek (poliós), grey	Poliomyelitis
colour		porphyr(o)-	Denotes a purple color	Greek (porphýra), purple	Porphyroblast
Introduction		reticul(o)-	net	Latin	
Colour, Eye		rhod(o)-	Denoting a rose-red color	Greek (rhódon), rose	Rhodophyte
Introduction		somat(o)-, somatico-	body, bodily	Greek	
Introduction		splanchn(i)-, splanchn(o)-	viscera	Greek	
Introduction		squamos(o)-	Denoting something as 'full of scales' or 'scaly'	Latin (sqāmōsus), full of scales; scaly	Squama
Introduction		therm(o)-	heat	Greek	
Introduction		viscer(o)-	Of or pertaining to the internal organs, the viscera	Latin (viscera), internal organs; plural of (viscerum), internal organ	Viscera
Colour		xanth(o)-	Denoting a yellow color, an abnormally yellow color	Greek (xanthós), yellow	Xanthopathy
Introduction		xen(o)-	Foreign, different	Greek (xenos), stranger	Xenograft
Introduction		zo(o)-	animal, animal life	Greek	
Introduction		body	somat-, som-	corpor-	-

Colour		black	melano-	nigr-	-
Colour		blue	cyano-	-	-
Colour		gray, grey	polio-	-	-
Colour		green	chlor(o)-	vir-	-
Colour		purple	porphyr(o)-	purpur-, purpureo-	-
Colour		red	erythr(o)-, rhod(o)-	rub-, rubr-	-
Colour		red-yellow	cirrh(o)-	-	-
Colour		white	leuc-, leuk-	alb-	-
Colour		yellow	xanth(o)-	flav-	

Anatomical Terminology

Before we get into the following learning units, which will provide more detailed discussion of topics on different human body systems, it is necessary to learn some useful terms for describing body structure. Knowing these terms will make it much easier for us to understand the content of the following learning units.

Three groups of terms are introduced here:

- Directional Terms
- Planes of the Body
- Body Cavities

Directions and Planes of the Body

Directional terms describe the positions of structures relative to other structures or locations in the body.

Superior or cranial - toward the head end of the body; upper (example, the hand is part of the superior extremity).

Inferior or caudal - away from the head; lower (example, the foot is part of the inferior extremity).

Anterior or ventral - front (example, the kneecap is located on the anterior side of the leg).

Posterior or dorsal - back (example, the shoulder blades are located on the posterior side of the body).

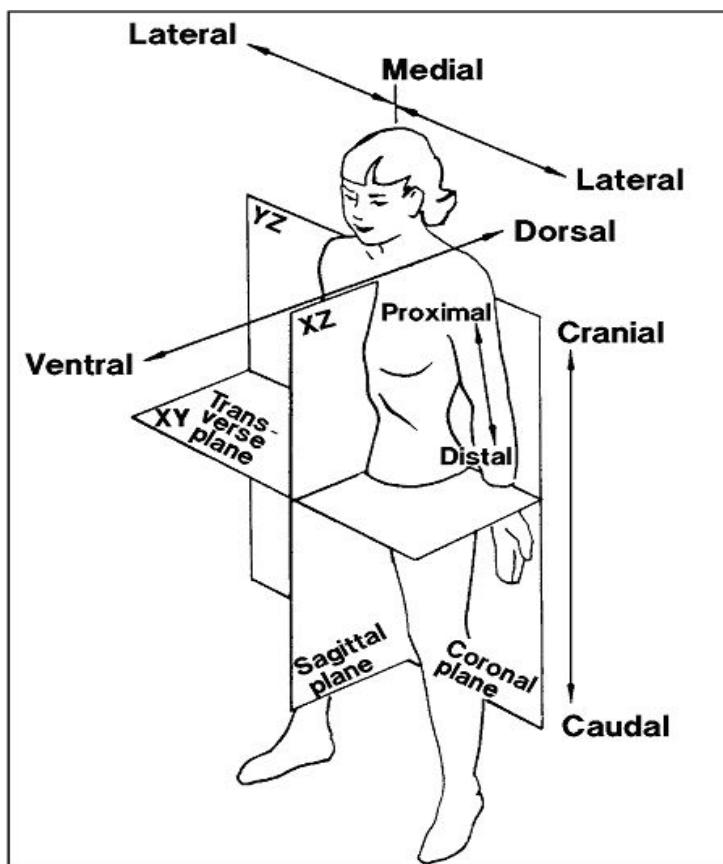
Medial - toward the midline of the body (example, the middle toe is located at the medial side of the foot).

Lateral - away from the midline of the body (example, the little toe is located at the lateral side of the foot).

Proximal - toward or nearest the trunk or the point of origin of a part (example, the proximal end of the femur joins with the pelvic bone).

Distal - Away from or farthest from the trunk or the point or origin of a part (example, the hand is located at the distal end of the forearm).

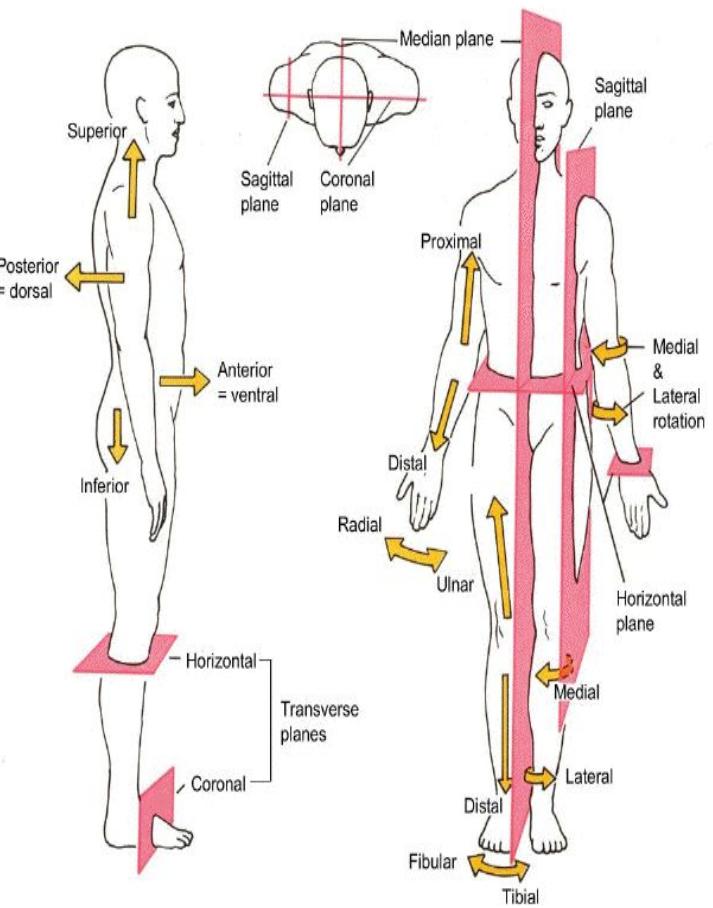
Coronal Plane (Frontal Plane) - A vertical plane that divides the body into ventral (Front) and dorsal (Back) sections; divides the body or any of its parts into anterior and posterior portions.



Sagittal Plane (Lateral Plane or longitudinal plane) - is an anatomical vertical plane which divides the body or any of its parts into right and left sides.

Axial Plane (Transverse Plane or Horizontal plane) - A horizontal plane; divides the body or any of its parts into upper and lower parts.

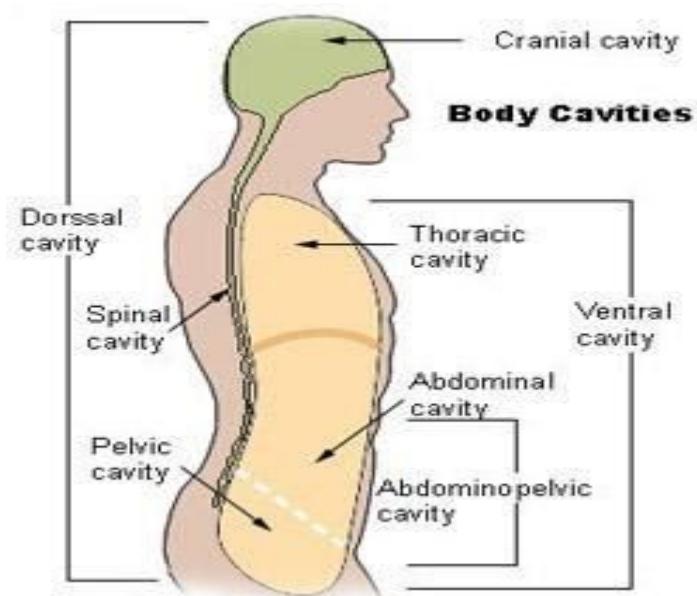
Median plane - Sagittal plane through the midline of the body; divides the body or any of its parts into right and left halves.



Body Cavities

Body Cavities:

The cavities, or spaces, of the body contain the internal organs, or viscera. The two main cavities are called the ventral and dorsal cavities. The ventral is the larger cavity and is subdivided into two parts (thoracic and abdominopelvic cavities) by the diaphragm, a dome-shaped respiratory muscle.



Thoracic cavity

The upper ventral, thoracic, or chest cavity contains the heart, lungs, trachea, esophagus, large blood vessels, and nerves. The thoracic cavity is bound laterally by the ribs (covered by costal pleura) and the diaphragm caudally (covered by diaphragmatic pleura).

Abdominal and pelvic cavity

The lower part of the ventral (abdominopelvic) cavity can be further divided into two portions: abdominal portion and pelvic portion.

1. The **abdominal cavity** contains most of the gastrointestinal tract as well as the kidneys and adrenal glands.
 - a. The abdominal cavity is bound cranially by the diaphragm, laterally by the body wall, and caudally by the pelvic cavity.
2. The **pelvic cavity** contains most of the urogenital system as well as the rectum. The pelvic cavity is bounded cranially by the abdominal cavity, dorsally by the sacrum, and laterally by the pelvis.

Dorsal cavity

The smaller of the two main cavities is called the dorsal cavity. As its name implies, it contains organs lying more posterior in the body. The dorsal cavity, again, can be divided into two portions.

- a. **Cranial cavity:** The upper portion, or the **cranial cavity**, houses the brain, and
- b. **Spinal Cavity:** the lower portion, or vertebral canal houses the spinal cord.

Medical Terminologies of Direction/Location/Planes/Position

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Direction/Location/Planes		ab-	away from	Latin	Abduction
Direction/Location/Planes		-ad	toward, in the direction of		dorsad
Direction/Location/Planes		ad-	increase, adherence, motion toward, very	Latin	Adduction
Direction/Location/Planes		ambi-	Denoting something as positioned on both sides; Describing both of two	Latin (ambi-, ambo), both, on both sides	Ambidextrous
Direction/Location/Planes		amph-, amph-	on both sides	Greek (amphi)	Amphicrania, amphismela, amphomycin
Direction/Location/Planes		ana-	back, again, up	Greek	Anaplasia
Direction/Location/Planes		aniso-	Describing something as unequal	Greek (anisos), unequal	Anisotropic, anisocytosis
Number/Quantity/Units		bi-	twice, double	Latin	

Direction/Location/ Planes		cis-	on this side	Latin (cis)	
Direction/Location/ Planes		cycl-	circle, cycle	Greek (kuklos)	
Direction/Location/ Planes		de-	away from, cessation	Latin	
Direction/Location/Planes		dextr(o)-	right, on the right side	Latin <i>dexter</i>	Dextrocardia
Number/Quantity/ Units		di-	two	Greek	
Direction/Location/ Planes		dia-	<i>through. during.</i>	Greek (diá), through, during, across	Diacetyl
Direction/Location/ Planes		ec-	out, away	Greek (ek-)	
Direction/Location/ Planes		ect(o)-	outer, outside	Greek	Ectopic pregnancy
Direction/Location/ Planes		endo-	Denotes something as 'inside' or 'within'	Greek (endo-), inside, internal	Endocrinology, Endospore
Direction/Location/ Planes		epi-	<i>on, upon</i>	Greek (epi-), before, upon, on, outside, outside of	Epistaxis, epicardium, episclera, epidural
Direction/Location/ Planes		ex-	out of, away from	Latin	
Direction/Location/ Planes		exo-	Denotes something as 'outside' another	Greek (exo-), outside of, external	Exoskeleton
Direction/Location/ Planes		extra-	outside	Latin	
Direction/Location/ Planes	Disease process	-form, -iform	Used to form adjectives indicating 'having the form of'	Latin (forma), form, shape	Cuneiform
Direction/Location/ Planes		hemi-	one-half	Greek (hēmi-), "half"	Cerebral hemisphere
Direction/Location/ Planes		heter(o)-	Denotes something as 'the other' (of two), as an addition, or different	Greek (héteros), the other (of two), another; different	Heterogeneous
Direction/Location/ Planes		home(o)-	similar	Greek (homoios)	Homeopathy
Direction/Location/ Planes		hom(o)-	Denotes something as 'the same' as another or common	Greek (homo-), the same, common	Homosexuality
Direction/Location/ Planes		hyper-	Denotes something as 'extreme' or 'beyond normal'	Greek (hyper), over, above; beyond, to the extreme	Hypertension

Direction/Location/ Planes		hyp(o)-	Denotes something as 'below normal'	Greek (hypo-), below, under	Hypovolemia
Size and Shape		-icle	small	Latin	Ovarian follicle
Direction/Location/ Planes		infra-	below	Latin	Infrathyroid muscles
Direction/Location/ Planes		inter-	between, among	Latin	Interarticular ligament
Direction/Location/ Planes		intra-	within	Latin	Intracranial hemorrhage
Direction/Location/ Planes		latero-	lateral	Latin	Lateral pectoral nerve
Size and Shape		lept(o)-	light, slender	Greek (leptos)	
Size and Shape		macr(o)-	large, long	Greek	Macrophage
Size and Shape		meg(a)-, megal(o)-, -megaly	enlargement	Greek	Splenomegaly
Direction/Location/ Planes		mero-	part	Greek (meros), part	merocrine, meroblastic
Direction/Location/ Planes		mes(o)-	middle	Greek (mesos), "middle"	Mesoderm
Direction/Location/ Planes		meta-	after, behind	Greek	Metacarpus
Size and Shape		micro-	denoting something as small, or relating to smallness	Greek (mikros), small	Microscope
Number/Quantity/ Units		mon(o)-	single	Greek	Infectious mononucleosis
Size and Shape		morph(o)-	form, shape	Greek	Morphology
Count		ole	small or little	Latin	
Count		olig(o)-	Denoting something as 'having little, having few'	Greek (oligos), few	Oligotrophy
Direction/Location/ Planes	Disease process	para-	alongside of, abnormal	Greek	
Size and Shape		parvo-	small	Latin parvus	Parvovirus
Direction/Location/ Planes		per-	through	Latin	
Direction/Location/ Planes		peri-	Denoting something with a position 'surrounding' or 'around' another	Greek (peri), around	Periodontal
Number/Quantity/ Units	Disease process	pleio-	more, excessive, multiple	Greek - pleion	pleiomorphism

Number/Quantity/ Units		poly-	Denotes a 'plurality' of something	Greek (polys), much, many	Polymyositis
Direction/Location/ Planes		post-	Denotes something as 'after' or 'behind' another	Latin (post), after, behind	Postoperation, Postmortem
Direction/Location/ Planes		pre-	Denotes something as 'before' another (in [physical] position or time)	Medieval Latin (pre-); Latin (præ), before, in front of	Prematurity
Direction/Location/ Planes		prim-	Denotes something as 'first' or 'most-important'	Latin (prīmus), first, most important	Primary
Direction/Location/ Planes		pro-	Denotes something as 'before' another (in [physical] position or time)	Greek (pro), before, in front of	Procephalic
Direction/Location/ Planes		prot(o)-	Denotes something as 'first' or 'most-important'	Greek (prōtos), first; principle, most important	Protoneuron
Number/Quantity/ Units		quadr(i)-	four	Latin	quadriceps
Direction/Location/ Planes	Disease process	re-	again, backward	Latin	relapse
Direction/Location/ Planes		retro-	backward, behind	Latin	retroverted
Direction/Location/ Planes		semi-	one-half, partly	Latin	
Direction/Location/ Planes		sinistr(o)-	left, left side	Latin	
Direction/Location/ Planes		sub-	beneath	Latin	subcutaneous tissue
Direction/Location/ Planes		super-	in excess, above, superior	Latin	superior vena cava
Direction/Location/ Planes		supra-	above, excessive	Latin	supraorbital vein
Direction/Location/ Planes		sy(l)-, sym-, syn-, sys-	Indicates similarity, likeness, or being together.	Greek (syn), with, together	Synalgia, Synesthesia, Syssarcosis
Direction/Location/ Planes		top(o)-	place, topical	Greek	
Direction/Location/ Planes		trans-	Denoting something as moving or situated 'across' or 'through'	Latin (trāns), across, through	Transfusion
Size and Shape	Disease process	-ula, -ule	small	Latin	Nodule
Number/Quantity/ Units		ultra-	beyond, excessive	Latin	

Number/Quantity/ Units		un(i)-	one	Latin (unus)	Unilateral hearing loss
Direction/Location/ Planes		wide, broad	eury-	lat(i)-	-
Direction/Location/ Planes		around	<u>peri-</u>	<u>circum-</u>	-
Direction/Location/ Planes		left	<u>levo-</u>	laev(o)-, sinistr-	-
Direction/Location/ Planes		middle	mes(o)-	medi-	-
Direction/Location/ Planes		right	dexi(o)-	dextr(o)-	-
Direction/Location/ Planes		surrounding	peri-	circum-	-
Direction/Location/ Planes		double	diplo-	dupli-	-
Direction/Location/ Planes		equal	iso-	equi-	-
Number/Quantity/ Units		twice	dis-	bis-	-
Number/Quantity/ Units		few	oligo-	pauci-	-
Number/Quantity/ Units		half	hemi-	semi-	
Number/Quantity/ Units		many, much	poly-	multi-	-

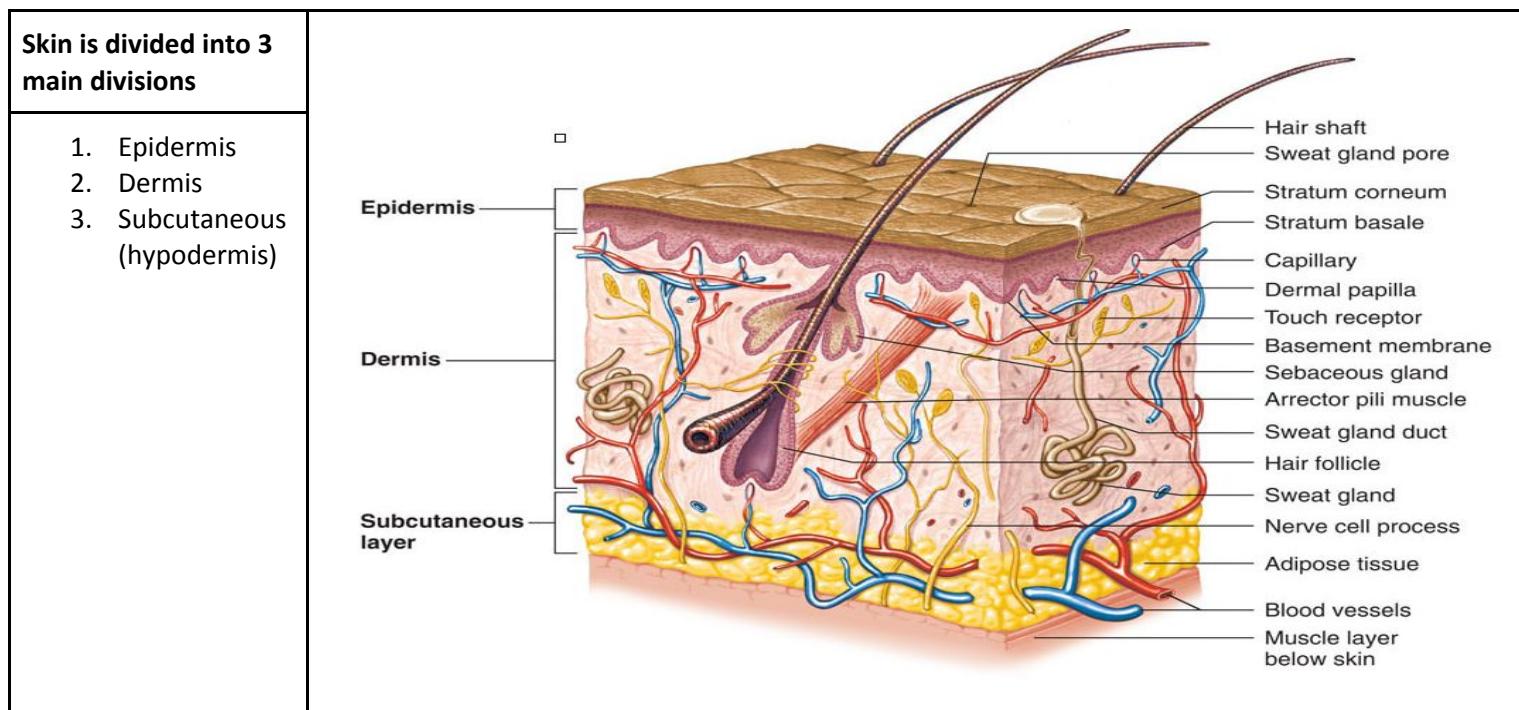
Human Anatomy System

Name:	Components	Role
<u>Skeletal System</u>	Bones, Associated cartilages, Joints	Strength, Support, Shape, Protection, Leverage, Cell Production
<u>Muscular System</u>	Muscles (Skeletal Muscles, Smooth muscles, Cardiac Muscles)	Motor power for movements of body parts.
<u>Nervous System</u>	Brain, Spinal Cord, Nerves, Nerve Endings	Control and Coordination of all body functions (Nervous coordination)
<u>Respiratory System</u>	Lungs, Nose, Trachea, Bronchi, Bronchioles, Alveolar sacs, Alveoli	Gaseous exchange
<u>Cardiovascular System</u> <u>Blood and basic immunology</u>	Heart, Blood vessels (Arteries, Veins and Capillaries), Blood	Flow of blood (and nutrients) throughout body
<u>Lymphatic System</u>	Lymph vessels, Central lymphoid tissue, Peripheral Lymphoid Organs, Lymphocytes	Drainage and Protection
<u>Endocrine System</u>	Endocrine glands (Pituitary gland, Thyroid gland, Parathyroid glands, Adrenal glands, Pancreas (endocrine part), Testes (endocrine part), Ovary (endocrine part), Liver (endocrine part))	Regulation of body functions (Chemical coordination)
<u>Digestive System</u>	Alimentary Canal (Oral Cavity, Esophagus, Stomach, Small Intestine, Large Intestine, Anus), Liver, Pancreas, Salivary glands, Teeth, Tongue	Digestion and absorption of food
<u>Urinary System</u>	Kidneys, Ureters, Urinary bladder, Urethra	Regulation of body's internal environment, and production and excretion of urine
<u>Male Reproductive System</u>	Penis, Testes	Formation of sperms and semen, and fertilizing the female
<u>Female Reproductive System</u>	Uterus, Ovaries, Vulva, Labia, Clitoris	Formation of eggs and bearing the fetus during development
<u>Obstetrics</u>	Pregnancy and delivery	

<u>Sensory</u>	Eye, Ear, Nose	
<u>Integumentary</u>	Skin, Hair and Nail	

Introduction of Integumentary system

- The integumentary system comprises the **skin, hair and nails**.
- Skin and its appendages act to protect the body from various kinds of damage, such as loss of water or damages from outside.
- **Skin is the largest sensory organ**, weighs 4kg, surface area 2m², thickness 0.3-3mm.



1. Epidermis:

The epidermis is the outermost of the three layers that make up the skin, the inner layers being the dermis and hypodermis.

Function: The epidermis layer provides a barrier to infection from environmental pathogens and regulates the amount of water released from the body.

Epidermis further divided into layers:

- **Stratum corneum**:- Horned layer, tightly packed, scale-like cells continuously shed & replace.
- **Stratum lucidum**:- Clear layer, small transparent cells through which light can pass (present only in hands and feet) this layer has resembles of drop of oil called eleidin.
- **Stratum granulosum**:- Granular layer, cells that look like distinct granules, It is formed of a special substance called keratohyalin, which helps in a process called **keratinization**.
- **Stratum spinosum**:- (or spinous layer/prickle cell layer) is a layer of the epidermis found between the stratum granulosum and stratum basale.
- **Stratum germinativum**:- The **stratum basale** (basal layer, sometimes referred to as stratum germinativum) is the deepest layer of the five layers of the epidermis. This layer consists of **melanocytes**, which produces **melanin**.

2. Dermis:

- The dermis or corium is a layer of skin between the epidermis (with which it makes up the cutis) and subcutaneous tissues.
- Dermis consist of hair follicle, gland, blood vessels, muscles & nerves.

3. Subcutaneous layer (hypodermis):

- The hypodermis (also called the subcutaneous layer or superficial fascia) is a layer directly below the dermis and serves to connect the skin to the underlying fascia (fibrous tissue) of the bones and muscles. It is the lowermost layer of the integumentary system
- The hypodermis consists of well-vascularized, loose, areolar connective tissue and adipose tissue (fat-storing cells called adipocytes)
- It regulates body temperature, acts as an insulator & padding.

Functions of skin:

1. Immunological functions
2. Secretory functions
3. Thermo regulations
4. Protection
5. Excretory functions
6. Activation of Vitamin D

Accessory structures of skin	
Hair follicle	follicle is a tunnel-shaped structure in the epidermis (outer layer) of the skin. <ul style="list-style-type: none">• Hair starts growing at the bottom of a hair follicle.
Sebaceous gland	Secrete an oily substance called sebum . <ul style="list-style-type: none">• Present in Dermis• It keeps skin from becoming dry, brittle & cracked.• It inhibits the growth of microorganisms.
Sweat glands	Skin has two types of sweat glands: Present in Dermis <ul style="list-style-type: none">• Eccrine glands occur over most of your body and open directly onto the surface of your skin.• Apocrine glands open into the hair follicle, leading to the surface of the skin.<ul style="list-style-type: none">○ Apocrine glands develop in areas abundant in hair follicles, such as on your scalp, armpits and groin.
Arrector pili muscle	Present in Dermis, Connected to each hair follicle of skin, that helps the hair to stand erect (Goosebumps).
Keratinocytes	are found in epidermis . The epidermis is composed of 95% keratinocyte. Keratinocyte is a cell that manufactures and stores the protein keratin <ul style="list-style-type: none">• Keratin is fibrous structural proteins known as scleroproteins.• It is the key structural material making up hair, nails, calluses, and skin (Epidermis)• Keratin also protects epithelial cells from damage or stress.

Melanocytes	are melanin-producing cells located in the bottom layer (the stratum basale) of the skin's epidermis , the middle layer of skin. <ul style="list-style-type: none"> • Melanin is a dark pigment primarily responsible for skin color. Melanin gives hair and skin its color, and also helps protect the living cells of the epidermis from ultraviolet (UV) radiation damage.
Langerhans cells	are members residing in the basal and suprabasal layers of the epidermis . They specialize in antigen (foreign body/Pathogen) presentation and belong to the skin immune system (SIS).
Merkel's cells	Merkel cells, also known as Merkel-Ranvier cells or tactile epithelial cells, are oval-shaped mechanoreceptors essential for light touch sensation .

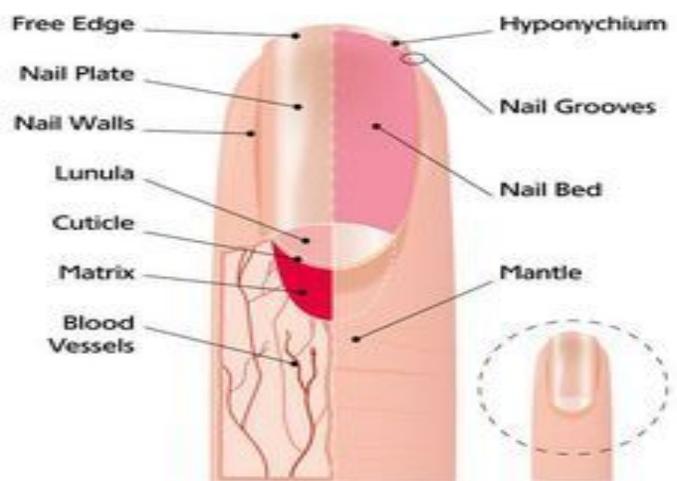
Nail

A nail is a horn-like keratinous envelope covering the tips of the fingers and toes.

Nail (Onych- (prefix): Pertaining to the nail)

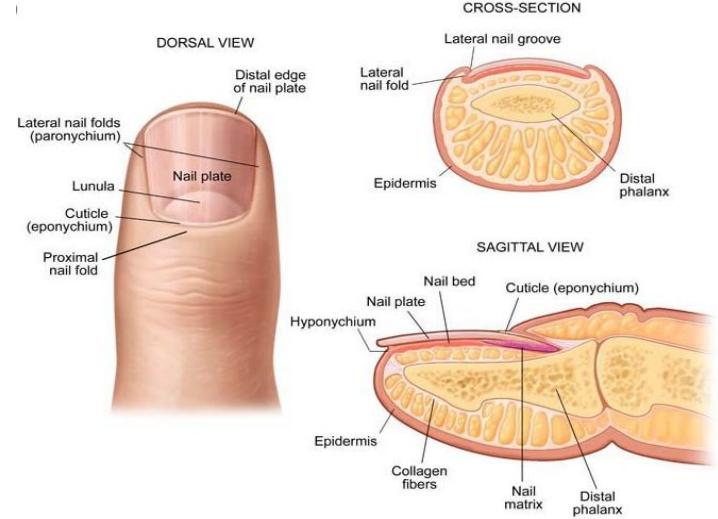
Each nail has several parts, including:

1. **Nail plate:** the visible hard part of the nail
2. **Nail folds:** the skin that frames the nail plate on three sides
3. **Nail bed:** the skin beneath the nail plate - The cells at the base of your nail bed are the ones that actually produce the fingernail or toenail plate.
4. **Cuticle:** the tissue that overlaps your nail plate at the base of your nail - it protects the new keratin cells that slowly emerge from the nail bed. The area underneath the cuticle is called the **matrix**.
5. **Lunula:** the whitish, half-moon shape at the base of your nail underneath the plate



Functions of Nail

- Nails are made of **keratin**, a tough protein.
- Nails act as protective plates over the fingertips and toes.
- Nails serve a number of purposes, including protecting the digits (Finger/Toe), enhancing sensations, and acting like tools.



Hair:

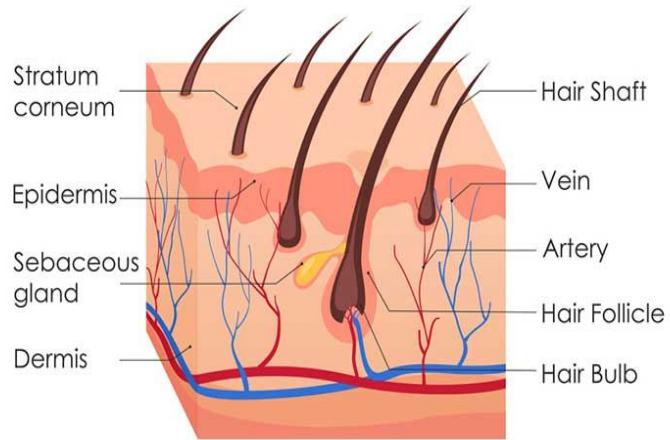
The definition of a hair is a fine, thread-like strand that grows on people.

- Hair is made of a tough protein called **keratin**.
- Hair is a derivative of the epidermis and consists of two distinct parts:
 - the hair follicle
 - the hair shaft
- hair bulb, the bulbous expansion at the proximal end of a hair, in which the hair shaft is generated.

Functions of Hair

- Hair serves many functions such as acting as a
 - Filter
 - Regulation of body temperature (keeping the body warm)
 - Protection
 - Facilitation of evaporation of perspiration; Apocrine gland
 - Hairs also act as sense organs

STRUCTURE OF THE HAIR



Medical Terminology of Integumentary

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Integumentary /Digestive		adip(o)-	Of or relating to fat or fatty tissue	Latin (adeps, adip-), fat	Adipocyte
Integumentary	Disease process	aesthesia- (BrE)	sensation	Greek	Anesthesia
Integumentary		axill-	Of or pertaining to the armpit	Latin (axilla), armpit	Axilla
Integumentary		capill-	Of or pertaining to hair	Latin (capillus), hair	Capillus
Integumentary		cerat(o)-	Of or pertaining to the cornu; a horn	Greek (kéras, kerat-), a horn	Ceratoid
Integumentary		cornu-	Applied to processes and parts of the body describing them likened or similar to horns	Latin (cornū), horn	
Integumentary		cutane-	skin	Latin	Subcutaneous
Integumentary		dermat(o)-, derm(o)-	Of or pertaining to the skin	Greek (dérma, démat-), skin, human skin	Dermatology
Integumentary		filli-	fine, hair like		
Integumentary		hidr(o)-	sweat	Greek	Hyperhidrosis
Integumentary		kerat(o)-	cornea (eye or skin)	Greek	Keratoscope

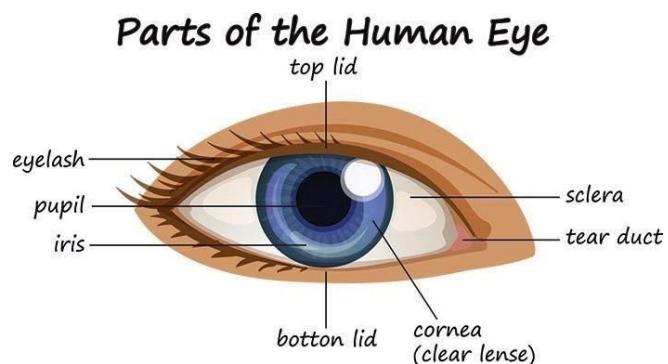
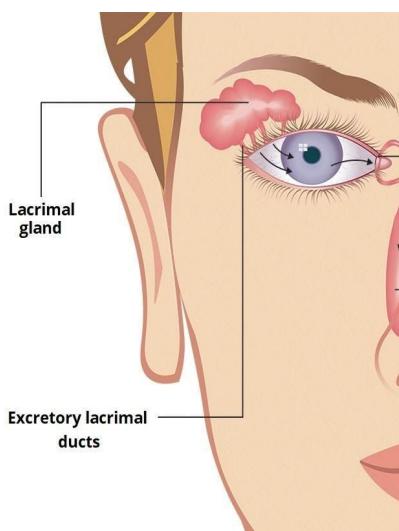
Integumentary		onych(o)-	Of or pertaining to the nail (of a finger or toe)	Greek (όνyx, ónycho-), nail; claw; talon	Onychophagy
Integumentary		papul(o)-	Indicates papulosity, a small elevation or swelling in the skin, a pimple, swelling	Latin (papula), pimple, pustule; a small elevation or swelling in the skin	Papulation
Integumentary		trich(i)-, trichia, trich(o)-	Of or pertaining to hair, hair-like structure	Greek, τρίχη (ο)- (thríx, trich(o)-), hair	Trichotomy
Integumentary		ungui-	Of or pertaining to the nail, a claw	Latin (unguis), nail, claw	Unguiform, Ungual
Integumentary		hair	trich(o)-	capill-	-
Integumentary		horn	cerat(o)-	cornu-	-
Integumentary		nail	onych(o)-	ungui-	-
Integumentary		skin	dermat(o)- (derm-)	cut-, cuticul-	-

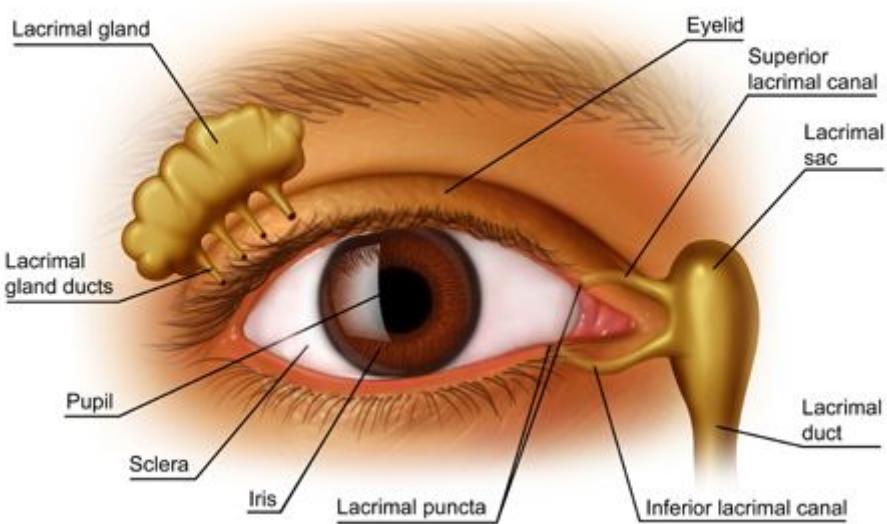
Introduction of Eye (Sensory Organ)

- The eye is a specialized **sense organ**, help us to understand (see) our environment.
- Eye is spherical in shape, has a diameter of 2.5 cm & situated in the orbital cavity.

Organs that protect the eye:

- Lacrimal apparatus:** It is physiological system for tear production and consist of :
 - Lacrimal gland:** A pair of almond-shaped **exocrine gland** (secretion through a duct), that **Secrets tear**.
 - Lacrimal sac:** Upper dilated end of Nasolacrimal duct. It drain tears from eyes surface.
 - NasoLacrimal duct:** Also called Tear duct which carries tear from the lacrimal sac of the eye into the nasal cavity.

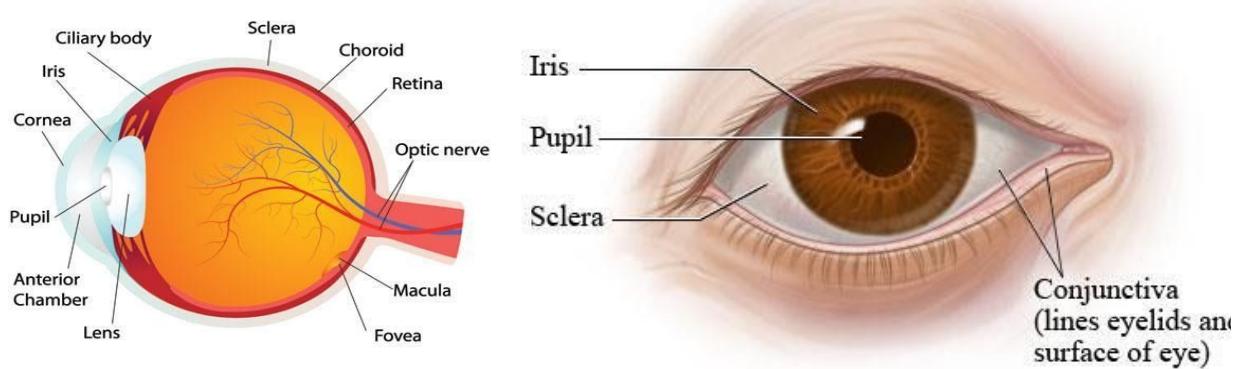




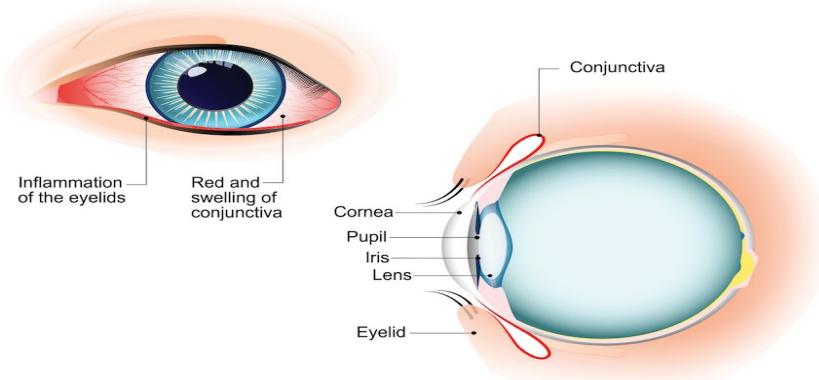
2. **Eyebrow:** Protect against foreign particles, perspiration (process of sweating) & direct rays of light.
3. **Eyelid:** the folds of skin that covers the surface of eye, closes by reflex action when an object approaches.
4. **Eyelashes:** An eyelash or simply lash is one of the hairs that grow at the edge of the eyelid. It secretes oils that prevent lids from sticking together.

External of eye

1. **Sclera:** White portion of eye, 0.3 to 1.0mm thickness. It is opaque, fibrous protective membrane & the outer layer of the human eye.
2. **Cornea:** Part of sclerotic coat, transparent, front part of eyeball through which light waves pass.
3. **Conjunctiva:** Clear, thin membrane that covers the part of front surface of the eye except the cornea.

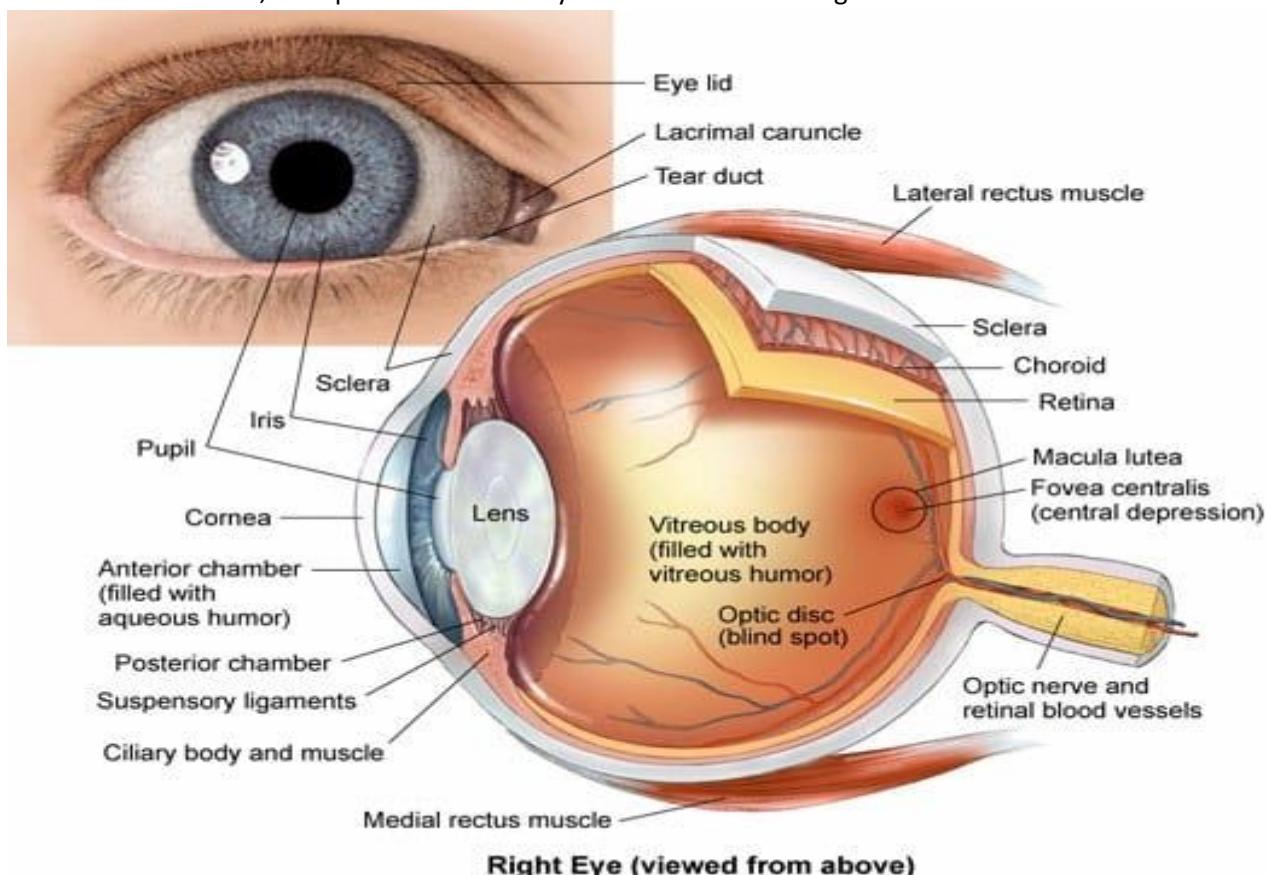


CONJUNCTIVITIS



Middle part of eye

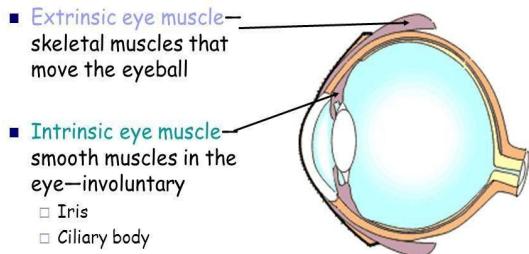
- Choroid layer:** Vascular layer (supplies blood vessels) of the eye that lies between the sclera and retina.
- Ciliary body:** Intrinsic muscles, smooth muscle fibers supports & modify lens shape (controls the shape of an eye).
- Iris:** Thin circular structure in the eye, responsible for controlling size of the pupil. This defines the eye colour.
- Pupil:** Rounded opening or hole in the center of iris through which light strike to retina.
- Lens:** Flexible, transparent biconvex crystal like structure along with the cornea.



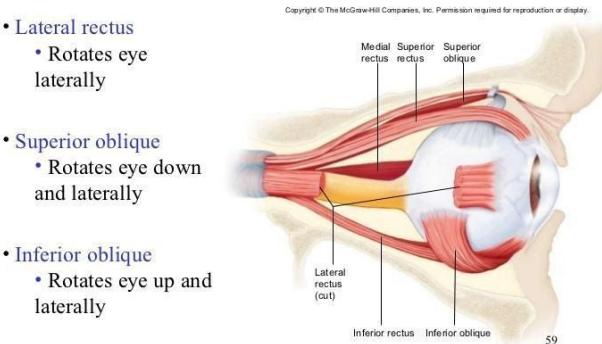
Muscles of eye

1. **Extrinsic eye muscle:** also called as extraocular muscles are the six muscles that control movement of the eye (Superior rectus, Inferior rectus, Lateral rectus, Medial rectus, Superior oblique and Inferior oblique) and one muscle that controls eyelid elevation (levator palpebrae)
2. **Intrinsic muscle of eye:** The intrinsic eye muscles are innervated by the autonomic systems and include the iris sphincter and the ciliary muscle.

Muscles of the Eye



Extrinsic Eye Muscles

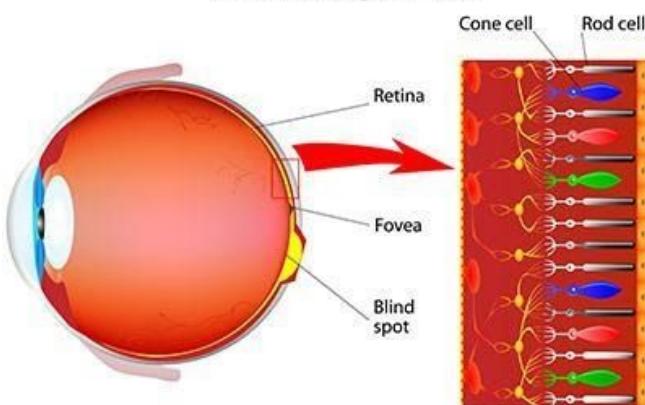


Inner part of eye

1. Retina: Inner most light sensitive layer of eyes, located near the optic nerve, Approximately 0.5mm thick & lines the back of the eye.

Purpose: To receive light that the lens has focused, converts the light into neural signals on the brain for visual recognition.

Photoreceptor cell



Photoreceptor cell: In the retina, is capable of visual phototransduction (It is a process by which light is converted into electrical signals in the rod cells, cone cells) These specialised cells are of 2 types:

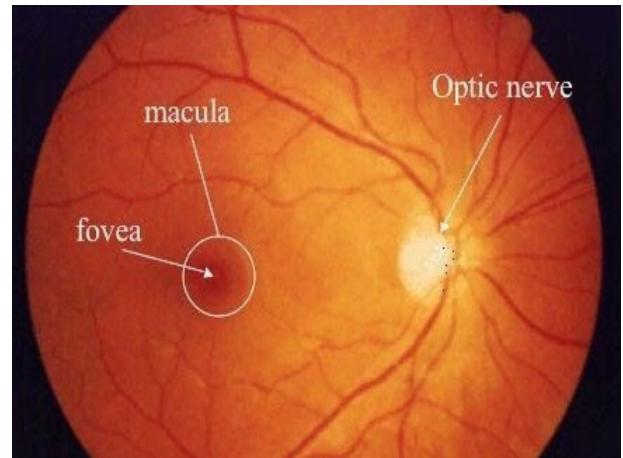
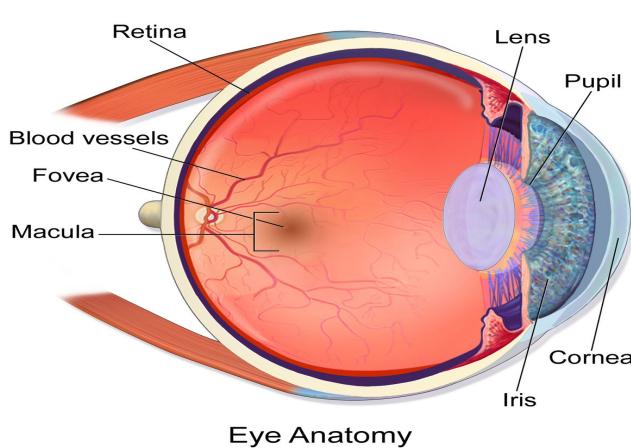
- **Rods:** Rod like structure, present in the boundary of retina, it is responsible for the **vision in dim lights or in nights (scotopic vision)**. Rods are 18 times more than cones.
 - **Rhodopsin (also called visual purple)** is the photochemical protein responsible for scotopic vision. Lack of rhodopsin results in **Night blindness**.
- **Cones:** Cone shaped structure, fewer in number & provides the vision in the day or in **bright light (photopic vision)**.

- **Iodopsin** is the photochemical protein responsible for photopic vision. Lack of Iodopsin results in **colour blindness**.

2. Blind Spot: Small portion of the visual field of each eye, also known as the optic nerve head (**There are no photoreceptors**).

3. Macula : Also called macula lutea, part of retina at the back of the eye. It has a **very high concentration of photoreceptors cells** that detect the light & sends signals to the brain. It gives **clear vision** and the ability to **see fine detail**.

4. Fovea: Also called the central fovea or fovea centralis, a tiny pit in the retina, where macula is in a larger area including & surrounding the fovea. The fovea is responsible for **sharp central vision** (also called foveal vision), which is necessary in humans for activities for which visual detail is of primary importance, such as **reading and driving**.

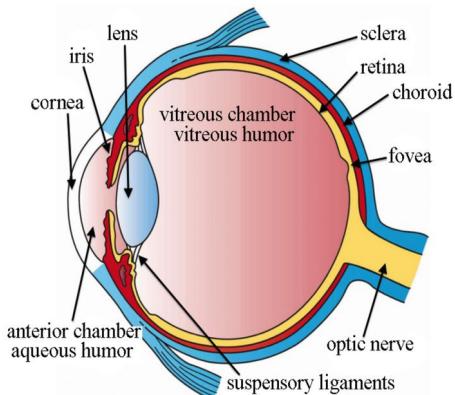


Fluids in eye

1. **Aqueous humor :** Clear transparent watery fluid similar to plasma, but containing low protein concentrations. It is secreted from the ciliary epithelium, found between the cornea & the lens of the eye.
 - a. Present in **Anterior Chamber**
 - b. It **nourishes** cornea & supply nutrition.
2. **Vitreous humor:** Clear gelatinous mass found in rear part of the eyeball between the lens and retina, 99% of it consists of water and the rest is a mixture of collagen, proteins, salts and sugars.
 - a. Present in **Vitreous Chamber**
 - b. It **Protect** Eye and holds its spherical shape.



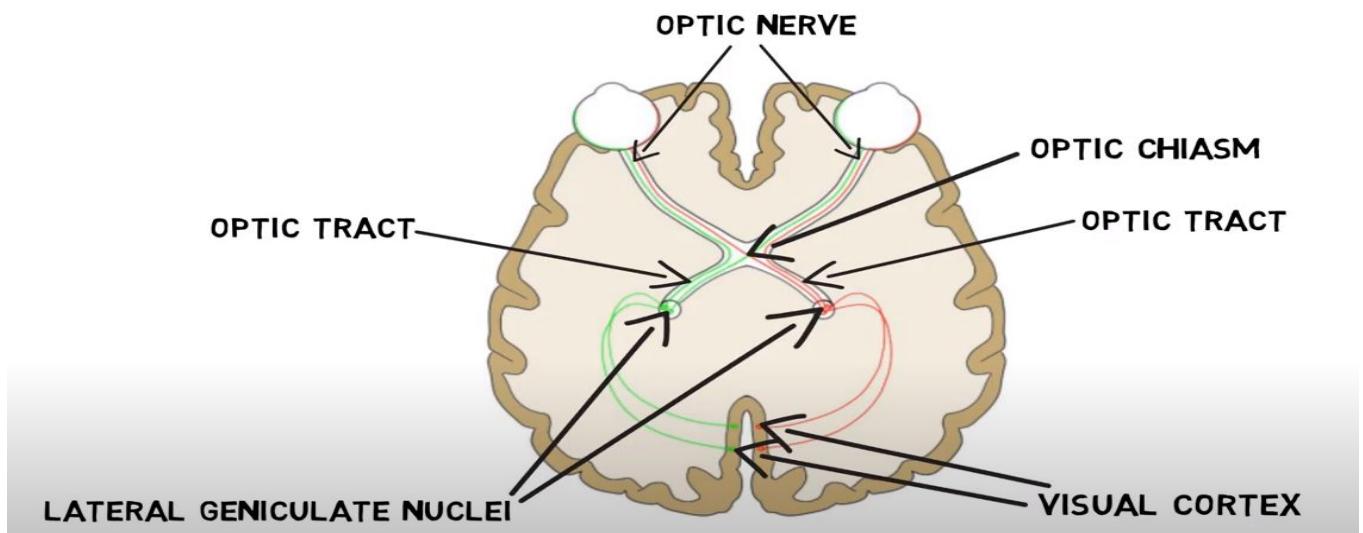
Aqueous Humour vs Vitreous Humour



www.majordifferences.com

Optic chiasm:

Optic chiasm is a structure located in the forebrain. It is the point at which the two optic nerves cross each other and travel to the opposite side of the brain.



Medical Terminology of Eye

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Eye		blephar(o)-	Of or pertaining to the eyelid	Greek (blépharon), eyelid	Blepharoplast
Eye		cata-	down, under	Greek (kata)	Cataract
Eye		cili-	Of or pertaining to the cilia, the eyelashes; eyelids	Latin (cilium), eyelash; eyelid	Ciliary
Eye		cor-, core-, coro-	Of or pertaining to eye's pupil	Greek (kórē), girl, doll; pupil of the eye	Corectomy
Eye		dacryo-	tear	Greek	
Eye, NS		fossa		Latin (fossa), ditch, pit	fossa ovalis
Eye		irid(o)-	iris	Greek	Iridectomy
Eye		lacrim(o)-	tear	Latin	Lacrimal canaliculi
Eye		ocul(o)-	Of or pertaining to the eye	Latin (oculus), the eye	Oculist
Eye		ophthalm(o)-	Of or pertaining to the eye	Greek (ophthalmós), the eye	Ophthalmology
Eye		optic(o)-	Of or relating to chemical properties of the eye	Middle French (optique); Greek (optikós); Cognate with Latin <i>oculus</i> , relating to the eye	Opticochemical
Eye		palpebr-	Of or pertaining to the eyelid	Latin (palpebra), eyelid	Palpebra
Eye		phaco-	lens-shaped	Greek	phacolysis, phacometer, phacoscotoma
Eye		phos-	Of or pertaining to light or its chemical properties.	Greek (phōs, phōt-), light	Phosphene
Eye		phot(o)-	Of or pertaining to light	Greek (phōs, phōt-), light	Photopathy
Eye		rhabd(o)-	rod shaped, striated	Greek	
Color, Eye		rhod(o)-	Denoting a rose-red color	Greek (rhódon), rose	Rhodophyte
Eye		eye	ophthalm(o)-	ocul(o)-	
Eye		eyelid	blephar(o)-	cili-; palpebr-	-
Eye		pupil (of the eye)	cor-, core-, coro-	-	-

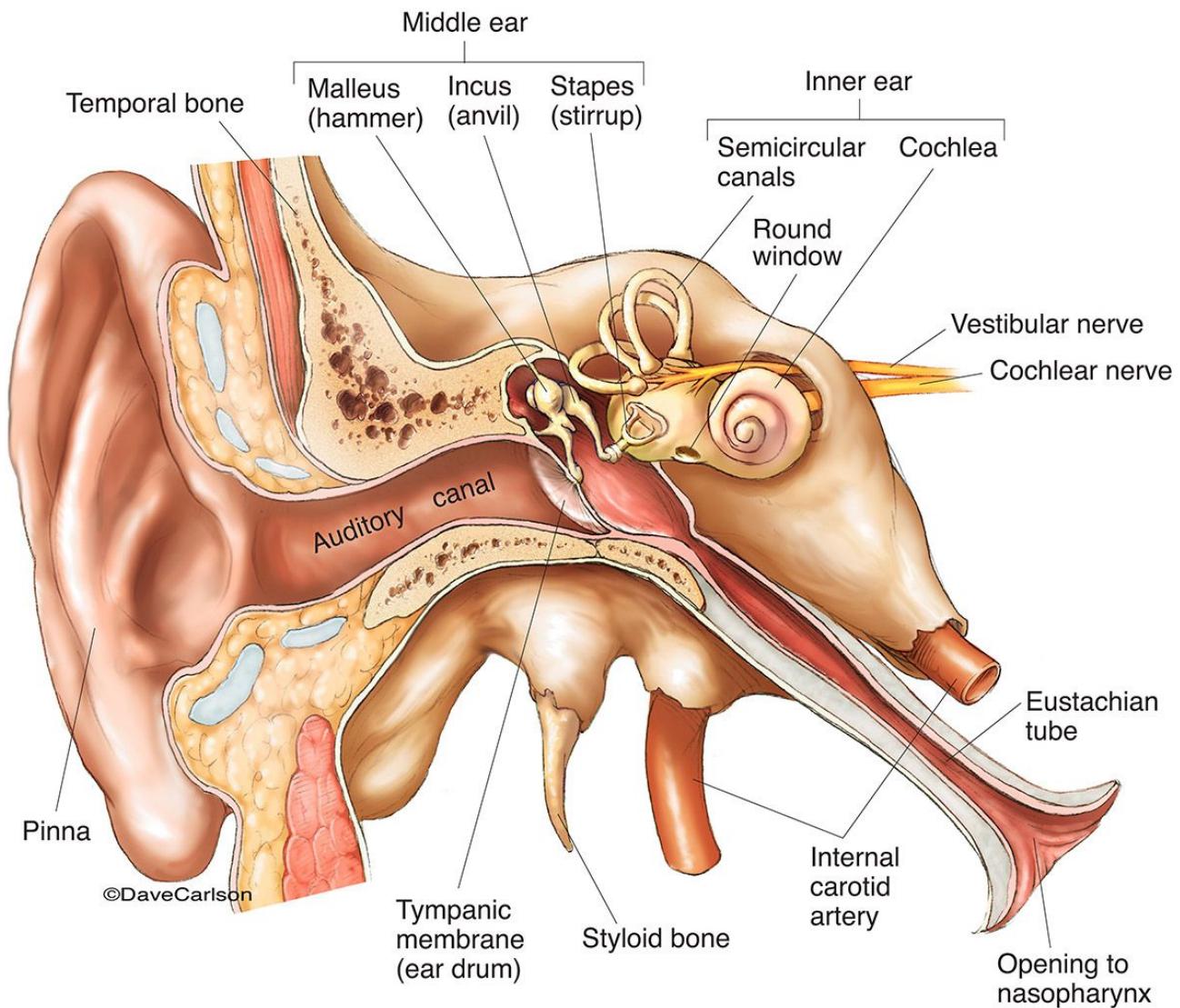
Summary of eye anatomy:

- Conjunctiva - Sclera - Cornea - Anterior chamber - Iris - Pupil - Lens - Ciliary Body - Vitreous Chamber - Retina (Blind spot, Macula, Fovea) - Choroid - Sclera
- Optic Nerve

Introduction of Ear (Sensory Organ)

The ear is one of the **sense organs**, which is responsible for **hearing and balance**. Ear has 3 parts

1. External ear (Outer)
2. Middle ear
3. Inner ear



External Ear:

The outer ear, external ear, or auris externa is the external portion of the ear, which consists of the

- **Pinna or auricle:** The outer ear is called the pinna and is made of ridged elastic cartilage covered by skin.
 - Sound funnels through the pinna into the external auditory canal
- **External Auditory canal/Meatus or Ear Canal:** It lies within the temporal bone & connects to the eardrum.
 - It contains a **ceruminous gland** which secretes ear wax. **Ear wax** is also called **cerumen**, is a brown, orange, red, yellowish or gray in colour.

- Earwax consists of dead skin cells, hair, and the secretions of cerumen by the ceruminous and sebaceous glands of the outer ear canal.
- **Tympanic membrane:** Is also called **eardrum**, which divides the external from the middle ear.
 - It converts (relating to sound or the sense of hearing) **acoustic energy** into mechanical energy.

Middle Ear:

It is also called tympanum/tympanic cavity, a small, narrow, irregular, compressed chamber, situated within the temporal bone. It contains:

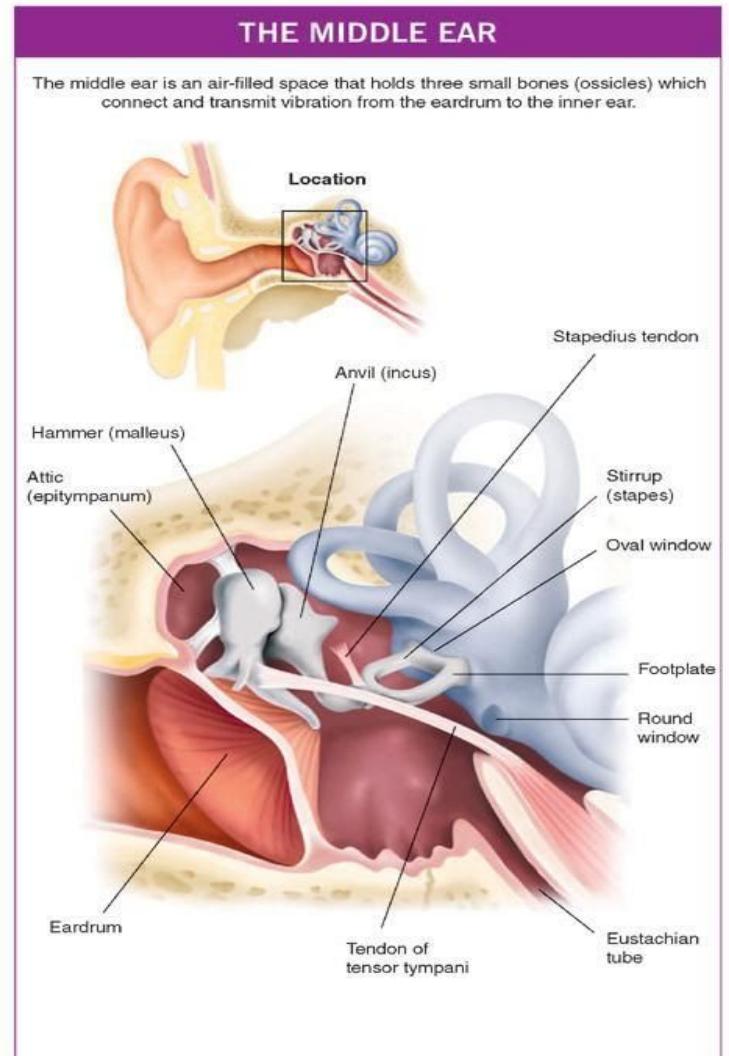
Auditory ossicles: Includes 3 bones, that are the smallest bones in the human body.

- **MALLEUS (Hammer bone):** Is attached to the tympanic membrane, from which vibrational Sound pressure motion is passed.
- **INCUS BONE (Anvil):** Connected to the other bones (Malleus, stapes).
- **STAPES BONE (Stirrup):** Articulates with incus & oval window & vestibule of inner ear. Smallest bone in human

Functions: Transmit vibration of the tympanic membrane to the oval window.

Eustachian tube: Also called Auditory tube or pharyngotympanic tube.

- It is 35mm (1.4 in) long & 3mm(0.12 in) in diameter.
- This links the Nasopharynx (It is a route for pathogens to travel from Nose & throat to ear causing Otitis media)



Oval window: The oval window (or fenestra vestibuli) is a membrane-covered opening that leads from the middle ear to the vestibule of the inner ear.

- Vibrations that contact the tympanic membrane travel through the three ossicles and into the inner ear.

Round window: The round window is one of the two openings from the middle ear into the inner ear.

Inner Ear:

Inner ear is also called labyrinth of the ear, it has 2 regions:

- **Bony labyrinth:** hard bony, outer shell
- **Membranous labyrinth:** fully contained inside the bony labyrinth

Labyrinth is divided into 3 sections:

1. Vestibule

It is 4mm long, oval portion. It is the central part lies between the cochlea in front & semicircular canal behind. Vestibule contains small thickened region called Macula, it contains 2 types of cells:

- Hair cells
- Supporting cells

Functions: Maintains posture and balance

2. Semicircular canal

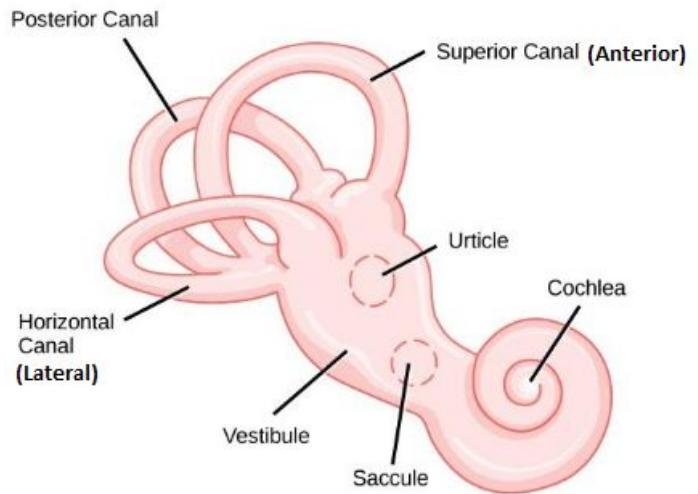
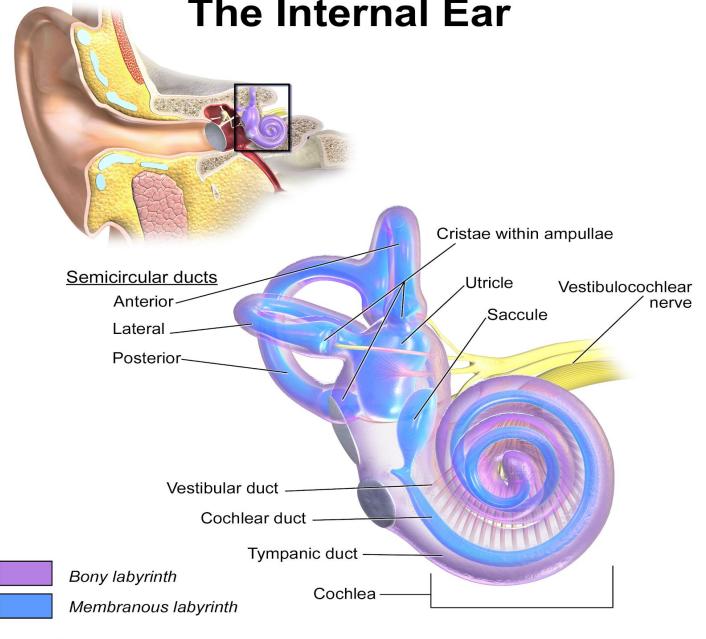
It is situated behind the vestibule. They are of 3 parts

- Anterior Semicircular or Superior Canal
- Posterior Semicircular canal
- Lateral Semicircular or Horizontal canal

3. Cochlea

Cochlea: Its a Snail shaped, bony spiral canal of 30mm long. Cochlea converts **mechanical energy into electrical energy.**

The Internal Ear



- **Cochlea** is divided into three channels:

- **Cochlear duct:** The **cochlear duct (or scala media)** is an **endolymph filled cavity** inside the cochlea, located between the tympanic duct and the vestibular duct. **The cochlear duct houses the organ of Corti.**
- **Scala vestibuli:** The **vestibular duct or scala vestibuli** is a **perilymph-filled cavity** inside the cochlea of the inner ear that conducts sound vibrations to the cochlear duct.

- **Scala tympani:** The **tympanic duct or scala tympani** is one of the **perilymph-filled cavities** in the inner ear of the human. It is separated from the cochlear duct by the basilar membrane, and it extends from the round window.

- **Fluid inside inner ear (cochlea):**

- **Perilymph** has a similar ionic composition as extracellular fluid found elsewhere in the body and fills the scala tympani and vestibuli.
- **Endolymph**, found inside the cochlear duct (scala media), has a unique composition not found elsewhere in the body.

The Cochlea

- Divided into 3 channels

- **Cochlear duct**

(scala media)

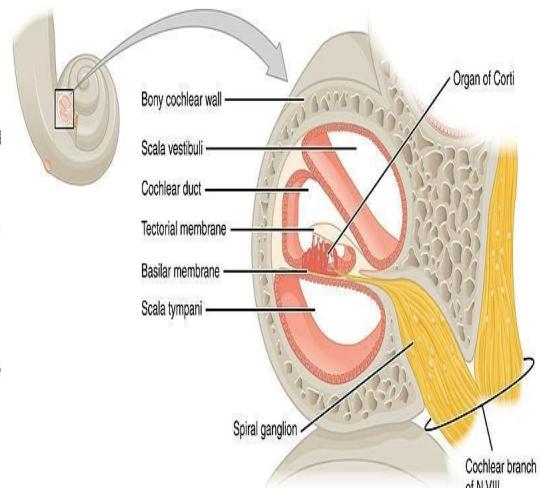
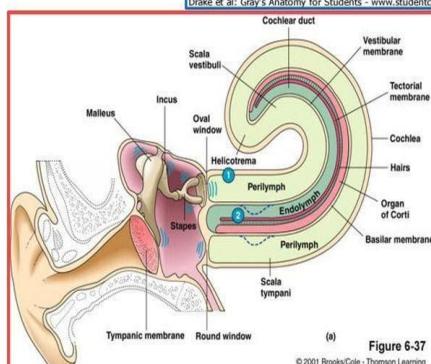
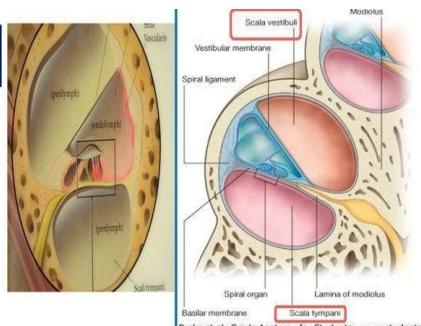
- Contains the **Organ of Corti**

- **Scala vestibuli**

- Ends at the **oval window**

- **Scala tympani**

- Ends at the **round window**



- **Organ of corti:** Its a end organ of hearing, it said as body's **microphone**.

- Organ of corti rests on the basilar membrane with scala media. It has hair cells, which **converts mechanical sound vibration into nerve impulses (Electrical energy)**.
- The **vestibulocochlear nerve (auditory vestibular nerve)**, known as the **eighth cranial nerve**, transmits sound and equilibrium (balance) information from the inner ear to brain

- **Mastoid bone:** is the back part of the temporal bone of the skull located just behind the inner ear



Medical Terminology of Ear

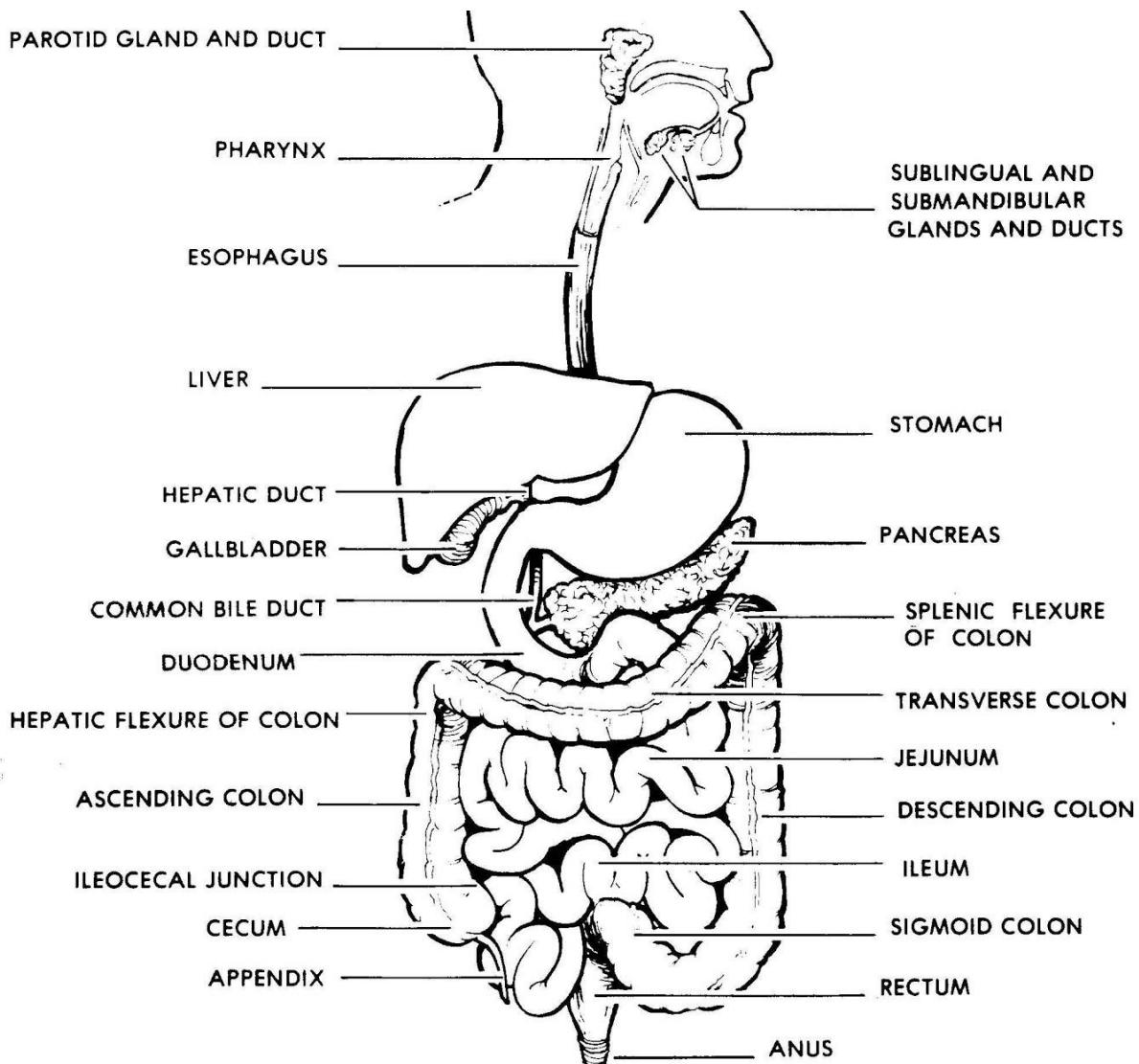
Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Ear		acous(io)-	Of or relating to hearing	Greek (acoustikos), of or for hearing	acoumeter, acoustician
Ear		-acusis	hearing	Greek (acoustikos), of or for hearing	paracusis
Ear		aur(i)-	Of or pertaining to the ear	Latin (auris), the ear	Aural
Ear		myring(o)-	eardrum	Latin	Myringotomy
Ear		ot(o)-	Of or pertaining to the ear	Greek (ous, ὄτ-), the ear	Otopathy
Ear		phon(o)-	sound	Greek	
Ear		tympan(o)-	eardrum	Greek	Tympanocentesis
Ear		ear	ot(o)-	aur-	-

Summary of ear anatomy:

- Outer Ear - Pinna - External Auditory canal - Tympanic Member
- Middle Ear - Auditory Ossicles - Malleus - Incus - Stapes (Oval Window) - Eustachian Tube (End of nasopharynx)
- Inner Ear (Labyrinth) - Vestibules - Semicircular canal - Cochlea
- Nerves - Vestibulocochlear Nerve (eighth cranial nerve)

Introduction to Digestive System: (Gastrointestinal System)

Digestive system is the food processing system of human body. The whole digestive system is in the form of a long, hollow, twisted and turned tube, called the **alimentary canal**, which starts from the oral cavity and ends at the anus. The overall process of digestion and absorption of food occurs in this tube. The tube is divided into different parts on the basis of structure and function of each part.



Human digestive system consists of the two categories of parts.

- The first category consists of those organs that are directly involved in the process of digestion and absorption.
 - The first category of organs may be called as “necessary organs”
- The second category consists of those organs that aid the process of digestion and absorption of food by producing chemical substances or by some other way, but are not directly involved in the process of digestion and absorption.

- The second category as “accessory organs” but it should be kept in mind that without the aid of accessory organs, the process of digestion is seriously impaired. When the accessory organs fail to perform their functions completely, the process of digestion may also completely stop.

These parts are described below.

Necessary Organs	Oral cavity	It is the cavity of mouth, irregular in shape, contains tongue, teeth and salivary glands,
	Esophagus	Muscular tube passing the food from pharynx to stomach
	Stomach	Muscular, hollow and dilated part of alimentary canal, involved in both mechanical and chemical digestion of food, secretes strong acid (HCl) and enzymes to aid in digestion of food
	Small Intestine	Lies between stomach and large intestine, majority of digestion and absorption takes place here, About 5 meters in length
	Large Intestine (Colon)	Second-to-last part of the alimentary canal, main function is to absorb water from indigestible food.
	Anus	Last part of alimentary canal, opens to outside for ejection of food, Controls the expulsion of feces
Accessory Organs	Liver	Produces bile for emulsification of fats
	Pancreas	Secretes pancreatic juice containing different digestive enzymes into the small intestine
	Gallbladder	The gallbladder holds bile produced in the liver until it is needed for digesting fatty foods in the duodenum of the small intestine
	Salivary gland	It helps in break down carbohydrates (with salivary amylase , formerly known as ptyalin) and lubricates the passage of food from the oropharynx, esophagus to the stomach.

Nutrients	Basic Unit
Carbohydrates	Glucose, Galactose
Protein	Amino Acid
Fat	Fatty acid
Micronutrients are one of the major groups of nutrients your body needs	Vitamins, Minerals (Zinc, Calcium etc)

Metabolism: Anabolism (Formation of food) + Catabolism (Break down of the food)

Parts of digestive system:

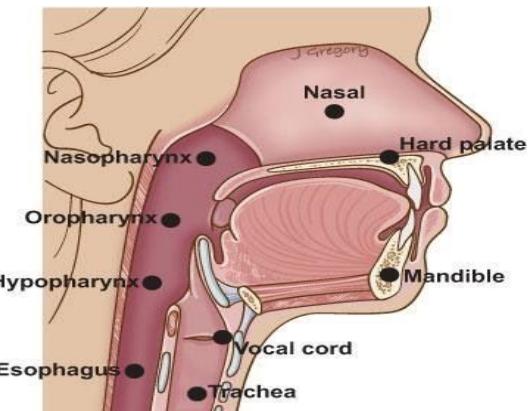
<p>1. Oral cavity (Buccal Cavity): The oral cavity includes the lips, gingivae, teeth, hard palate, cheek mucosa, Soft palate, tongue, and floor of the mouth.</p> <p>Teeth: Are of 2 types: temporary/milk teeth =20, are seen in infants and preschoolers, later on it falls & permanent teeth appears.</p> <ol style="list-style-type: none"> 1. The process of chewing (crushed and ground) the food by teeth is called as Mastication 2. Function: It tears and crushes the food. 3. Permanent teeth = 32 <ul style="list-style-type: none"> o 1 Incisors o 2 Canines o 3 Premolar o 4 Molars 	<p>Mouth (Oral Cavity)</p> <p>Lips Gingiva (gums) Hard palate Uvula Papillae of tongue Palatine tonsil Molars Premolar Canine Incisor</p>
<p>Tongue:</p> <ol style="list-style-type: none"> 1. It is a Muscular structure which contains taste buds. 2. Function: <ul style="list-style-type: none"> o helps in process of mastication & swallowing o Functions include speech & Taste 	<p>Hard palate Soft palate Palatine tonsil Epiglottis Vocal fold Trachea Esophagus</p>
<p>Gingiva (Gums)</p>	

2. **Pharynx:** Its common passage for air & food. The pharynx, or throat, is a funnel-shaped tube connected to the posterior end of the mouth. The pharynx is responsible for the passing of masses of chewed food from the mouth to the esophagus.

It has 3 parts

- **Nasopharynx:** not a part of digestive system
- **Oropharynx:** it is situated posterior to oral cavity.
- **Laryngopharynx:** situated below the oropharynx & connects to esophagus.

Epiglottis: Is a flap like structure at the back of the throat that prevents food from entering the wind pipe. It opens during breathing.



3. **Esophagus:** It is a muscular tube runs from pharynx to stomach, it is of 25cm long.

- The food passes from mouth to stomach through esophagus by peristaltic movement (Peristalsis) (wave movement due to smooth muscle contractions).
- **Peristalsis:** the involuntary constriction and relaxation of the muscles of the intestine or another canal, creating wave-like movements that push the contents of the canal forward.

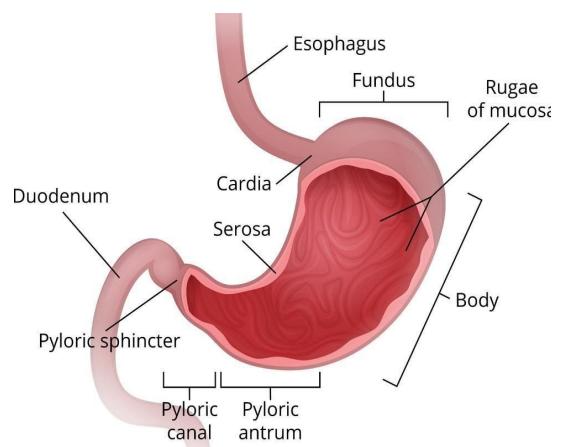
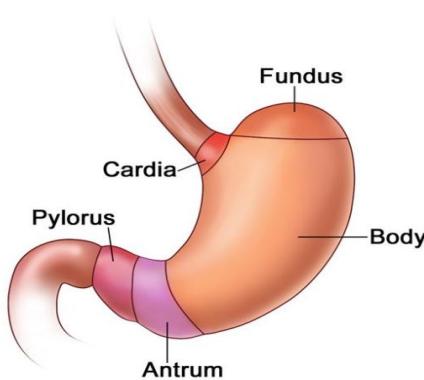
4. Stomach:

The stomach is a J-shaped muscular organ located on the left side of the upper abdomen.

It has following regions:

1. Cardia
2. Fundus
3. Body
4. Antrum
5. Pylorus

Sections of the Stomach



Cells in stomach

- **Mucus cells:** secrete the alkaline mucous for protecting the layer from hydrochloric acid (HCL)
- **Chief cells:** it secretes pepsin
- **G cells:** secretes gastrin which stimulate the secretion of hydrochloric acid

Function:

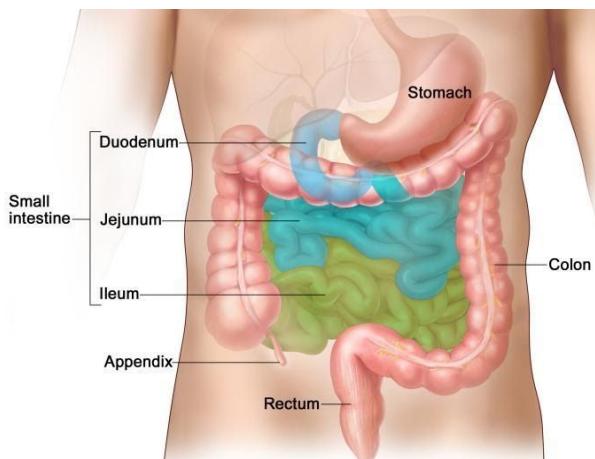
The stomach secretes acid and enzymes that digest food, stores the food

5. Small intestine:

The small intestine is about 6 meters or 20 feet long and is the part of the alimentary canal which extends from the pyloric end of the stomach to the caecum (First part of the large intestine).

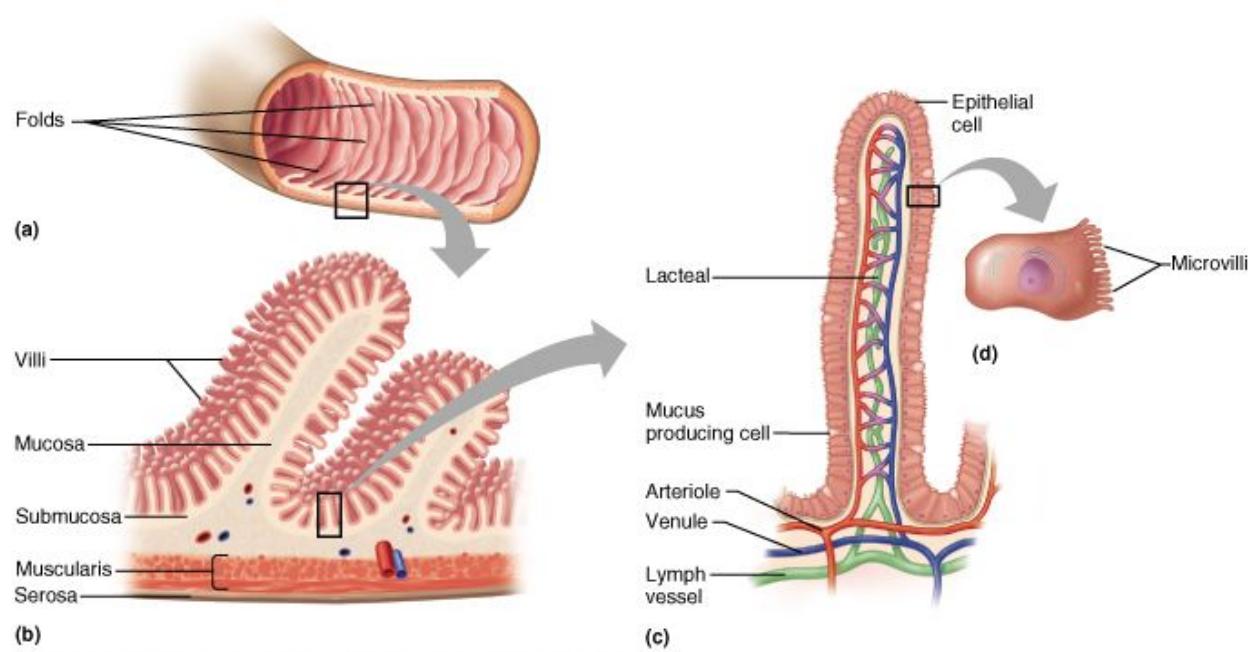
It has 3 parts:

1. **Duodenum:** C shaped structure of Small intestine. The bile duct & pancreatic duct opens together at duodenum.
2. **Jejunum:** It is the continuation of duodenum & it is the middle portion of the small intestine.
3. **Ileum:** it is the last part of the small intestine.



Functions: The acidic **chyme** from the stomach enters small intestine, where Absorption of digested food occurs through **villi** (Minute finger like projection)

Villi: Intestinal villi (singular: villus) are small, finger-like projections that extend into the lumen of the small intestine



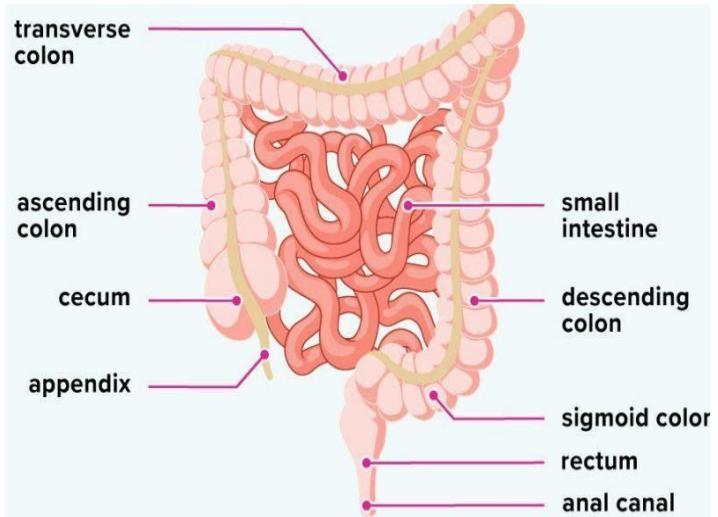
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6. Large intestine (Colon):

The large intestine is about 1.5 meters or 5 feet long & It extends from the end of the ileum to rectum.

Its parts are:

1. **Caecum**
2. **Appendix:** a hollow tube that is closed at one end and is attached at the other end to the cecum, a pouchlike beginning of the large intestine into which the small intestine empties its contents
3. **Ascending colon**
4. **Transverse colon**
5. **Descending colon**
6. **Sigmoid colon:** The sigmoid colon (or pelvic colon) is the part of the large intestine that is closest to the rectum and anus. It forms a loop that averages about 35–40 cm (13.78–15.75 in) in length
7. **Function:** its function is to store fecal wastes until they are ready to leave the body.



7. **Rectum:** Its a 8 inch chamber that connects the colon to anus.

- **Function:** To hold stool until evacuation happens.

8. **Anus:** Last part of digestive system where evacuation of waste product takes place.

Sphincters of GI System

Sphincters: A circular muscle that normally maintains constriction of passage.

1. **Upper esophageal sphincter**

2. **In stomach:**

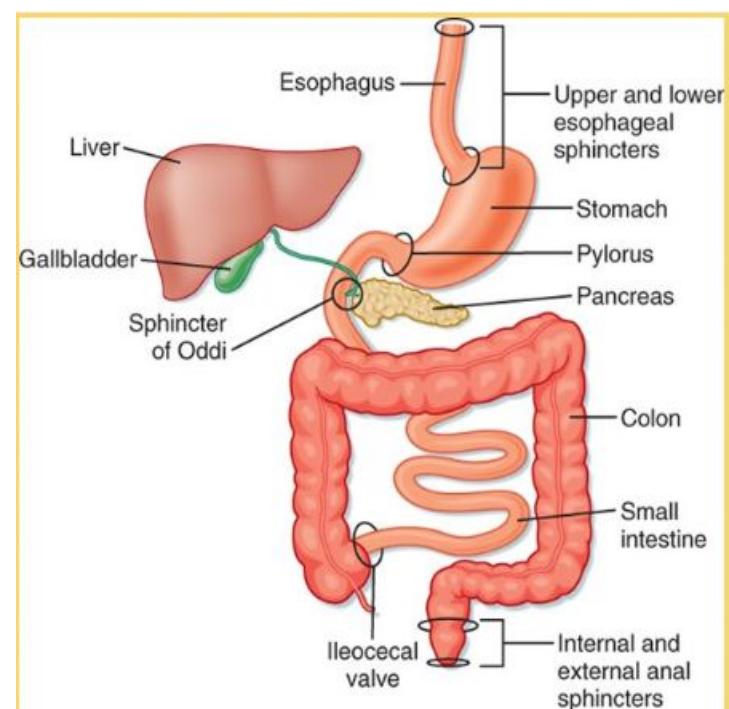
- **The lower esophageal or cardiac sphincter:** Its the upper portion of stomach, it prevents the backflow of acidic contents of stomach.
- **The pyloric sphincter:** Its in the end portion of stomach, allows partially digested food(chyme) to pass into duodenum.

3. **Sphincter of Oddi:** is a muscle that opens and closes to allow bile and pancreatic juice to flow between the pancreas and the small intestine

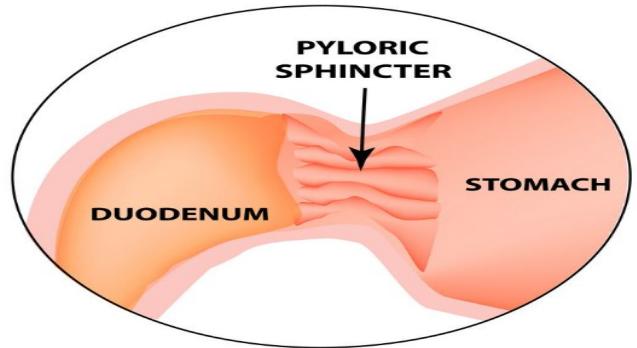
4. **Ileocecal valve**

5. **Anal sphincter:**

- **Inner or internal sphincter:** The internal sphincter contracts during rest and sleep, and keeps small amounts of liquid and gas from escaping unexpectedly.



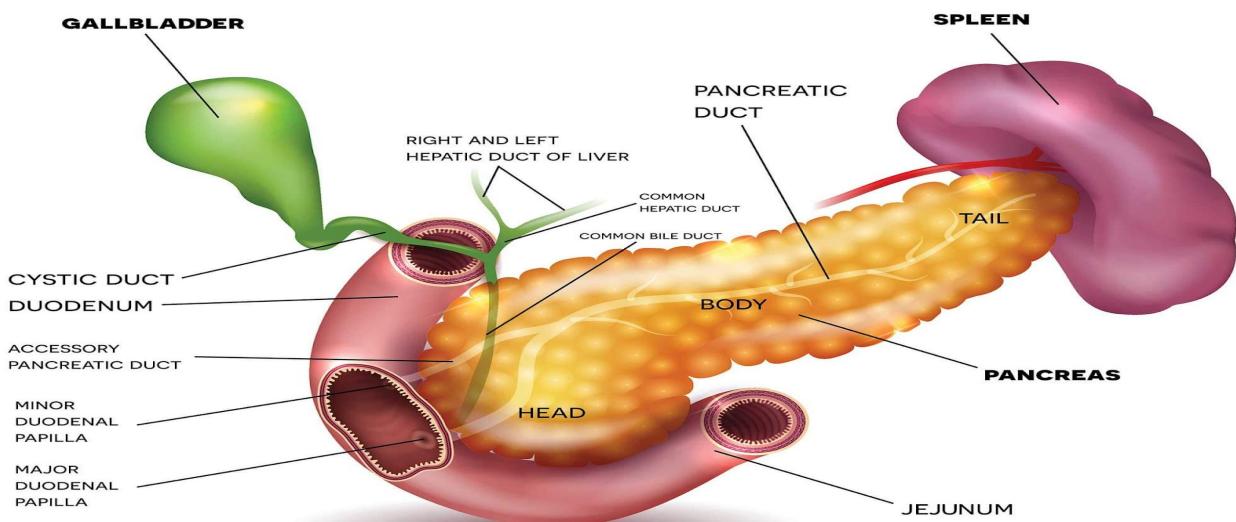
- **Outer or external sphincter:** It's under voluntary control, it maintains continence & keeps stool in rectum.



Accessory Organs of the digestive system:

1. **Pancreas:** It is closely associated with duodenum of small intestine.
 - a. Head of pancreas is located in c shaped curve of duodenum
 - b. 3 Parts
 - i. Head
 - ii. Body
 - iii. Tail
 - c. **Duct:** Pancreatic Duct
 - d. **Function:** It secretes pancreatic juice, contains enzymes (Amylase, lipase) that digest carbohydrates, fats & proteins.

PANCREAS



2. Liver:

- It is reddish brown structure located in the upper Right quadrant of the abdominal cavity.
- Liver is made up of 2 lobes:
 - Right Liver Lobe
 - Left Liver Lobe

Hepatocytes in the **liver** produce **bile**, which then passes through the bile ducts to be **stored** in the **gallbladder**

Function:

- Stores glycogen, iron, vitamin A, B12, D
- Its also stores 200-400ml of blood.
- Production of bile
 - Bile is a mixture of water, bile salts, cholesterol, and the pigment bilirubin. Its yellowish green liquid secreted by liver
 - Bile emulsify fats & aid in absorption of fatty acids

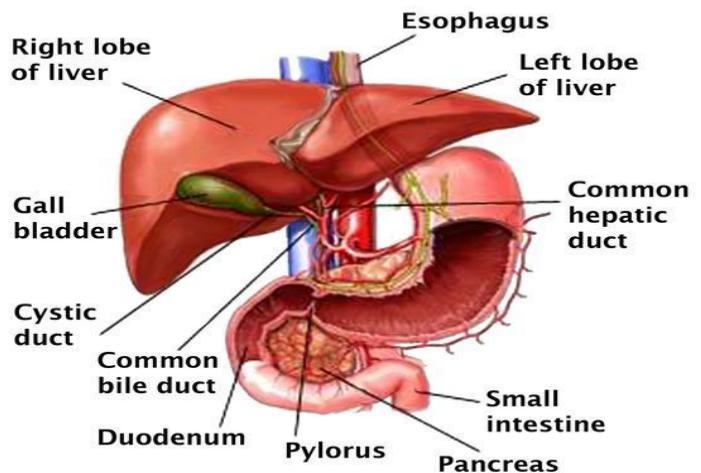
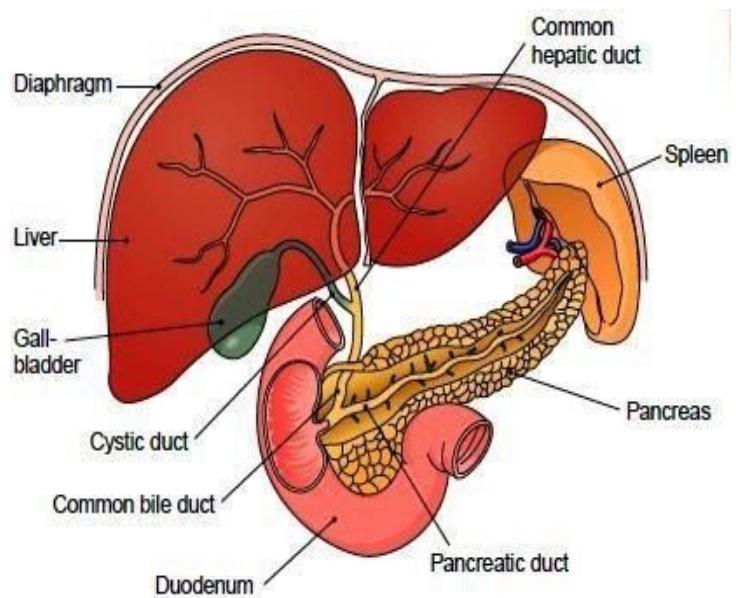
Ducts:

- Right Hepatic Duct
- Left Hepatic Duct
- Common Hepatic Duct - Right and Left Hepatic Duct merge to form Common Hepatic duct
- Gallbladder:** Pear shaped sac like structure located on inferior surface of liver

Function: It stores approximately 30-50ml of bile.

Duct:

- Cystic Duct:** Narrows into a small bile duct known as cystic duct
- Common Bile Duct (CBD)**



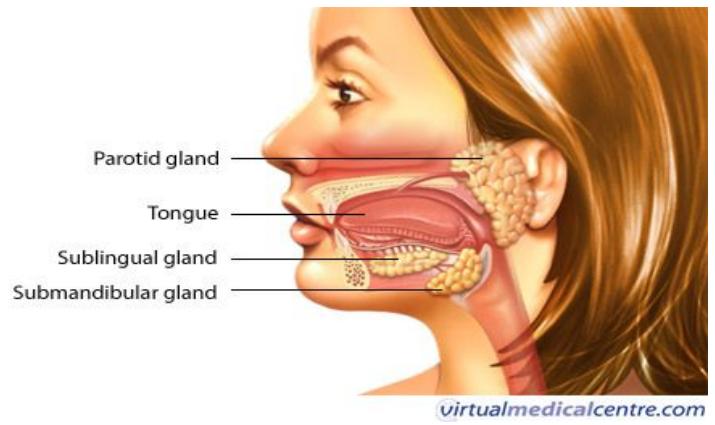
4. Salivary gland:

Saliva is the watery and usually somewhat frothy substance produced in the mouths of some animals, including humans. Produced in salivary glands, saliva is 98% water, but it contains many important substances, including electrolytes, mucus, antibacterial compounds and various **enzymes**

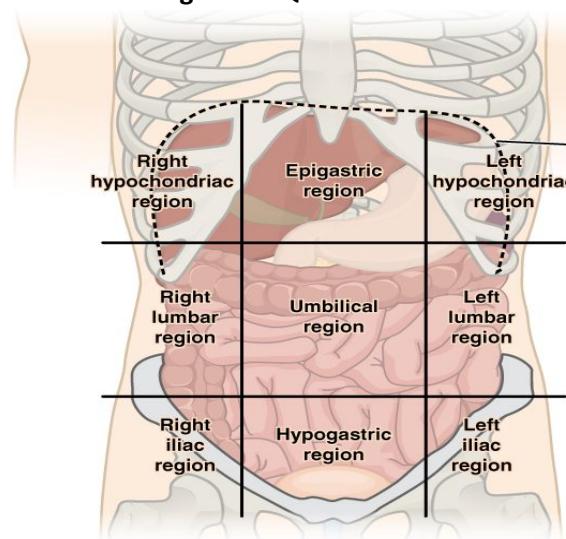
We have 3 salivary glands:

1. Parotid
2. Sublingual
3. Submandibular

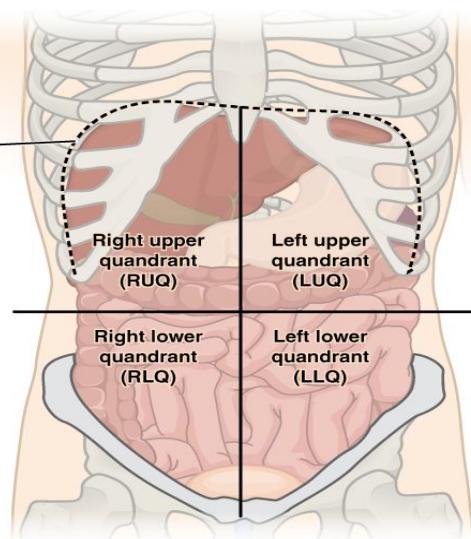
Function: It helps in break down carbohydrates (with salivary **amylase**, formerly known as ptyalin) and lubricates the passage of food from the oropharynx, esophagus to the stomach.



Abdominal Regions & Quadrants



(a) Abdominopelvic regions



(b) Abdominopelvic quadrants

Functions of digestive system:

1. **Ingestion:** Taking in food
2. **Digestion:** Breaking down food into nutrients
3. **Absorption:** Absorption of nutrients by cells
4. **Excretion:** Removing out waste products

Medical Terminology Digestive System

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
DS		abdomin(o)-	Of or relating to the abdomen	Latin (abdōmen), abdomen, fat around the belly	Abdomen
DS		an(o)	anus	Latin	
DS		-ase	enzyme	Greek -division	Lactase
DS		bucc(o)-	Of or pertaining to the cheek	Latin (bucca), cheek	Buccolabial
DS		chol(e)-	Of or pertaining to bile	Greek (cholē), bile	Cholaemia
DS		cholecyst(o)-	Of or pertaining to the gallbladder	Greek (cholékystis); gallbladder = (cholē) -bile, gall + (kýstis), bladder	Cholecystectomy
DS		col-, colo-, colono-	colon		Colonoscopy
DS		dent-	Of or pertaining to teeth	Latin (dens, dentis), tooth	Dentist
DS		duodeno-	duodenum, twelve: upper part of the small intestine (twelve inches long on average), connects to the stomach	Latin <i>duodenī</i>	Duodenal atresia
DS		enter(o)-	Of or pertaining to the intestine	Greek (énteron), intestine	Gastroenterology
DS		-esophageal, -esophago	gullet (AmE)	Greek	
DS		gastr(o)-	Of or pertaining to the stomach	Greek (gastēr), stomach, belly	Gastric bypass
DS		gingiv-	Of or pertaining to the gums	Latin (gingīva), gum	Gingivitis
DS		gloss(o)-, glott(o)-	Of or pertaining to the tongue	Greek (glōssa, glōtta), tongue	Glossology
DS		gluco-	glucose	Greek sweet	Glucocorticoid
DS		glyco-	sugar		Glycolysis
DS		hepat- (hepatic-)	Of or pertaining to the liver	Greek (hēpar, hēpato-), the liver	Hepatology
DS, Urinary		hydr(o)-	water	Greek	Hydrophobe
DS		ileo-	ileum	Greek	Ileocecal valve
DS		labi(o)-	Of or pertaining to the lip	Latin (labium), lip	Labiodental
DS		lapar(o)-	Of or pertaining to the abdomen-wall, flank	Greek (lapárā), flank	Laparotomy
DS, Respiratory		laryng(o)-	Of or pertaining to the larynx,	Greek (lárynx, laryng-), throat, gullet	Larynx
DS		lingu(a)-, lingu(o)-	Of or pertaining to the tongue	Latin (lingua), tongue	Linguistics
DS		lip(o)-	fat	Greek	Liposuction

DS, Urinary		lith(o)-	stone, calculus	Greek	Lithotripsy
DS		myx(o)-	mucus	Greek	Myxoma
DS		odont(o)-	Of or pertaining to teeth	Greek (odoús, odont-), tooth	orthodontist
DS		omphal(o)-	Of or pertaining to the navel, the umbilicus	Greek (omphalós), navel, belly-button	Omphalotomy
DS		or(o)-	Of or pertaining to the mouth	Latin (ōs, or-), mouth	Oral
DS MS		orth(o)-	Denoting something as straight or correct	Greek (orthos), straight, correct, normal	Orthodontist
DS, CVS	Disease process	-phago-	eating, devouring	Greek	phagocyte
DS, CVS		-phagy	Forms nouns that denotes 'feeding on' the first element or part of the word	Greek (phagia) eating; see -phagia	Anthropophagy
DS		proct(o)-	anus, rectum		proctology
DS		rect(o)-	rectum	Latin	
DS		sial(o)-	saliva, salivary gland	Greek (sialos)	sialagogue
DS		sigmoid(o)-	sigmoid, sigmoid colon	Greek	
DS		sito-	food, grain	Greek	
DS		stom(a)	mouth	Greek	stomatognathic system
DS		stomat(o)-	Of or pertaining to the mouth	Greek (stóma, stomat-), mouth	Stomatogastric
DS		umbilic-	Of or pertaining to the navel, the umbilicus	Latin (umbilicus), navel, belly-button	Umbilical
DS		ventr(o)-	Of or pertaining to the belly; the stomach cavities	Latin (venter), the belly, the stomach; the womb	Ventrodorsal
Urinary, DS		vesic(o)-	Of or pertaining to the bladder	Latin (vēsīca), bladder; blister	Vesica
DS		zym(o)-	fermentation, enzyme	Greek	
DS		Digestion	-pepsia	-	-
DS		Eating	-phagia	-	-
DS		abdomen	lapar(o)-	abdomin-	-
DS		cheek	-	bucc-	-
MS, DS		fat, fatty tissue	lip(o)-	adip-	-
DS		gallbladder	cholecyst(o)-	fell-	-
DS		gums	-	gingiv-	-
DS		intestine	enter(o)-	-	-
DS		jaw	gnath(o)-	-	-
DS		liver	hepat(o)- (hepatic-)	jecor-	-
DS		mouth	stomat(o)-	or-	-

DS		navel	omphal(o)-	umbilic-	-
DS		tooth	odont(o)-	dent(i)-	-
DS		tongue	gloss-, glott-	lingu(a)-	-

Summary of Digestive System:

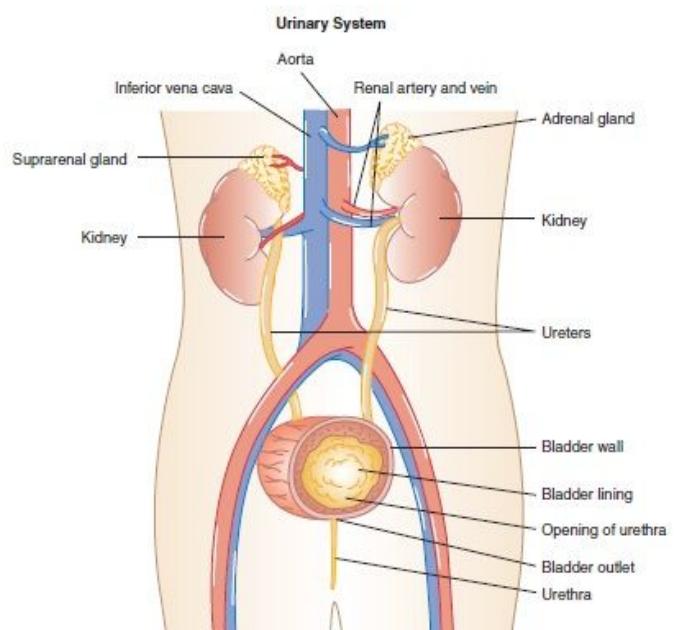
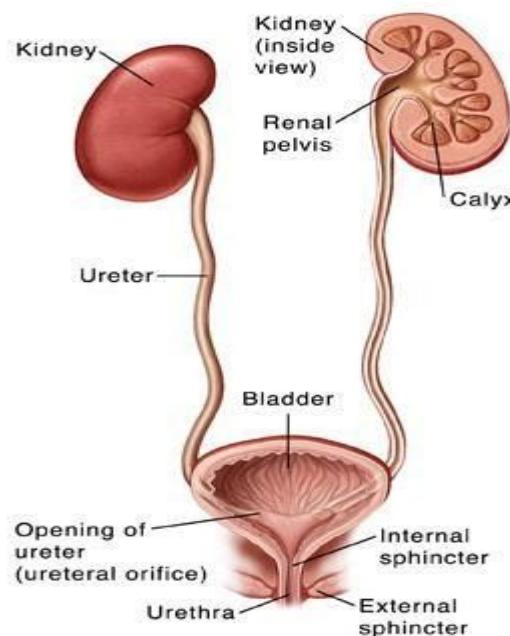
Mouth - Pharynx - Esophagus - Stomach - Small Intestine - Large Intestine (Colon) - Rectum - Anus

Accessory: Salivary Glands - Liver - Gallbladder - Pancreas

Introduction to Urinary System: Renal System

- Urinary system is also known as the **excretory system** of the human body. It is the system of production, storage and elimination of urine
- Formation and elimination of urine is important for the human body because urine contains nitrogenous wastes of the body that must be eliminated to maintain homeostasis
- Nitrogenous wastes are formed by metabolic activities in the cells. These nitrogenous wastes along with excess of salts and water are combined in the kidneys to form urine
- Urinary system is important for keeping the internal environment of the body clean.
- Urinary system maintains proper homeostasis of water, salts and nitrogenous wastes

Kidneys	Kidneys are two bean shaped organs lying close to the lumbar spine on either side, they are multifunction organ, form urine and control its concentration
Ureters	Two hollow muscular tubes one arising from each kidney and ending at the urinary bladder, connect kidneys to the bladder
Urinary Bladder	Stores urine before it is excreted from the body, hollow muscular and distensible organ, sits on the pelvic floor.
Urethra	A tube connecting the urinary bladder to the genitals for excretion
Functions	Excretion of nitrogenous wastes, Osmoregulation, Acid-Base balance



Components of urinary system:

1. Kidney (Renal):

We have 1 pair (Right and Left) of kidneys on each side. It is a bean shaped structure located in the Retroperitoneal region. Adrenal gland on superior pole.

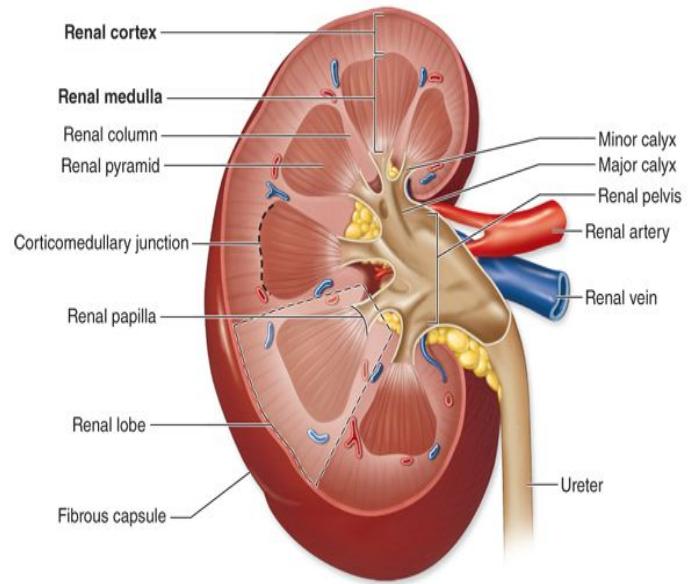
- Superior pole: lies at T12 vertebrae.
- Inferior pole: lies at L3 vertebrae.
- Right kidney 2 cm lower than left.

Kidney has 2 main region

- **Cortex:** Its Outer layer & light reddish brown in colour, granular appearance (due to many capillaries)
- **Medulla:** Darker striped appearance (due to tubules)
 - **Renal Pyramid**

Formation of urine in kidney: Takes place by 3 process

- Filtration
- Reabsorption
- Secretion



Urine collection in kidney

Ducts within each renal papilla release urine into

MINOR CALYX

↓

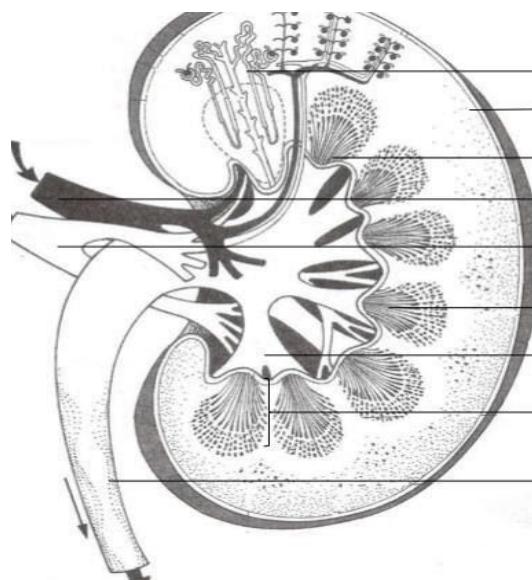
MAJOR CALYX

↓

RENAL PELVIS

↓

URETER



- | |
|--|
| Nephron |
| Renal Capsule |
| Protects kidney |
| Papilla |
| Tips of each pyramid, fits into calyx |
| Renal artery |
| Carries blood to kidneys |
| Renal vein |
| Carries blood from kidneys |
| Pyramid |
| Made up of collecting ducts |
| Calyx |
| Collects urine from collecting duct |
| Medulla |
| Made up of pyramids |
| Ureter |
| Carries urine from pelvis to bladder for storage |

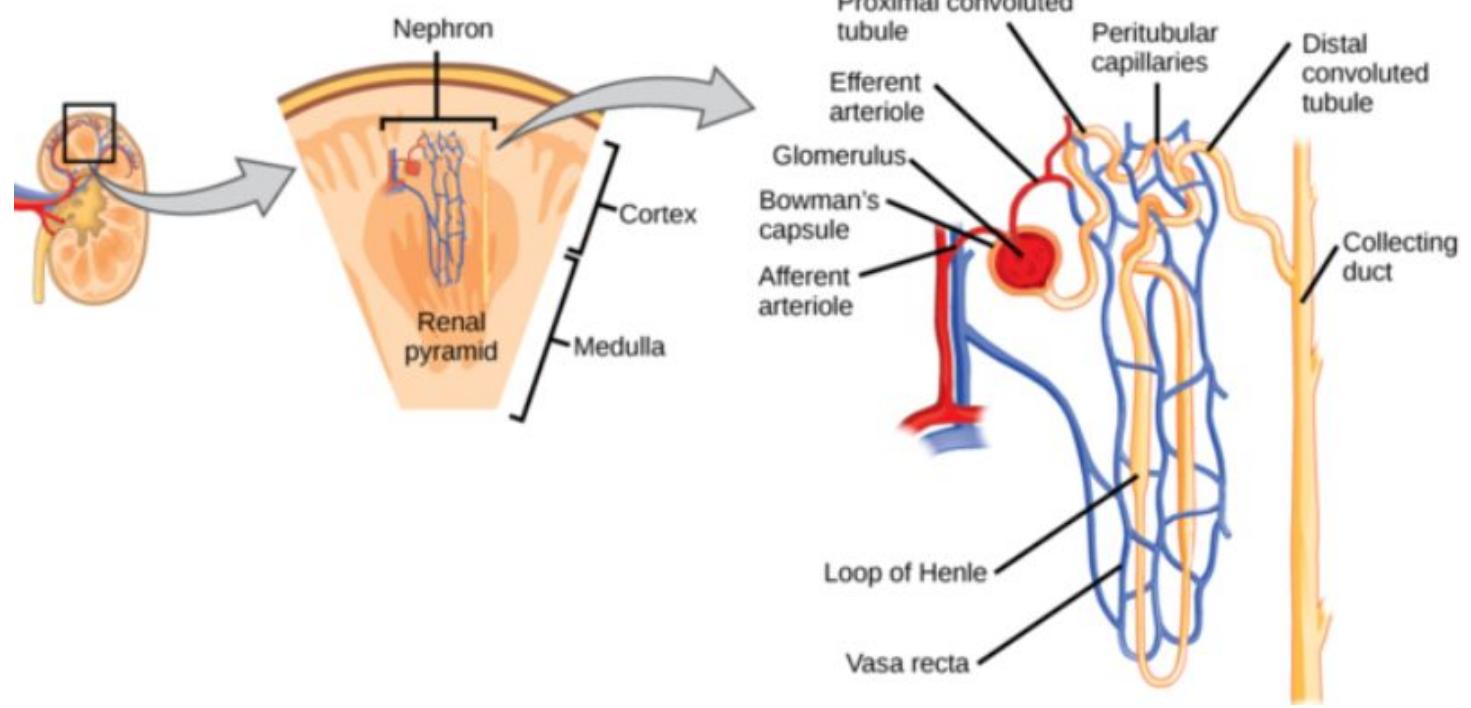
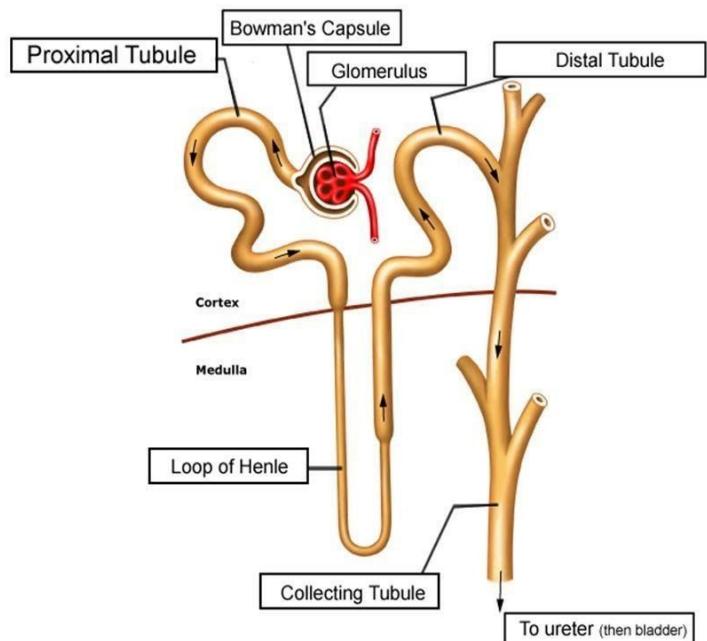
Nephron

Nephron is structural & functional unit of kidney.

In both kidney approximately 2.5 millions of nephrons are present.

Parts of nephron:

1. **Glomerulus:** Tuft of capillaries (Blood vessels)
2. **Bowman's capsule:** Its a cup like sac at the beginning of nephron, This is the place where 1st step of filtration of blood to form urine takes place
3. **Proximal convoluted tubule (PCT):** It's between Bowman's capsule & distal convoluted tubule.
4. **Loop of Henle:** It's a part where recovery of water & sodium chloride(NaCl) from urine takes place.
5. **Distal convoluted tubule DCT:** Is a duct of renal tubule located in the cortex of kidney.
6. **Collective Duct:** Is a series of tubules & ducts that physically connect Nephron to minor calyx or directly to renal pelvis

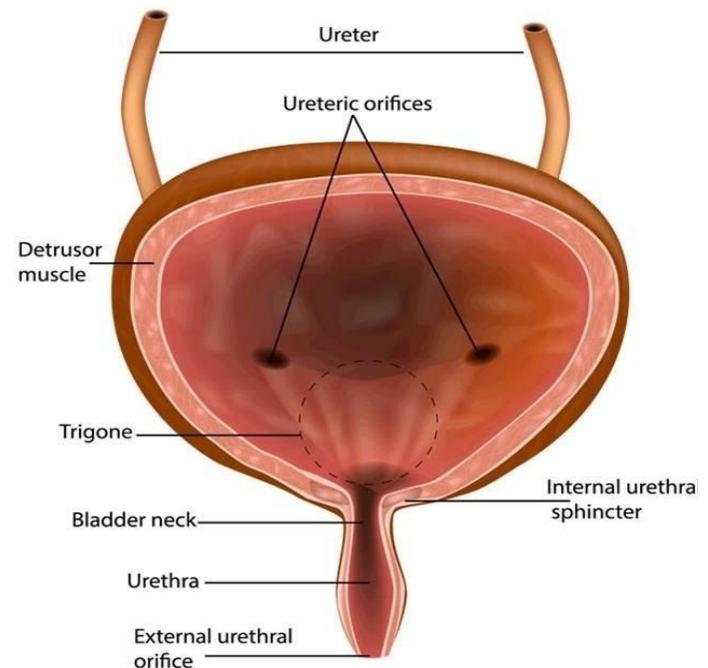


2. Ureter:

- We have 1 pair (Right and Left) of long, fibromuscular tubes
- Average size is of 25 centimetres in length
- Ureter originates at the renal pelvis.
- **Function:** Carry urine from kidney to bladder.

3. Bladder:

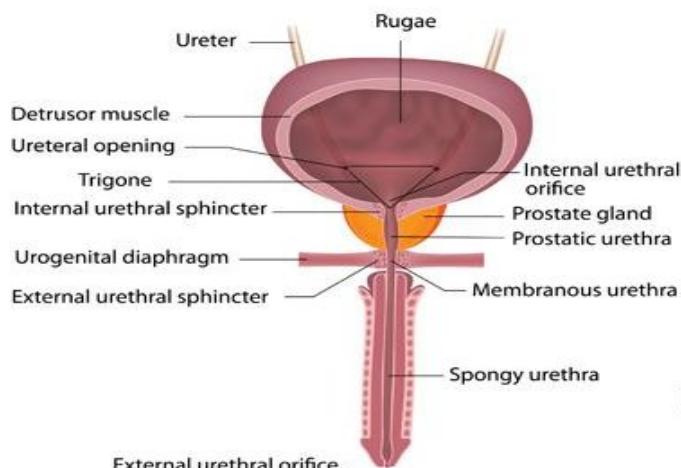
- It is located in the Retroperitoneal region, behind pubis.
- It has internal folds called **Rugae**, that permits the expansion (Maximum holding capacity is 1 litre) for urine storage.
- **Trigone:** Posterior inferior triangular area of the urinary bladder wall, formed by imaginary lines.
 - It connects the 2 posterior ureteral opening with the anterior urethral opening.
 - **Function:** Acts as a funnel.



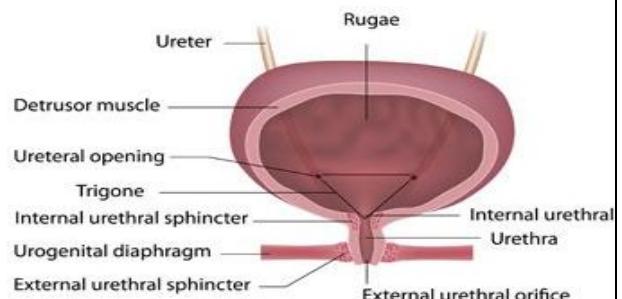
4. Urethra:

- a. The urethra is more than just a urinary opening, it also serves as a conduit for semen and sperm during sexual acts.
- b. Male and Female difference, see diagram
 - i. It is shorter in females (3-5cm long)
 - ii. Whereas In males (20cm long)
- c. **It has 2 sphincters:**
 - i. **Internal sphincter:** Its under involuntary control & it Restrict the release of urine until the pressure within the urinary bladder is high.
 - ii. **External sphincter:** Its under voluntary control & activity is needed to release the urine.

Male



Female



Urinary Bladder and Urethra

- **Micturition:** Micturition or urination is the process of expelling urine from the bladder. This act is also known as voiding of the bladder. The process of micturition is regulated by the nervous system. The urinary bladder can store around 350-400ml of urine before it expels it out.
- **Components of urine**
 - 1-2 liter of urine/day is excreted
 - Contains 95% of water & remaining 5% consist of Urea, uric acid, creatinine, ammonia etc
 - Depends on diet & state of health

Functions of urinary system:

1. **FORMATION AND ELIMINATION OF URINE:** The main function of urinary system is formation and elimination of urine. Urine is formed by the kidneys in 3 steps;
 1. Glomerular Filtration
 2. Tubular reabsorption
 3. Tubular secretion
2. **OSMOREGULATION:** Kidneys are important osmoregulatory organs of human body. They maintain salt and water balance of the body. If the concentration of salt or water is increased above normal, kidney will excrete the excess amount. If the concentration is decreased, kidneys will reduce the loss of water and salts in urine.
3. **ACID BASE (pH) BALANCE:** Kidneys are important regulators of pH of body fluids. Kidneys keep the pH balanced within a very small range and provide an optimum environment for all processes of life.

Medical Terminology of Urinary System

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Urinary		cyst(o)-, cyst(i)-	Of or pertaining to the urinary bladder	Greek (kýstis), bladder; cyst	Cystotomy
DS, Urinary		hydr(o)-	water	Greek	Hydrophobe
DS, Urinary		lith(o)-	stone, calculus	Greek	Lithotripsy
Urinary		nephro-	Of or pertaining to the kidney	Greek (nephróς), kidney	Nephrology
MS, Urinary		pyel(o)-	pelvis	Greek (pyelos)	Pyelonephritis
Urinary		ren(o)-	Of or pertaining to the kidney	Latin (rēnes), kidney	renal
Urinary		ur(o)-	Of or pertaining to urine, the urinary system.	Greek (ouron), urine	Urology
Urinary		uri(c)-, urico-	uric acid	Greek	
Urinary		urin-	Of or pertaining to urine, the urinary system	Latin (ūrīna), urine; Greek (ouron), see above.	Uriniferous
Urinary, DS		vesic(o)-	Of or pertaining to the bladder	Latin (vēsīca), bladder; blister	Vesica
Urinary		bladder	cyst(o)-	vesic(o)-	-
Urinary		kidney	nephro-	ren-	-
Urinary		ureter	ureter(o)-	ureter(o)-	-
Urinary		urethra	urethr(o)-, urethr(a)-	urethr(o)-, urethr(a)-	-
Urinary		urine, urinary System	ur(o)-	urin(o)-	-

Summary of Urinary System:

- Kidney - Renal Capsule, Renal Cortex, Medulla (Renal pyramid - Minor Calyx, Major Calyx), Renal Pelvis
- Ureter
- Urinary Bladder - Ureteric Orifice, Trigone
- Urethra - Urethral opening, Internal and external Sphincters
- Nephron (Cortex and Medulla)
 - Glomerulus
 - Bowman's Capsule
 - PCT
 - Loop of Henle
 - DCT
 - Collective Duct
- Renal Papilla
- Minor Calyx
- Major
- Pelvis
- Ureter

Introduction to the Respiratory System

When the respiratory system is mentioned, people generally think of breathing, but breathing is only one of the activities of the respiratory system. The body cells need a continuous supply of oxygen for the metabolic processes that are necessary to maintain life. The respiratory system works with the circulatory system to provide this oxygen and to remove the waste products of metabolism.

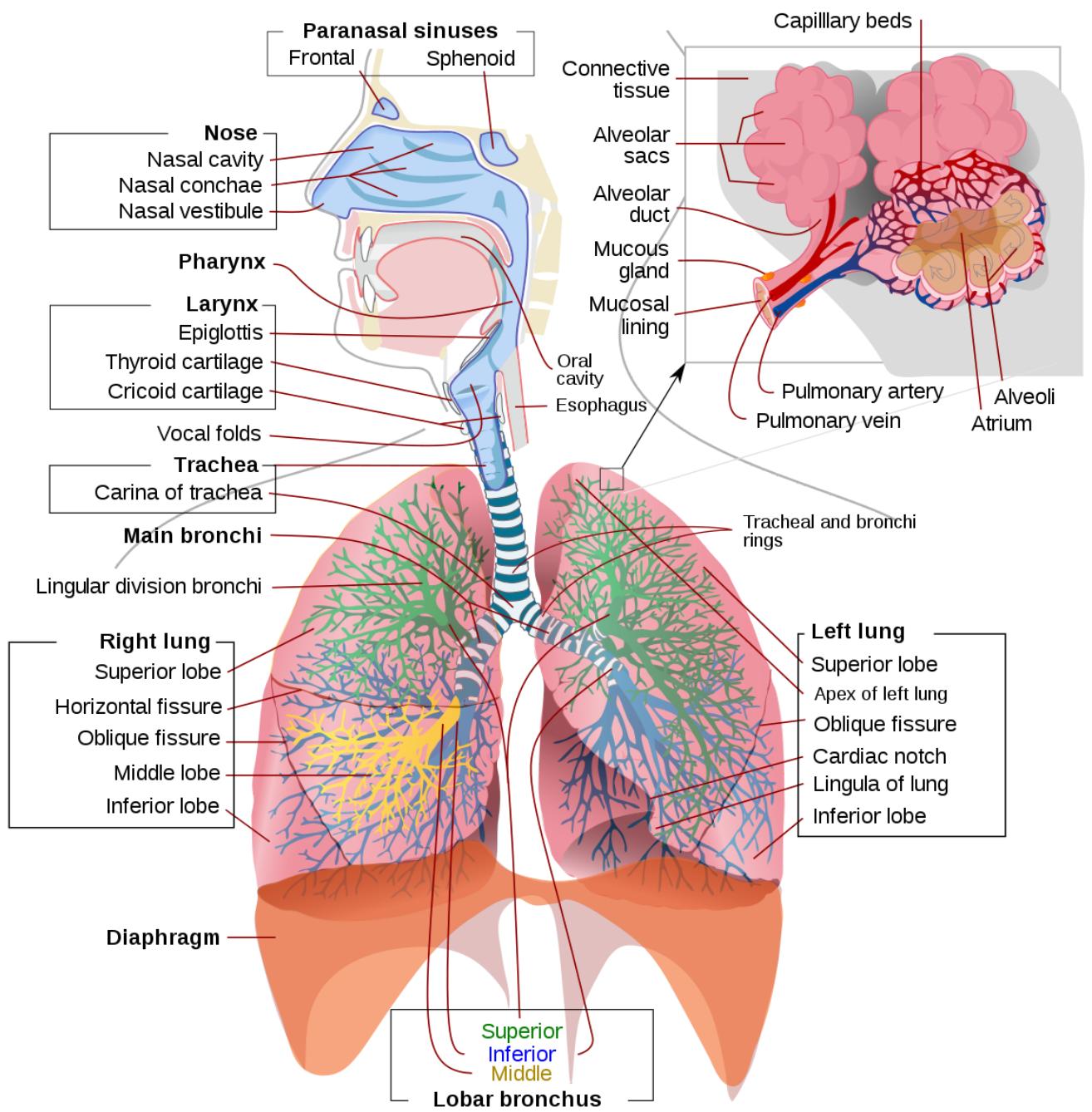
Respiration is the sequence of events that results in the exchange of oxygen and carbon dioxide between the atmosphere and the body cells.

- **External respiration:** An exchange of gases between the lungs and the blood. The blood transports the gases to and from the tissue cells.
- **Internal respiration:** The exchange of gases between the blood and tissue cells.
- **Cellular metabolism, or cellular respiration:** The cells utilize the oxygen for their specific activities
- **The upper airways or upper respiratory tract**
 - includes the nose and nasal passages, paranasal sinuses, the pharynx, and the portion of the larynx above the vocal folds (cords).
- **The lower airways or lower respiratory tract**
 - includes the portion of the larynx below the vocal folds, trachea, bronchi and bronchioles

Components	Nose	The most external organ, air is inhaled and exhaled through nose, has different mechanisms for cleaning and condensing the inhaled air
	Pharynx	The pharynx (plural: pharynges) is the part of the throat behind the mouth and nasal cavity, and above the esophagus and larynx – the tubes going down to the stomach and the lungs
	Larynx	Also known as soundbox/Voicebox , formed of cartilages, connects the trachea to the laryngopharynx
	Trachea	Tubular structure with about 1 inch diameter, composed of 15-20 C shaped cartilages that keep it dilated
	Bronchi	Left and Right divisions of trachea, enters the lungs and divide into secondary bronchi
	Lungs	Main organs of respiration, two in number (one on each side of heart) Conical in shape, divided into lobes
Parts	Conductive Parts	Parts of respiratory system where exchange of gases does not take place include Nose, larynx, trachea, and bronchi.
	Respiratory Parts	Parts of respiratory system where exchange of gases takes place include Lungs
Functions	Gaseous Exchange, Excretion of carbon dioxide, Oxygenation of blood	

Breathing has 2 processes:

- **Inhalation:** It is also called inspiration, Breath in(draws gasses into the lungs)
- **Exhalation:** It is also called expiration, breath out(force gasses out of the lungs)



Main Components of Respiration

Nose:

The nose is also made up of types of soft tissue such as skin, epithelia, mucous membrane, muscles, nerves, and blood. In the skin there are sebaceous glands, and in the mucous membrane there are nasal glands.

Hair in the nares are responsible for filtering out foreign body. Sneezing is a reflex to expel unwanted particles from the nose that irritate the mucosal lining.

Function:

- Moistens & warms entering air
- Filters & cleans entering air
- Detects odor (**Sensory organ, smelling**)
- Its Resonating chamber for speech

Nares/Nostribs: is one of the two channels of the nose, from the point where they bifurcate to the external opening.

Nasal septum: is the bone and cartilage in the nose that **separates** the nasal cavity into the two nostrils

Pharynx

It is commonly called throat, it is a common passage for air & food.

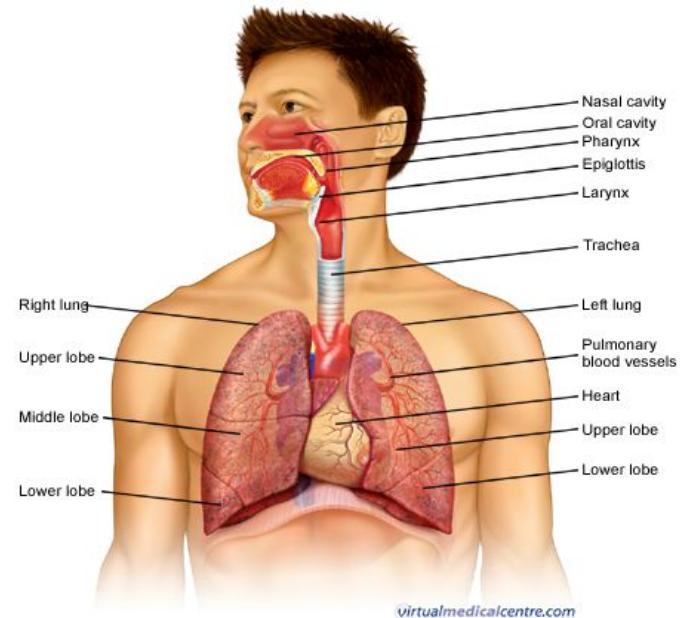
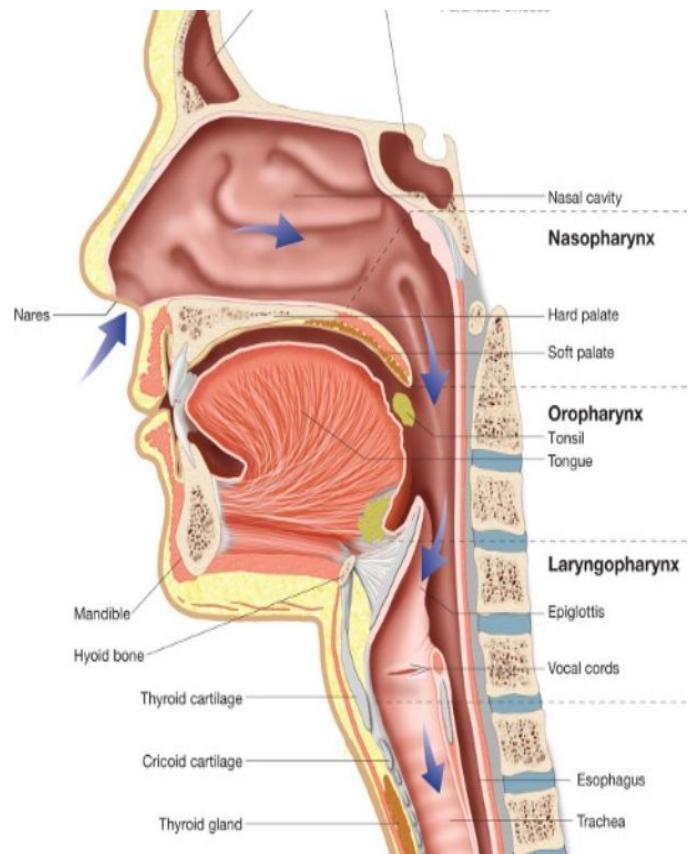
It has 3 sections:

- **Nasopharynx:** it is a connection between nose & pharynx
- **Oropharynx:** it is a connection between mouth and pharynx, its responsible for air passage.
- **Laryngopharynx:** its a junction where respiratory tract divides into esophagus & the lungs.

Larynx: It is also called **voice box (Adams Apple)**, because it has **vocal cord**(vocal folds) which vibrate with expelled air to create sound(speech)

It has cartilage (thyroid, hyaline, cricoid) & a spoon shaped flap of elastic cartilage called **Epiglottis**.

Trachea: is also called **windpipe**. It connects the larynx with bronchi. The Walls are made of c shaped hyaline.



Lung

We have 1 pair of lungs on either side of the thoracic cavity. It is conical in shape & occupies most of the thoracic cavity.

- **Apex:** is near the clavicle (Top of the lung)
- **Base:** Rest on the diaphragm, it is concave in shape.
- **Hilum of lung:** The hilum of the lung is found on the medial aspect of each lung, and it is the only site of entrance or exit of structures associated with the lungs.
- **Lobes:** Each lung is divided into lobes by fissures
 - Right - 3 lobes, divided by oblique & horizontal fissure (Upper lobe, Middle lobe & Lower lobe)
 - Left - 2 lobes, that is divided by oblique fissure (Upper lobe & Lower)

Bronchus (Bronchi): Primary, Secondary and Tertiary Bronchi
● Bronchioles

Alveolus (Alveoli): The bronchioles eventually end in a cluster of microscopic air sac called **alveoli**.

Structure of alveoli has:

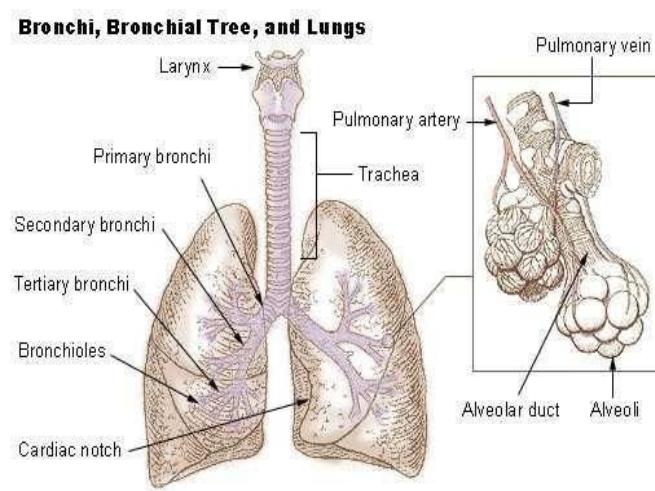
- Alveolar duct
- Alveolar sac
- Alveolus

Alveolar ducts are tiny ducts that connect the respiratory bronchioles to alveolar sacs, each of which contains a collection of alveoli (small mucus-lined pouches made of flattened epithelial cells).

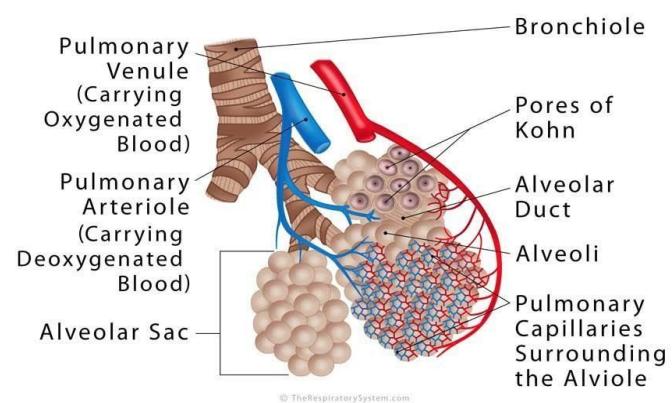
Gas exchange: Gas crosses the respiratory membrane by diffusion.

- Oxygen enters the blood
- Carbon dioxide enters the alveoli
- Macrophages add protection.

Pulmonary Artery brings deoxygenated Blood from heart to lung
Pulmonary Vein takes oxygenated blood from lungs to the heart

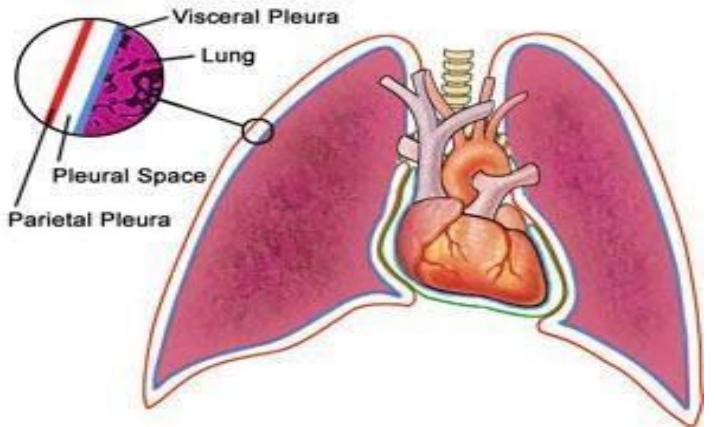


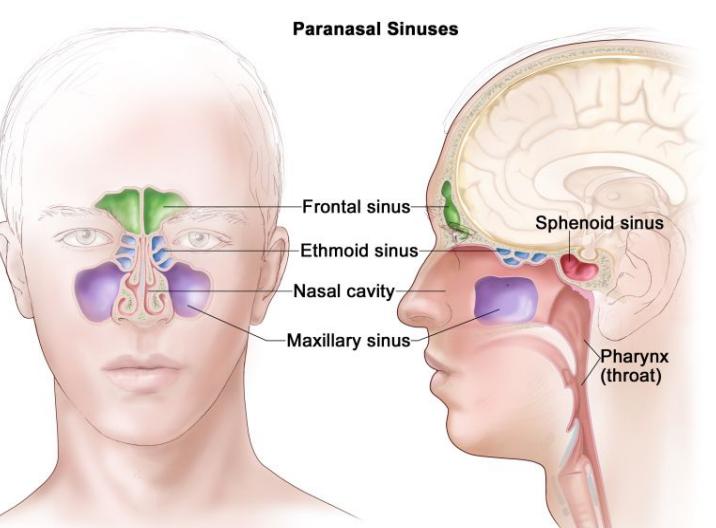
Alveoli



Diaphragm: Dome-shaped, muscular and membranous structure that separates the thoracic (chest) and abdominal cavities.

- Diaphragm squeezes downward when you breathe in, making a vacuum that causes a rush of fresh air into your lungs. The opposite happens when you breathe out - your diaphragm relaxes upward, pushing on your lungs, letting them deflate.
- When you breathe in, or inhale, your diaphragm contracts and moves downward. This increases the space in your chest cavity, and your lungs expand into it.
- The muscles (**Intercostal muscles**) between your ribs also help enlarge the chest cavity. They contract to pull your rib cage both upward and outward when you inhale

Layers of lungs:	
Visceral pleura: Outer surface of lung is tightly covered by visceral pleura(pulmonary pleura).	
Parietal pleura: Lines the walls of the thoracic cavity.	

Sinuses: Your sinuses are air spaces in your skull and facial bones that make up the upper part of your respiratory tract from your nose into your throat.	
<ul style="list-style-type: none"> • Frontal (Pair): The sinuses are in your forehead • Sphenoid (Pair): behind the nose • Ethmoid (Pair): behind the nose • Maxillary (Pair): inside your cheekbones 	

Functions of Respiratory System	
GASEOUS EXCHANGE	Main function of the respiratory system is gaseous exchange. Through the respiratory system new air is always brought into the body and used air is expelled out. In this way oxygen is gained and carbon dioxide is lost by the body.
EXCRETION OF CARBON DIOXIDE	Carbon dioxide is produced as a result of metabolic break down of carbohydrates in the body and must be eliminated quickly. Carbon dioxide is brought to the lungs by blood and is lost from the lungs through gaseous exchange with fresh air in lungs.
OXYGENATION OF BLOOD	Oxygen is required by the body for breakdown of food and must be continuously supplied for continuous supply of energy. Supply of oxygen is maintained by the respiratory system.
HELPS TO REGULATE BLOOD Ph LEVEL	

Medical Terminology of Respiratory system

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Respiratory		aer(o)-	air, gas	Greek	Aerosinusitis
Respiratory		bronch(i)-	bronchus		Bronchiolitis obliterans
DS, Respiratory		laryng(o)-	Of or pertaining to the larynx, throat, gullet	Greek (lárynx, laryng-), throat, gullet	Larynx
Respiratory		log(o)-	speech	Greek	
Respiratory		nas(o)-	Of or pertaining to the nose	Latin (nāsum), nose	nasal
Respiratory		oxo-	addition of oxygen	Greek	
Respiratory		oxy-	sharp, acid, acute, oxygen	Greek	
Respiratory		pharyng(o)-	Of or pertaining to the pharynx, the upper throat cavity	Greek (phárynx, pháryng-), throat, windpipe; chasm	Pharyngitis, Pharyngoscopy
Respiratory		pneum(o)-	Of or pertaining to the lungs	Greek (pneumon-), lung (pneuma), wind, spirit	Pneumonocyte, Pneumonia
Respiratory		pneumat(o)-	air, lung		
Respiratory		pulmon-, pulmo-	Of or relating to the lungs.	Latin: a lung	pulmonary
Respiratory		rhin(o)-	Of or pertaining to the nose	Greek (rhīs, rhīno-), nose	rhinoceros, rhinoplasty
Respiratory		sinus-	Of or pertaining to the sinus	Latin (sinus), a curve, bend, bay	Sinusitis
Respiratory		trache(o)-	trachea	Greek	
Respiratory		trachel(o)-	Of or pertaining to the neck	Greek (tráchēlos), neck	Tracheotomy
Respiratory		lungs	pneumon-	pulmon(i)-(pulmo-)	-
Respiratory		neck	trachel(o)-	cervic-	-
Respiratory		nose	rhin(o)-	nas-	-
Respiratory		sinus	-	sinus-	-
Respiratory		stomach	gastr(o)-	ventr(o)-	-
Respiratory		throat (upper throat cavity)	pharyng(o)-	-	-
Respiratory		throat (lower throat cavity/voice box])	laryng(o)-	-	-

Summary of the Respiratory System:

Nose - Nares - Nasal Septum - Nasal Cavity

Pharynx - Larynx - Trachea - Lungs - Bronchi (Primary, Secondary, Tertiary)

Bronchi - Bronchioles - Alveoli

Muscles - Diaphragm, Intercostal muscles

Sinuses - Frontal, Sphenoid, Ethmoid and Maxillary

Pleura - Membrane, Pleural fluid

Heart - Deoxygenated Blood (CO₂) - Pulmonary Artery - Arterioles - Blood capillary (Oxygenation (Diffusion) takes places in Alveoli) - Oxygenated Blood - Venules - Pulmonary Vein - Heart

Introduction to the Cardiovascular System (CVS)

The cardiovascular system is sometimes called the **blood-vascular**, or simply the **circulatory system**. It consists of the heart, which is a muscular pumping device, and a closed system of vessels called **arteries, veins, and capillaries**. As the name implies, blood contained in the circulatory system is pumped by the heart around a closed circle or circuit of vessels as it passes again and again through the various "circulations" of the body.

The vital role of the cardiovascular system in maintaining homeostasis depends on the continuous and controlled movement of blood through the thousands of miles of capillaries that permeate every tissue and reach every cell in the body. It is in the microscopic capillaries that blood performs its ultimate transport function. Nutrients and other essential materials pass from capillary blood into fluids surrounding the cells as waste products are removed.

Heart	Hollow muscular organ providing the force for flow of blood throughout human body
Blood Vessels	Pathways of blood flow in human body, hollow tubes, of 3 types <ul style="list-style-type: none"> ● Arteries Carry blood away from heart to other body parts, very muscular and elastic ● Capillaries Microscopic blood vessels where exchange of nutrients with tissues take place ● Veins Carry blood towards the heart from other body parts, their walls are thinner as compared to corresponding arteries
Blood	Special type of body tissue that is in fluid form, consists of the following components; <ul style="list-style-type: none"> ● Plasma ● Blood cells <ul style="list-style-type: none"> ○ White Blood Cells (WBC) ○ Red Blood Cells (RBC) ○ Platelets
Functions	Provide nutrients to body parts, Remove excretory Products from body parts, Protects body against infection, Distribution of heat.

Heart

It weighs 250-350gms, it is a cone shaped muscular organ at medial cavity of thorax called "**mediastinum**" between the lungs behind the sternum, protected within 2nd to 5th ribs.

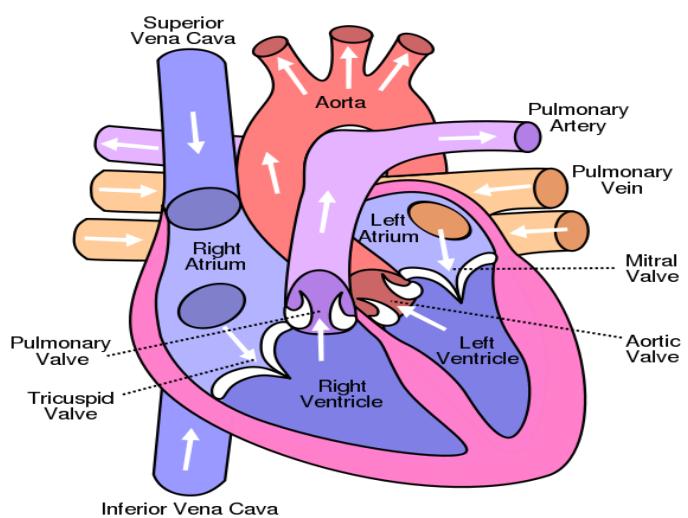
Systolic-pumping, diastolic-filling.

Heart has 4 chambers:

Right & left of the heart is divided by septum

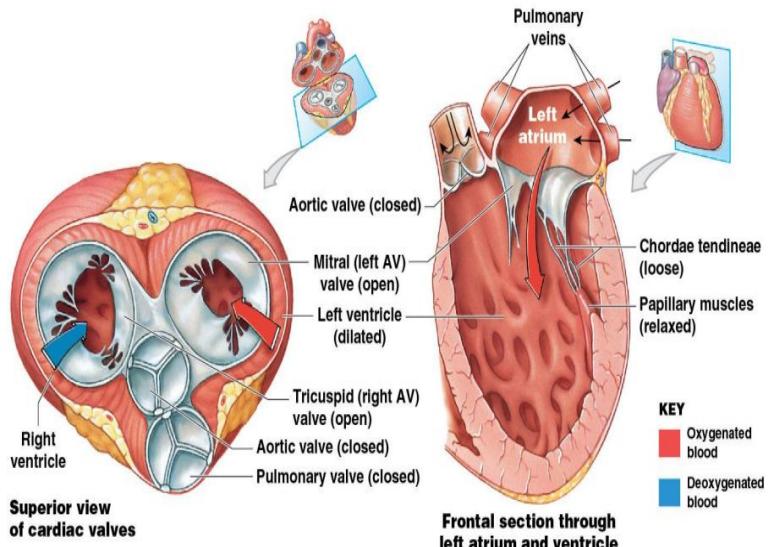
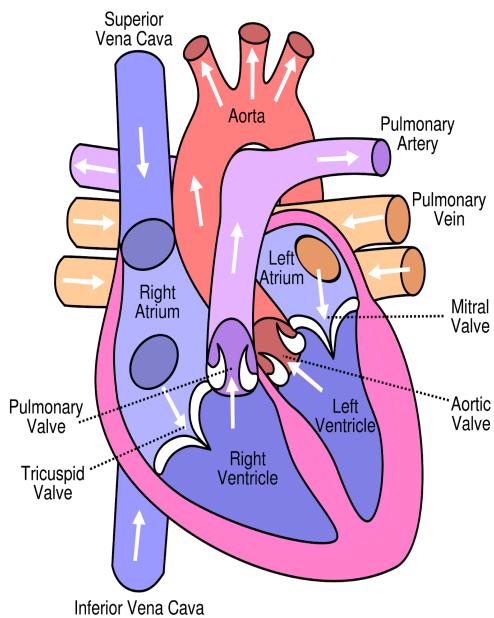
The **atrioventricular septum** is a septum of the heart between the right atrium (RA) and the left ventricle (LV).

1. Right & left atrium
2. Right & left ventricles

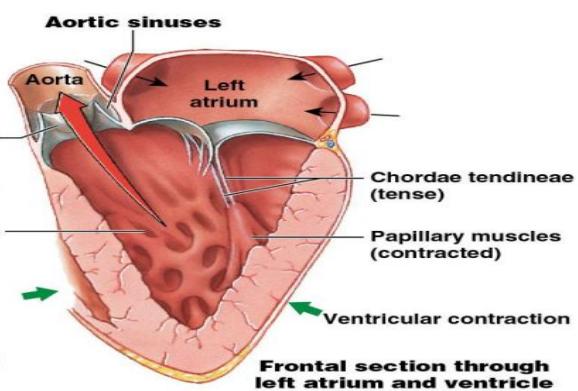
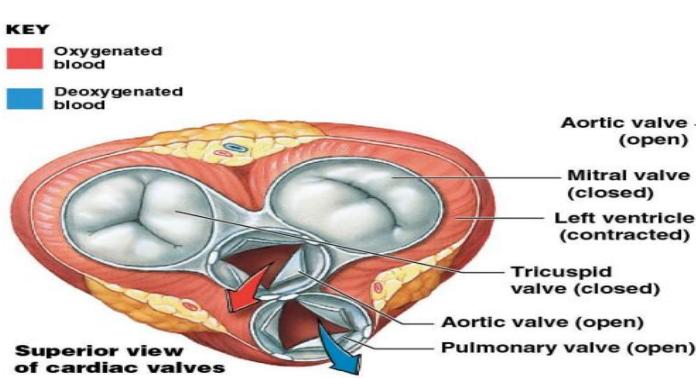


Valves of Heart	
Atrioventricular (AV) valves: <ul style="list-style-type: none"> The valves between the atria and ventricles. AV Valves prevents backflow of blood in the heart. Heart sound (lub dup) is due to closing of AV valves. Tricuspid and bicuspid (Mitral) valves 	Semilunar valves: The aortic and pulmonary valves are located at the base of the aorta and the pulmonary trunk respectively
Tricuspid valve: Atrioventricular valve between Right atrium & ventricle	Aortic valve: The aortic valve is a valve in the human heart between the left ventricle and the aorta.
Bicuspid / mitral valve: Atrioventricular valve between left atrium & ventricle.	Pulmonic valve (also called pulmonary valve): pulmonary valve is the semilunar valve of the heart that lies between the right ventricle and pulmonary artery & it has 3 cups

Position of heart valves while ventricles are filling (ventricular relaxation)

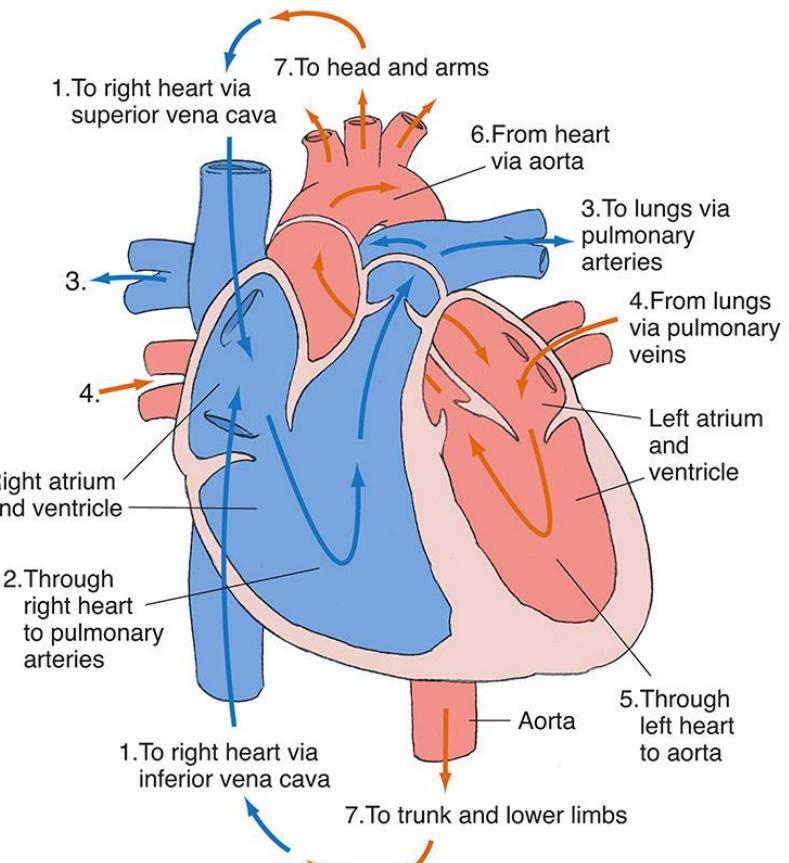
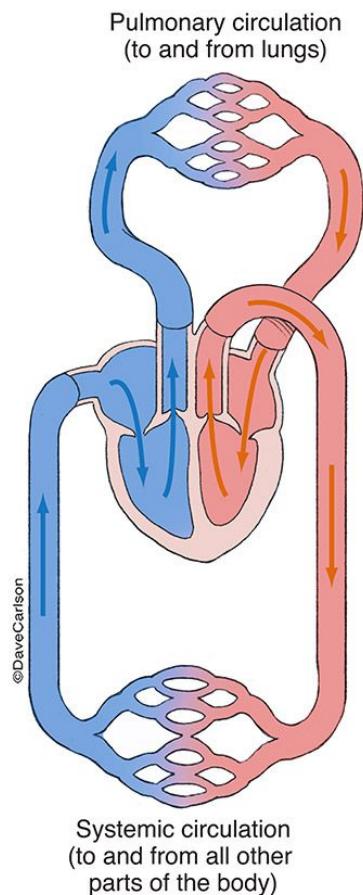


Position of heart valves while ventricles are emptying (ventricular contraction)



Circulation of heart: Circulation of heart are of 2 types:

- Pulmonary circulation:** Moves blood between the heart & lungs
- Systemic circulation:** Moves blood between the heart & rest of the body, it sends oxygenated blood out to cells & returns deoxygenated blood to the heart



How Does Blood Flow Through the Heart?

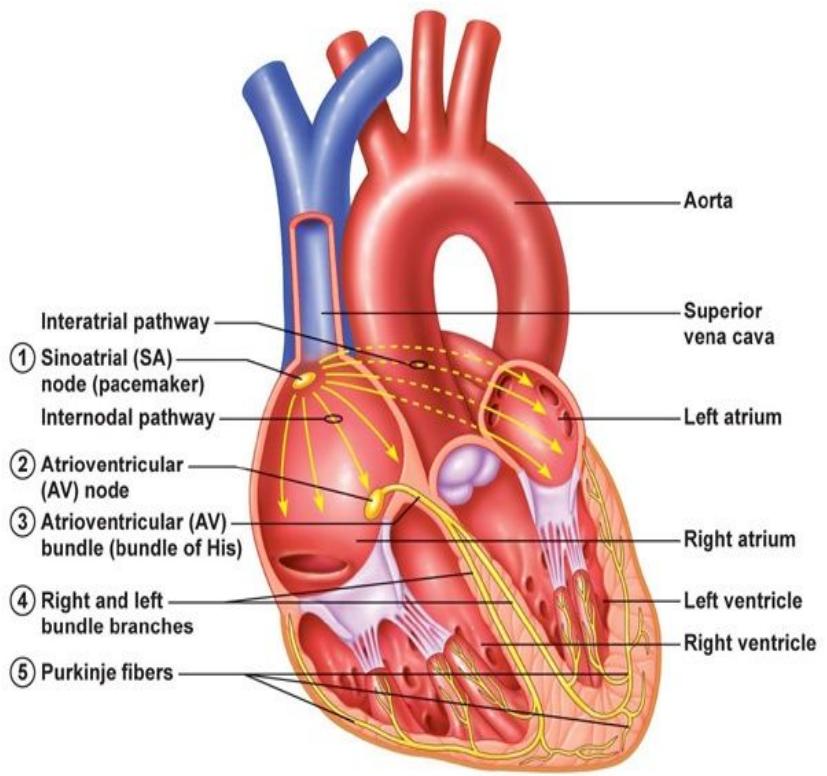
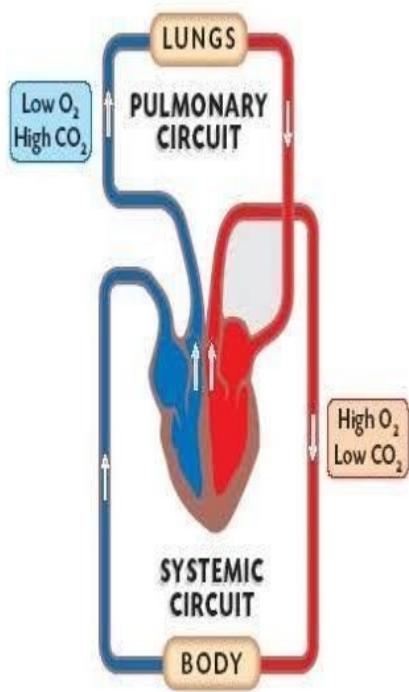
The right and left sides of the heart work together. The pattern described below is repeated over and over, causing blood to flow continuously to the heart, lungs, and body.

Right side

- Blood enters the heart through two large veins, the **inferior and superior vena cava**, emptying **oxygen-poor** blood from the body into the **right atrium**.
- As the **atrium** contracts, blood flows from your right atrium into your **right ventricle** through the **open tricuspid valve**.
- When the **ventricle is full**, the **tricuspid valve shuts**. This prevents blood from flowing backward into the atria while the ventricle contracts.
- As the **ventricle contracts**, blood leaves the heart through the **pulmonic valve**, into the **pulmonary artery** and to the lungs where it is oxygenated.

Left side

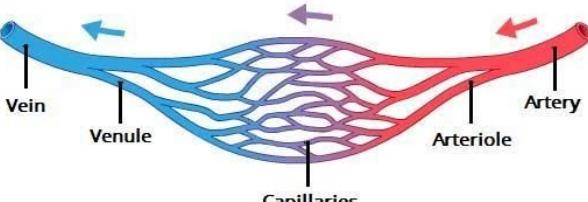
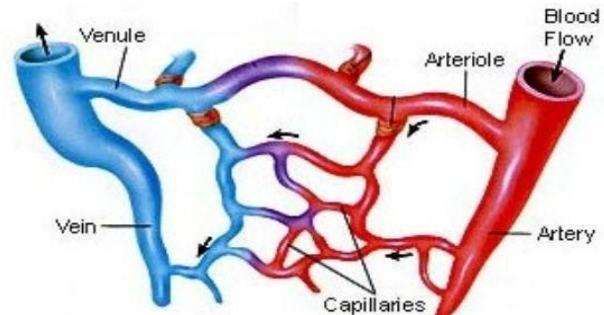
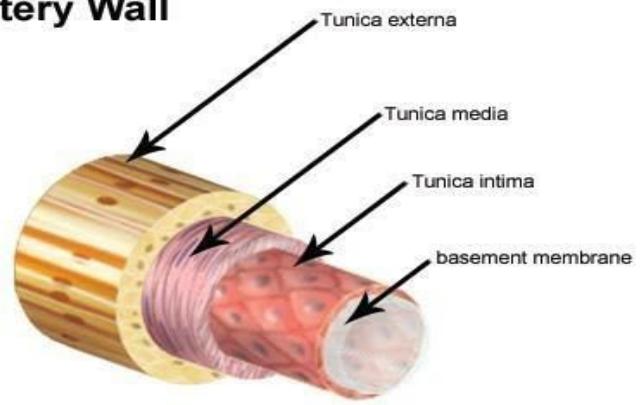
- The **pulmonary vein** empties **oxygen-rich** blood from the lungs into the **left atrium**.
- As the **atrium contracts**, blood flows from your left atrium into your **left ventricle** through the **open mitral valve**.
- When the **ventricle is full**, the **mitral valve shuts**. This prevents blood from flowing backward into the atrium while the ventricle contracts.
- As the **ventricle contracts**, blood leaves the heart through the **aortic valve**, into the **aorta** and to the body.

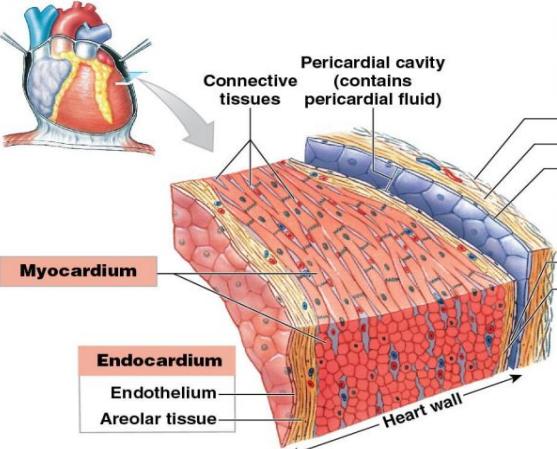


Conduction system of heart:

The cardiac impulse is a wave of excitation. The impulses are carried out by the conducting system of the heart. The conducting system provides the heart its automatic rhythmic beat, for the heart to pump efficiently. The systemic & pulmonary circulation to operate in synchrony.

- Sinoatrial node (SA node):** This is a **pacemaker** of the heart. It acts like a battery. This bundle of specialized muscle tissue is situated within the **upper part of the right atrium**. Current electricity generated by pacemaker causes walls of atria to contract and force blood to ventricles (ending diastole).
- Sinoatrial (SV) to Atrioventricular (AV)node:** The wave of electricity passes from SA node to another region of myocardium at lower part of interatrial septum called atrioventricular (AV node).
- AV bundle of HIS:** AV node sends excitation wave to bundle of HIS present in interventricular septum. It divides into right and left branches.
- Purkinje fibers:** The bundle of HIS fibers after dividing and subdividing forms Purkinje fibers which enter the ventricular cardiac muscle. This receives cardiac impulse from the AV bundle of HIS and causes right and left ventricles to contract. Then systole occurs and blood is pumped away from the heart.
- This signals stimulates contractions first of the Right & Left atrium, then the Right & Left ventricles. This process allows blood to be pumped throughout the body.

Blood vessels has 3 types of Cardiovascular System	
Artery: Carry blood away from the heart. Oxygenated blood (only exception is Pulmonary Artery) Aorta is the largest artery.	<ul style="list-style-type: none"> • Arteries → Arterioles → Capillaries • Arterioles: Small branch of artery leading to capillary.
Vein: Carry blood towards the heart. It carries about 70% of the body's blood & acts as a reservoir during hemorrhage. Deoxygenated blood (only exception is Pulmonary Vein) It has valves that prevent backflow of blood.	<ul style="list-style-type: none"> • Veins → Venules → Capillaries • Venules: That allows blood to return from the capillary beds to larger veins.
Capillaries: Where nutrients & gas exchanges occur.  A schematic diagram showing a network of blood vessels. On the left, a blue line labeled 'Vein' with an arrow pointing away from the heart is connected to a purple line labeled 'Venule'. This leads to a dense, branching network of red lines labeled 'Capillaries'. From the capillaries, a red line labeled 'Arteriole' with an arrow pointing towards the heart leads to a larger red line labeled 'Artery'.	<p>How Blood Travels thru Vessels</p> <p>heart → artery → arteriole → capillary → venule → vein → heart</p>  A detailed anatomical diagram showing the circulatory system. It starts with a large blue vein on the left, which branches into smaller purple venules. These venules converge into a larger purple vein. From the purple vein, the flow goes into a red artery. The artery branches into smaller red arterioles, which then connect to a dense network of tiny red capillaries. The capillaries are shown as a mesh where blood is exchange occurring. Arrows indicate the direction of blood flow from the artery through the capillaries and back to the vein.
Layers of artery & veins: <ul style="list-style-type: none"> • Tunica Interna: Inner layer • Tunica Media: Middle layer, it is also responsible for vasoconstriction & vasodilation of Blood vessels. • Tunica externa (Adventitia): Outer layer Capillaries are composed of Endothelium • Lumen: Central blood containing space surrounded by tunics. 	<p>Artery Wall</p>  A cross-section diagram of an artery wall. The outermost layer is labeled 'Tunica externa'. The middle layer is labeled 'Tunica media'. The innermost layer is labeled 'Tunica intima'. Within the tunica intima, there is a thin layer labeled 'basement membrane' that separates the intima from the underlying tissue.

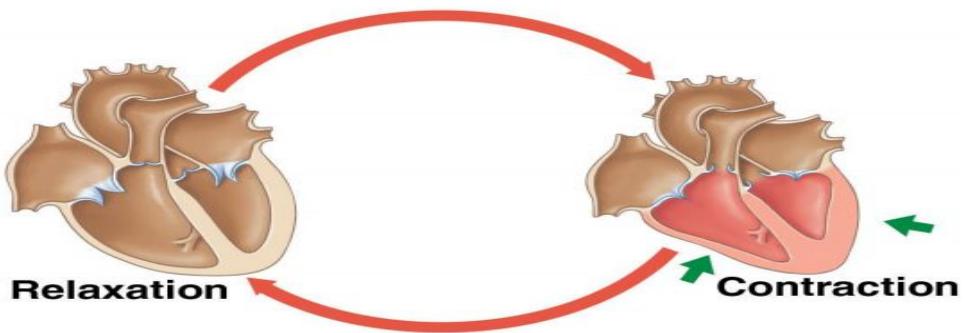
The layer of Heart	The layers of the heart wall							
<p>Pericardium: heart is surrounded by this membrane. It is a doubled walled sac containing the heart. This cavity or sac contains a small amount of serous fluid that acts to reduce a surface tension & helps in lubrication.</p>	 <p>The Pericardium</p> <table border="1"> <tr> <td>Parietal Layer of Serous Pericardium</td> </tr> <tr> <td>Dense fibrous tissue</td> </tr> <tr> <td>Areolar tissue</td> </tr> <tr> <td>Mesothelium</td> </tr> </table> <table border="1"> <tr> <td>Visceral Layer of Serous Pericardium</td> </tr> <tr> <td>Mesothelium</td> </tr> <tr> <td>Areolar tissue</td> </tr> </table>	Parietal Layer of Serous Pericardium	Dense fibrous tissue	Areolar tissue	Mesothelium	Visceral Layer of Serous Pericardium	Mesothelium	Areolar tissue
Parietal Layer of Serous Pericardium								
Dense fibrous tissue								
Areolar tissue								
Mesothelium								
Visceral Layer of Serous Pericardium								
Mesothelium								
Areolar tissue								
<p>Myocardium: middle layer of heart, which is responsible for pumping. Cardiac Muscle</p>								
<p>Endometrium: deepest layer of heart.</p>								

Heartbeat:

- There are **two phases** of heartbeat. These phases are called **diastolic** (relaxation) and **systole** (contraction).
- This diastole-systole cardiac cycle occurs between 70-80 times per minute.
- **Diastole** occurs when both the ventricles are dilated simultaneously. Now the tricuspid and bicuspid valves are kept open. So atria freely communicate with ventricles. Simultaneous contraction of atria helps in sending blood into ventricular chambers. Then the semilunar valves of aorta and pulmonary trunk are closed.
- **Systole** occurs when both the ventricles are contracting simultaneously. Now the tricuspid and bicuspid valves are closed. The semilunar valves of aorta and pulmonary trunk are opened. So from the right ventricle blood is pumped into the pulmonary trunk and from the left ventricle blood enters the aorta.

Cardiac cycle

- **Two phases:**
 - **Contraction (systole)**—blood leaves the chamber
 - **Relaxation (diastole)**—chamber refills



Heart sounds

- **S₁** (“lubb”)—when AV valves close; marks start of ventricular contraction
- **S₂** (“dupp”)—when semilunar valves close
- **S₃** and **S₄**—very faint; rarely heard in adults
 - S₃—blood flowing into ventricles
 - S₄—atrial contraction



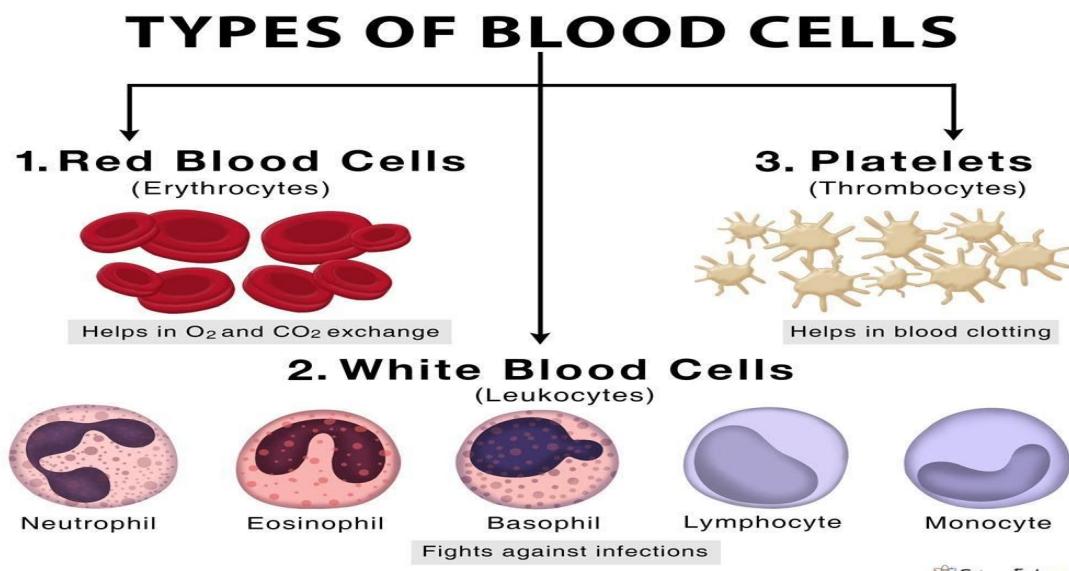
Blood:

Fluid that transports oxygen and nutrients to the cells and carries away carbon dioxide and other waste products.

It separates into 2 main parts:

1. **Plasma (55%)**: Blood plasma is a yellowish liquid component of blood. Plasma contains mostly water (90-92%) & plasma protein (7-8%) but it also contains nutrients & wastes.
2. **Formed elements (45%)**: The three classes of formed elements are the erythrocytes (red blood cells-RBC), leukocytes (white blood cells-WBC), and the thrombocytes (platelets).

The clear yellowish fluid obtained upon separating whole blood into its solid and liquid components after it has been allowed to clot. Also called **blood serum**



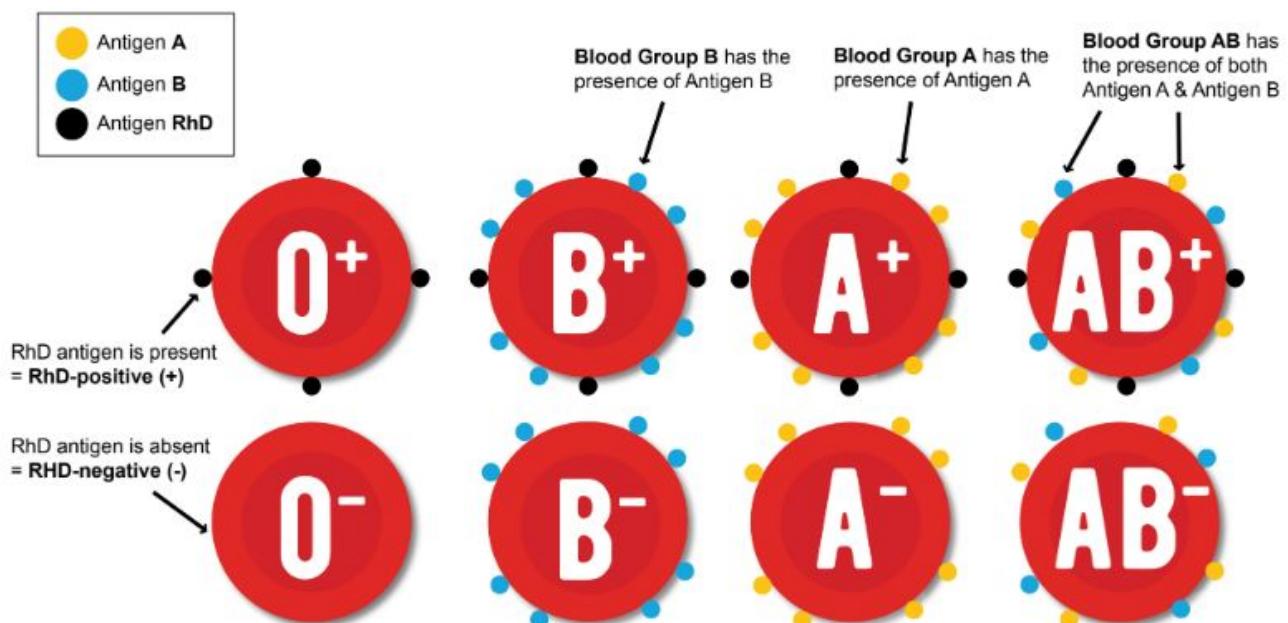
1. **RBC (red blood cells/erythrocytes)**: It Originates from **bone marrow**. RBC contains the pigment called **haemoglobin** for transport of gases. RBCs typically make up about 40% of the blood volume.
 - a. Heme: Iron
 - b. Globulin: protein
 - c. RBC life span is about 120 days. Lack of hemoglobin results in Anemia

2. **WBC (White blood cells/leukocytes):** They are fewer in number than RBCs. It is divided into 2 types based on their appearance
- Granular:** Also called granulated WBC, contains granules in their cytoplasm. Granules are tiny sacs that contain various enzymes, These enzymes & proteins defend the body against microbes. They are:
 - Neutrophil
 - Eosinophil
 - Basophil
 - Granulocytes are phagocytes, that is they are able to ingest foreign cells such as bacteria, viruses and other parasites.
- Agranular:** Also called Agranulated WBC, usually lack these granules. They are:
 - Monocytes:** Monocytes can develop into two types of cell:
 - Dendritic cells
 - Macrophages
 - Lymphocytes:** Lymphocytes are cells which help to regulate the body's immune system. The main types of lymphocytes are:
 - B lymphocytes (B cells)
 - T lymphocytes (T cells)
3. **Thrombocytes (platelets):** Thrombocytes are pieces of very large cells in the bone marrow called megakaryocytes. They help form **blood clots** to slow or stop bleeding and to help wounds heal. (clotting factors of blood)

Blood Type:

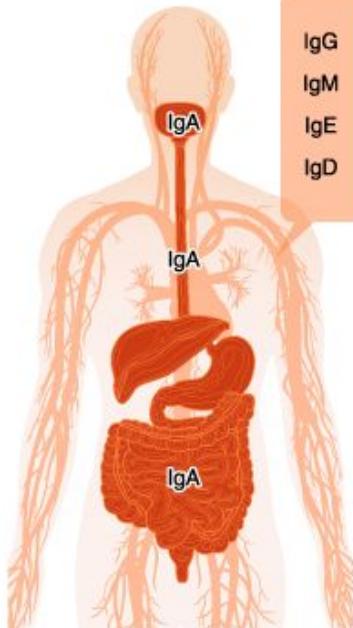
A, B, AB, O: +ve/-ve, +ve mean Rh (Rhesus monkey factor) is positive

UNDERSTANDING BLOOD TYPES



Immune system

- **Immunology** is a branch of biology that covers the study of immune systems in all organisms.
- The immune system is a complex network of cells (WBC) and proteins (Ig) that defends the body against infection.
- The immune system keeps a record of every germ (microbe) it has ever defeated so it can recognise (Antibody) and destroy the microbe (Antigen) quickly if it enters the body again.
- **Antigen:** Foreign body or Pathogen
 - In immunology, an antigen is a molecule or molecular structure, such as may be present at the outside of a pathogen, that can be bound to by an antigen-specific antibody or B cell antigen receptor. The presence of antigens in the body normally triggers an immune response.
- **Antibody:** a protective protein produced by the immune system in response to the presence of a foreign substance, called an antigen
 - Antibodies are produced by specialized **white blood cells** called B lymphocytes (or B cells).
 - Human antibodies (**Immunoglobulins-Ig**) are classified into **five isotypes** (IgM, IgD, IgG, IgA, and IgE)

Types and characteristics of antibodies			Distribution in the body
IgG		<ul style="list-style-type: none"> • Highest opsonization and neutralization activities. • Classified into four subclasses (IgG1, IgG2, IgG3, and IgG4). 	
IgM		<ul style="list-style-type: none"> • Produced first upon antigen invasion. Increases transiently. 	
IgA	 or 	<ul style="list-style-type: none"> • Expressed in mucosal tissues. Forms dimers after secretion. 	
IgD		<ul style="list-style-type: none"> • Unknown function. 	
IgE		<ul style="list-style-type: none"> • Involved in allergy. 	 <p>IgG IgM IgE IgD</p>

CVS has few main functions:

1. **Transport** of nutrients, oxygen, and hormones to cells throughout the body and **Removal** of metabolic wastes (carbon dioxide, nitrogenous wastes).
2. **Protection** of the body by white blood cells, antibodies, and complement proteins that circulate in the blood and defend the body against foreign microbes and toxins.
3. **Clotting** mechanisms are also present that protect the body from blood loss after injuries.
4. **Regulation of body temperature, fluid pH, and water content of cells.**

Medical Terminology CVS and blood

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
CVS	Disease process	-aemia (BrE)	blood condition	Greek -without blood	Anaemia
Blood		angi(o)-	blood vessel	Greek	Angiogram
CVS		arteri(o)-	Of or pertaining to an artery	Greek (artēria), a wind-pipe, artery (used distinctly versus a vein)	Artery, Arteriole
CVS	Disease process	atel(o)	imperfect or incomplete development		atelocardia : imperfect development of the heart
CVS		atri(o)-	an atrium (esp. heart atrium)		atrioventricular
CVS		brachy-	Indicating 'short' or less commonly 'little'	Greek (brachys), short; little, shallow	brachycephalic
CVS		brady-	'slow'	Greek (bradys), slow	Bradycardia
CVS		cardi(o)-	Of or pertaining to the heart	Greek (kardía), heart	Cardiology
CVS		cordi-	Of or pertaining to the heart	Latin (cor, cordi-), heart	Commotio cordis
Blood	Disease process	-emia	blood condition (AmE)	Greek- without blood	Anemia
Colour, Blood		erythr(o)-	Denotes a red color	Greek (erythros), red	Erythrocyte
Blood		hemat-, haemato- (haem-, hem-)	Of or pertaining to blood	Latin (hæma) < Greek (haima, haimat-), blood	Hematology, older form Haematology
Blood		hema or hemo-	blood (AmE)	Greek	Hematological malignancy
Colour, Blood		leuc(o)-, leuk(o)-	Denoting a white color	Greek (leukos), white, bright	Leukocyte
Blood, MS		myel(o)-	Of or relating to bone marrow	Greek (myelon), marrow; bone-marrow	Myeloblast
DS, CVS	Disease process	-phago-	eating, devouring	Greek	phagocyte
DS, CVS		-phagy	Forms nouns that denotes 'feeding on' the first element or part of the word	Greek (phagia) eating; see -phagia	Anthropophagy
CVS		phleb(o)-	Of or pertaining to the (blood) veins, a vein	Greek (phleps, phlebo-), blood-vessel, vein	Phlebography, Phlebotomy
CVS		sangui-, sanguine-	Of or pertaining to blood	Latin (sanguis, sanguin-), blood	Sanguine

CVS	Disease process	varic(o)-	swollen or twisted vein	Latin	varicose
CVS		vas(o)-	duct, blood vessel	Latin	vasoconstriction
CVS		vasculo-	blood vessel	Latin	
CVS		ven-	Of or pertaining to the (blood) veins, a vein [used in terms pertaining to the vascular system.]	Latin (vēna), blood-vessel, vein	Vein, Venospasm
CVS		aorta	aort(o)-	aort(o)-	-
CVS		artery	arteri(o)-	-	-
Blood		blood	haemat-, hemat- (haem-, hem-)	sangui-, sanguine-	-
Blood		blood clot	thromb(o)-	-	-
Blood		blood vessel	angi(o)-	vascul-, vas-	-
CVS		chest	steth(o)-	-	-
CVS		heart	cardi(o)-	cordi-	-
Blood		marrow, bone marrow	myel(o)-	medull-	-
CVS		vein	phleb(o)-	ven-	-

Summary of CVS:

Introduction to the Lymphatic System

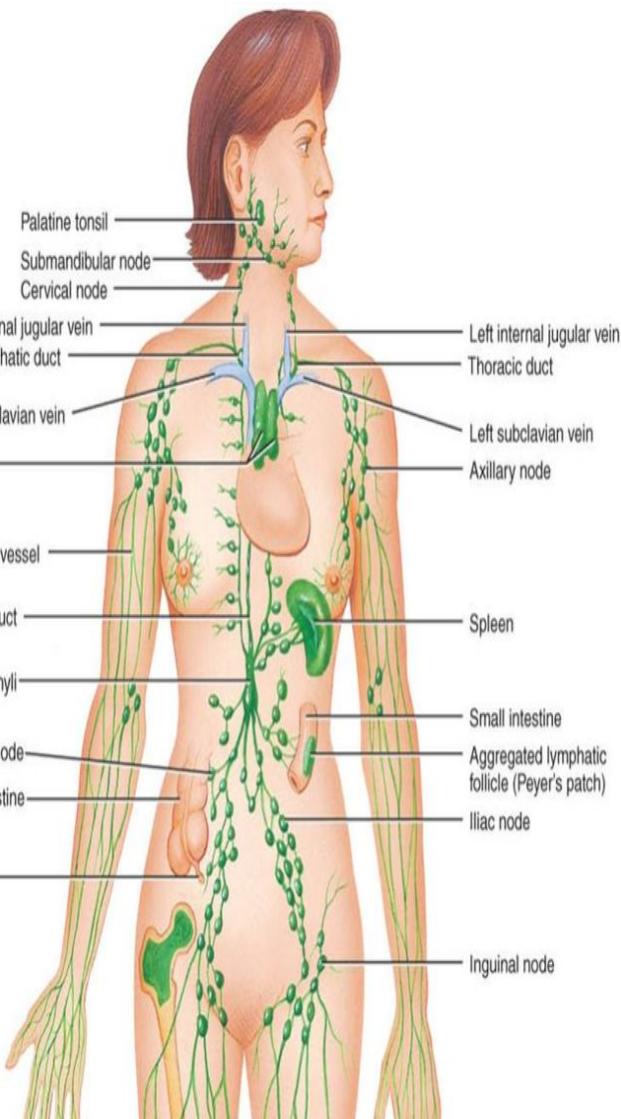
- The lymphatic system is a Latin word *systema lymphoideum*.
- Around 2 liters of fluid leak from the CVS into body tissues everyday. The lymphatic system is a network of vessels that collects these fluids.
- This interstitial fluid gets drained through lymphatic ducts in our trunk
 - The right lymphatic duct: internal jugular vein
 - The thoracic duct: left subclavian vein

The lymphatic system has three primary functions.

1. First of all, it returns excess interstitial fluid to the **blood**. Of the fluid that leaves the capillary, about 90 percent is returned. The **10 percent** that does not return becomes part of the interstitial fluid that surrounds the tissue cells. **Small protein molecules may "leak"** through the capillary wall and increase the osmotic pressure of the interstitial fluid. This further **inhibits the return of fluid into the capillaries**, and fluid tends to accumulate in the tissue spaces. If this continues, blood volume and blood pressure decrease significantly and the volume of tissue fluid increases, which results in edema (swelling). **Lymph capillaries pick up the excess interstitial fluid and proteins and return them to the venous blood**. After the fluid enters the lymph capillaries, it is called **lymph**.

2. The second function of the lymphatic system is the absorption of fats and fat-soluble **vitamins** from the digestive system and the subsequent transport of these substances to the venous circulation. The mucosa that lines the small intestine is covered with fingerlike projections called **villi**. There are blood capillaries and **special lymph capillaries**, called **lacteals**, in the center of each villus. The blood capillaries absorb most nutrients, but the **fats and fat-soluble vitamins are absorbed by the lacteals**. The lymph in the lacteals has a milky appearance due to its high-fat content and is called **chyle**

3. The third and probably most well-known function of the lymphatic system is **defense against invading microorganisms and disease**. Lymph nodes and other lymphatic organs filter the lymph to remove microorganisms and other foreign particles. Lymphatic organs contain lymphocytes that destroy invading organisms.



Lymph vessels	Carry lymph from tissue spaces to the venous system, starts blindly as lymph capillaries in tissue spaces, their walls are permeable to substances of much greater size
Central Lymphoid Tissues	<ul style="list-style-type: none"> ● Bone Marrow: Produces all pluripotent lymphoid cells (in adults), helps in differentiation of B-Lymphocytes <ul style="list-style-type: none"> ○ Bone marrow is not lymphatic tissue, but it can be considered part of the lymphatic system because it is here that the B cell lymphocytes of the immune system mature. ● Thymus: Helps in differentiation (mature) of T-Lymphocytes
Peripheral Lymphoid Organs	<ul style="list-style-type: none"> ● Lymph node Small nodules of lymphoid tissue found in the course of smaller lymph vessels, purify the lymph from harmful agents ● Spleen Removes old blood cells from circulating pool, Keeps a reserve of blood for emergency, Synthesizes antibodies ● Epithelio-lymphoid tissues Lymphoid nodules in places like alimentary canal and respiratory tracts, Works as a security check against all the incoming agents. Ex: Tonsils
Lymphocytes	Mature B- and T-Lymphocytes circulating in blood, protects the body against any infectious agent that enters the blood
Functions	Removal of particulate matter, Production of lymphocytes, Generation of immune responses

Lymph: Is an alkaline, clear colourless liquid with composition similar to blood, but does not contain RBC.

Lymph vessels: These carry lymph through your body, they are different from blood vessels.

Lymph flows due to smooth muscle contractions and it travels alongside parallel to blood vessels.

Lymph Nodes: It's also called glands.

- They are small, bean shaped, soft nodules of tissue
- These nodes are a cleaner cell of the body

3 main regions:

1. **Capsule:** Outer covering
2. **Cortex:** Outer region, contains T-cells, **Macrophages** and has follicular dendritic cells (aid in **T-Cell activation**)
T-Cells are lymphocytes.
3. **Medulla:** Inner region, contains macrophage and plasma cells, which originate in bone marrow. Plasma cells secrete a protein called **antibodies**.

Lymph passes through nodes, the bacteria & other materials are trapped by reticular fiber within the nodes

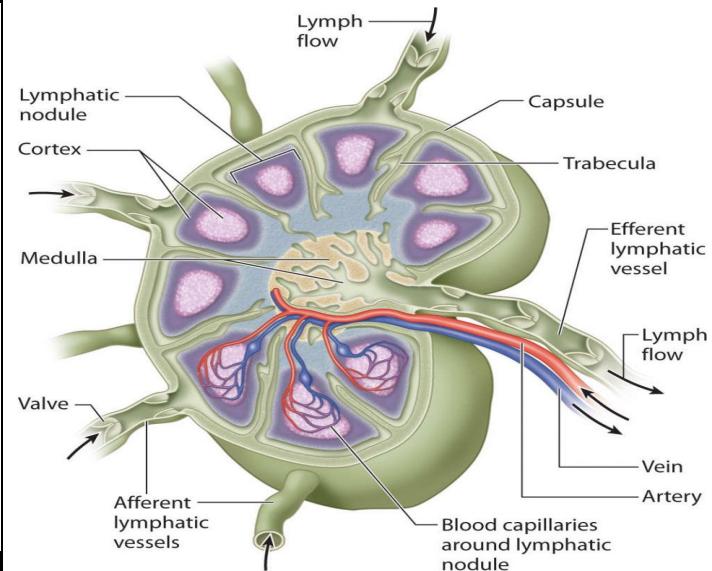
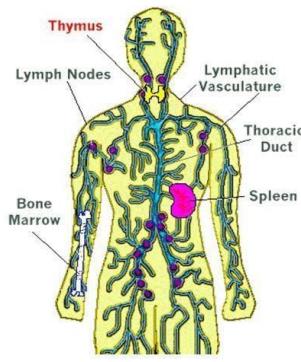
Major lymph Nodes

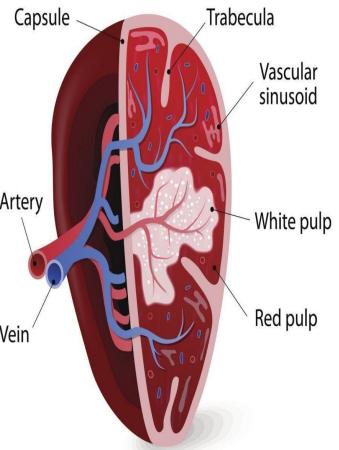
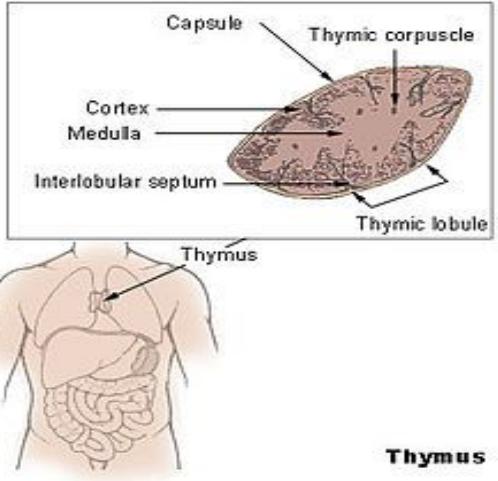
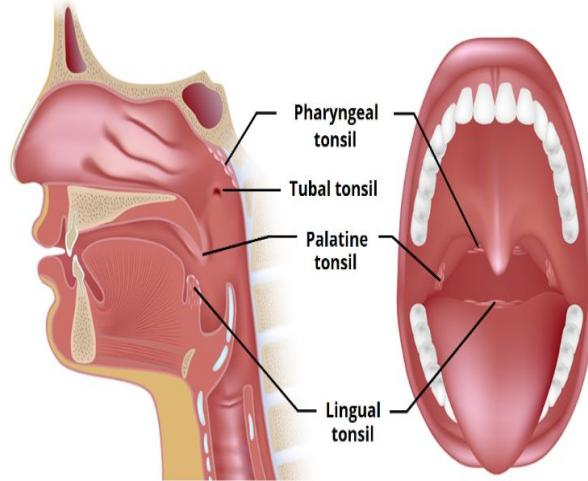
1. **Cervical Lymph node:** neck area, filter lymph from head and neck
2. **Axillary:** Armpit, filter lymph from hand & breast
3. **Inguinal:** Groin area, filter lymph from lower extremities and external genital organs.
4. **Mesenteric:** Abdominal peritoneum region, aid in infection control during abdominal surgery, filter lymph of abdominal cavity.

Cisterna Chyli is one of the two reservoirs holding lymph and other bodily fluids found in lymphatic system

Components of lymphatic system:

- Lymph (watery fluid collected from tissues)
- Lymphocytes
- Lymphatic vessels
- Lymph nodes
- Tonsils
- Spleen
- Thymus gland



<h2>Lymph organ</h2>	
<p>Spleen: It sits in the upper left of the abdomen protected by the 9th and 11th rib cage. Size 3 - 5.5 inches long, wt 150-200 grams.</p> <ul style="list-style-type: none"> • It's the largest organ of the lymphatic system. • Covered by tough connective tissues called capsule. <p>Contains 2 main region of tissue:</p> <ul style="list-style-type: none"> • White pulp: contains immune cells (T-Cells & B-cells) • Red pulp: contains venous sinuses(cavity filled with blood) & splenic cord (connective tissues contains RBC & WBC) <p>Functions:</p> <ol style="list-style-type: none"> 1. It recycles old red cells & stores platelets & WBC 2. Filters the blood 3. Detects any RBC that are old or damaged and destroy them, uses left out products like Iron 4. In humans around 1 cup of blood is kept in the spleen, ready to release during blood loss. 	<h2>SPLEEN ANATOMY</h2> 
<p>Thymus:</p> <ul style="list-style-type: none"> • Located on Anterior superior mediastinum behind/posterior to sternum • It's pinkish grey in colour. • It's largest & most active in the fetus during prenatal period, infancy & childhood. <ul style="list-style-type: none"> ◦ At birth - 10 gram ◦ Puberty - 25 to 35 grams ◦ At 40 years - 15 grams ◦ At 60-65 years - It shrinks and disappears • Thymus Hormone aid in maturation of T-cells, Mature T-Cells travel to lymph nodes, spleen, diffuse lymphatic tissues. • Divided into: <ul style="list-style-type: none"> ◦ Capsule, Cortex ◦ Medulla 	
<p>Diffuse lymphoid tissue:</p> <ul style="list-style-type: none"> • Also called mucosa-associated lymphatic tissue, is a diffuse system of small concentrated lymphoid tissue found in the submucosal membrane. It's not enclosed by capsule <p>Tonsil (Example): In the back of the mouth, there are tonsils. These produce lymphocytes, a type of white blood cell, and antibodies</p> <p>3 types of Tonsils</p> <ol style="list-style-type: none"> 1. Nasopharyngeal tonsil: It's also called adenoids. Located behind the nose or posterior part of the nasal cavity 2. Palatine tonsil: located back of mouth, lateral walls of pharynx & most commonly removed (tonsillectomy) due to certain condition like obstructive sleep apnea 3. Lingual tonsil: located in base of tongue, first-line defense for pathogens or antigens 	

Functions of Lymphatic System:

1. **REMOVE PARTICULATE MATTER:** Lymph capillaries absorb and remove large protein molecules, Fats, Fat-soluble Vitamins and other particulate matter from tissue spaces. In this way cellular debris and other harmful particles are washed away.
2. **FILTER THE LYMPH FOR FOREIGN HARMFUL PARTICLES:** Lymph nodes act as filter for the lymph and in this way they purify the lymph flowing through them.
3. **PHAGOCYTOSIS:** Antigens are removed from lymph by phagocytic activity of cells of lymph nodes.
4. **PRODUCTION OF LYMPHOCYTES:** Mature B-lymphocytes and mature T-lymphocytes are produced in lymph nodes.
5. **IMMUNE RESPONSES:** Lymphatic system can induce both cellular and humoral immune responses.

Medical terminology of Lymphatic system

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
LS		lymph(o)-	lymph	Greek	Lymphedema
LS		splen(o)-	spleen	Greek	Splenectomy

Summary of Lymphatic System:

Tonsil (3) - Lymph nodes(multiple nodes) - Thymus - Spleen - Cisterna Chyli - Bone marrow - Lymphocytes (B and T-cells)

Interstitial fluid - Lymph capillaries/Lacteals - Lymph - Lymph vessel - Lymph nodes - Lymph - Venous (Blood vessel)

Introduction to the Reproductive System

The major function of the reproductive system is to ensure survival of the species. Other systems in the body, such as the endocrine and urinary systems, work continuously to maintain homeostasis for survival of the individual. An individual may live a long, healthy, and happy life without producing offspring, but if the species is to continue, at least some individuals must produce offspring.

Within the context of producing offspring, the reproductive system has four functions:

- To produce egg (Ova) and sperm cells
- To transport and sustain these cells
- To nurture the developing offspring
- To produce hormones

These functions are divided between the primary and secondary, or accessory, reproductive organs.

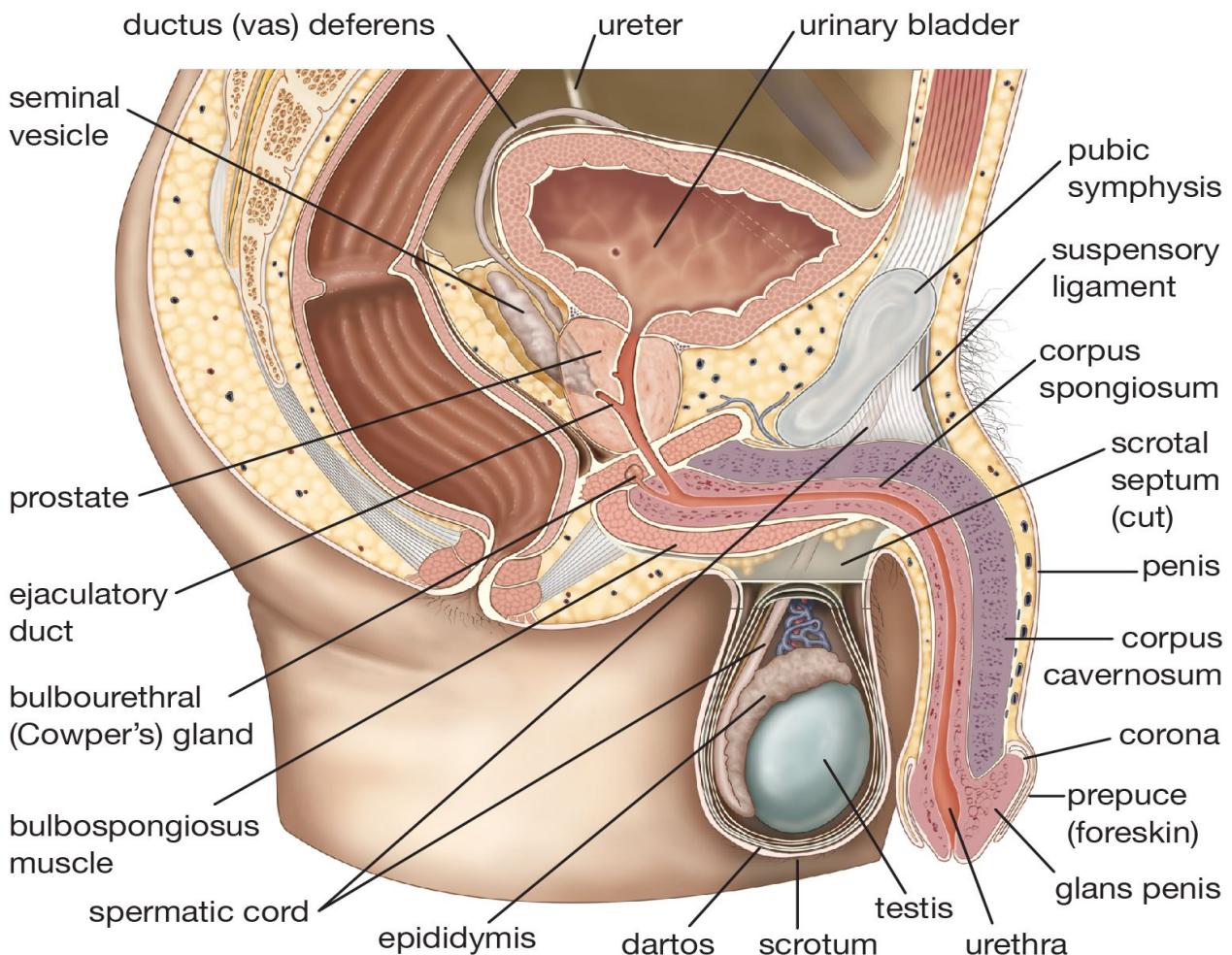
1. The primary reproductive organs, or gonads, consist of the ovaries and testes. These organs are responsible for producing the egg and sperm cells- gametes), and hormones. These hormones function in the maturation of the reproductive system, the development of sexual characteristics, and regulation of the normal physiology of the reproductive system.
2. All other organs, ducts, and glands in the reproductive system are considered secondary, or accessory, reproductive organs. These structures transport and sustain the gametes and nurture the developing offspring.

	Male ♂	Female ♀
Gonads	Testes	Ovary
• Gametes	Sperm Cells	Ova (Egg)
• Chromosomes	• Sperm (22+Y) or (22+X) = 23 Chromosome	• Ova (22+X) = 23
• Hormone	Testosterone	Progesterone, Estrogen

Male Reproductive System:

Male reproductive system is the system of sex organs of male human beings that are a part of the overall reproductive process of human beings. Reproduction is the capacity of all living organisms to give rise to their babies that are similar to them. In human beings, sexual type of reproduction takes place and for this type of reproduction, male and female reproductive systems are required. Male reproductive system is mainly concerned with production of semen (whitish viscous fluid emitted from the male reproductive tract that contains sperm and fluids) and transferring it into the female reproductive tract.

Penis	Male copulatory organ having a long shaft and a bulbous tip, transfers the semen into the female reproductive tract
Testes	Components of both reproductive system and endocrine system, produce semen that contains sperms
Functions	Fertilization of females to produce offspring



Organs of male reproductive system:

Penis:

The male organ for Copulation (sex/intercourse), the release of semen & urination. The urethra passes from the bladder to the tip of the penis.

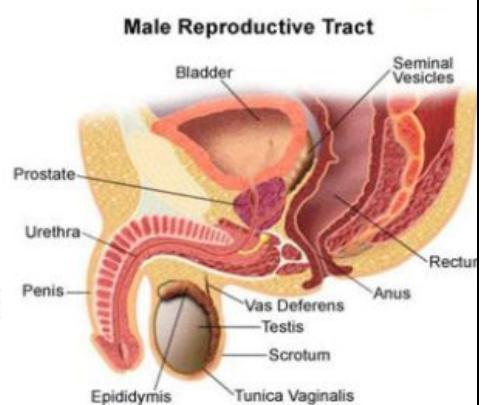
It is the external sexual organ of male human beings.

Glans Penis:

Sensitive tissue on the head of the penis with purpose for sexual stimulation.

Foreskin: The sheath of skin that covers the head of the glans penis. Also called the **prepuce**

- Penis
- Scrotum
- Testes
 - Epididymis
 - Seminiferous tubules
 - Vas deferens
- Seminal vesicle
- Prostate gland
- Cowper's gland
- Urethra
- Semen



Scrotum:

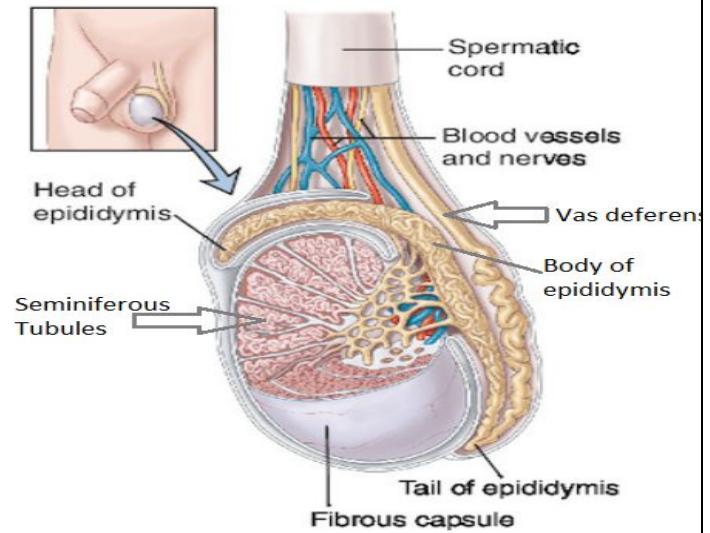
A pouch of skin that encloses the two testes and also maintains the testes at a temperature suitable for sperm production. It is the external sexual organ of male human beings.

Testes:

Also known as testicles & male gonads. A paired oval shaped organ. Testes are components of both reproductive (produce sperm) and endocrine system (male hormones - androgens)

It has main 3 parts:

1. **Seminiferous Tubules:** Coiled tubules where **sperm are produced** by the process called Spermatogenesis.
2. **Epididymis:** A pair of elongated crescent shaped structures attached to each of the two testes where the **sperm matures and stored**
3. **Vas deferens:** Thick walled tube in the male reproductive system that transports sperm cells from the Epididymis.



Spermatic cord:

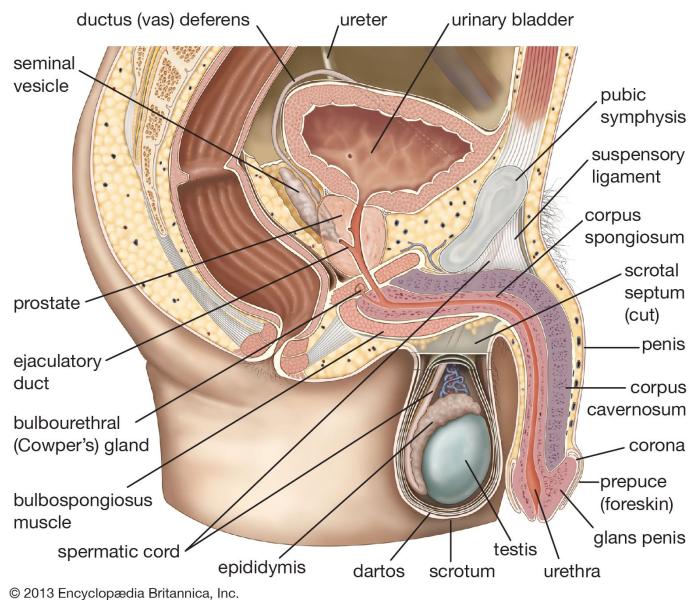
a cord that suspends the testis within the scrotum, contains the vas deferens and vessels and nerves of the testis, and extends from the deep inguinal ring through the inguinal canal and superficial inguinal ring downward into the scrotum

Seminal vesicles:

Sac like glands that secrete fluid (sugar rich fluid that provides energy to sperm) that contribute approximately 60% of the semen.

Ejaculatory duct:

a duct through which semen is ejaculated specifically either of the paired ducts in the human male that are formed by the junction of the duct from the seminal vesicle with the vas deferens and that pass through the prostate to empty into the urethra

**Prostate Gland:**

Chestnut shaped reproductive organ located beneath the bladder in male, which adds secretions to the sperm during the ejaculation of semen. The prostate secretes fluid that nourishes and protects sperm. The prostate contributes 15- 30% of semen.

Bulbourethral (Cowper's) gland:

Are pea shaped glands that secrete clear & thick fluid that acts as a **lubricant**.

It helps to make the semen less watery & to provide a suitable living environment for the sperm.

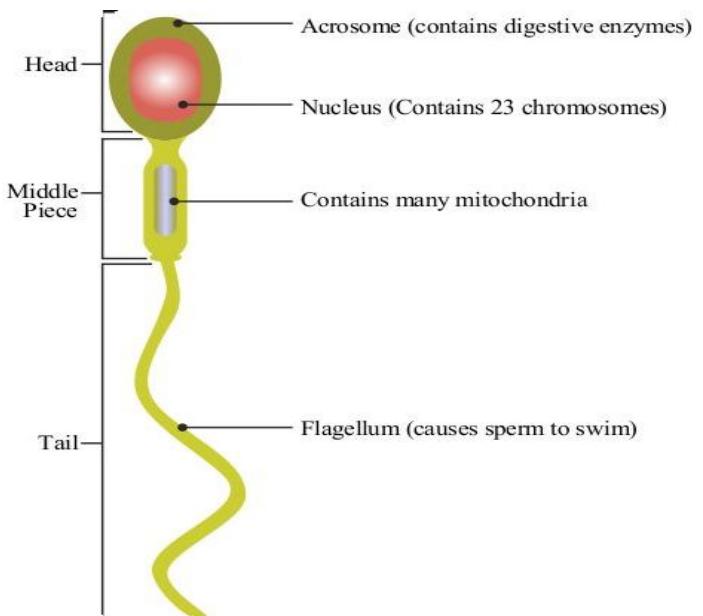
Urethra:

Tube that passes urine and semen out of the body, Also the entry point in males for STDs (sexual transmitted disease)

Semen: A milky white fluid that is emitted from the male reproductive tract which contains sperm cells. In human beings each ejaculation contains normally 50- 150 million sperm/ml.

Sperm: Is the male reproductive cell or gamete. It has 3 parts:

- **Head:** contains nucleus and acrosome, where nucleus holds the DNA (genetic material).
- **Mid piece:** Contains tightly packed Mitochondria, that provide the energy required for movement or swimming.
- **Tail:** Sometimes called the **flagellum**, a slender, hairlike bundle of filaments, helps in sperm cell movements.



Functions of the male reproductive system:

- Male reproductive system is mainly concerned with production of **semen and its transfer to the female reproductive tract**.
- Testes, that are organs of male reproductive system, also produce **male sex hormones** that distinguish maleness from femaleness.
- Reproduction is the process through which life continues to exist. Every individual has a limited life span and no one can survive forever. For the survival of life, reproduction is a necessary process because otherwise no new life will be formed and old life will disappear. So both reproductive systems, whether male or female, are **important for survival of species**.

Medical Terminology of Male

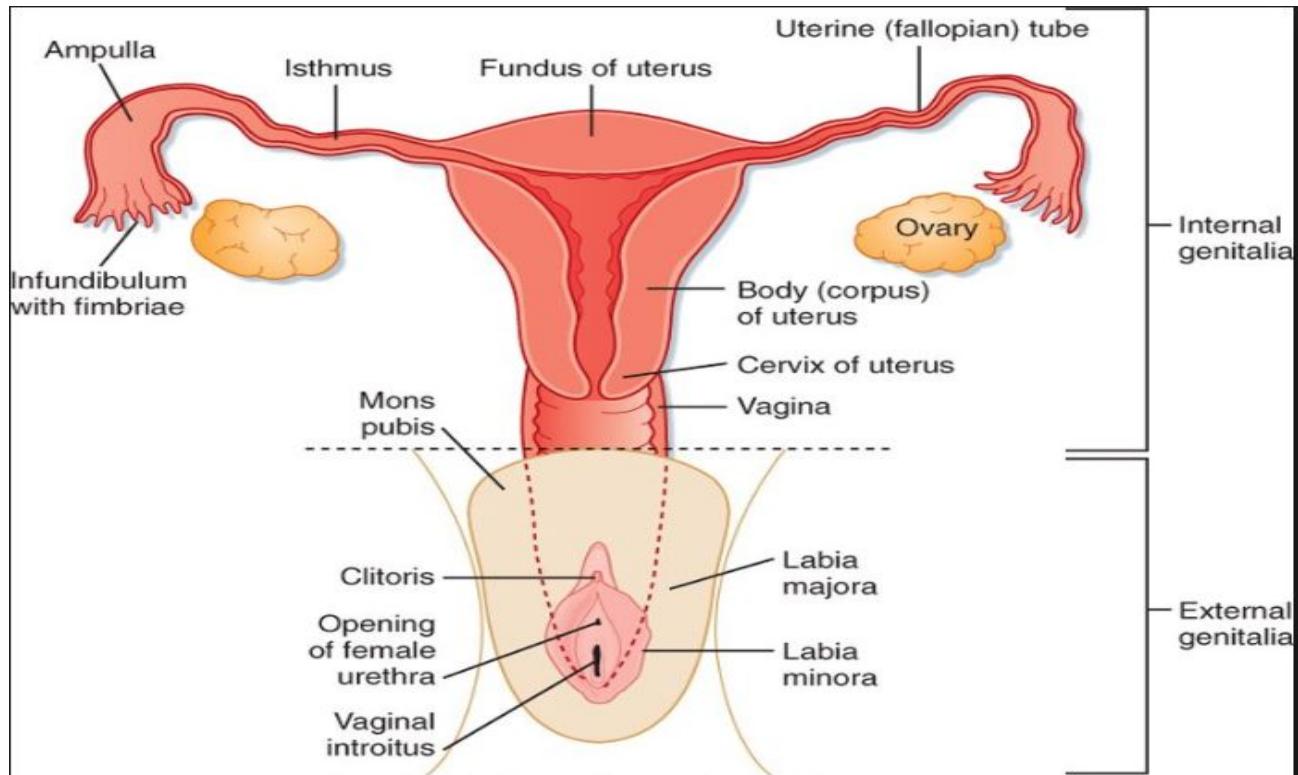
Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Male		andr(o)-	pertaining to a man	Greek	Andrology, android
Male		balano-	Of the glans penis or glans clitoridis	Greek - <i>balanos</i> , acorn, glans	Balanitis
Male		circum-	Denoting something as 'around' another	Latin (circum), around	Circumcision
Male		gon(o)-	seed, semen; also, reproductive	Greek	Gonorrhea
Male		orchi(o)-, orchido-	testis	Greek (orkhis, orkhi-)	Orchiectomy, Orchidectomy
Male		peo-	Of or pertaining to the penis	Greek (peos)	Peotomy
Male		phall- , phalli- , phallo-	Combining forms meaning the penis	Greek (phallos)	Aphallia
Male		sperma-, spermo-, spermato-	semen, spermatozoa	Greek (sperma)	Spermatogenesis
Male/Female		genitals, sexually undifferentiated	gon(o)-, phall(o)-	-	-
Male		glans penis or clitoridis	balan(o)-	-	-
Female/Male		loins, pubic region	episi(o)-	pudend-	-
Male		penis	pe(o)-	-	-
Male		testis	orchi(o)-, orchid(o)-	-	-

Summary of Male Reproductive System:

Scrotum - Testis - Seminiferous tubules - Epididymis - Vas Deferens - Spermatic cord - Vas Deferens - Seminal Vesicle - Ejaculatory duct - Prostate - Urethra - Bulbourethral gland - Penis - Glans penis - Foreskin (prepuce)

Introduction to Female Reproductive System:

The female reproductive system is made up of the **internal** and **external sex organs** that function in reproduction of new offspring. In humans, the female reproductive system is immature at birth and develops to maturity at puberty to be able to produce gametes (Ovum, Ova, Egg), and to carry a fetus to full term



Internal Parts	Uterus	Major female reproductive organ, one end called cervix opens into vagina and other end is connected to the fallopian tubes, Development of fetus occurs within uterus
	Ovaries	Two in number, Egg producing female reproductive organ, oval in shape and ovary of each side is located in the ovarian fossa of corresponding side of pelvis, also produces hormones
External Parts	Vulva	External genital organ of females, contains the opening of vagina
	Labia	Structures of skin and adipose tissue that extends on both sides of vulva
	Clitoris	Button like portion near the labia minora, erects on sexual arousal .
Functions	Receives the sperms from male reproductive system, bear the developing fetus through the entire period of gestation	

The external genital organs:

The external genital organs include the mons pubis, labia majora, labia minora, Bartholin glands, and clitoris. The area containing these organs is called the **vulva**.

Vulva: Includes all visible external genital organs in perineum. It consists of

Mons pubis: Known as Mons veneris, fat pad covering on the pubic bone, which give cushioning and also protects the bones.

Labia Majora: Two prominent longitudinal cutaneous folds that extend downward and backward from the mons pubis to perineum.

Labia Minora: Known as inner labia, two fold flaps of skin either side of the vaginal opening situated between labia majora.

Bartholin's gland: Also called greater vestibular glands, two pea shaped compound racemose gland located posteriorly on either side of the opening of vagina.

Secret mucus to lubricate the vagina.

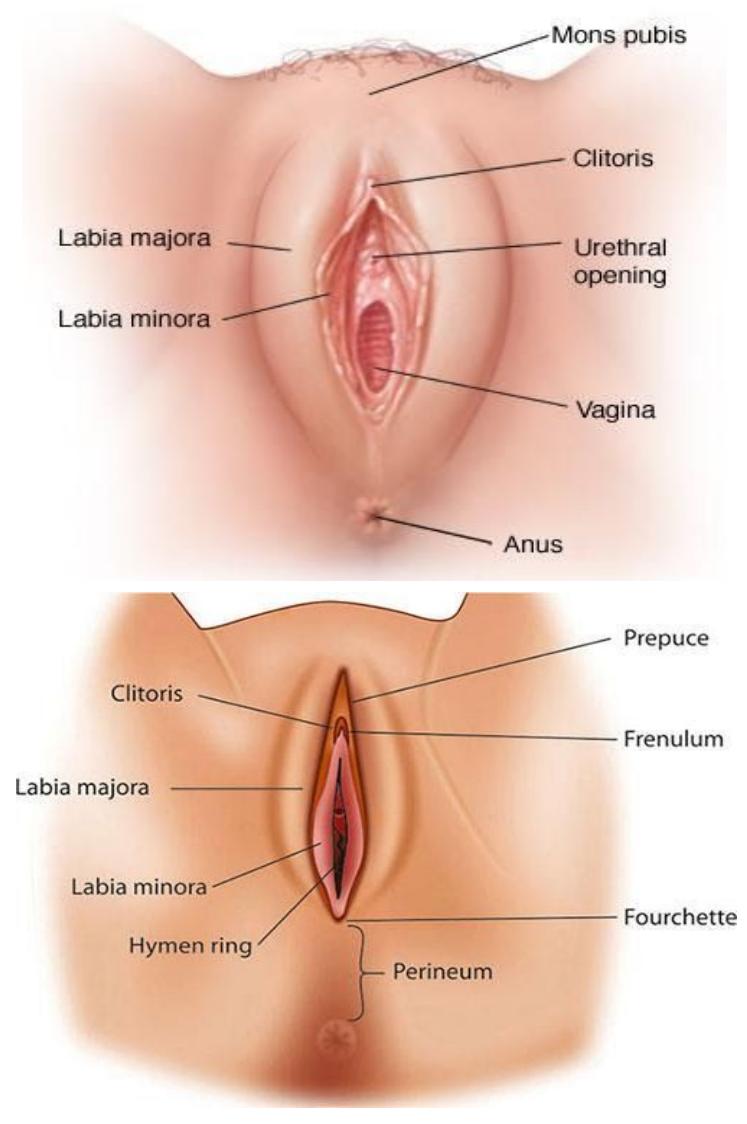
Fourchette: The frenulum of labia, where labia minora meet posteriorly

- **Hymen:** A thin piece of mucosal tissue that surrounds or partially covers the external vaginal opening.

Clitoris: Small sensitive tissue located at the top of vulva, with a sole purpose for **sexual stimulation**.

The clitoris is covered by a fold of skin, called the **prepuce**, which is similar to the foreskin at the end of the penis

Urethra: Opening for urine.



The internal genital organs:

The internal genitalia are those organs that are within the true pelvis. These include the vagina, uterus, cervix, uterine tubes (oviducts or fallopian tubes), and ovaries.

Vagina: The birth canal, pathway for menstrual flow and sperm, also opening for sexual intercourse and contains vaginal secretion (for lubrication).

Uterus: Its hollow pear shaped organ, located in the lower abdomen, between the bladder and rectum. Also known as **Womb**, the function of the uterus is to receive and implant the **zygote (Ova+Sperm)**. It has 3 main parts:

- **Fundus:** Dome shaped, top portion of the uterus.
- **Body:** Also called **uterine cavity**, usually the site for **implantation (Embryo)**
- **Cervix:** Lower end of the uterus, an opening between the uterus and vagina that passes sperm, menstrual fluid and a fetus.

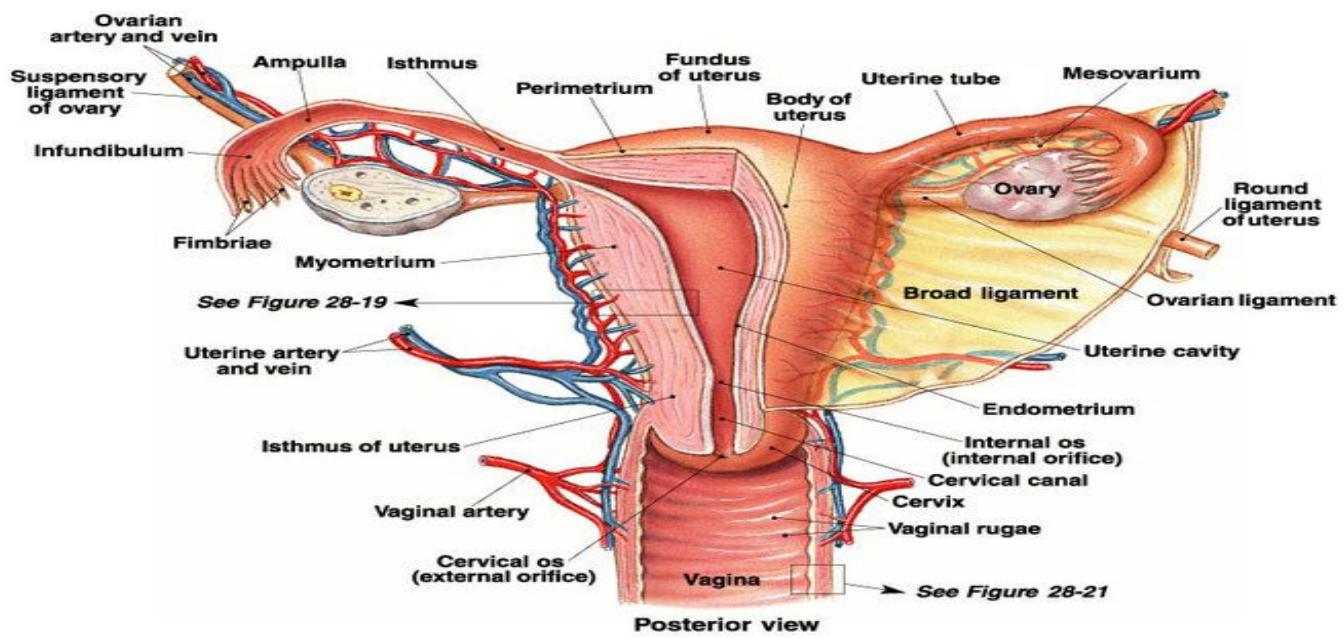
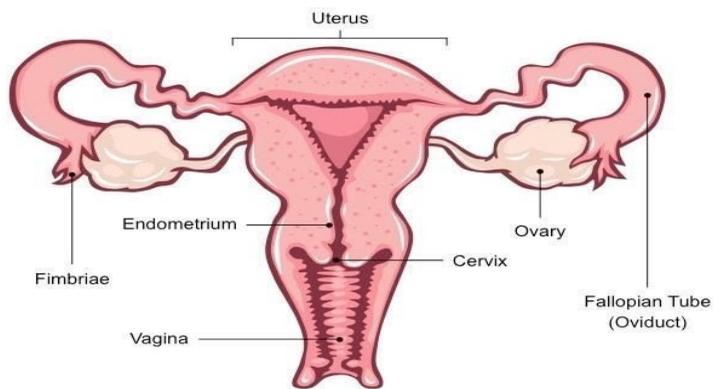
Fallopian tubes: The **uterine tubes**, also known as **oviducts** or fallopian tubes. Its a slender tube that transports **ovum (Egg)** to the uterus and also the passage way for fertilization of zygote (fertilized egg cell).

It is the site of ectopic (abnormal) pregnancy and site where tubal ligation occurs (sterilisation or permanent contraceptive method).

Parts: Isthmus, Ampulla and Infundibulum

Fimbria: Finger-like projection located at the ends of the fallopian tube, activated by hormones to catch a released egg and move it down into the fallopian tube.

Ovary: Oval shaped glands located on either side of uterus, where female eggs are produced as well as hormones (estrogen and progesterone)

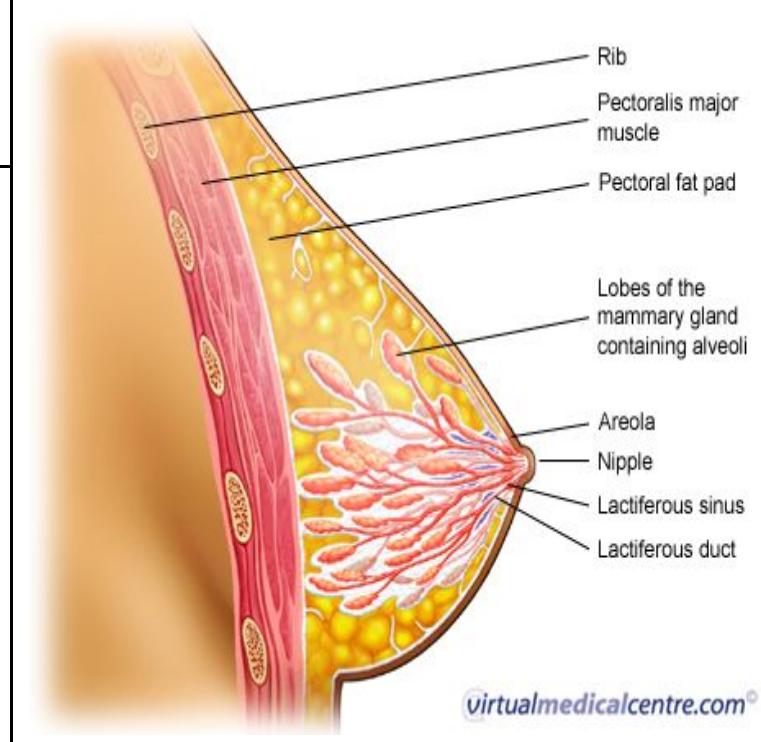


Layers of uterus:	Structure of the Uterus
Endometrium: Inner layer that lines the uterus. When no fertilization of egg takes place, the lining of the uterus (endometrium) sheds for the Menstrual cycle.	<p>The diagram illustrates the internal structure of the uterus. The top part shows the fundus (the upper, rounded portion). Below it is the uterine cavity. The outer layer is the perimetrium. The middle layer is the myometrium, which is mostly smooth muscle. The innermost layer is the endometrium. At the bottom, the uterus narrows into the cervix, which extends into the vaginal canal.</p>
Myometrium: Middle and thickest layer, mostly smooth muscle.	
Perimetrium: Outer layer of uterus.	

Breast: Lateral aspect of pectoral region, located between ribs 3 & 7 and extends from sternum to Axilla.
The breast of an adult woman produce Milk. It is supported by and attached to the front of the chest wall on either side of the sternum by ligaments.

Composition : Breast is a mass of glandular, fatty and fibrous tissue and contains **no muscle tissues**.
A layer of fat surrounds the gland and extends throughout breast. This fatty tissue gives the breast a soft consistency.

- **Mammary or Milk glands (lobules):** It is 15- 20 in numbers and produces milk.
- **Ducts:** Transport milk from glands to the nipple
- **Nipple:** hairless skin in the center of a dark area of skin called the areola.
- **Areola:** pink or brown pigmented region surrounding the nipple.



Functions of female reproductive system:

- Female reproductive system is mainly concerned with **production of eggs and bearing the fetus throughout the developmental phase**.
 - The ovaries produce eggs, which are fertilized by sperms and zygote is formed. The development of zygote to a complete human baby takes place in female reproductive system.
- Produce hormones
- Female reproductive system is the system of reproduction in female human beings. The female reproductive system is complex as compared to the male reproductive system. Females have to bear fetus during fetal period of development within their bodies. Modifications and adaptations to bear

the fetus make female reproductive system more complex. The female body also shows certain adaptations to become capable of bearing the fetus for nine months.

Summary of Female Reproductive system:

Vulva External parts

Mons pubis - Labia majora - Labia Minora - Prepuce - Clitoris - Hymen - Vaginal opening - Bartholin's gland

Internal

Vagina - Uterus (Cervix - Body - Fundus) - Fallopian tube (Isthmus - Ampulla - Infundibulum) - Fimbriae - Ovary

Layers of uterus: Endometrium - Myometrium - Perimetrium

Medical Terminology of Female:

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Pregnancy		amnio-	Pertaining to the membranous fetal sac (amnion)	Greek	Amniocentesis
Pregnancy		blast(o)-	germ or bud	Greek	Blastomere
Pregnancy		clast	break	Greek	osteoclast
Female		colp(o)-	Of or pertaining to the vagina	Greek (kólpos), bosom, womb; hollow, depth	Colposcopy
Female		episi(o)-	Of or pertaining to the pubic region, the loins	Greek (épíσion), the pubic area, loins; vulva	Episiotomy
Female		galact(o)-	milk	Greek	Galactorrhea
Female		gyn(aec)o- (BrE), gyn(ec)o- (AmE)	woman	Greek	Gynecomastia
Female		hyster(o)-	Of or pertaining to the womb, the uterus	Greek (hystéra), womb	Hysterectomy
Female		lact(i)-, lact(o)	milk	Latin	Lactation
Female		mamm(o)-	Of or pertaining to the breast	Latin (mamma), breast; udder	Mammogram
Female		mammill(o)-	Of or pertaining to the nipple	Latin (mammilla), nipple	
Female		mast(o)-	Of or pertaining to the breast	Greek (mastós), breast, women's breast; man's pectoral muscle	Mastectomy
Female		oo-	Of or pertaining to the an egg, a woman's egg, the ovum	Greek (ōón, ōo-), egg, ovum	Oogenesis
Female		oophor(o)-	Of or pertaining to the woman's ovary	Neoclassical Greek (ōophóron), ovary, egg-bearing	Oophorectomy
Female		ovari(o)-	Of or pertaining to the ovaries	Latin (ōvarium), ovary	Ovariectomy

Female		ovo-, ovi-, ov-	Of or pertaining to the eggs, the ovum	Latin (ōvum), egg, ovum	Oogenesis
Female		papill-	Of or pertaining to the nipple (of the chest/breast)	Latin (papilla), nipple; dimunitive of papula (see below)	Papillitis
Female		salping(o)-	Of or pertaining to the fallopian tubes	Greek, (sálpinx, salpingo-) trumpet	Salpingectomy
Female		thel(e)-, thel(o)-	Of or pertaining to a nipple	Greek (thēlē), a teat, nipple	Theleplasty
Female		thely-	Denoting something as 'relating to a woman, feminine'	Greek (thēlys), female, feminine	Thelygenous
Pregnancy	Disease process	toco-	childbirth	Greek	
Female		uter(o)-	Of or pertaining to the uterus or womb	Latin (uterus), womb, uterus	Uterus
Female		vagin-	Of or pertaining to the vagina	Latin (vāgīna), sheath, scabbard	Vagina
Female		breast	mast(o)-	mamm(o)-	-
Female		eggs, ova	oo-	ov-	-
Female		fallopian tubes	salping(o)-	-	-
Male/Female		genitals, sexually undifferentiated	gon(o)-, phall(o)-	-	-
Female/Male		loins, pubic region	episi(o)-	pudend-	-
Female		nipple, teat	thele-	papill-, mammill-	-
Female		ovary	oophor(o)-	ovari(o)-	-
Female		uterine tubes	sarping(o)-	sarping(o)-	-
Female		uterus	hyster(o)-, metr(o)-	uter(o)-	-
Female		vagina	colp(o)-	vagin-	-
Female		vulva	episi(o)-	vulv-	-
Pregnancy		womb	hyster(o)-, metr(o)-	uter(o)-	-

Pregnancy: Obstetrics And Gynaecology

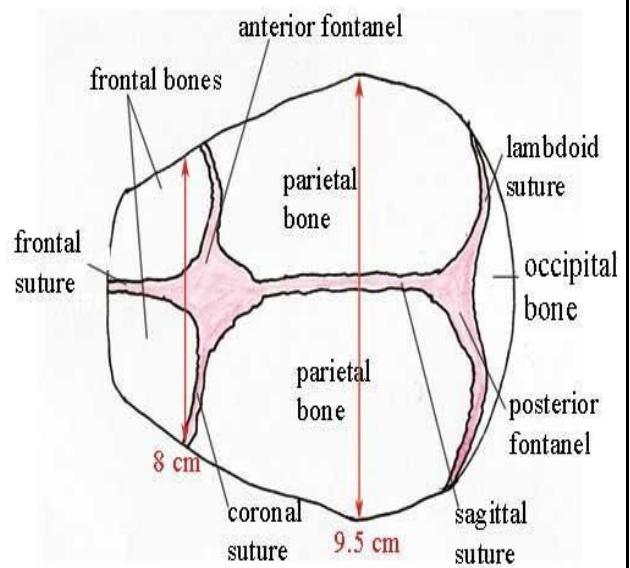
- **Obstetrics (OB)** is a branch of medicine or surgery concerned with childbirth. Involves care during pre-conception, pregnancy, childbirth and immediately after delivery.
- **Gynaecology** is the study of the **female reproductive system** and its functions. It involves care of all women's health issues.
- **Midwifery:** Profession or practice of assisting women in childbirth.

Fetal skull: The fetal skull bones are as follows: The frontal bone, which forms the forehead. In the fetus, the frontal bone is in two halves, which fuse (join) into a single bone after the age of eight years. The two parietal bones, which lie on either side of the skull and occupy most of the skull. The occipital bone (back and lower part of the skull).

The sagittal suture joins the two parietal bones together. The coronal suture joins the frontal bone to the two parietal bones. The frontal suture joins the two frontal bones together.

There are 2 fontanelles (the space between the bones of an infant's skull where the sutures intersect) that are covered by tough membranes that protect the underlying soft tissues and brain. The fontanelles include:

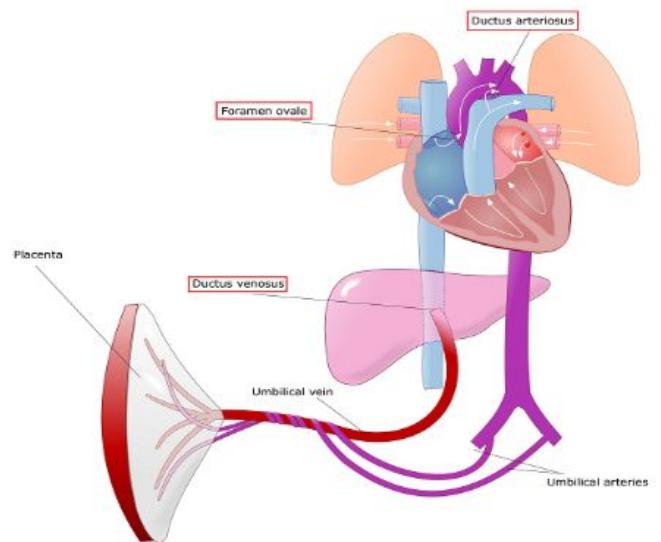
1. **Anterior fontanelle or bregma:** Soft membranous gap between frontal and parietal bone and takes 1½ years to close.
2. **Posterior fontanelle or lambda:** It's between parietal and occipital bone and closes with 1½ months.



Fetal circulation: The term usually encompasses the entire fetoplacental circulation, which includes the umbilical cord and the blood vessels within the placenta that carry fetal blood.

Three major shunts found in the fetus are :

1. **Foramen ovale:** (oval opening) blood entering inferior vena cava pass across the left atrium.
2. **Ductus venosus:** (from vein to vein) connects the umbilical vein to inferior vena cava.
3. **Ductus arteriosus:** (from an artery to an artery) blood flows from pulmonary artery to aorta.

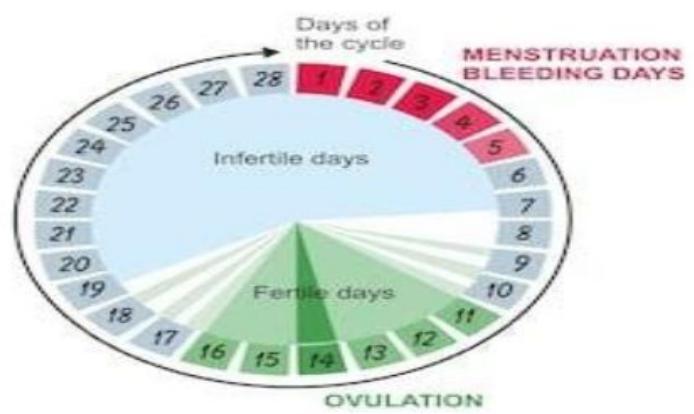


Menstrual cycle: The menstrual cycle is the monthly series of changes a woman's body goes through in preparation for the possibility of pregnancy. Each month, one of the ovaries releases an egg — a process called **ovulation**. At the same time, hormonal changes prepare the uterus for pregnancy. If ovulation takes place and the egg **isn't fertilized**, the lining of the uterus sheds (Endometrium layer) through the vagina along the ovum. This is a menstrual period.

The four main phases of the menstrual cycle are:

1. Menstruation
2. The follicular phase
3. Ovulation
4. The luteal phase

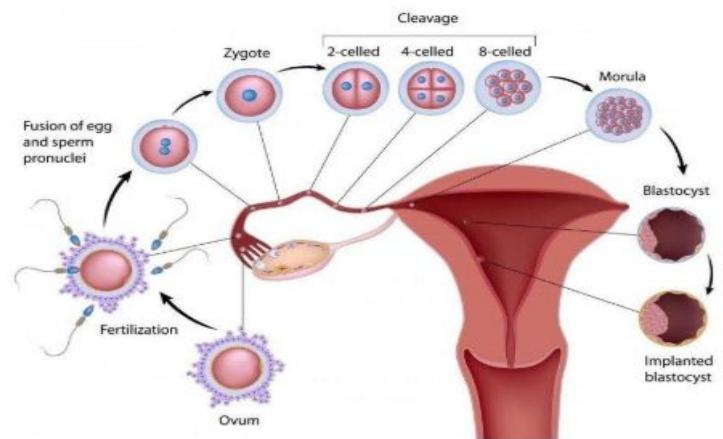
THE MENSTRUAL CYCLE



Fertilization: Human fertilization is the union of a human egg(Ova) and sperm, usually occurring in the ampulla of the fallopian tube. The result of this union is the production of a **zygote cell**.

Fertilising egg cells undergoes division into 2,4,8,16 and finally forms morula (16 mass of cell) resembles a mulberry fruit, this division occurs slowly once in 12hrs, Morula has a fluid filled cavity called blastocele, which later on becomes blastocyst, reaches uterus within 3-4 days for implantation. The endometrium layer during pregnancy called as decidua, thickens due to hormone progesterone.

An **embryo** is an early stage of development of a multicellular organism. Embryonic development refers to the portion of the life cycle that begins just after fertilization and continues through the **formation of body structures, such as tissues and organs**.

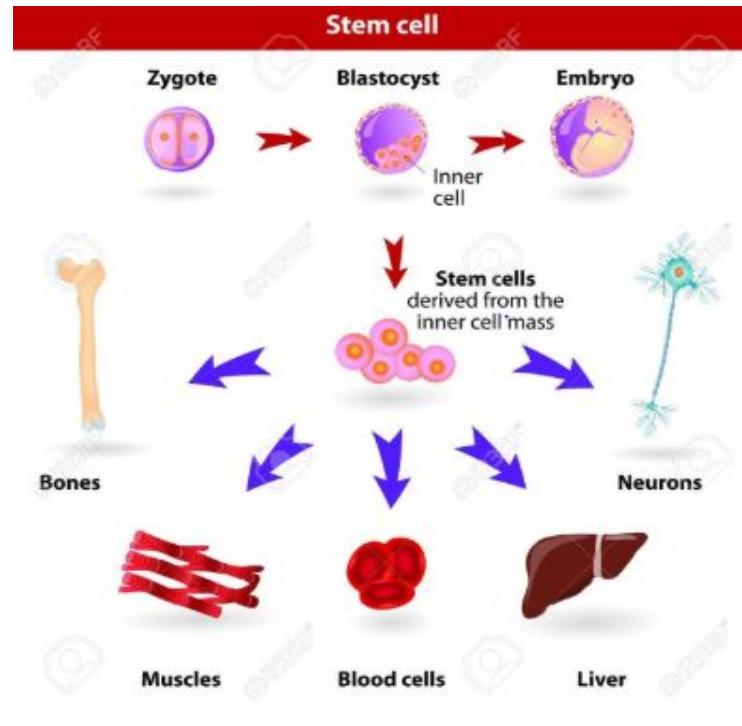
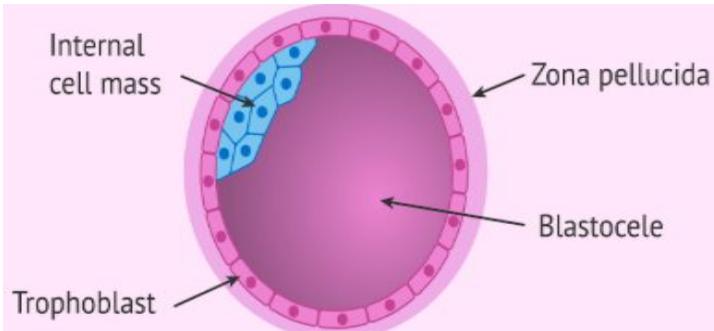


Blastocyst divides into:

1. **Trophoblast:** It divides into placenta and chorion.
2. **Inner mass cell:** Divides into fetus, umbilical cord and amnion.

Inner mass cell has 3 layers:

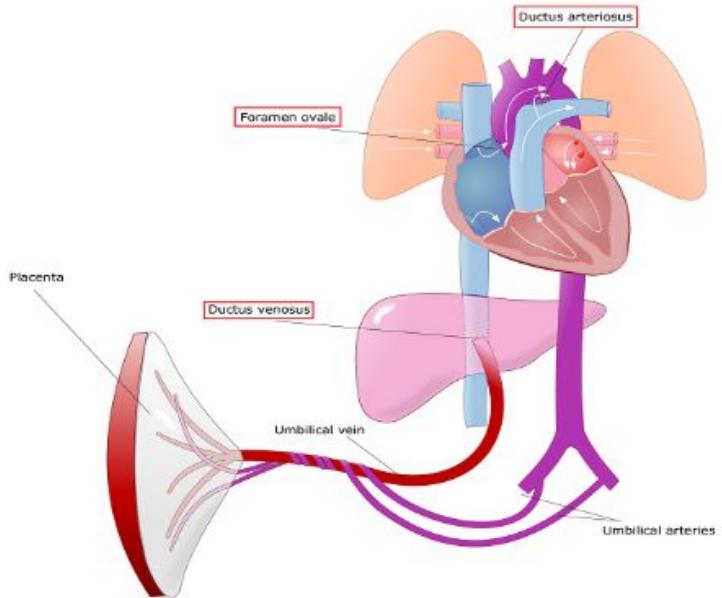
- a. **Ectoderm:** forms skin and nervous system
- b. **Mesoderm :** Forms bones, muscles, heart, blood.
- c. **Endoderm :** forms mucous membrane and glands.



Placenta: The placenta is a large organ that develops during pregnancy. It is attached to the wall of the uterus, usually at the top or side. The umbilical cord connects the placenta to your baby. Blood from the mother passes through the placenta, filtering oxygen, glucose and other nutrients to your baby via the umbilical cord.

Placenta functions 10 weeks after fertilization. Placenta has 2 surfaces:

- **Foetal surface:** smooth, glistening and is covered by the amnion which is reflected on the cord. The umbilical cord is inserted near or at the center of this surface and its radiating branches can be seen beneath the amnion.
- **Maternal surface:** dull greyish red in colour and is divided into 15-20 lobes
- **Functions of placenta:**
 - o Respiration
 - o Nutrition
 - o Storage(glycogen, fat soluble vit, Iron)
 - o Excretion
 - o Protection (from infection) except **TORCH** (TOXOPLASMOSIS, RUBELLA, CYTOMEGALOVIRUS, HERPES SIMPLEX, SYPHILIS, PARVOVIRUS, VARICELLA ZOSTER, ZIKA VIRUS)



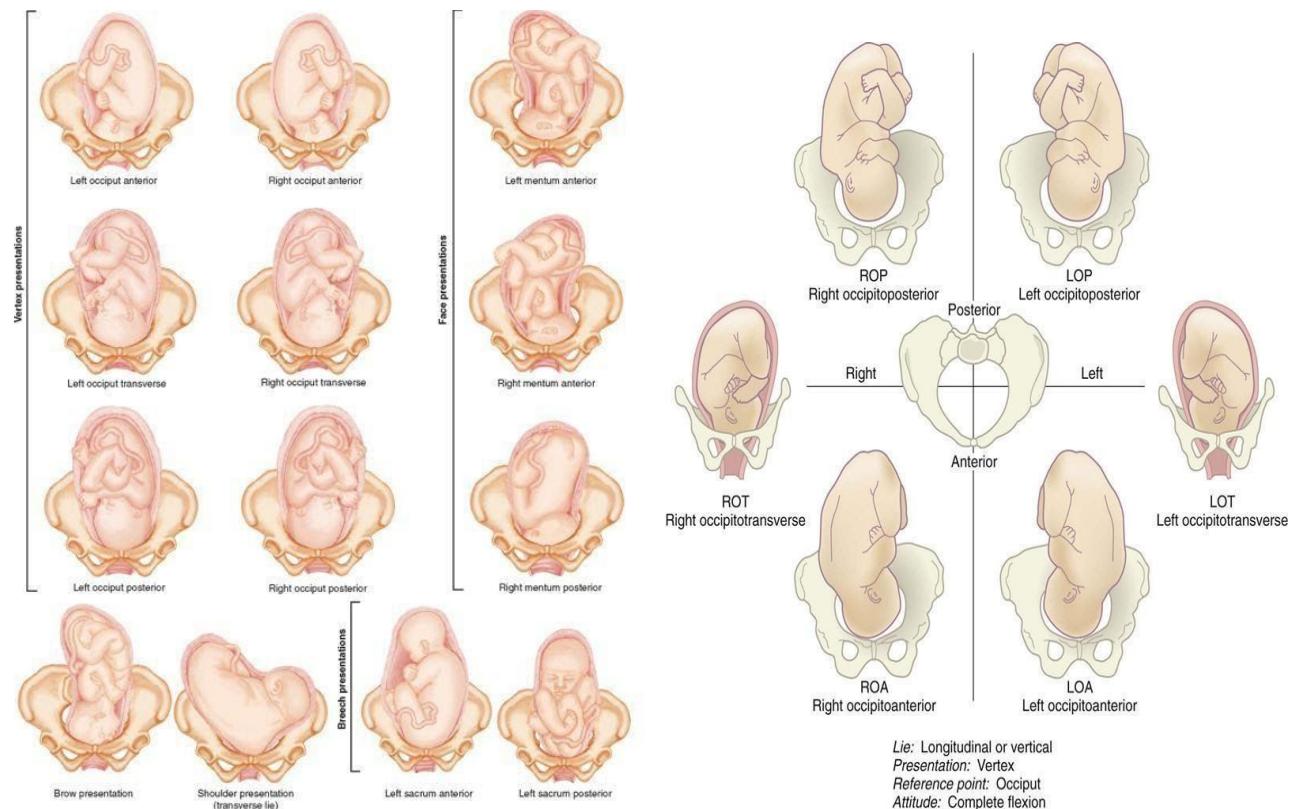
<p>Chorion: The outermost of the two fetal membranes (the amnion is the innermost) that surround the embryo.</p>	
<p>Amnion: A thin membrane that surrounds the fetus during pregnancy. The amnion is the inner of the two fetal membranes (the chorion is the outer one).</p>	
<p>Amniotic sac: The amniotic sac is filled with clear, pale, straw-coloured fluid in which the unborn baby floats and moves. The amniotic fluid helps to cushion the baby from bumps and injury, and maintains constant temperature for the baby. It also helps your baby's lungs, digestive system and musculoskeletal system to develop. It contains 99% of water 1% of dissolved organic matter including waste. Total fluid is about 1 liter at pregnancy, reduces to 800ml at 38 weeks.</p>	
<ul style="list-style-type: none"> • Disorder: Some conditions can cause there to be more or less than the normal amounts of amniotic fluid. <ul style="list-style-type: none"> ○ Oligohydramnios is when there is too little amniotic fluid (300ml). ○ Polyhydramnios, also referred to as hydramnios or amniotic fluid disorder, is when there is too much fluid (1500 ml). 	

Normal labour

Childbirth, the process of delivering a baby and the placenta, membranes, and umbilical cord from the uterus to the vagina to the outside world.

Fetal orientation during childbirth is described in terms of lie, presenting part, position and attitude.

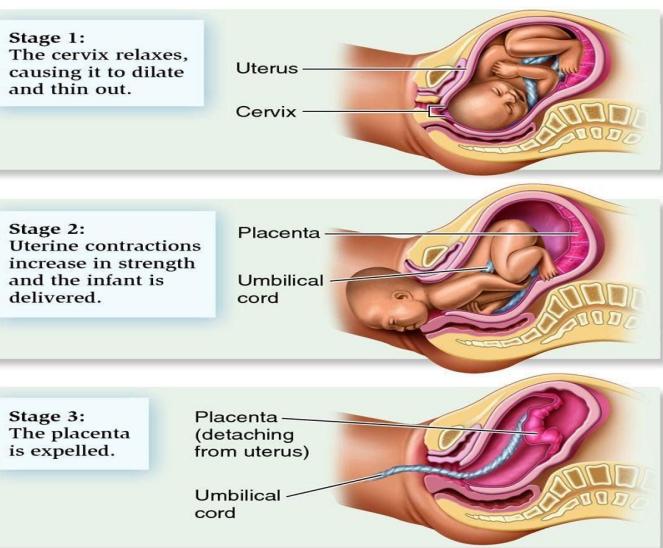
- **Fetal lie** refers to the relationship between the long axis of the fetus with respect to the long axis of the mother. (Longitudinal lie is normal)
- **Fetal attitude** refers to the posture of a fetus during labor(Flexion is the normal attitude) Flexion of the fetal head on the chest allows for the delivery of the head by its smallest bony diameter.
- **Fetal position** is the positioning of the body of a prenatal fetus as it develops.(The Left Occiput Anterior position is the most common)
- **Presenting part** is the part of the baby that leads the way through the birth canal. Most often, it is the baby's head. (vertex presentation).



Stages of labour

Childbirth progresses in three stages:

- First stage:** This starts with contractions and your cervix dilating and ends when your cervix is fully open. This stage is further broken down into latent phase and active phase. In early labor, your contractions are regular, but still quite far apart. Cervical dilation in latent labor is from 0 to 6 centimeters and the dilation is gradual. During the active phase of labor, your cervix will dilate more rapidly.
- Second stage:** This is when you push your baby through the birth canal.
- Third stage:** This ends with the delivery of the placenta, also called afterbirth.

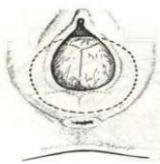


Mechanism of labour

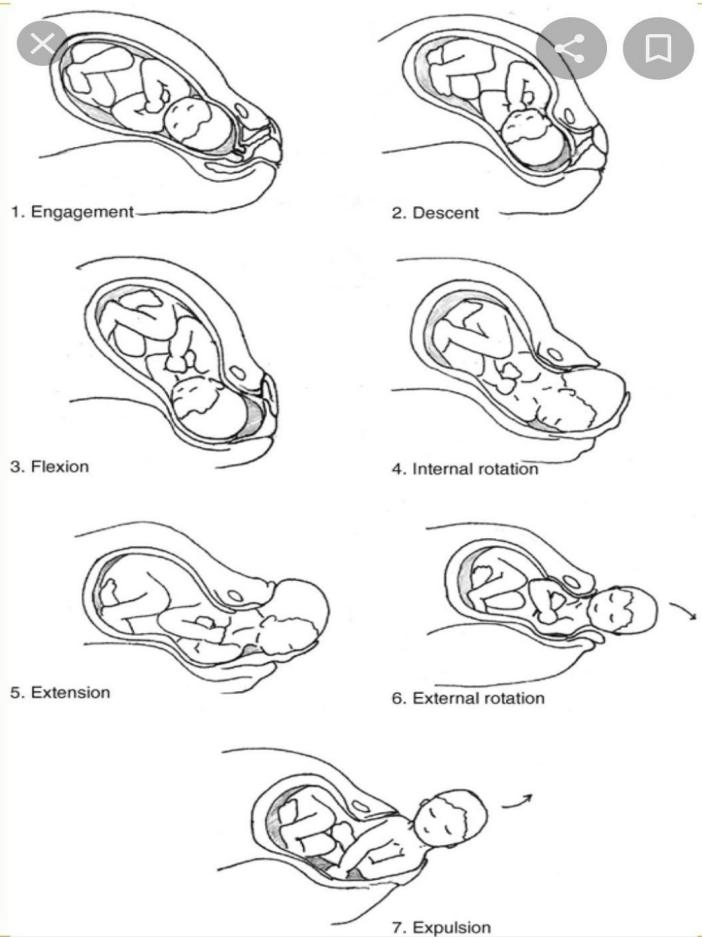
Although labor and delivery occurs in a continuous fashion, the cardinal movements are described as the following 7 discrete sequences :

- Engagement.
- Descent.
- Flexion.
- Internal rotation.
- Extension.
- Restitution and external rotation.
- Expulsion

Crowning



- Occiput is now below symphysis pubis
- Further descent pushes the head forward with a movement of extension and the occiput is delivered



Episiotomy performed at crowning

Birth **crowning**, which is when your baby's head starts to emerge bit by bit during each contraction, occurs during the second stage of labor.

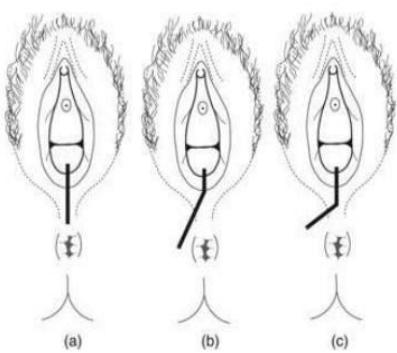
Episiotomy, also known as perineotomy, is a **surgical incision** of the perineum and the posterior vaginal wall generally done by a midwife or obstetrician. Episiotomy is usually performed during the second stage of labor to quickly enlarge the opening for the baby to pass through.

Types of episiotomy.

1. Median episiotomy,
2. 'J'-shaped episiotomy,
3. Mediolateral episiotomy,
4. Lateral episiotomy.

TYPES

- a) Median
- b) Mediolateral
- c) 'J' shaped
- d) Lateral



High Risk pregnancy

"high-risk" pregnancy means a woman has one or more things that raise her — or her baby's — chances for health problems or preterm (early) delivery.

A woman's pregnancy might be considered high risk if she:

- is age 17 or younger
- is age 35 or older
- was underweight or overweight before becoming pregnant
- is pregnant with twins, triplets, or other multiples
- has high blood pressure, diabetes, depression, or another health problem
- had problems with a previous pregnancy, including premature labor or having a child with a genetic problem or birth defect
- Smoking, taking illegal drugs, and drinking alcohol also can cause health problems for a pregnant woman and her baby.

High Risk Pregnancy

1st term:

- Abortion
- Ectopic Pregnancy
- Hydatidiform Mole
- Hyperemesis Gravidarum

2nd & 3rd term:

- Placenta Previa
- Abruptio Placenta
- PIH(pregnancy induced hypertension)
 - preeclampsia
 - eclampsia
 - HELLP syndrome

Other diseases

- Diabetes mellitus
- Cardiac diseases

Terminologies related to obstetrics :

1. **Gestation:** The average length of human gestation is 280 days, or 40 weeks, from the first day of the woman's last menstrual period. Fetal development period from the time of conception until birth. Its divided into Trimester (3 months) - 3 Trimester in pregnancy
2. **Gravidae :** (plural form of gravida) Gravida or gravidity describes the total number of confirmed pregnancies that a woman has had, regardless of the outcome.
3. **Para:** Para or parity is defined as the number of births that a woman has had after 20 weeks gestation.
4. **Multipara:** A woman who has had two or more pregnancies resulting in potentially viable offspring.
5. **Nullipara:** Woman who has never given birth to a child
6. **Primigravidae:** Defined as a woman who conceives for the first time
7. **Multigravidae:** A pregnant woman who has had at least two previous pregnancies.
8. **Nulligravida:** A woman who has never conceived a child.
9. **Invitro:** taking place in a test tube or outside a living organism.
10. **Invivo:** performed or taking place in a living organism
11. **InUtero:** In women uterus before birth.
12. **Antepartum:** Relating to the period before parturition: before childbirth.
13. **Post partum:** following childbirth (first 6 week)
14. **Peripartum:** occurs around the time of childbirth (typically, a few weeks before or after)
15. **Puerperium:** from the time of uterus expel until woman's reproductive organs come back to an pregravidian stage
16. **Perinatal period:** Pertaining to the period immediately before and after birth. Depending on the definition, it starts at the 20th to 28th week of gestation and ends 1 to 4 weeks after birth.
17. **Neonate:** newborn (from 0- 28 days)

Introduction to the Skeletal System

- Humans are vertebrates, animals having a vertebral column or backbone.
- The human skeletal system consists of
 - bones, cartilage, ligaments, Joints and tendons, accounts for about 20 percent of the body weight.
- Bones provide a rigid framework, known as the skeleton that support and protect the soft organs of the body
- Bones contain more calcium than any other organ, the most important being is calcium phosphate.
- When blood calcium levels decrease below normal, calcium is released from the bones so that there will be an adequate supply for metabolic needs. When blood calcium levels are increased, the excess calcium is stored in the bone matrix. The dynamic process of releasing and storing calcium goes on almost continuously.
- **Bones:** Bone is a tough and rigid form of **connective tissue**. It is the weight bearing organ of human body and it is responsible for almost all strength of the human skeleton.

Bone marrow: Bone marrow is where blood cells are produced.

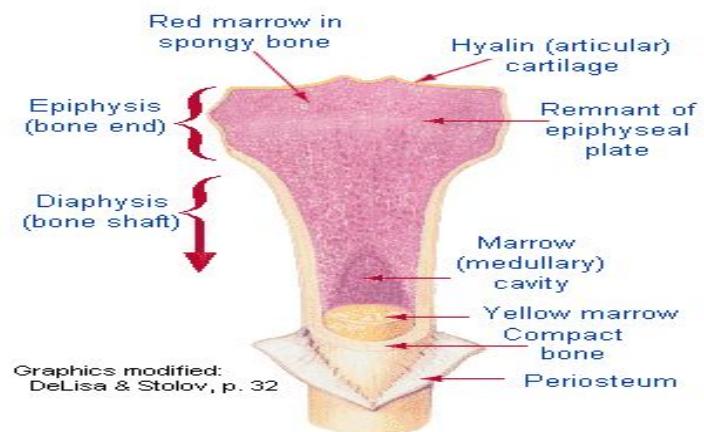
The three different types of blood cell made by bone marrow include:

- Red blood cells – carry oxygen around the body.
- White blood cells – make up the body's immune system.
- Platelets – are used for clotting.

Hematopoiesis, the formation of blood cells, mostly takes place in the red marrow of the bones.

Cavity in bone:

- Red bone marrow produces RBC
- Yellow bone marrow is deposits of fats



In infants, red marrow is found in the bone cavities. With age, it is largely replaced by yellow marrow for fat storage. In adults, red marrow is limited to the spongy bone in the skull, ribs, sternum, clavicles, vertebrae and pelvis.

Bones are been classified by their shape

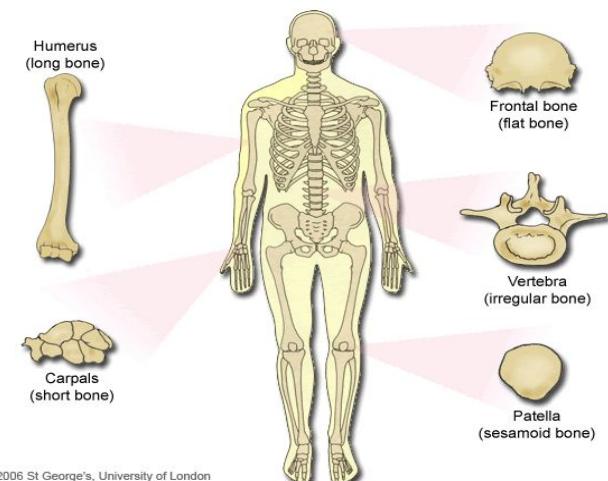
Long bone. eg: Humerus, Femur

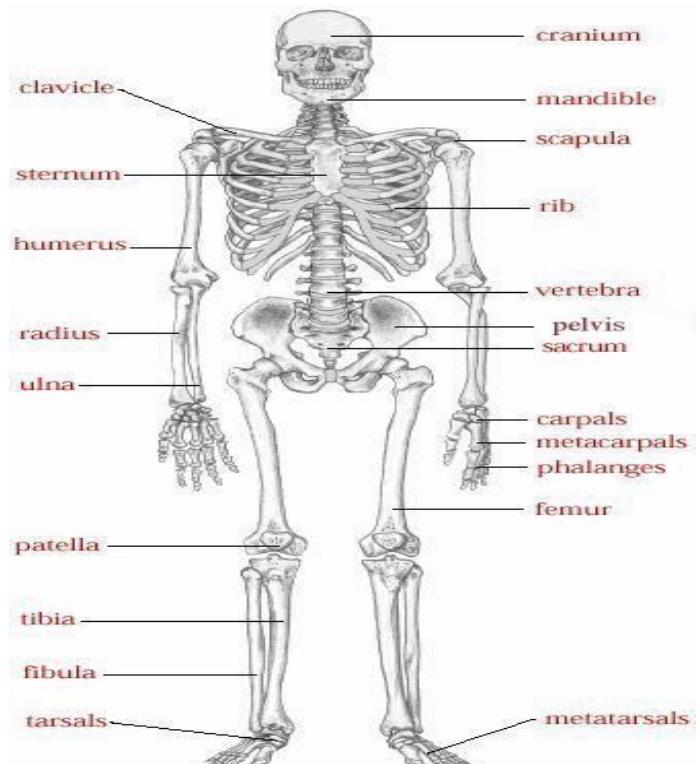
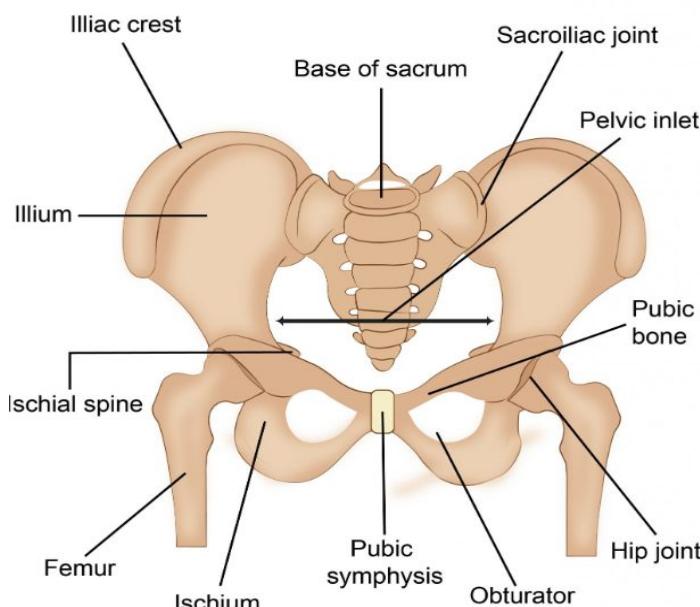
Short bone. eg: Carpal, Tarsal

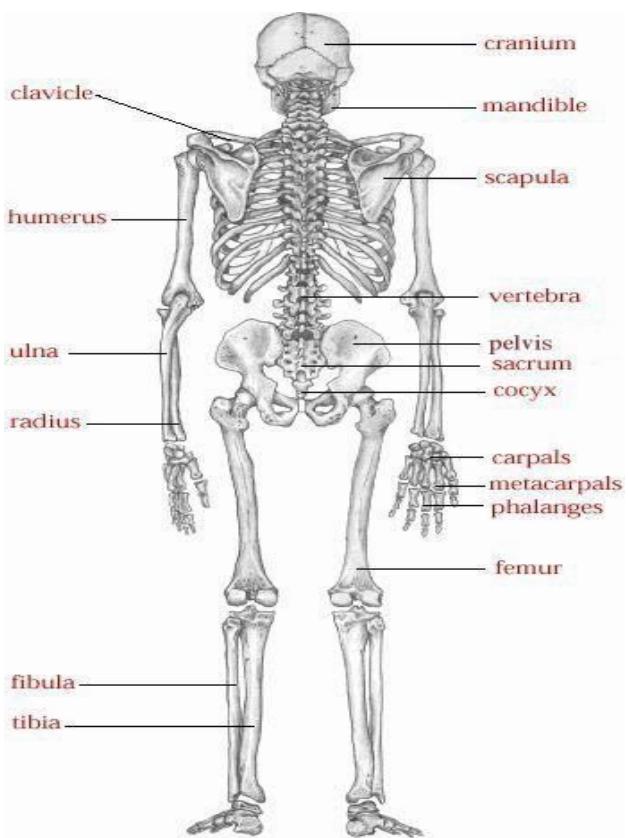
Flat bone. eg: Sternum, Skull

Irregular bone. eg: Vertebra, Hip

Sesamoid bone. eg: Patella (Knee cap)



Major Bone of Human being	
Skull (Cranium) – including the jaw bone	
Spine/Vertebrae – are the 33 individual bones that interlock with each other to form the spinal column.	
Chest – ribs and breastbone (sternum)	
Arms – shoulder blade (scapula), collar bone (clavicle), humerus, radius and ulna	
Hands – carpals (wrist bones), metacarpals and phalanges (Digits)	
Pelvis – hip bones - Iliac, Ilium, Pubic bone, Ischium, Sacroiliac joint	
Legs – femur (thigh bone), patella (knee cap), shin bone (tibia) and fibula	
Feet – tarsals, metatarsals, Calcaneus (Heel bone) & phalanges	
Pelvic Girdle	
	



Gross anatomy of long bone

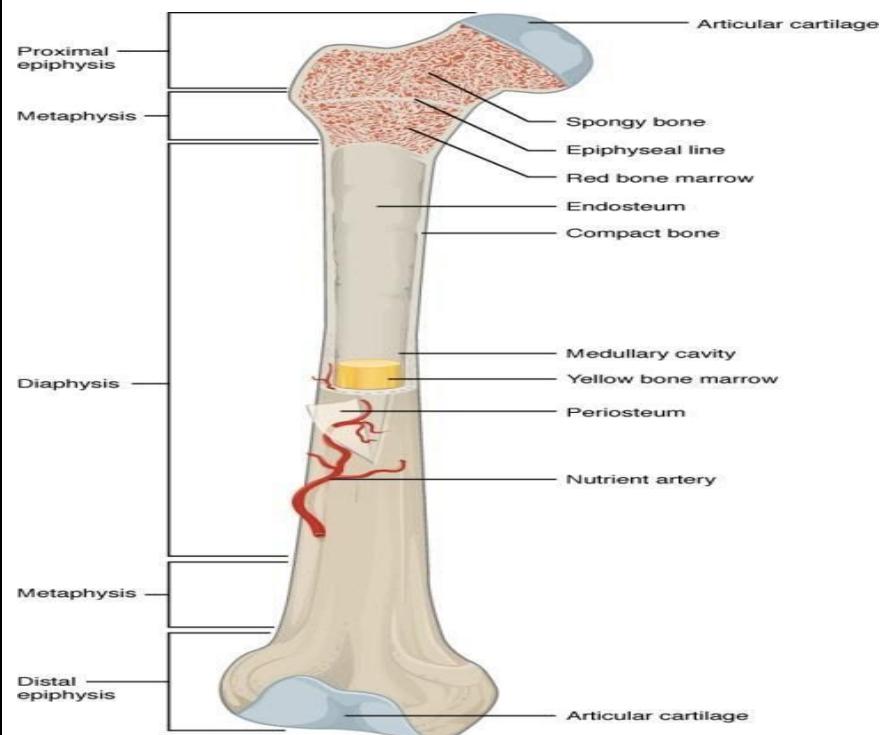
Diaphysis: Tubular **Shaft**, between the proximal & distal end of the bone. It is Composed of compact bone

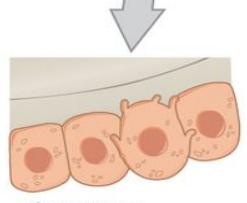
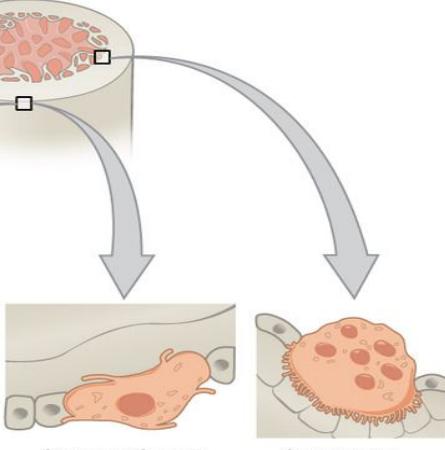
Epiphysis: Wider section at each ends of the bone Composed of spongy bone. RBC fills the space between spongy bone

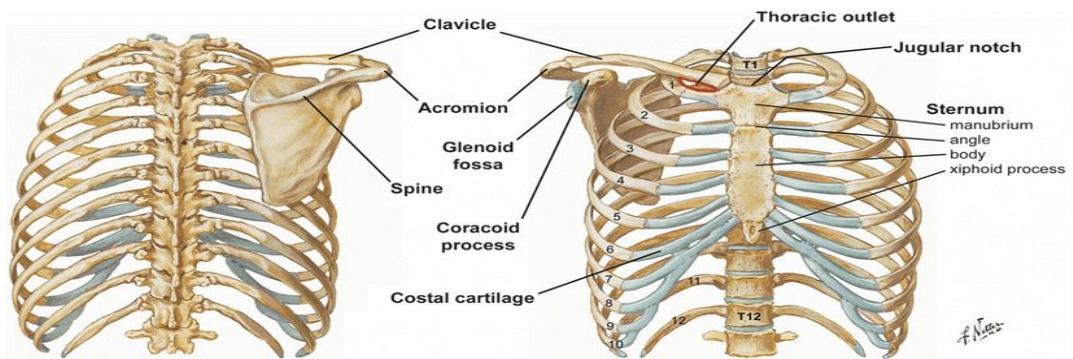
Metaphysis: Each epiphysis meets the diaphysis at this point

Periosteum: Outside covering of diaphysis

Endosteum: Inner covering of diaphysis



Types of bone cells	
Osteocytes: Mature bone cells	
Osteoblasts: Bone forming cells	
Osteoclasts: Bone destroying cells. Breakdown bone matrix for remodeling (remodelling process takes place by both Osteoclasts & osteoblasts) Release of calcium.	 <p>Osteocyte (maintains bone tissue)</p> <p>Osteoblast (forms bone matrix)</p> <p>Osteogenic cell (stem cell)</p> <p>Osteoclast (resorbs bone)</p>

Human rib cage consists of <ul style="list-style-type: none"> • 24 ribs in 12 pairs • Sternum • Xiphoid process • Costal cartilages • the 12 thoracic vertebrae (Spine) 	
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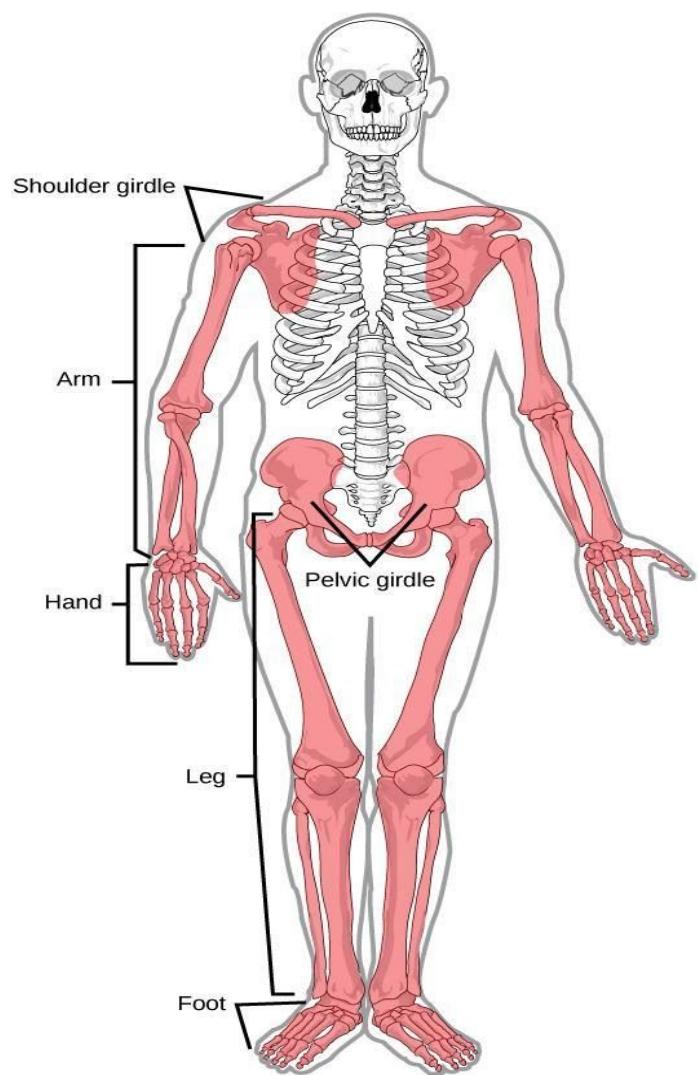
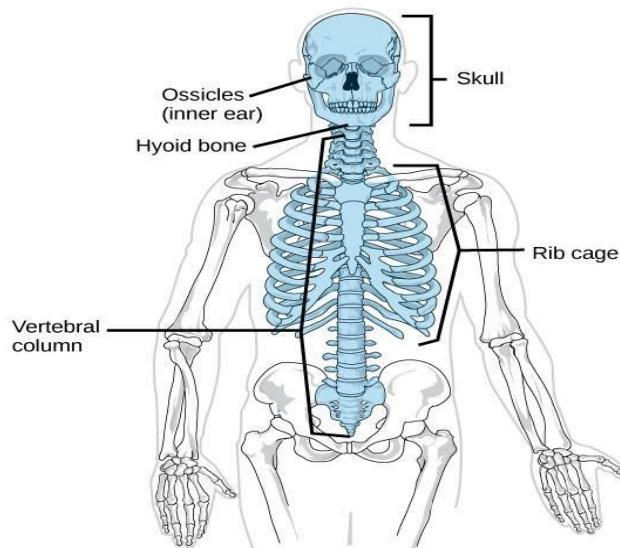
The Human body consists of **206 bones**. Bones are classified based on their place where they are situated i.e.,

AXIAL BONES

- Skull (cranium & facial bones) 22 bones
- Hyoid bone 1
- Vertebral column or spine 26
- Thorax (ribs & sternum) 25
- Middle ear bones 6

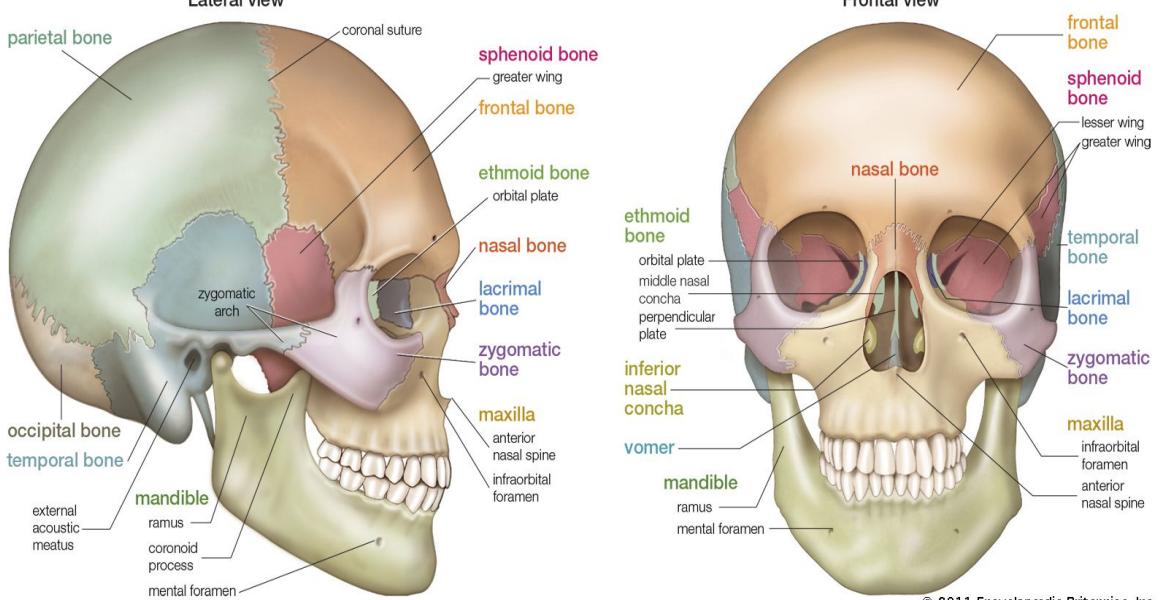
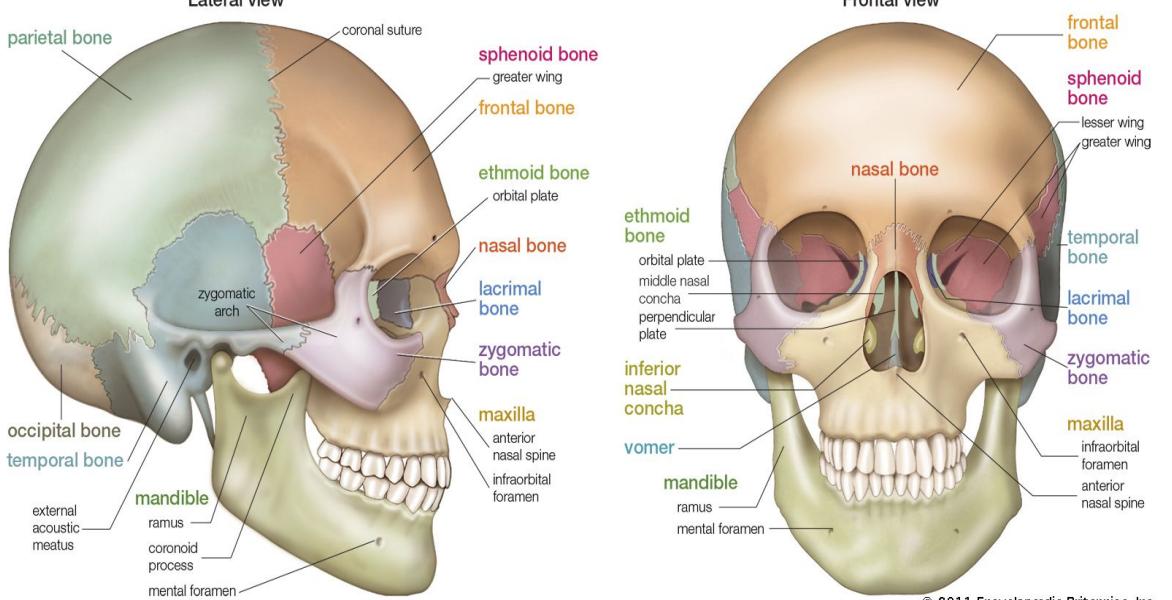
APPENDICULAR

- Pectoral girdle (Clavicle & Scapular) 4
- Upper limbs (Arms) 60
- Pelvic girdle (Ilium, Ischium, Pubic bone) 6
- Lower limbs (Legs) 60



Common Joints

- **Upper Limb** - Shoulder, Elbow, Wrist, Interphalangeal joint
- **Lower Limb** - Hip, Knee, Ankle, Interphalangeal joint
- **Jaw region** - Temporomandibular Joint (TMJ)
- **Pelvic region** - Sacroiliac Joint

Skull Bone	 <p><small>© 2011 Encyclopædia Britannica, Inc.</small></p>
<p>The brain, which performs these various functions, is protected by a part of the skull called the cranium.</p>	
<p>Eight bones that form it:</p> <ul style="list-style-type: none"> • Ethmoid bone • Sphenoid • Frontal • Occipital • 2 Parietal • 2 Temporal <p>Mandible - Jaw Temporomandibular joint</p>	 <p><small>© 2011 Encyclopædia Britannica, Inc.</small></p>

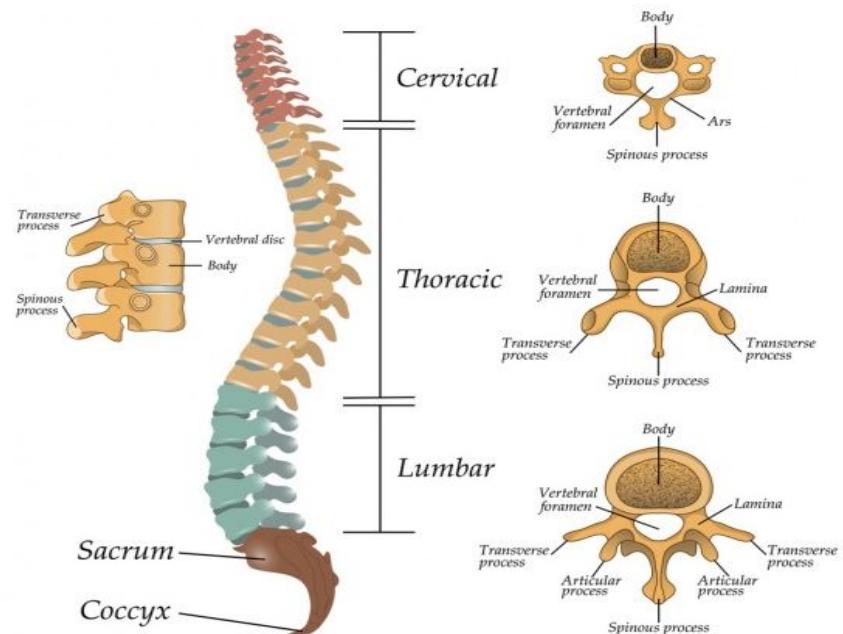
Spine/Vertebrae – are the **33 individual bones** that interlock with each other to form the spinal column.

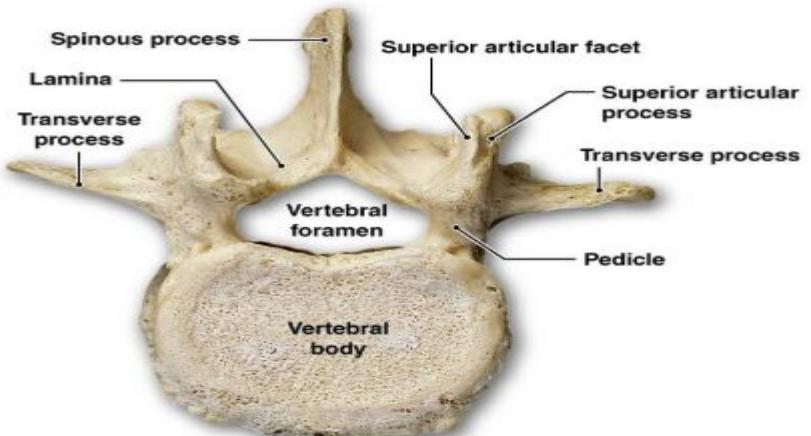
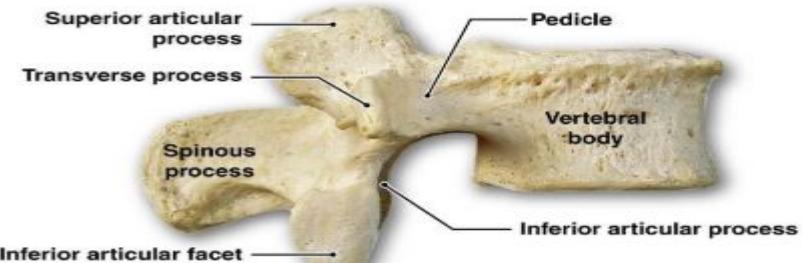
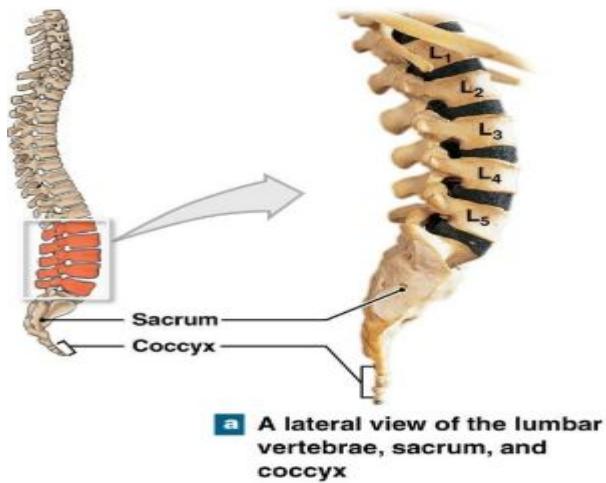
- **Cervical spine:** 7 vertebrae (C1–C7), C1-Atlas, C2-Axis
- **Thoracic spine:** 12 vertebrae (T1–T12)
- **Lumbar spine:** 5 vertebrae (L1–L5)
- **Sacrum:** 5 (fused) vertebrae (S1–S5)
- **Coccyx:** 4 (3–5) (fused) vertebrae (**Tailbone**)

Vertebrae

- Body
- Spinous process
- Transverse process
- Articular process
- Articular Facet
- Formen
- Lamina
- Pedicle

The structure of the segments of the spine





c A superior view of the same vertebra shown in part b

Joints

Joints are the areas where 2 or more bones meet. Most joints are mobile, allowing the bones to move.

A joint occurs between “two or more bones”, “bone and cartilage” and “cartilage and cartilage”.

They are divided into

Fibrous Joint:- fixed or immovable. Ex:-Skull, Pelvis

Cartilaginous Joint:- partially movable. Ex:- Rib and Spine

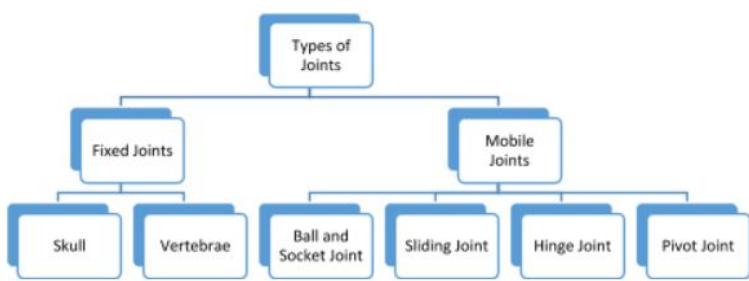
Synovial Joint:- covered by synovial fluid. allows for much movement than a cartilaginous joint filled with synovial fluid which helps lubrication & protection.

Types of Joints



Joints

- Bony ends covered with **hyaline cartilage**
- Ligaments** bind the bone together
- Joint cavity** enclosed by a capsule-synovial membrane
- Cavity contains **lubricant fluid-synovial fluid**

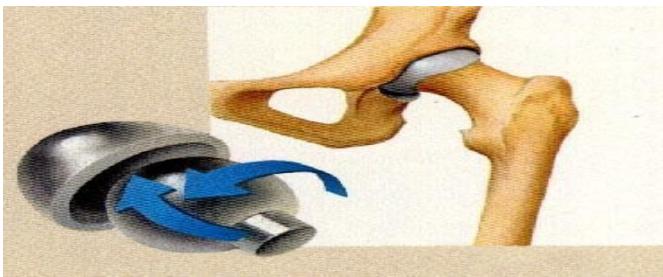


Types of Mobile joints:

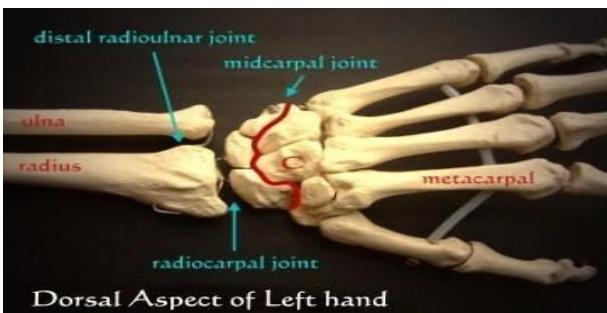
Ball and Socket joints:- They are cup shaped. They are **360° rotatable**. **Present at Hip and Shoulder.**

Shoulder: Glenohumeral joint, (is a ball and socket articulation between the head of the humerus and the glenoid cavity of the scapula)

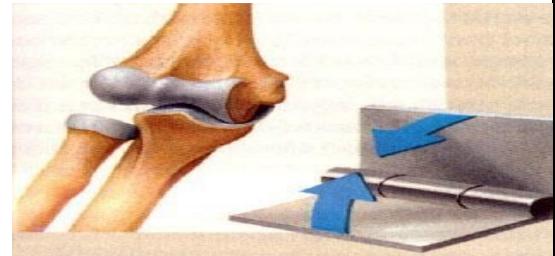
The femur head has a **ball-shaped head** on its end that fits into a **socket formed in the pelvis**, called the **acetabulum**



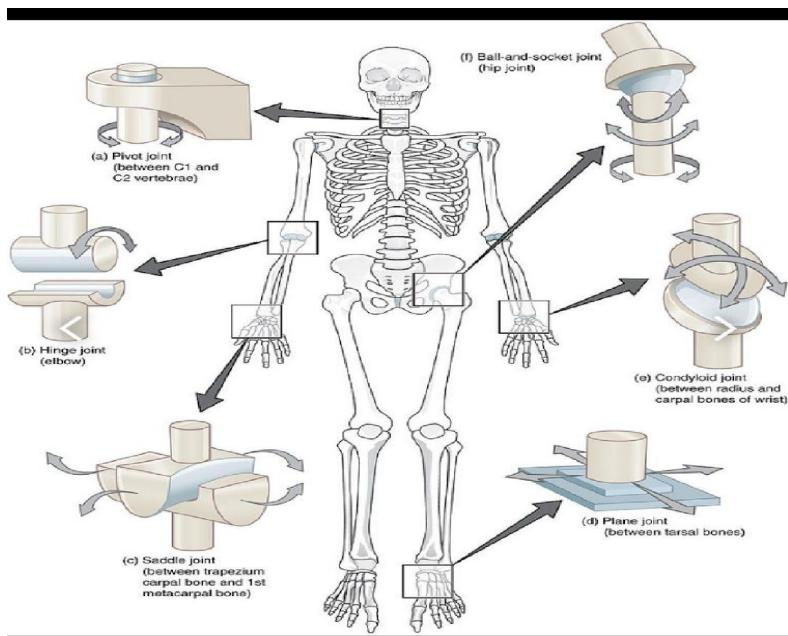
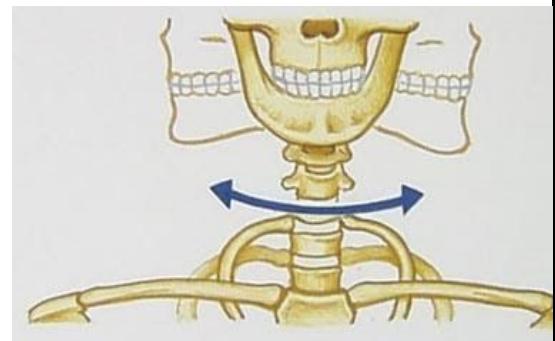
Sliding joint or Gliding Joint:- This joint allows two or more flat or slightly rounded bones to move easily together without any friction or grinding. This joint also helps in bending, smooth sliding, stretching, circular motion etc. Ex :- fore arms to wrist. And leg to ankle.



Hinge joints:- These joints can move only in one direction or one plane. **Present at elbow, fingers, toes and knees.** Knee is unusual and allows the knee to swivel and also helps in turning the foot from side to side.

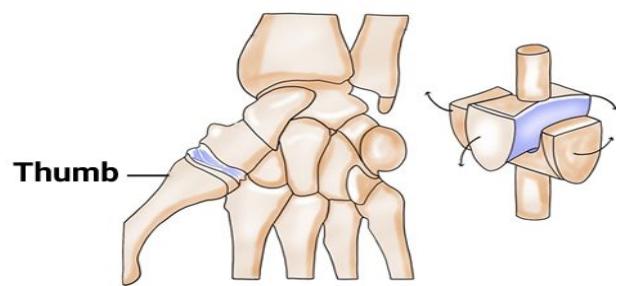


Pivot joint:- one end fits like a cylinder inside a ring. **Ex:- Base of skull allows the head to rotate.**



- **Condyloid joint:-** Joint of wrist and fingers, move both side to side, up & down.
- **Saddle joint:-** Joint of thumb, move back, up & down.

Saddle joint

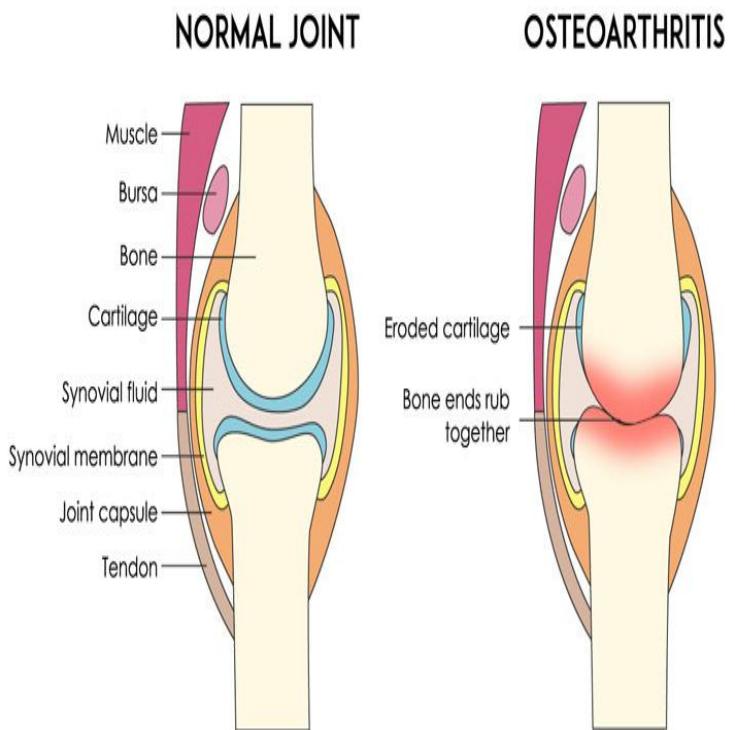
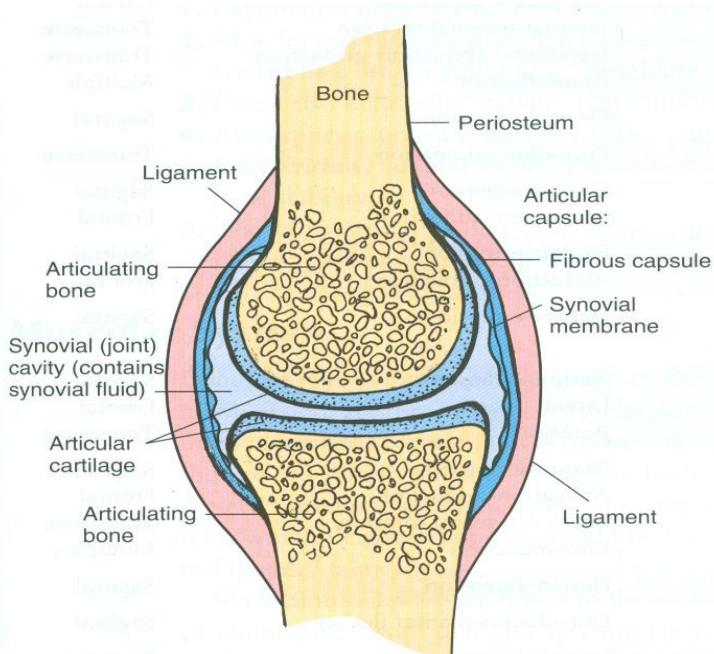


Major parts of MS

Connective tissue: A material made up of fibers forming a framework and support structure for body tissues and organs. Connective tissue surrounds many organs. Cartilage and bone are specialized forms of connective tissue.

- **Types of connective tissues:-** adipose tissues, blood tissue, cartilage, bone, lymphatic tissue, loose and dense ordinary connective tissue

- **A tendon** or sinew is a tough band of fibrous connective tissue that **connects muscle to bone**
- **A ligament** is the fibrous connective tissue that **connects bones to other bones**
- **Fascia**: connective tissues that **connects muscle to skin**
- **Cartilage** cushions bone to bone



- **Bursa**:- it is lubricated cushion located at points of frictions between a bone and the surrounding soft tissue. (synovium and synovium membrane)
- **Cartilages**:

Cartilage is also a form of connective tissue but is not as tough and rigid as bone. The main difference in the cartilage and bone is the mineralization factor. Bones are highly mineralized with calcium salts while cartilages are not. It is smooth elastic tissue, a rubber like padding that covers and protects the ends of long bones at the joints.

- Ex: Meniscus:- C shaped piece of tough rubber cartilage that acts as a shock absorber between thigh bones.
- **Synovial Joint**
 - Synovial Cavity
 - Synovial Fluid
 - Synovial member

Conditions of MS

- **Bursitis**:- inflammation of Bursa
- **Arthritis**:- inflammation of joints.
- **Osteoporosis**:- reduced bone mineral density. This occurs mainly during postmenopausal or senile i.e., after age of 75. Other related diseases are osteopenia and osteomalacia.
- **Paget's disease**:- Enlarged and misshapen bones.

Conditions of Spine	
<ul style="list-style-type: none"> • Spondylosis:- painful condition of the spine resulting from degeneration of intervertebral disc. • Spondylolisthesis:- forward displacement of a lumbar vertebrae. 	
<ul style="list-style-type: none"> • Scoliosis: sideways curvature of the spine that occurs most often during the growth just before puberty (S or C shaped) 	
<ul style="list-style-type: none"> • Kyphosis:- abnormal excessive convex curvature of spine (hump shaped) occurring in thoracic & sacral region 	
<ul style="list-style-type: none"> • Lordosis:- excessive inward curve of the spine (opposite of kyphosis) 	

Functions of human skeleton:

Human skeleton performs some important functions that are necessary for survival of human beings.

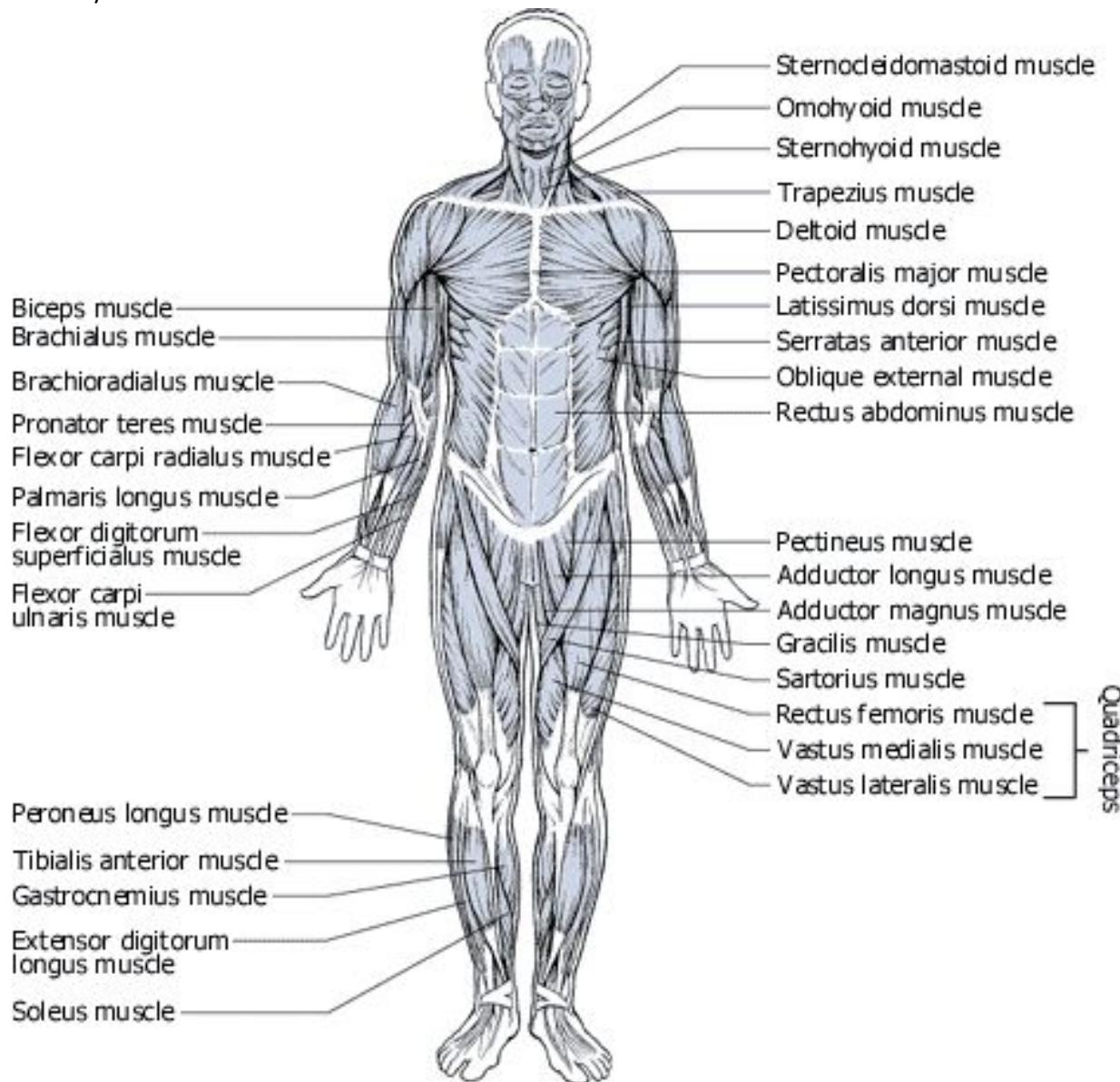
1. **STRENGTH, SUPPORT AND SHAPE**: It gives strength, support and shape to the body. Without a hard and rigid skeletal system, human body cannot stand upright, and it will become just a bag of soft tissues without any proper shape
2. **PROTECTION OF DELICATE ORGANS**: In areas like the rib cage and skull, the skeleton protects inner soft but vital organs like heart and brain from external shocks. Any damage to these organs can prove fatal, therefore protective function of skeleton is very important
3. **LEVERAGE FOR MOVEMENTS**: Bones of the human skeleton in all parts of the body provide attachment to the muscles. These muscles provide motor power for producing movements of body parts. In these movements the parts of the skeleton acts like levers of different types thus producing movements according to the needs of the human body.
4. **PRODUCTION OF RED BLOOD CELLS**: Bones like the sternum, and heads of tibia have hematopoietic activity (blood cells production). These are the sites of production of new blood cells.

Introduction to the Muscular System

The muscular system is composed of **specialized cells** called **muscle fibers**. Muscles, attached to bones or internal organs and blood vessels, are responsible for movement. Nearly all movement in the body is the result of muscle contraction.

The integrated action of joints, bones, and skeletal muscles produces obvious movements such as walking and running. Skeletal muscles also produce more subtle movements that result in various facial expressions, eye movements, and respiration.

Posture, such as sitting and standing, is maintained as a result of muscle contraction. The tendons of many muscles extend over joints and in this way contribute to joint stability. Heat production, to maintain body temperature, is an important by-product of muscle metabolism. Nearly 85 percent of the heat produced in the body is the result of muscle contraction.



Muscles: Muscles are special type of tissues of human body that possess the ability of contraction and relaxation. They can contract actively thus producing force for different body movements.

Skeletal Muscle	Striated	voluntary control	Uni-nucleated	found attached to skeleton , produce major movements of body parts
Smooth Muscle	Non-striated	involuntary	Uni-nucleated	found in soft organs of body, responsible for processes like digestion of food etc
Cardiac Muscle	Striated	involuntary	Multi-nucleated, Branched	present exclusively in heart , responsible for pumping activity of heart, very strong and tough
Functions	Movements of body parts, Stability and Posture, Heat production, Circulation, Help in Digestion			

Muscle structure:-

There are 600 to 700 muscles in the body. These muscles helps in controlling Walking, Talking, Sitting, Standing etc.

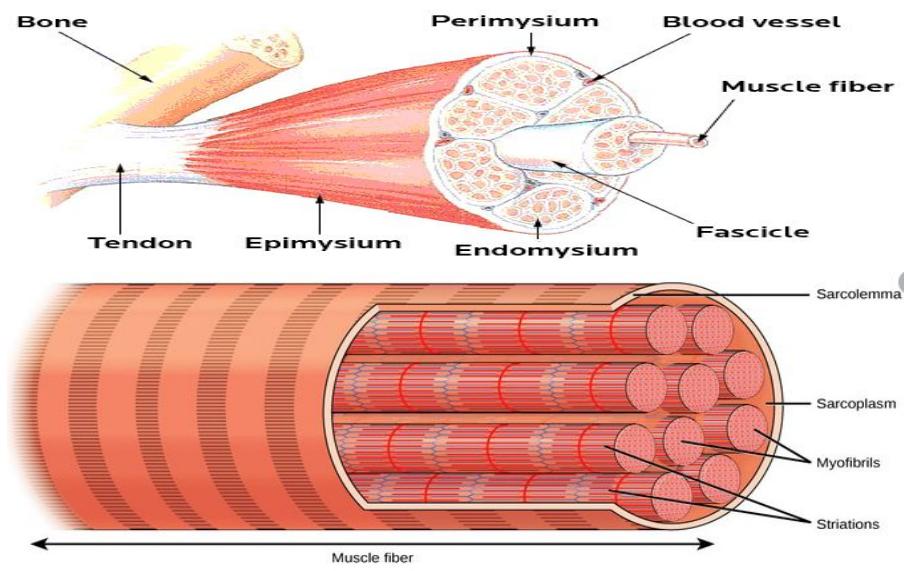
Myocyte is a muscle cell, which is made up of many **Myofibrils** (myofibers). There are various specialized forms of Myocyte with distinct properties in cardiac, skeletal, and smooth muscle.

Myofibril is a rod like unit of muscle cell
Sarcoplasm is the cytoplasm of a myocyte
The **sarcolemma** is a specialized cell membrane which surrounds striated muscle fiber cells. AKA **myolemma**

Fascicle bundle of muscle fibers

The interstitial connective tissue of muscle is subdivided into

- **Epimysium** (surrounds the entire muscle)
- **Perimysium** (surrounds large angular fascicles divided into primary fascicles of 10–100 fibers)
- **Endomysium** (surrounds individual muscle fibers)



Muscles:

Muscles are body tissues that provide the force for all body movements. They are made of special types of cells.

Types of muscles:

Muscles are basically of three types; Skeletal Muscles, Smooth Muscles and Cardiac Muscles.

Skeletal Muscles:

Skeletal muscles form most of the human body weight. They are under the control of **human will (Voluntary)** and all body movements occurring by our will are produced by skeletal muscles. They are called skeletal muscles because they are almost always found attached to the skeleton and produce movements in different parts of the skeleton.

Striated Muscle, Multinucleated

Smooth Muscles:

Smooth muscles form the soft body organs like stomach, intestine, blood vessels etc. They are **not under the will of human beings (Involuntary)** and are responsible for unconscious body activities like digestion of food. They are called smooth muscles because when seen under the microscope, they do not have any striation in contrast to the other two types of muscles.

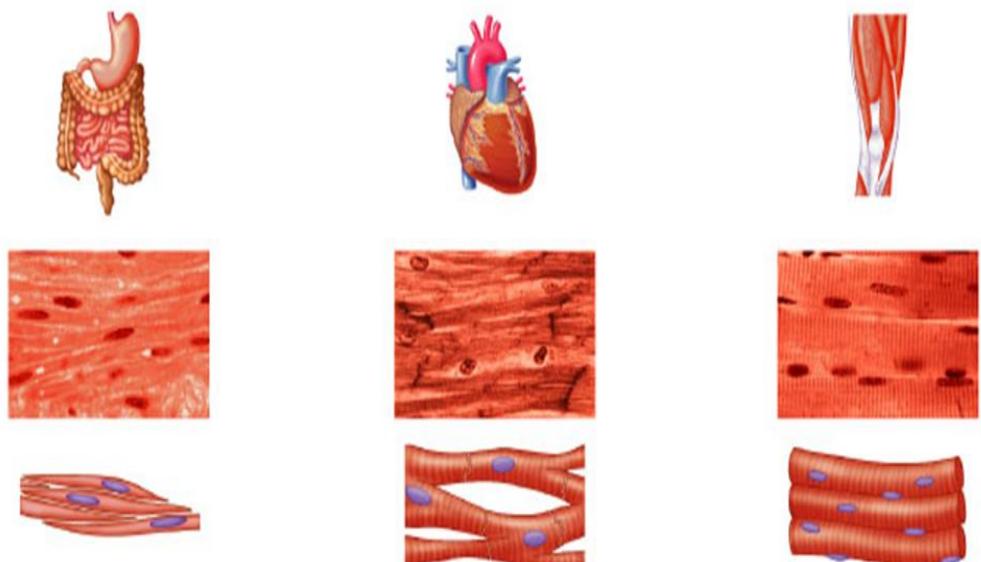
Non-Striated Muscle, uninucleated

Cardiac Muscles:

Cardiac muscles are exclusively found in human heart and nowhere else. They are extremely strong and powerful muscles. They are not under the control of human will and are **involuntary**. The pumping of blood by human heart is because of the force provided by the contraction of cardiac muscles.

Striated Muscle, uninucleated, Branched

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Smooth muscle

- has spindle-shaped, nonstriated uninucleated fibers.
- occurs in walls of internal organs.
- is involuntary.

Cardiac muscle

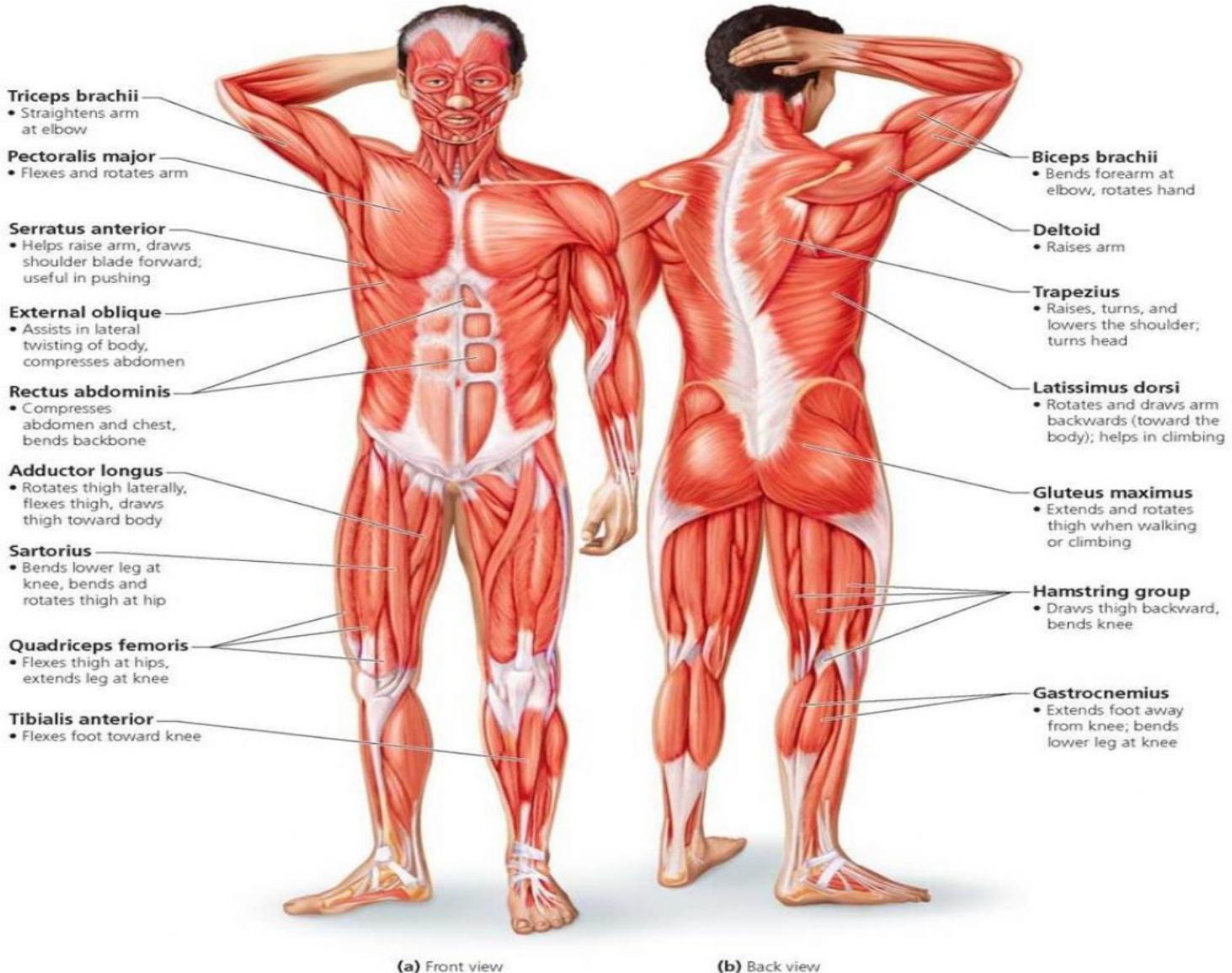
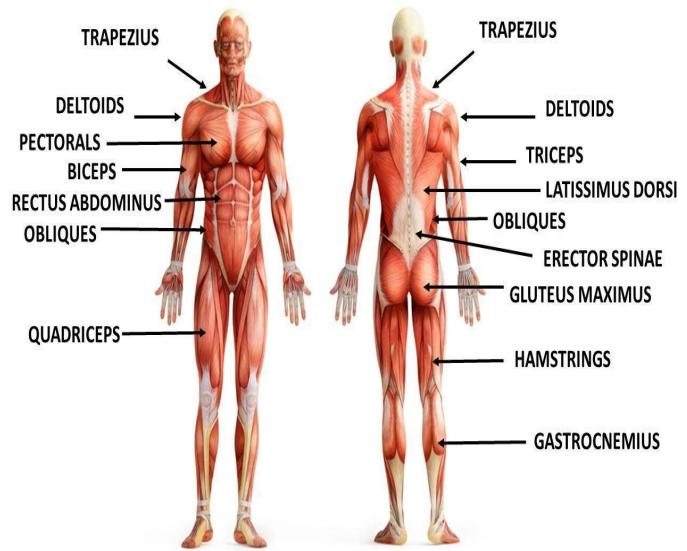
- has striated, branched, uninucleated fibers.
- occurs in walls of heart.
- is involuntary.

Skeletal muscle

- has striated, tubular, multinucleated fibers.
- is usually attached to skeleton.
- is voluntary.

Major Muscles of Human body

- Deltoid muscle
- Biceps & Triceps
- Trapezius
- **Pectoralis:** major & minor
- **Abdominal:** External & internal oblique, rectus abdominis
- **Quadriceps:** vastus lateralis, medialis, intermedius & rectus femoris.
- **Latissimus dorsi:** largest muscle in upper body.
- **Gluteus:** maximus, mediumus, minimus. Gluteus maximus is the largest muscle of the body.
- **Hamstring:** It flexes the knee joint & helps in activities like walking, running and other physical activities.



Functions of Muscular System:

Muscular system has the following important functions in human body;

1. **MOVEMENTS OF BODY PARTS:** **Skeletal muscles** are responsible for all voluntary movements of human body parts. They provide the force by contracting actively at the expense of energy. In other words, muscles are motors of body where chemical energy of food is converted into mechanical work.
 1. Eye Muscle :- In an hour it has 10,000 co-ordinate movements.
2. **STABILITY AND POSTURE:** **Skeletal muscles** stabilize human skeleton and give a proper posture to human beings. Some joints of human body are weak and they require the support of muscular system to achieve stability. Skeletal muscles are very important for such joints.
3. **HEAT PRODUCTION:** A large share of body's energy is used by muscular system. As a result of high metabolic rate, muscles produce great amount of heat in the body. Heat produced by muscles is very important in cold climates.
4. **CIRCULATION:** **Cardiac muscles** provide the main force for circulation of blood through out human body. The regular pumping of heart keeps the blood in motion and nutrients are readily available to every tissue of human body.
 1. Heart:- 2 ounces (57 grams) of blood with every beat. Daily heart pumps at least 2500 gallons(9464 lt) of blood, i.e., more than 3 billion times in a precious life.
5. **HELP IN DIGESTION:** **Smooth muscles** of organs like stomach and intestine help the digestive system in the process of digestion of food.

Medical Terminology of MS

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
MS		acanth(o)-	thorn or spine	Greek (akantha), thorn	acanthion, acanthocyte, acanthoma, acanthulus
MS		acr(o)-	extremity, topmost	Greek (akron), highest or farthest point	Acrocrany, acromegaly, acroosteolysis, acroposthia
MS		ankyl(o)-, ancylo(o)-	Denoting something as crooked or bent	Greek (ankýlos), crooked, curved	Ankylosis
MS		arthr(o)-	Of or pertaining to the joints, limbs	Greek (arthros), a joint, limb	Arthritis
MS		articul(o)-	joint	Latin articulum	Articulation
MS		brachi(o)-	Of or relating to the arm	Latin (brachium), from Greek (brachiōn), arm	Brachium of inferior colliculus
MS		burs(o)-	bursa fluid sac between the bones Latin	Bursitis	
MS		capit-	Pertaining to the head (as a whole)	Latin (caput, capit-), the head	Capitation

MS		carp(o)-	Of or pertaining to the wrist	Latin (carpus); Greek (karpós) wrist; NOTE: This root should not be confused with the mirror root carp(o)- meaning fruit.	Carpopedal
MS		cervic-	Of or pertaining to the neck, the cervix	Latin (cervix, cervīc-), neck, cervix	Cervicodorsal
MS		chir(o)-, cheir(o)-	Of or pertaining to the hand	Greek (cheir, cheiro-), hand	Chiropractor
MS		chondr(i)o-	cartilage, granule, granular	Greek (chondros)	Chondrocalcinosis
MS		cost(o)-	Of or pertaining to the ribs	Latin (costa), rib	Costochondral
MS		cox-	Of or relating to the hip, haunch, or hip-joint	Latin (coxa), hip	Coxopodite
MS		crani(o)-	Belonging or relating to the cranium	Latin (cranium); Greek (krānion), the cranium, skull, bones enclosing the brain	Craniology
MS		dactyl(o)-	Of or pertaining to a finger, toe	Greek (dáktylos), finger, toe	Dactylogy
MS		digit-	Of or pertaining to the finger [rare as a root]	Latin (digitus), finger, toe	Digit
MS		dors(o)-, dors(i)-	Of or pertaining to the back	Latin (dorsum), back	dorsal, Dorocephalad
MS		faci(o)-	Of or pertaining to the face	Latin (faciēs), the face, countenance	Facioplegic
MS		fibr(o)	fiber		Fibroblast
MS		front-	Of or pertaining to the forehead	Latin (frōns, front-), the forehead	Frontonasal
MS		genu-	Of or pertaining to the knee	Latin (genū), knee	Genu valgum
MS		gnath(o)-	Of or pertaining to the jaw	Greek (gnáthos), jaw	Gnathodynamometer
MS		halluc-	to wander in mind	Classical Latin to wander in mind	Hallucinosis
MS		hist(o)-, histio-	tissue	Greek	Histology
MS		humer(o)-	Of or pertaining to the shoulder or upper arm	Incorrect Etymology; Latin (umerus), shoulder	Humerus
MS		ischio-	Of or pertaining to the ischium, the hip-joint	Greek (ischión), hip-joint, ischium	Ischiorrhagic
MS		koil(o)-	hollow	Greek (koilos)	Koilocyte
MS	Disease process	kyph(o)-	humped	Greek	Kyphoscoliosis
MS		lei(o)-	smooth	Greek	Leiomyoma
MS		manu-	Of or pertaining to the hand	Latin (manus), hand	Manufacture
MS		melos	extremity	Greek	erythromelalgia
MS		muscul(o)-	muscle	Latin	Musculoskeletal system
MS		my(o)-	Of or relating to muscle	Greek (mys, my-), muscle; mouse; mussel	Myoblast

Blood, MS		myel(o)-	Of or relating to bone marrow	Greek (myelon), marrow; bone-marrow	Myeloblast
MS		om(o)-	Of or pertaining to the shoulder	Greek (ōmos), shoulder	Omoplate
DS MS		orth(o)-	Denoting something as straight or correct	Greek (orthos), straight, correct, normal	Orthodontist
MS		osseo-	bony	Latin	
MS		ossi-	bone	Latin	Peripheral ossifying fibroma
MS		ost(e)-, oste(o)-	bone	Greek	Osteoporosis
MS		ped-, -ped-, -pes	Of or pertaining to the foot; -footed	Latin (pēs, pēd-), foot	Pedoscope
MS		pelv(i)-, pelv(o)-	hip bone	Latin	Pelvis
MS		pleur(o)-, pleur(a)	Of or pertaining to the ribs	Latin (pleura); Greek (pleurón), rib, side of the body	Pleurogenous
MS		pod-, -pod-, -pus	Of or pertaining to the foot, -footed	Greek (poús, pod-), foot	Podiatry
MS, Urinary		pyel(o)-	pelvis	Greek (pyelos)	Pyelonephritis
MS		rhachi(o)-	spine	Greek	rachial, rachialgia, rachidian, rachiopathy
MS		spondyl(o)-	Of or pertaining to the spine, the vertebra	Greek (spónylos / sphónylos), the spine	Spondylitis
MS		steth(o)-	Of or pertaining to the upper chest, chest	Greek (stēthos), chest, cuirass	Stethoscope
MS NS		thec-	case, sheath	Greek (theke)	Intrathecal
MS		thorac(i)-, thorac(o)-, thoracico-	Of or pertaining to the upper chest, chest	Latin (thōrāx); Greek (thōrax), chest, cuirass	Thorax
MS		arm	brachi(o)-	-	-
MS		armpit	-	axill-	-
MS		back	-	dors-	-
MS		big toe	-	allic-	-
MS		bone	oste(o)-	ossi-	-
MS		bone marrow, marrow	myel(o)-	medull-	-
MS		face	-	faci(o)-	-
MS, DS		fat, fatty tissue	lip(o)-	adip-	-
MS		finger	dactyl(o)-	digit-	-
MS		forehead	-	front(o)-	-
MS		hand	cheir(o)-, chir(o)-	manu-	-
MS		hip, hip-joint	-	cox-	-

MS		knee	gon-	genu-	-
MS		muscle	my(o)-	-	-
MS		pelvis	pyel(o)-	pelv(i)-	-
MS		rib	pleur(o)-	cost(o)-	-
MS		rib cage	thorac(i)-, thorac(o)-	-	-
MS		shoulder	om(o)-	humer(o)-	-
MS		skull	crani(o)-	-	-
MS		thumb	-	pollic-	-
MS		toe	dactyl(o)-	digit-	-
MS		wrist	carp(o)-	carp(o)-	-

Introduction to the Nervous System

The nervous system is the major controlling, regulatory, and communicating system in the body. It is the center of all mental activity including thought, learning, and memory. Together with the endocrine system, the nervous system is responsible for regulating and maintaining homeostasis. Through its receptors, the nervous system keeps us in touch with our environment, both external and internal.

Like other systems in the body, the nervous system is composed of organs, principally the **brain, spinal cord, nerves, and ganglia**. These, in turn, consist of various tissues, including nerve, blood, and connective tissue. Together these carry out the complex activities of the nervous system.

The various activities of the nervous system can be grouped together as three general, overlapping functions:

- Sensory
- Integrative
- Motor

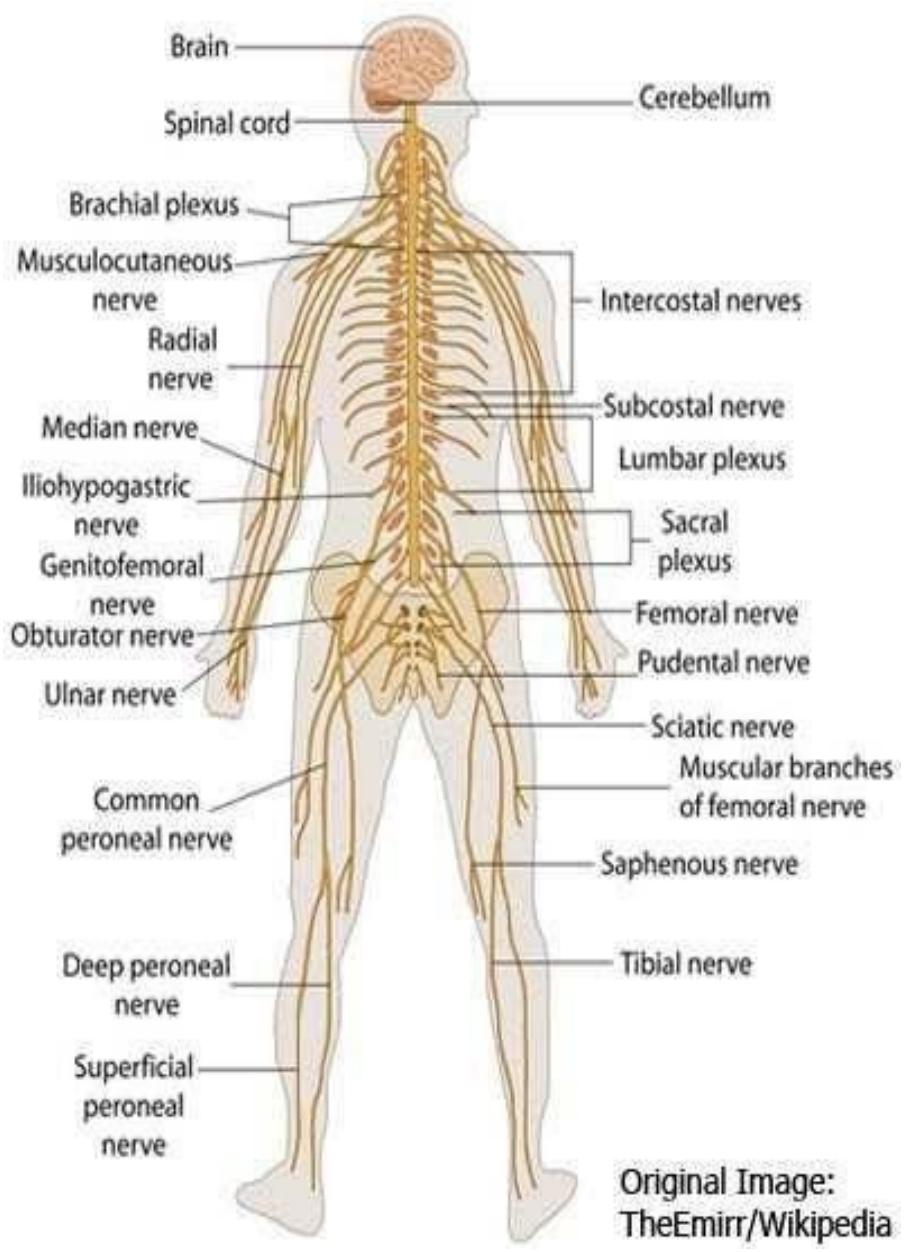
Millions of sensory receptors detect changes, called **stimuli**, which occur inside and outside the body. They monitor such things as temperature, light, and sound from the external environment. Inside the body, the internal environment, receptors detect variations in pressure, **pH**, carbon dioxide concentration, and the levels of various **electrolytes**. All of this gathered information is called **sensory input**.

Sensory input is converted into electrical signals called **nerve impulses** that are transmitted to the brain. There the signals are brought together to create sensations, to produce thoughts, or to add to memory; Decisions are made each moment based on the sensory input. This is integration.

Based on the sensory input and integration, the nervous system responds by sending signals to muscles, causing them to contract, or to glands, causing them to produce secretions. Muscles and glands are called **effectors** because they cause an effect in response to directions from the nervous system. This is the **motor output or motor function**.

Components	Brain	Central part of nervous system, Controls all body functions
	Spinal Cord	Long and thin bundle of nervous tissue extending from lower part of brain, transmits neural signals between brain and rest of the body
	Nerves	A bundle of peripheral axons enclosed by connective tissue. Carries nervous signals from nervous system to body and from body to nervous system
	Nerve Endings	Motor and sensory neurons end in special type of structures depending on their function. These structures are called nerve endings
Divisions	Central Nervous System (CNS)	Brain and Spinal Cord
	Peripheral Nervous System (PNS)	<ul style="list-style-type: none">• Cranial nerves, Spinal nerves and Ganglia• Divisions of PNS<ul style="list-style-type: none">○ Autonomic nervous & Somatic Nervous System
Functions	Control of all body functions, Coordination of different body organs	

- Nervous system is the chief controlling and coordinating system of the body. It controls and regulates all voluntary and involuntary activities of human body.
- There are three characteristic properties of nervous system of human body;
 - **Sensitivity**
 - **Conductivity**
 - **Responsiveness**



Original Image:
TheEmirr/Wikipedia

Parts of nervous system:

Nervous system of human body is divided broadly into two parts; Central Nervous System (CNS) and Peripheral Nervous System (PNS)

CENTRAL NERVOUS SYSTEM (CNS):

Central nervous system includes brain and spinal cord.

PERIPHERAL NERVOUS SYSTEM (PNS):

Peripheral nervous system includes all the parts of nervous system **except brain and spinal cord**.

It is further divided into two components;

- Somatic nervous system
- Autonomic nervous system

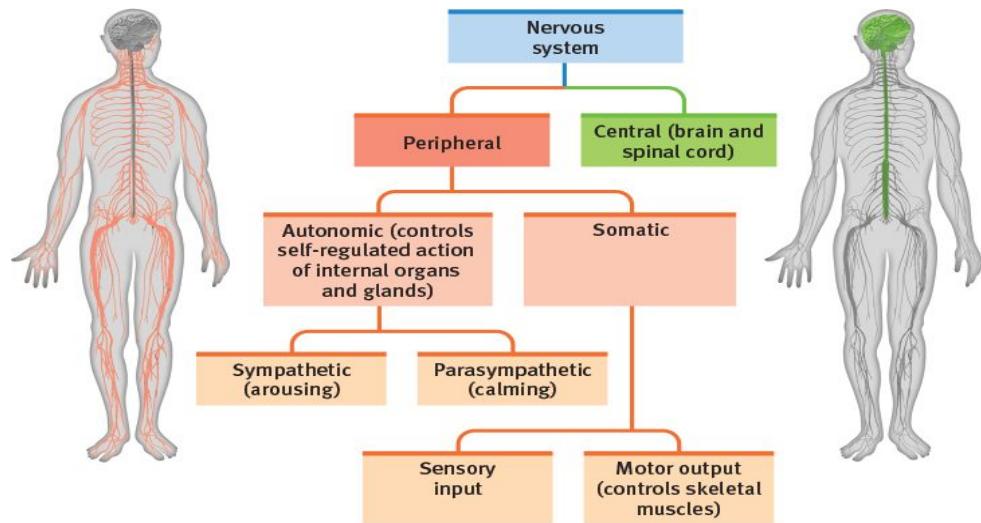
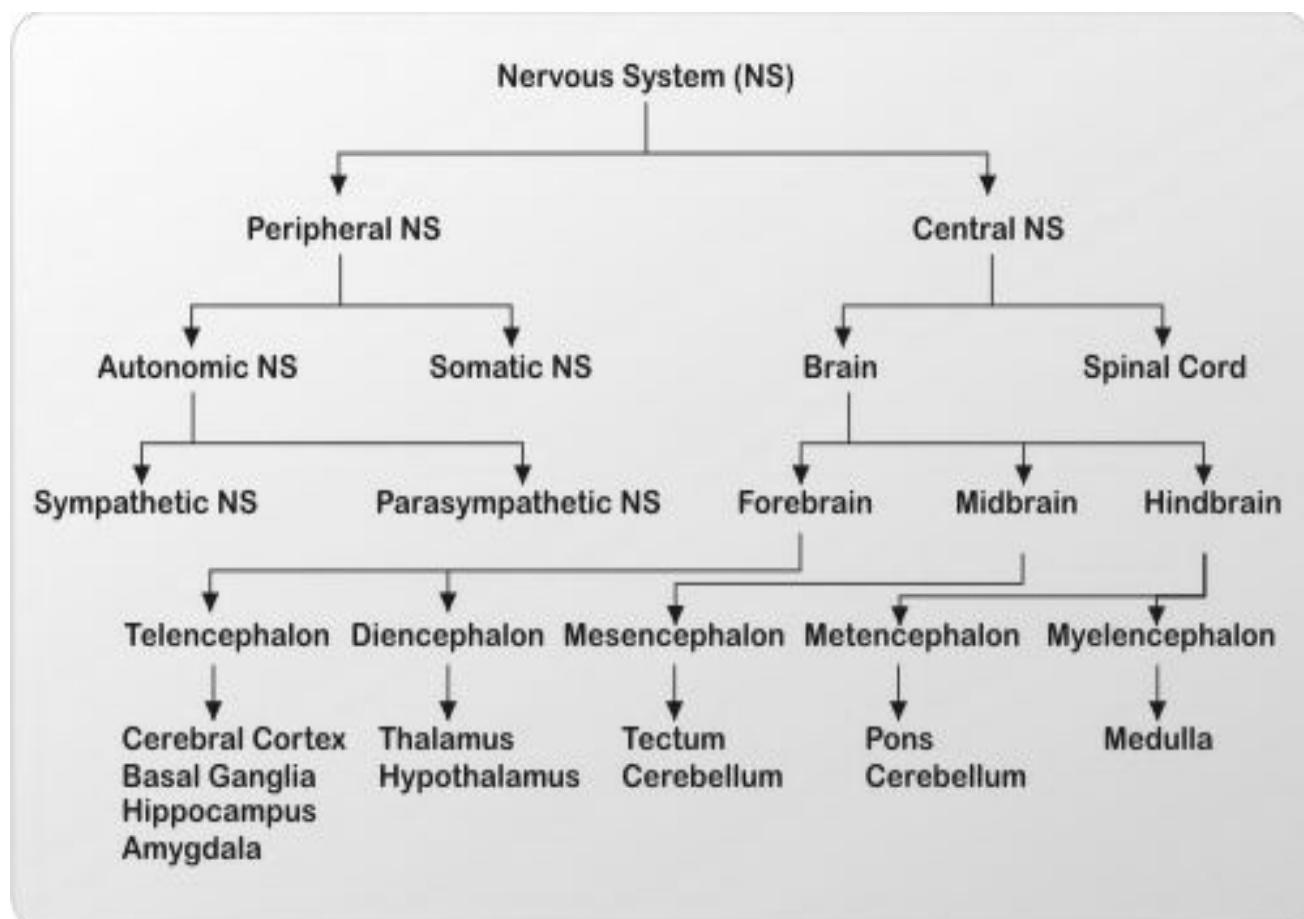


Figure 2.5

Myers/DeWall, *Psychology in Everyday Life*, 4e, © 2017 Worth Publishers

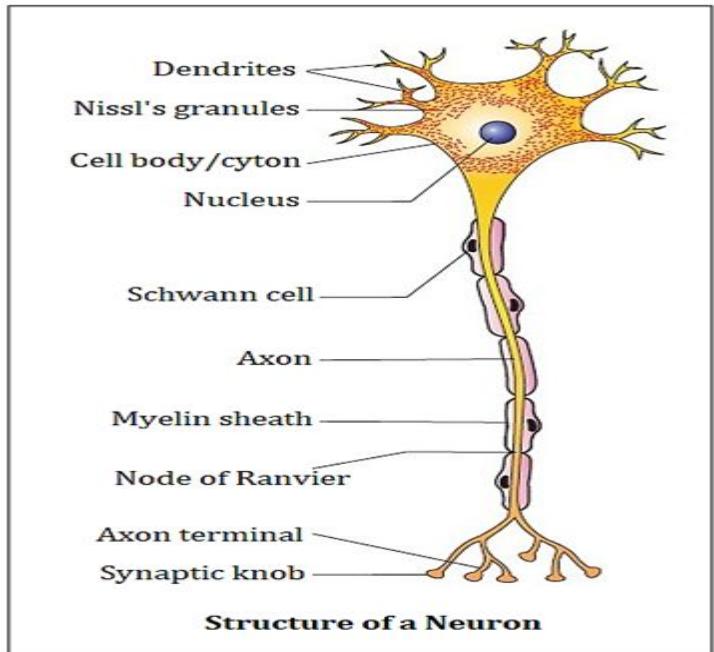


Neuron is the unit of nervous system:

The structural and functional unit of the nervous system is called the **neuron**. It is a special type of cell with a cell body and cell processes.

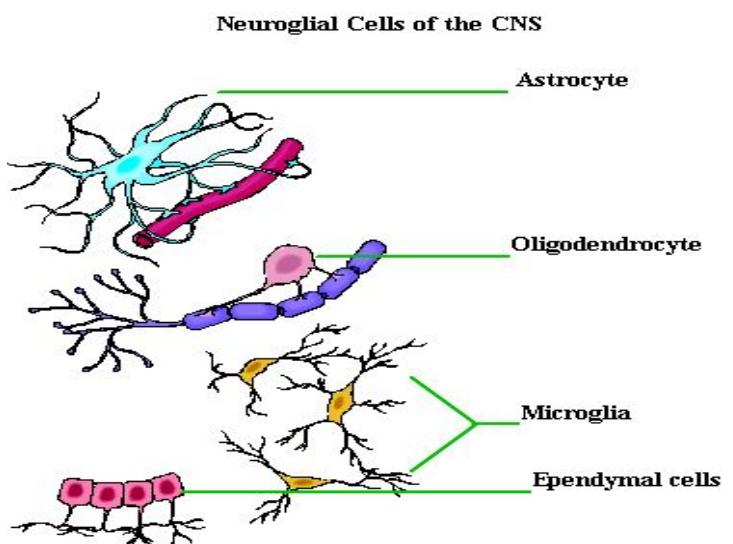
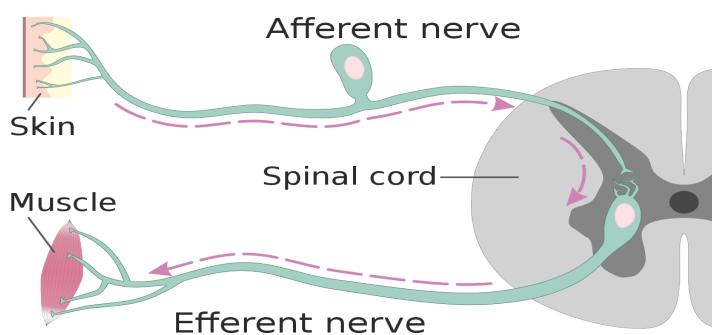
Neurons have

1. **Cell body/Cyton**:- the main processing center of the cell.
2. **Dendrites**:- they conduct nerve impulses towards the body.
3. **Axon or nerve fibers**:- long slender projection of nerve cells. This conduct nerve impulses away from cell body.
 - a. Myelin sheath
 - b. Node of Ranvier
 - c. Schwann cell
4. **Axon terminal or Terminal ends**:- it is axon terminal or synaptic knob. These axon terminals separated from neighbouring neurons by a small gap called **synapse**.



Types of Neurons:

1. **Efferent neuron (motor)**:- conveys information from the CNS to muscles & glands.
2. **Afferent neuron (sensory)**:- carry information from (Body part)sensory receptors to the CNS.
3. **Inter neurons**:- carry & process sensory information.



Neuroglia

These are non-neuronal cells in CNS & PNS, they don't produce electrical impulses.

Function: They support, protect, connect & remove debris from the nervous system.

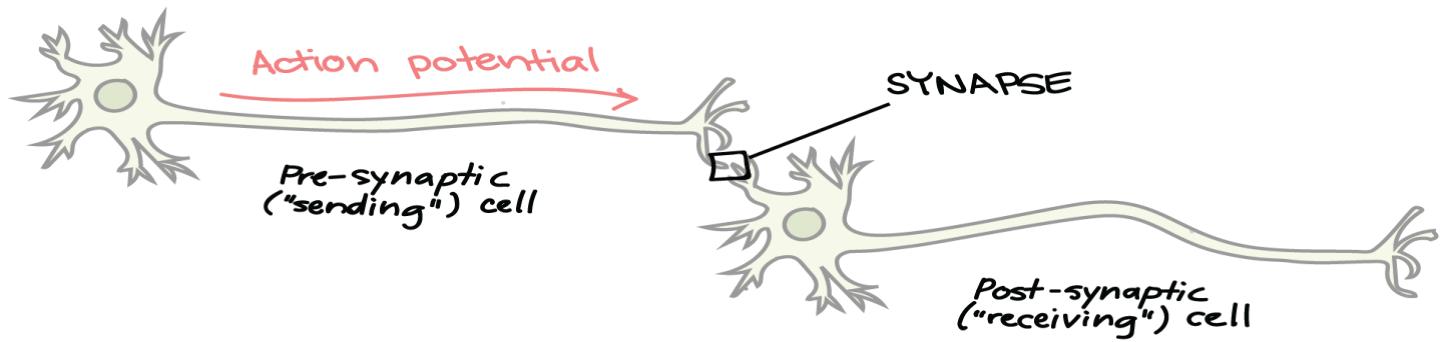
Types of neuroglial cells:

1. Astrocytes
2. oligodendroglia
3. Microglia

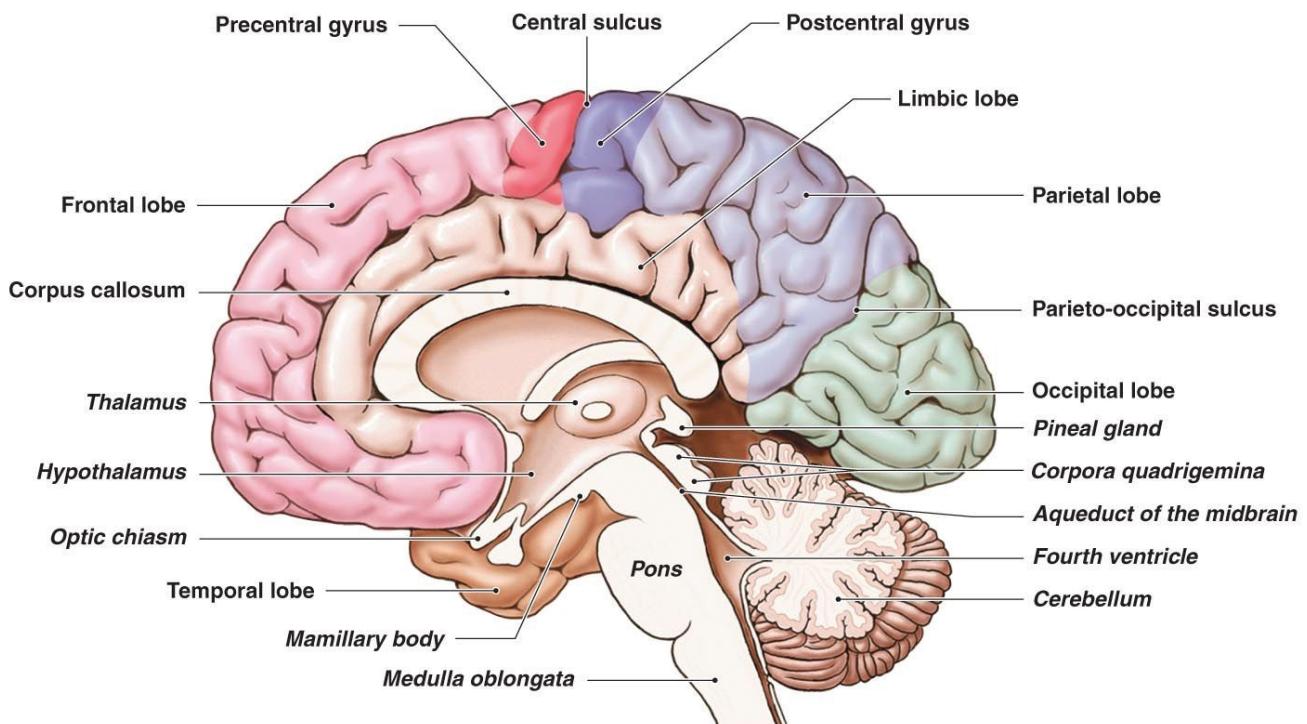
Synapse: The function of the synapse is to transfer electric activity (information) from one cell to another. The transfer can be from nerve to nerve (neuro-neuro), or nerve to muscle (neuro-myo)

Neurotransmitters

Are the chemicals that convey information to the target cells such as Dopamine, serotonin, epinephrine, norepinephrine



A midsagittal view showing the inner boundaries of the lobes of the cerebral cortex
(Structures outside of the cerebrum are labeled in italics.)



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CNS (Central Nervous System)

It has 2 major interconnected organ

- BRAIN & SPINAL CORD
- It acts as the integrating & command center of the Nervous system.

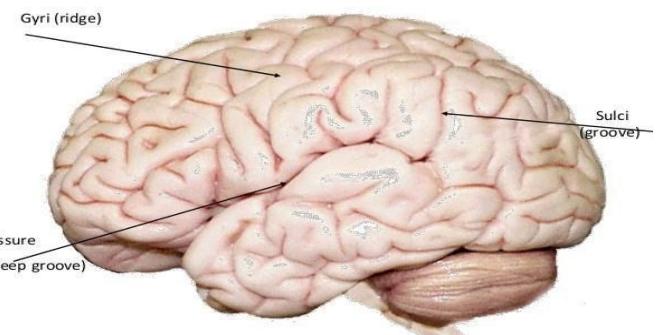
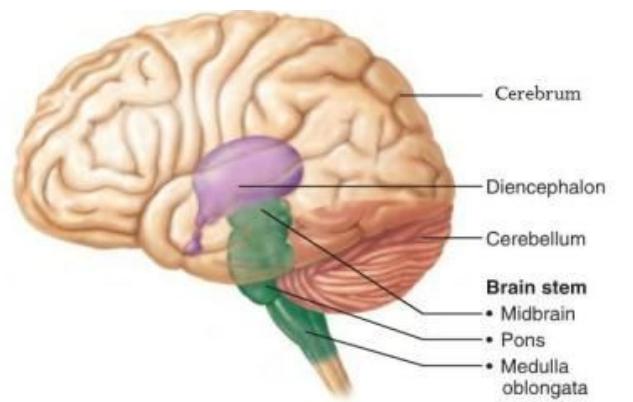
1.BRAIN:

Is located within the cranial cavity of the skull. It weighs 3 pounds, consists of 75% of water, 20% of oxygen & contains over 100 billion neurons. BRAIN CONSIST OF

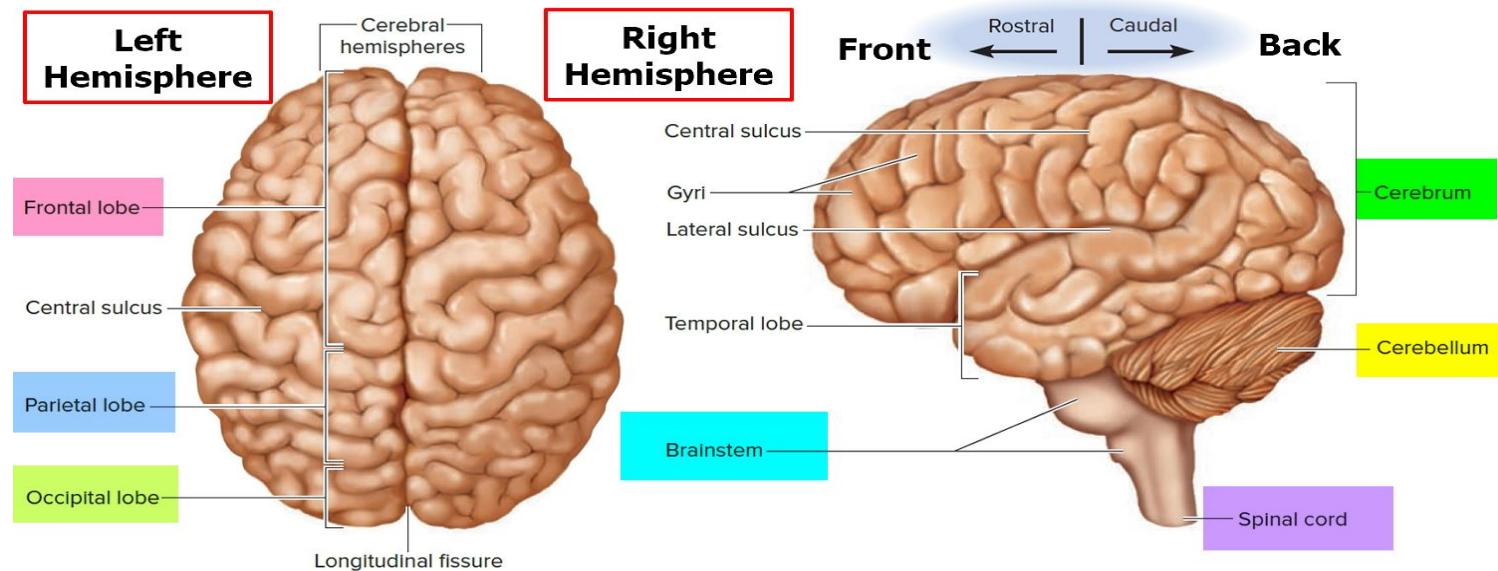
- Cerebrum
- Diencephalon
- Brain stem
- Cerebellum

Cerebral cortex has

Sulci, the grooves, and gyri, the folds or ridges, make up the folded surface of the cerebral cortex. A **sulcus** is a shallower groove that surrounds a gyrus. A **fissure** is a large furrow that divides the brain into **lobes** and also into the **two hemispheres** as the longitudinal fissure. It has 2 hemispheres: It has 4 lobes cortex **gray matter** (speech, memory, logical and emotional consciousness, voluntary and involuntary), **white matter**, basal nuclei.



- **Cerebrum:** Is the largest part of the brain, located above the cerebellum, its surface is called cerebral cortex. Connected by a bridge of nerve fibers that relay information between the 2 hemisphere called the **Corpus Callosum**.
- **Diencephalon:** It consist of **Thalamus & Hypothalamus**.
- **Brain stem:** Made up of **midbrain, pons, medulla oblongata**. Midbrain involves in visual reflex, pons controls respiratory function & medulla oblongata regulate heart & lungs and involves in swallowing, coughing, vomiting & sneezing process.
- **Cerebellum:** Right & Left (two hemispheres(grey(out),white(in)) The cerebellum is the area at the back and bottom of the brain, behind the brainstem. The cerebellum has several functions relating to **movement and coordination**, including: **Maintaining balance**.



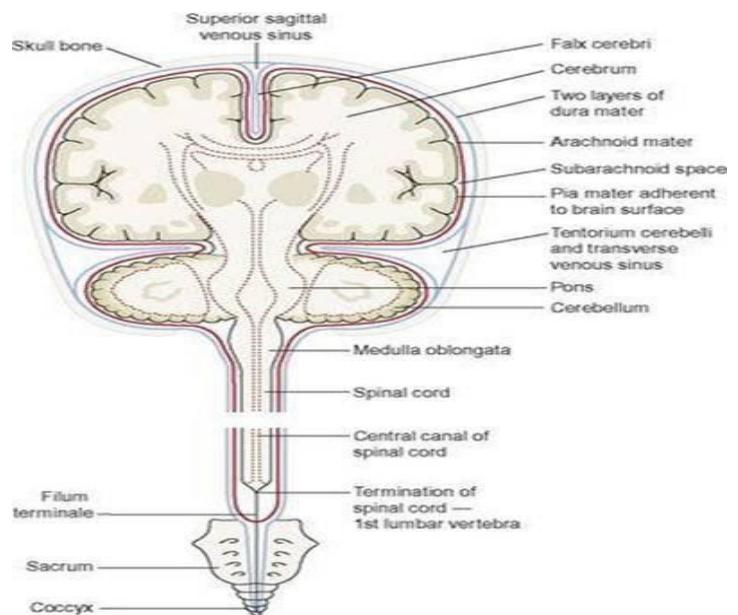
2. SPINAL CORD

It is a reflex center & conduction pathway.

It extends inside the foramen magnum from the **Medulla oblongata** of the brain to the area around the **first lumbar vertebra** in the lower back.

Protected by

- Vertebral column
- Cerebrospinal fluid (CSF)
- Meninges



Meninges

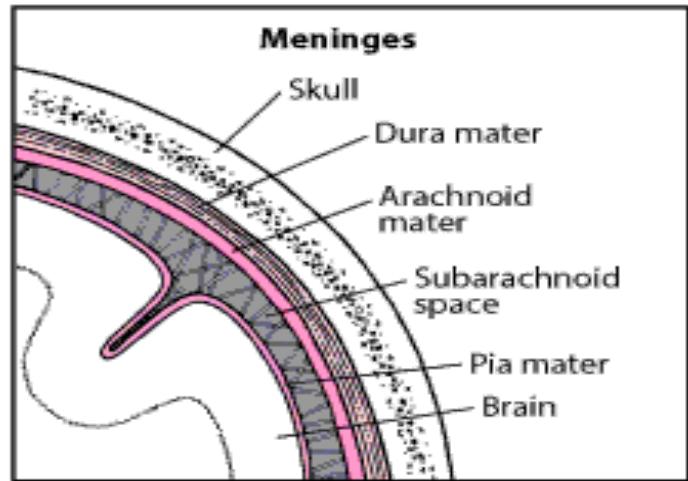
The meninges refer to the membranous coverings of the brain and spinal cord.

There are **three layers of meninges**:

1. **Dura mater**: outer membrane
2. **Arachnoid mater**: Middle membrane
3. **Pia mater**: innermost layer
4. Space between **pia** and **arachnoid** is called **subarachnoid space**.

This space contains a fluid called **CSF (cerebrospinal fluid)**.

CSF protects the brain and spinal cord from trauma. CSF supplies nutrients to nervous system tissue. CSF removes waste products from cerebral metabolism.



PNS (Peripheral Nervous System)

Divided into 2 major division

- Somatic nervous system
- Autonomic nervous system

Carries sensory, motor information between the CNS & all other organs & tissues of the body. **It consists of the nerves** that extend from the brain & spinal cord.

Nerves:

Nerves are solid cords composed of bundles of nerve fibers (each nerve fiber is an axon with its coverings) bound together by connective tissue.

Nerves are of two types;

- **Cranial nerves (12 Pairs)**: Cranial nerves arise from the **brain**. Carry impulses from & to the brain. See image at end of this chapter
- **Spinal Nerves (31 Pairs)**: Spinal nerves arise from the **spinal cord**. Carry impulses from & to the spinal cord

The collection of nerves at the end of the spinal cord is known as the **cauda equina**, it is horse tail like ending nerve.

Somatic nervous system

It is associated with **voluntary control** eg. Skeleton system. Carries sensory information from sensory organs to the central nervous system relays movement on command to muscles, controls voluntary movements.
Responsible for receiving & processing sensory input from the skin, muscle, sense organs.

Autonomic nervous system

- It is associated with **involuntary control**, Involuntary **bodily processes**, including heart rate, respiration, digestion, and pupil contraction, operates automatically without conscious direction. Eg: glands
- Responsible for carrying impulses from the CNS to glands, various smooth muscles, cardiac muscles.

Sympathetic nervous system (stimulates/arousing):- it prepares the body for action and stress. This is called “**flight or fight**”.

- Eg. Increase heart rate, Increase BP.
- **Sympathetic components** prepare body for stress and action
- (Neurotransmitter used = norepinephrine)
- Diverts blood from internal organs to skeletal muscles, heart & brain.

Parasympathetic nervous system (inhibits/calming):- it calms the body and helps the body to conserve energy. (maintains homeostasis)

- Eg. A normal digestion & elimination process occurs.
- **Parasympathetic** brings things back to normal
- (Neurotransmitter used = acetylcholine)
- Work in conjunction/opposition to each other
- Eg: “On” /“Off” switches

Functions of nervous system:

1. **CONTROL OF ALL BODY FUNCTIONS:** Nervous system is the master system of human body. It controls the activity of all other systems in such a way that all the systems collectively make a human being. Without a controlling system, there is no concept of life because in such case there will be no coordination between different body functions and they will all act separately. Nervous system not only controls the voluntary functions of human body that are directed by human will, but it also controls those functions that are below the level of consciousness of human beings. Control of a function means that the intensity of that function can be increased or decreased according to the demands of human body.
2. **COORDINATION OF DIFFERENT BODY ORGANS:** Nervous system not only produces coordination between different systems, but also between different organs of a system. To form an organ system, role of the component organs must also be coordinated. So nervous system is not only important for formation of an organism by different organ systems, but also for formation of a system by different organs of human body.
3. **Homeostasis:** The function depends on the activities of the Nervous System to detect, interpret and respond to changes in the internal and external conditions.

Medical Terminology of Nervous system

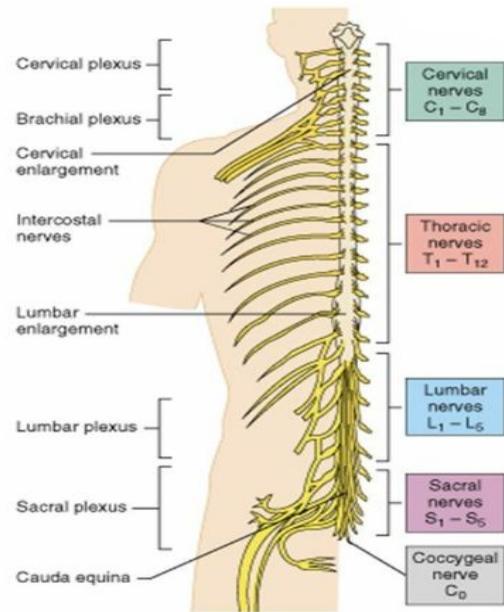
Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Nervous System		cephal(o)-	Of or pertaining to the head (as a whole)	Greek (képhalē), the head	Cephalalgia
Nervous System		cerebell(o)-	Of or pertaining to the cerebellum	Latin (cerebellum), little brain	Cerebellum

Nervous System	cerebr(o)-	Of or pertaining to the brain	Latin (cerebrum), brain	Cerebrology
Nervous System	encephal(o)-	Of or pertaining to the brain. Also see Cerebro.	Greek (enképhalos), the brain	Encephalogram
Eye, NS	fossa		Latin (fossa), ditch, pit	fossa ovalis
Nervous System	mening(o)-	membrane	Greek	Meningitis
Nervous System	narc(o)-	numb, sleep	Greek	narcolepsy
Nervous System	nerv-	Of or pertaining to nerves and the nervous system	Latin (nervus), tendon; nerve; Cognate with the Greek (neuron)	Nerve
Nervous System	neur(i)-, neur(o)-	Of or pertaining to nerves and the nervous system	Greek (neuron), tendon, sinew; nerve	Neurofibromatosis
Nervous System	phren(i)-, phren(o)-, phrenico	Combining forms denoting the diaphragm; the mind; the phrenic nerve	Greek	Phrenic nerve, schizophrenia
Nervous System	psych(e)-, psych(o)	Of or pertaining to the mind	Greek (psyché), breath, life, soul	Psychology, Psychiatry
Nervous System	rubr(o)-	Of or pertaining to the red nucleus of the brain	Latin (ruber), red	Rubrospinal
MS NS	thec-	case, sheath	Greek (theke)	Intrathecal
Nervous System	brain	encephal(o)-	cerebr(o)-	-
Nervous System	head	cephal(o)-	capit(o)-	-
Nervous System	mind	psych-	ment-	-
Nervous System	nerve; the nervous system	neur(o)-	nerv-	-

Cranial and spinal nerves

Spinal Nerves

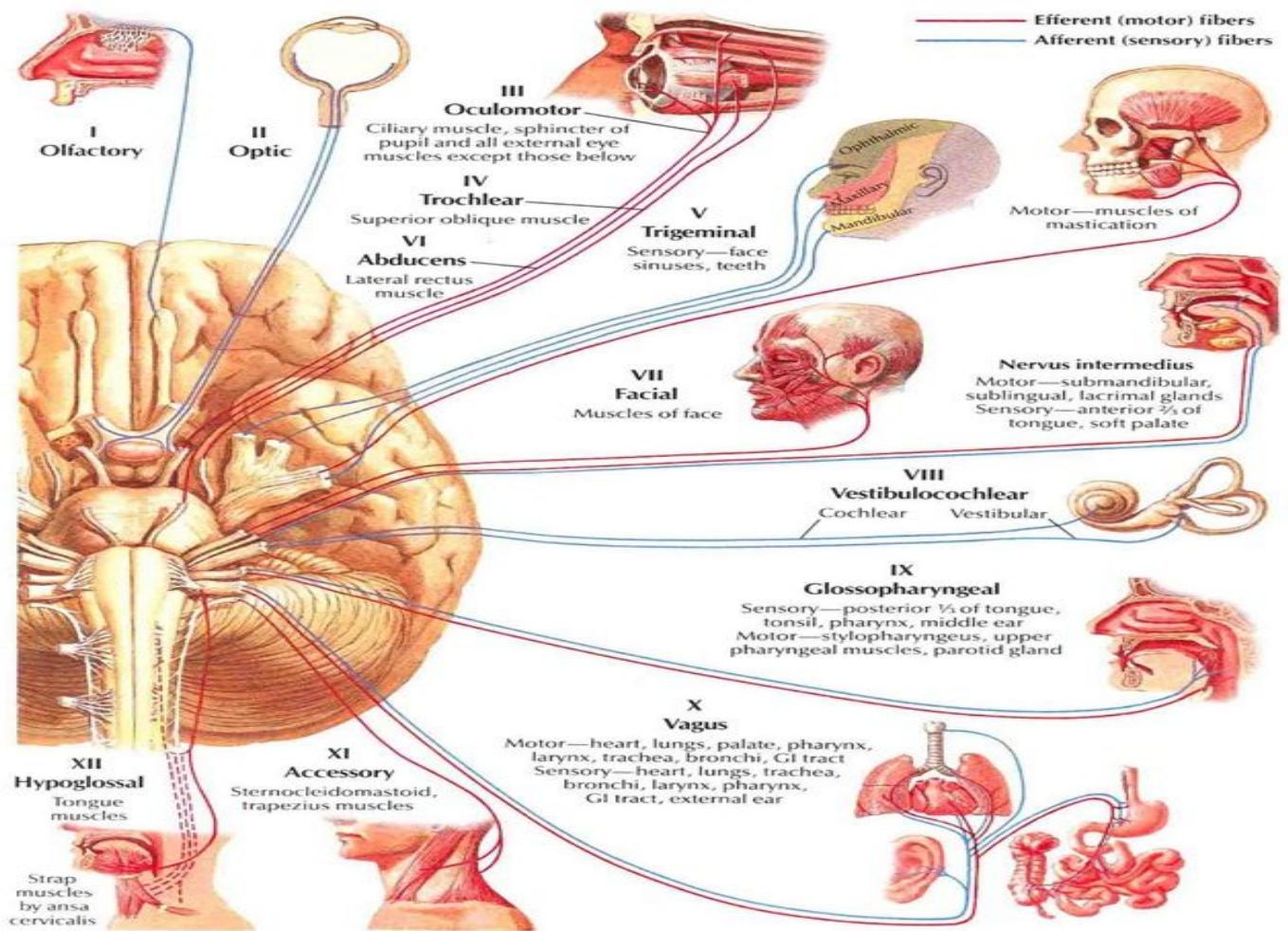
- 31 nerves connecting the spinal cord and various body regions.
 - 8 paired cervical nerves
 - 12 paired thoracic nerves
 - 5 paired lumbar nerves
 - 5 paired sacral nerves
 - 1 pair of coccygeal nerves



The Cranial Nerves

Nerve Number and Name	Composition	Some Functions
I Olfactory	Sensory only	Olfaction (smell)
II Optic	Sensory only	Vision
III Oculomotor	Motor and sensory	Serves muscles of the eye
IV Trochlear	Motor and sensory	Serves the superior oblique eye muscle
V Trigeminal	Motor and sensory	Sensory from face and mouth; motor to muscles of mastication (chewing)
VI Abducens	Motor and sensory	Serves the lateral rectus eye muscle
VII Facial	Motor and sensory	Serves the muscles of facial expression, lacrimal glands, and salivary glands
VIII Vestibulocochlear	Sensory only	Equilibrium and hearing
IX Glossopharyngeal	Motor and sensory	Serves the pharynx (throat) for swallowing, posterior third of tongue, parotid salivary gland
X Vagus	Motor and sensory	Sensations from visceral (internal) organs, and parasympathetic motor regulation of visceral organs
XI Accessory	Motor and sensory	Serves muscles that move head, neck, and shoulders
XII Hypoglossal	Motor and sensory	Serves muscles of the tongue

- Olfactory smell
- Optic vision, afferent light reflex
- Oculomotor eyelid elevation, eye elevation, adduction.
- Trochlear eye intorsion
- Trigeminal facial and corneal sensation, muscles of mastication
- Abducent eye abduction
- Facial facial movement, taste fibres
- Vestibular balance
- Cochlear hearing
- Glossopharyngeal sensation-soft palate, taste fibres
- Vagus cough, palatal and vocal cord movements
- Accessory head turning, shoulder shrugging
- Hypoglossal Tongue Movement



Introduction to Endocrine System:

- **Endocrine system** is the system of **glands** of human body. The secretions of endocrine glands are known as **hormones**
- Endocrine glands are **ductless glands** of human body that pour their secretions (hormones) **directly into the blood**. They have three characteristic features that are:
 1. They are ductless
 2. They are highly vascularized
 3. They possess intracellular vacuoles or granules that store the hormones
- Generally the hormones regulate different functions of human body like growth, mood, development, and metabolism etc. They perform their function by attaching to the target cells and then communicating with them.
- **Exocrine glands** secrete its products directly into **its ducts**. Eg: Sweat, Salivary, Lacrimal gland

Endocrine glands are divided into 2 categories

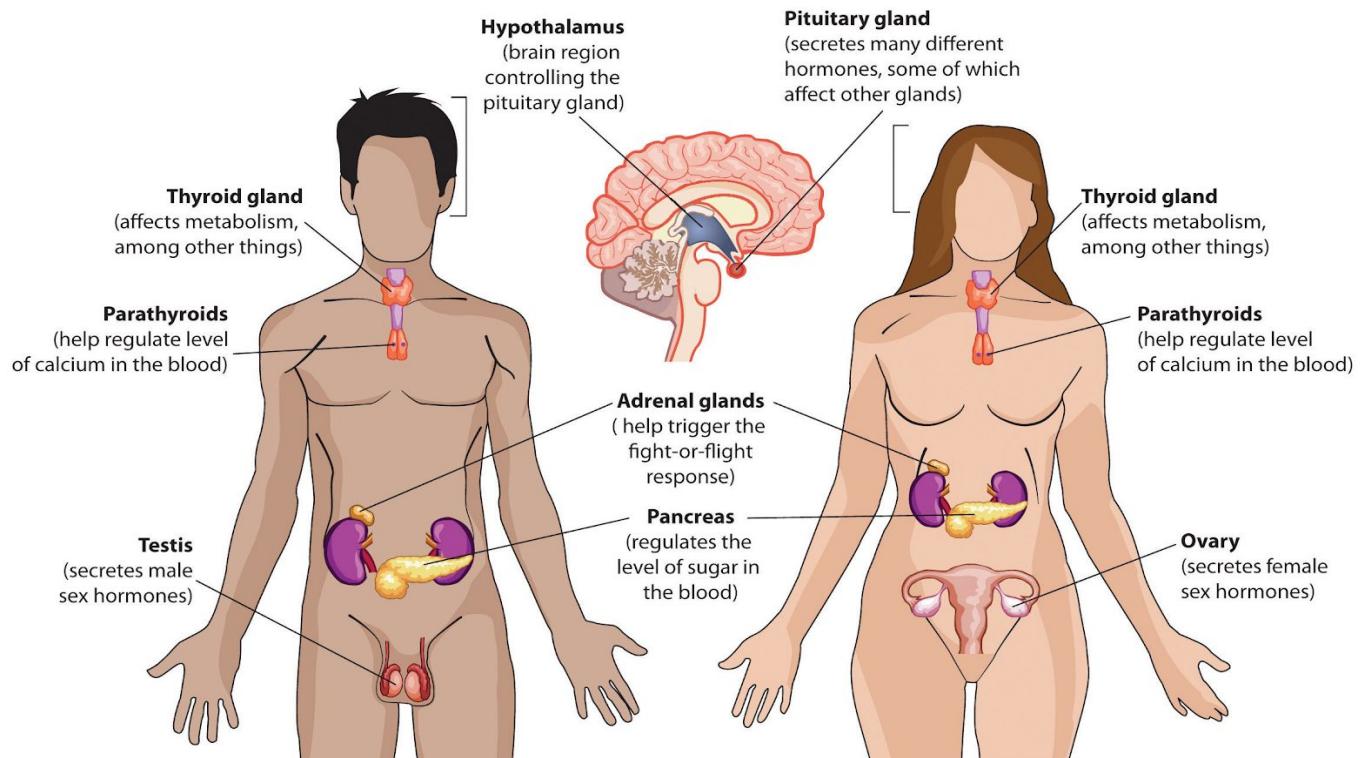
1. TYPICAL ENDOCRINE GLANDS: These glands have the **primary function** of producing hormones for the human body. Typical endocrine glands include;

- a. PITUITARY GLAND
- b. THYROID GLAND
- c. PARATHYROID GLANDS
- d. ADRENAL GLANDS

2. ORGANS HAVING SECONDARY ENDOCRINE FUNCTION:

These organs **primarily belong to some other system** of the body but have a **secondary function of producing hormones**. They include;

- a. PANCREAS (Hormones of Pancreas)
- b. OVARIES (In females) (Hormones of Ovaries)
- c. TESTES (In males) (Hormones of Testes)
- d. KIDNEYS (Hormones of Kidneys)
- e. LIVER (Hormones of Liver)

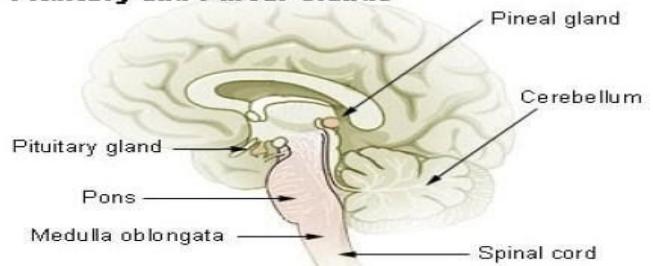


Glands in detail

Pineal gland

- It is a pea shaped structure in the brain.
- It produces **Melatonin**.
- It regulates sleep patterns, called as **circadian Rhythms**

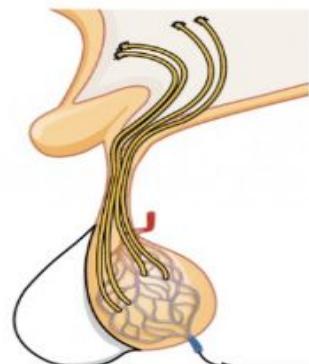
Pituitary and Pineal Glands



Hypothalamus

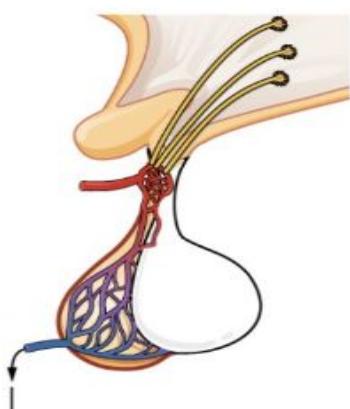
The hypothalamus is a part of the brain that has a vital role in controlling many bodily functions including the release of hormones from the pituitary gland

Hormones produced in the hypothalamus are corticotropin releasing hormone, dopamine, growth hormone releasing hormone, somatostatin, gonadotrophin releasing hormone & thyrotrophin releasing hormone, ADH and Oxytocin



Posterior Pituitary Hormones

Releasing hormone (hypothalamus)	Pituitary hormone	Target	Effects
ADH	Stores ADH	Kidneys, sweat glands, circulatory system	Water balance
-	OT	Female reproductive system	Triggers uterine contractions during childbirth



Anterior Pituitary Hormones

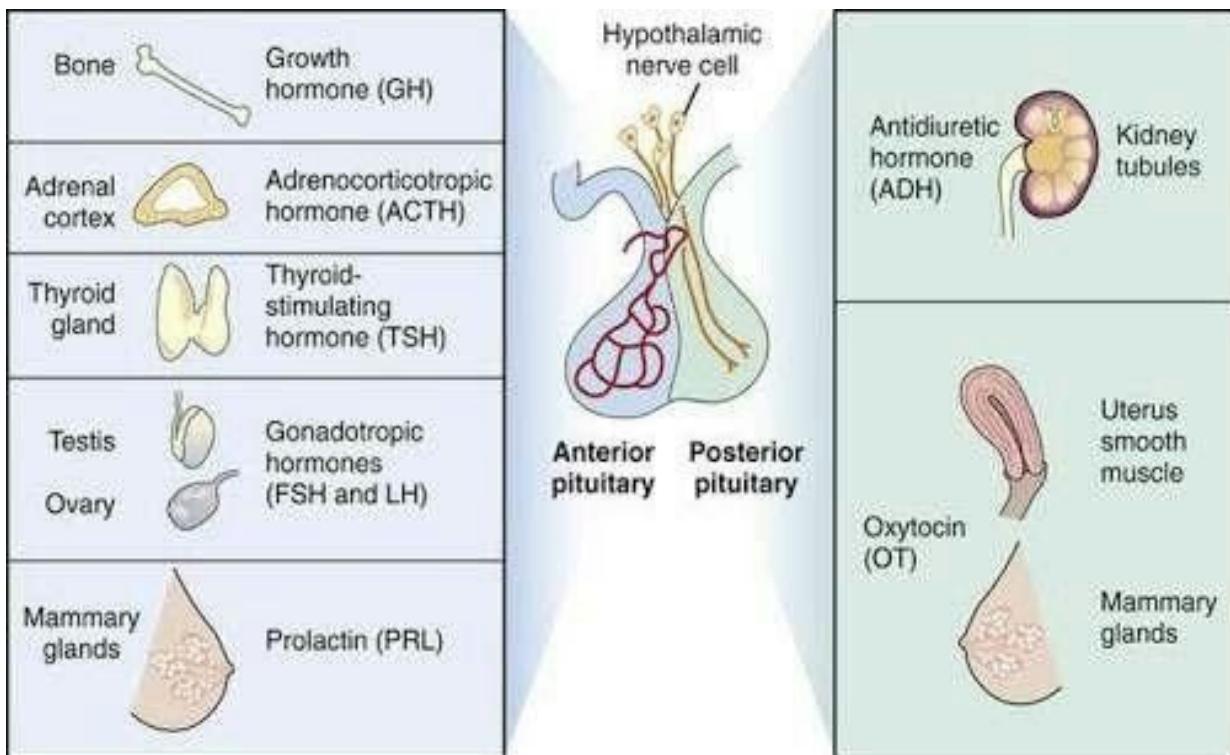
Releasing hormone (hypothalamus)	Pituitary hormone	Target	Effects
GnRH	LH	Reproductive system	Stimulates production of sex hormones by gonads
GnRH	FSH	Reproductive system	Stimulates production of sperm and eggs
TRH	TSH	Thyroid gland	Stimulates the release of thyroid hormone (TH). TH regulates metabolism.
PRH (inhibited by PIH)	PRL	Mammary glands	Promotes milk production
GHRH (inhibited by GHIH)	GH	Liver, bone, muscles	Induces targets to produce insulin-like growth factors (IGF). IGFs stimulate body growth and a higher metabolic rate.
CRH	ACTH	Adrenal glands	Induces targets to produce glucocorticoids, which regulate metabolism and the stress response

Pituitary Gland

The pituitary gland is a small pea-sized gland that plays a major role in regulating vital body functions and general wellbeing. It is referred to as the body's '**master gland**' because it controls the activity of most other hormone-secreting glands.

It has 3 lobes:-

1. Anterior lobe or anterior pituitary gland
2. Intermediate lobe
3. Posterior lobe or posterior pituitary gland



Anterior pituitary gland secretes

1. **GH (Growth hormone):** It mainly acts on bone during the growth period.
 - a. GH releasing hormone (GHRH) & GH inhibiting hormone (GHIH) is secreted by hypothalamus. (GH regulating hormones)
 - b. **Diseases:-** Gigantism, Acromegaly, Dwarfism
2. **Prolactin:** Helps in Development of the mammary gland & in milk production or synthesis.
3. **TSH (Thyroid Stimulating Hormone):** Hypothalamus secrete **TRH** (thyroid releasing hormone) that acts on anterior pituitary gland to secrete TSH. This TSH acts on the thyroid gland for secreting its (T3 & T4) hormone.
4. **ACTH (Adrenocorticotrophic Hormone):** Often produced in response to biological stress.
 - a. Its effects are increased production & release of corticosteroids (cortisol)
5. **FSH (Follicle Stimulating Hormone):** Acts on ovarian follicles. Regulates the development, growth, pubertal maturation & Reproductive process of the body.
6. **LH (Luteinizing Hormone):** Rise of LH triggers ovulation & development of corpus luteum (is a mass of cells that forms in a ovary & responsible for the production of hormone progesterone during early pregnancy)
 - a. In male it stimulates the production of testosterone

<p>Intermediate lobe secrete</p> <p>Melanocyte stimulating hormone (MSH) stimulates the production and release of melanin by melanocytes in skin and hair. Acting in the hypothalamus, MSH suppresses appetite.</p> <ul style="list-style-type: none"> • MSH secreted in the hypothalamus also contributes to sexual arousal. 	<p>Posterior pituitary gland.</p> <ol style="list-style-type: none"> 1. ADH/Vasopressin (Antidiuretic Hormone) <ol style="list-style-type: none"> Hypothalamus synthesis this hormone and are in the posterior pituitary gland. Function:- <ol style="list-style-type: none"> To retain water in the body To constrict blood vessels. Diseases:- Diabetes insipidus(increase thirst & increase polyuria) 2. Oxytocin <ol style="list-style-type: none"> Hypothalamus synthesis this hormone and are stored in the posterior pituitary gland. <ol style="list-style-type: none"> Contraction of mammary gland for milk production. Stimulate contraction of smooth muscle of the uterus during labour
---	--

Thyroid Gland: It weighs 25g, looks like a butterfly in shape, and consists of **2 lobes**. It secretes

- **T3 (Tri-iodothyronine)**
- **T4 (Thyroxine)**

T3 helps in growth & development of the body.

- It regulates the body's Metabolism, temperature & heart rate
- It involves in the Iodine trapping process

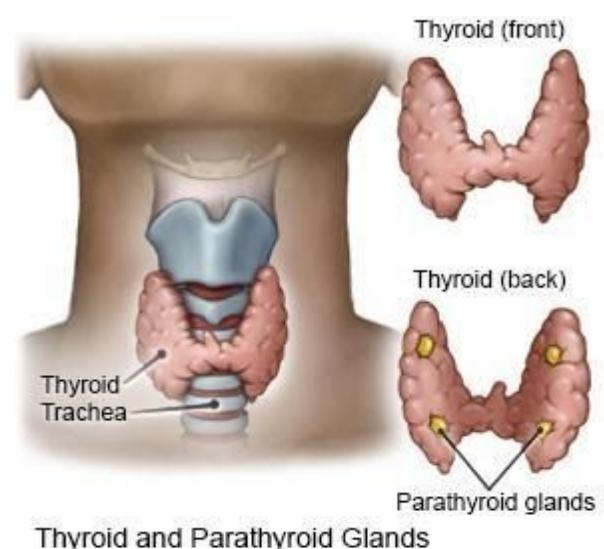
T4 controls the development of body and maturation.

- Deficiency of T4 causes delayed development of the body.

Calcitonin is an hormone secreted by C cells of the thyroid gland

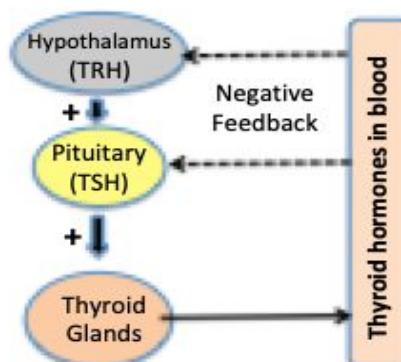
- Increase bone calcium
- Decrease blood calcium level

Disease:- Goiter (enlargement of thyroid gland due to deficiency of iodine), Hypothyroidism, Hyperthyroidism



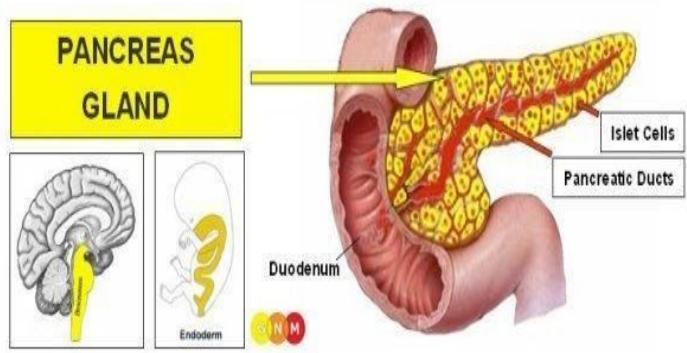
Parathyroid gland

- **4 parathyroid glands** are present in the thyroid gland, the chief cells of parathyroid gland secrets **Parathyroid hormone**.
- It's essential for life, removal of these glands causes death from asphyxia.
- **Functions:-** Increase the blood calcium level. Controls calcium and phosphorus
- **Diseases:-** Rickets, Osteomalacia, Hypoparathyroidism, Hyperparathyroidism



Pancreas

- The pancreas is unique in gland, it has both an endocrine and exocrine function.
- Exocrine gland** secrete digestive enzymes.
- Endocrine functions:-** The **islets of Langerhans** are a cluster of cells within the pancreas, which have
 - Alpha cells:** **Glucagon** (Increase blood sugar level)
 - Beta cells:** **Insulin** (decrease blood sugar level)
 - Delta cells:** **Somatostatin** (regulate blood sugar level)
- Disease:** Diabetes mellitus Type 1 & Type 2

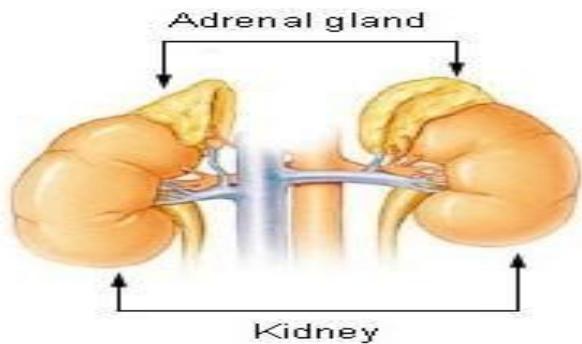


Adrenal gland

It's also called **suprarenal gland**. It is 4cm long & 3cm thick.

It has 2 regions

- Outer part called cortex
- Inner part called medulla



Cortex produces 3 hormones, they are collectively called **adrenocorticoids**.

- Glucocorticoids:-** It produce **cortisol** (steroid) hormone
 - Its function is to control blood sugar levels and metabolism.
- Mineralocorticoids:-** **Aldosterone** is the main mineralocorticoids.
 - It maintains water & electrolyte balance.
- Sex hormones:-** **Androgens** are main sex hormone
 - In male, it acts on testis to produce **testosterone**
 - In female, it acts on the ovary to produce **estrogen**.
 - They contribute to the onset of puberty.

Diseases:- Cushing syndrome (cause due to increase cortisol), Addison's disease (cause due to decrease cortisol)

Medulla region of adrenal gland produces

Epinephrine, also called adrenaline, has powerful effects on the body. These include:

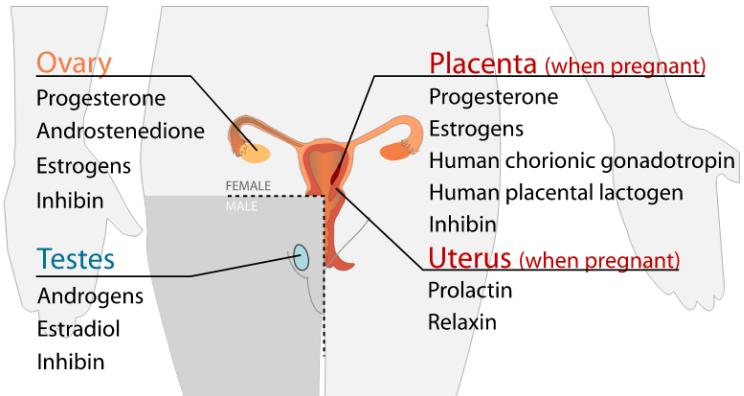
- increased blood sugar levels
- increased heart rate
- increased contractility (how hard the heart squeezes)
- relaxation of smooth muscle in the airways to improve breathing

These effects are designed to provide your body with extra energy. When you're very stressed or afraid, your body releases a flood of epinephrine. This is known as the **fight-or-flight response, or adrenaline rush**.

Norepinephrine, also called noradrenaline, has effects similar to those of epinephrine, such as:

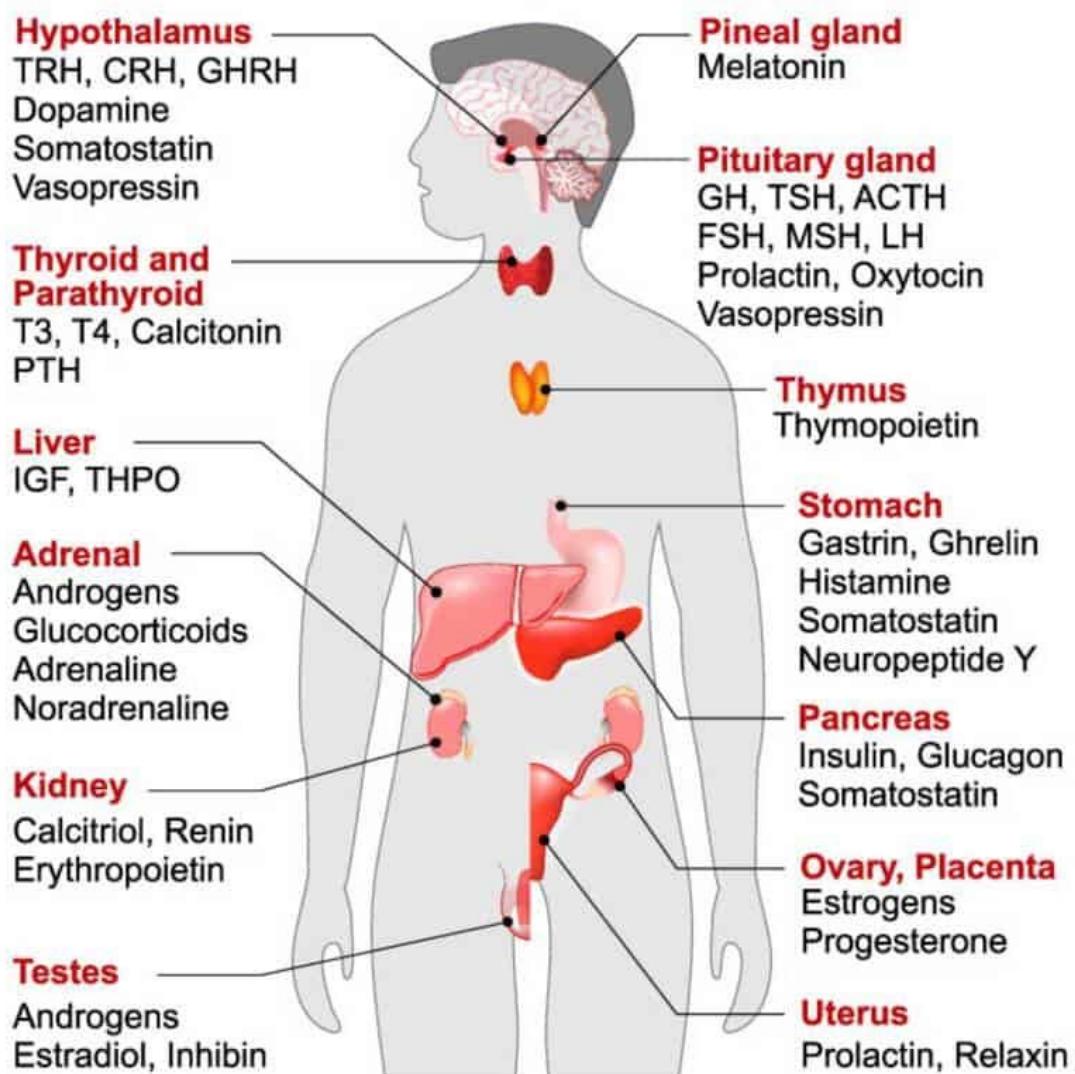
- increased blood sugar levels
- increased heart rate
- increased contractility

Norepinephrine can also cause your blood vessels to narrow, which increases blood pressure.

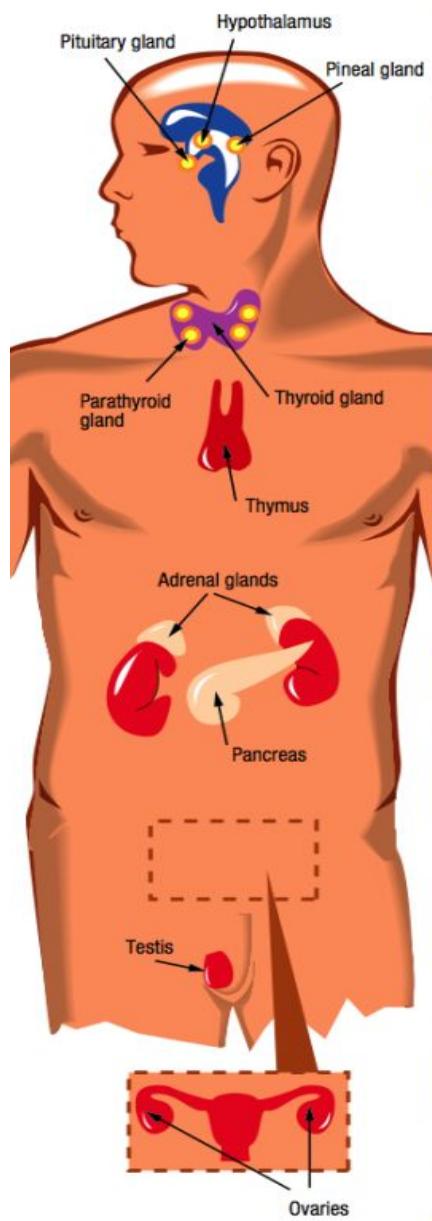
<p>Gonads: Its a sex organs, which produce hormones.</p> <ul style="list-style-type: none"> In males:- Testis is the sex organ where hormone testosterone is produced. Its function is to stimulate, develop & maintain secondary sexual characteristics such as Hair growth & deep pitch voice In females:- Ovaries are the sex organ where hormones like progesterone & estrogen is produced 	 <p>The diagram illustrates the female reproductive system with the following hormone secretions:</p> <ul style="list-style-type: none"> Ovary: Progesterone, Androstenedione, Estrogens, Inhibin Testes: Androgens, Estradiol, Inhibin Placenta (when pregnant): Progesterone, Estrogens, Human chorionic gonadotropin, Human placental lactogen, Inhibin Uterus (when pregnant): Prolactin, Relaxin
<ul style="list-style-type: none"> ESTROGEN results in secondary sexual characteristics & prepares the body for childbirth. It is increased at the time of puberty causing the growth of uterus. PROGESTERONE are secreted by the corpus luteum, which prepares the uterus for implantation of fertilized egg & allows complete shedding of the endometrium layer during menstruation <p>A corpus luteum is a mass of cells that forms in an ovary and is responsible for the production of the hormone progesterone during early pregnancy.</p> <ul style="list-style-type: none"> Relaxin is a hormone produced by the ovary and the placenta with important effects in the female reproductive system and during pregnancy. In preparation for childbirth, it relaxes the ligaments in the pelvis and softens and widens the cervix. 	<ul style="list-style-type: none"> Human chorionic gonadotropin (HCG) is a hormone produced by cells that are surrounding a growing embryo, which eventually forms the placenta after implantation. The presence of hCG is detected in some pregnancy tests Inhibin, hormone secreted by the granulosa cells in the ovaries of women that acts primarily to inhibit the secretion of follicle-stimulating hormone (FSH) by the anterior pituitary gland Prolactin is produced by the pituitary gland in the brain. It's also known as PRL or lactogenic hormone. Prolactin is mainly used to help women produce milk after childbirth. Produced in male also but use not known
<p>Kidney</p> <ol style="list-style-type: none"> Erythropoietin is a hormone, produced mainly in the kidneys, which stimulates the production and maintenance of red blood cells Vitamin D (Calcitriol) Bioactive vitamin D or calcitriol is a steroid hormone that has long been known for its important role in regulating body levels of calcium and phosphorus, and in mineralization of bone 	

Functions of the Endocrine System:

- The endocrine system is a regulatory system of human body. In fact it associates the nervous system in controlling body functions.
- The control of body function by the nervous system is called **nervous coordination** and the control of body functions by the endocrine system is called **chemical coordination**.
- The control of body functions by the endocrine system is a long term control system.
- All the necessary changes and adaptations of the body, required for the long term control of a specific function, are influenced by the hormonal system.



Endocrine System



Gland	Hormone	Type	Action
Hypothalamus	Oxytocin Antidiuretic hormone Regulatory hormones of anterior pituitary hormones	Peptide	Moves to posterior pituitary for storage Moves to posterior pituitary for storage Act on anterior pituitary to stimulate or inhibit hormone production
Pituitary gland			
Posterior	Oxytocin Antidiuretic hormone	Peptide	Initiates labor, initiates milk ejection Stimulates water resorption by kidneys
Anterior	Growth hormone Prolactin Follicle-stimulating hormone Luteinizing hormone Thyroid-stimulating hormone Adrenocorticotropic hormone	Protein Protein Glyco-protein Glyco-protein Glyco-protein	Stimulates body growth Promotes lactation Stimulates follicle maturation and production of estrogen; stimulates sperm production Triggers ovulation and production of estrogen and progesterone by ovary; promotes sperm production Stimulates release of T ₃ and T ₄ Promotes release of glucocorticoids and androgens from adrenal cortex
Thyroid gland	T ₃ (Triiodothyronine) T ₄ (Thyroxine) Calcitonin	Amine Amine Peptide	Increases metabolism, blood pressure, regulates tissue growth Increases metabolism, blood pressure, regulates tissue growth Childhood regulation of blood calcium levels through uptake by bone
Parathyroid gland	Parathyroid hormone	Peptide	Increases blood calcium levels through action on bone, kidneys and intestine
Pancreas	Insulin Glucagon	Protein Protein	Reduces blood sugar levels by regulating cell uptake Increases blood sugar levels
Adrenal glands			
Adrenal medulla	Epinephrine Norepinephrine	Amine Amine	Short-term stress response: increased blood sugar levels, vasoconstriction, increased heart rate, blood diversion Short-term stress response: increased blood sugar levels, vasoconstriction, increased heart rate, blood diversion
Adrenal cortex	Glucocorticoids Mineralocorticoids	Steroid Steroid	Long-term stress response: increased blood glucose levels, blood volume maintenance, immune suppression Long-term stress response: blood volume and pressure maintenance, sodium and water retention by kidneys
Gonads			
Testes	Androgens	Steroid	Reproductive maturation, sperm production
Ovaries	Estrogens Progesterone	Steroid	Reproductive maturation, regulation of menstrual cycle Regulation of menstrual cycle
Pineal gland	Melatonin	Amine	Circadian timing
Thymus	Thymosin	Peptide	Development of T lymphocytes

Medical Terminology of Endocrine

Organ System	Disease process	Prefix or suffix	Meaning	Origin language and Etymology	Example(s)
Endocrine		aden(o)-, aden(i)-	Of or relating to a gland	Greek (adēn, aden-), an acorn; a gland	Adenocarcinoma, adenology, adenotome, adenopathy
Endocrine		adren(o)-	Of or relating to adrenal glands	Latin	adrenal artery

Endocrine		-crine	to secrete		Endocrine
Endocrine		thyro-	thyroid	Greek	
Endocrine		gland	aden(o)-	-	-