

Diseases and disorders:

1. Obesity - excess body fat, BMI - used to assess obesity
2. BMI -  $\frac{\text{Body wt (kg)}}{\text{height (m)}^2}$ , Normal BMI - 19 - 25
3. Peptic ulcer - eroded mucosa of stomach and duodenum infection by Helicobacter pylori and excess aspirin intake
4. PEM - Protein energy malnutrition
5. Marasmus - thin - PEMalnutrition
6. Kwashiorkar - Oedema, Protein Energy malnutrition
7. Indigestion - digestive disorder
8. Constipation - Rectum region (faeces retained)
9. Vomiting - reverse peristalsis - contaminated food
10. Gall stone - gall bladder crystals of cholesterol
11. Jaundice - defective liver, failure of the break down and removal of Bile pigment from blood
12. Liver Cirrhosis - degeneration of Liver cells, by poison malnutrition
13. Duodenal ulcer - 25-45 yrs
14. Appendicitis - inflammation of appendix
15. Peritonitis - delayed appendicitis and rupture
16. Hiatus Hernia - diaphragmatic hernia - stomach above diaphragm, lifting heavy object
17. Diarrhoea - gastrointestinal disorder, colon infection
18. Renal failure - kidney stops functioning, decrease in Nephron function
19. Gastric ulcer - above 50 yrs
20. Acute Mountain sickness - AMS - high altitudes low PO<sub>2</sub>, low O<sub>2</sub> binding with Hb-Haemoglobin, dizziness
21. Nitrogen Narcosis - Scuba divers, Nitrogen bubble in blood
22. Asthma - inflammation of bronchi and bronchiole caused by pollution
23. Emphysema - widening alveoli, smoking
24. Bronchitis - inflammation of Bronchi - pollution
25. Pneumonia - inflammation of lungs and infection
26. T.B - infection of lungs and bones
27. COPD - emphysema, chronic bronchitis and asthma
28. COLD - emphysema and chronic bronchitis
29. Coronary heart disease - caused by atheroma
30. atheroma - cholesterol and cells form atherosclerosis
31. Angina pectoris - ischemic pain, in heart muscle caused by Atheroma (block)
32. Stroke - Brain haemorrhage
33. Myocardial infarction - Heart failure, Ischemic defect in heart muscle contractibility, lack of O<sub>2</sub>
34. Rheumatoid Heart disease - auto immune disease, Streptococcal infection
35. Cardio Pulmonary Resuscitation (CPR)- James Elam and Peter Safar - first to do CPR
36. Urethritis - inflammation of Urethra
37. Cystitis - bladder infection
38. Pyelitis (or) pyelonephritis - renal inflammation
39. dysuria - painful urination
40. Renal failure - kidney stops functioning
41. Uremia - increase in urea and creatinine in blood, Normal 17-30 mg/100 ml of bl
42. Renal calculi - Renal stone
43. Nephrolithiasis - Renal stone
44. Renal stone - sodium oxalate and phosphate stone removed by lithotripsy and pyelotomy
45. Glomerulo nephritis or Bright's disease - inflammation of glomeruli, caused by streptococcal
46. Glomerulo nephritis symptom - water and salt retention, proteinuria
47. Myasthenia gravis - Auto immune disorder, acetyl choline is affected, paralysis of skeletal muscle
48. Muscle pull - Muscle sprain, tear
49. Osteoarthritis - wear off of joints in aged people
50. Osteoporosis - deficiency of vitamin D, hormone imbalance
51. Rheumatoid arthritis - inflammation of synovial membrane and fluid accumulation in joints
52. Arthritis - inflammation and damage of joint

53. Gouty Arthritis - caused by accumulation of uric acid, crystal at joints
54. Muscular dystrophy - weakening of Muscle fibre also called as Duchene Muscular dystrophy
55. Muscle Atrophy - cessation of muscle activity, reduction in muscle size
56. Muscle fatigue - inability of muscle to contract lack of ATP, accumulation of lactic acid
57. Haemodialysis - Malfunctioning of kidney, accumulation of urea
58. Hypermetropia - long sightedness, corrected by convex lens
59. Presbyopia - aging, less elasticity of lens, corrected by convex lens
60. Tetany - Rapid muscle spasm, deficiency of parathyroid hormone, reduced calcium level
61. Astigmatism - irregular curvature of lens and cornea
62. Myopia - Refractive error - short sightedness, corrected by concave lens
63. Cataract - lens opaque
64. Dwarfism - hypo or less secretion of Growth hormone in children, height-4 feet
65. Gigantism - hyper or more secretion of Growth hormone in children, height-8 feet
66. Acromegaly - excess secretion of Growth hormone in Adult, over growth of Jaw bones and visceral organ
67. Cretinism - hypothyroidism, retarded skeletal growth, protruding tongue, retarded mental ability
68. Myxoedema (or) Gull's disease - Hypo or less secretion of thyroxine in Adults, sparse hair, low BMR, memory loss
69. Thyrotoxicosis - Grave's disease, exophthalmic goitre, hyper secretion of thyroid, protrusion of eye ball
70. Simple or endemic goitre - hyposecretion of thyroxine enlargement of thyroid
71. Addison's disease - hypo secretion or less secretion of glucocorticoids and mineralocorticoids hyper pigmentation

72. Cushing's Syndrome - excess secretion of cortisol or glucocorticoids, redness of face, Atrophy of gonads
73. Diabetes mellitus - less secretion of Insulin, more blood, glucose level
74. Diabetes insipidus - less secretion of vasopressin or ADH dilute urine

### Structure and organs

1. Renal pelvis - broad funnel shaped space inner to hilum
2. gastric rugae - folds of stomach
3. Brunner's gland - duodenum
4. tonsil - pharynx
5. tendon - collagen fibres attaching skeletal muscle and bone
6. Trachea - wind pipe
7. Oesophagus - food pipe
8. Peyer's patches - ileal mucosa
9. Crypts of leiberkuhn - small intestine, found at the base of villi
10. haustra - dilation in colon
11. Olecranon process - upper end of ulna, pointing to form elbow
12. piles or haemorrhoids - enlarged Anal column
13. Maculae - equilibrium receptor in Sacculae and utricle it has hair cells as mechanoreceptors
14. Vestibule - inner ear - organ of equilibrium
15. villi - finger like projection, ileal mucosa
16. Peyer's patches - ileal mucosa
17. Tactile merkel - epidermis of skin, sense of touch
18. Ruffini - dermis of skin, sense of continuous pressure
19. Pacinian corpuscle - dermis of skin, sense of vibration and Texture
20. Meissner's corpuscle - dermis of skin, light pressure is sensed, hairless region
21. vermiform appendix - caecum region, vestigial organ, small finger like, long in cattle
22. serosa - peritoneum
23. peptic or zymogen cells or chief cells - stomach, gastric gland

24. Goblet cells – digestive track – secrete mucus
25. Parietal or oxyntic cells – stomach secrete Hcl & intrinsic factor
26. Stenson duct – found in parotid, salivary gland
27. Wharton's duct – sub mandibular or sub maxillary salivary gland has this duct.
28. Rivinis or Bartholin's duct – associated with sublingual salivary gland
29. Glisson's capsule – thin sheath covering hepatic lobes
30. Sphincter of oddi – guarding hepato pancreatic duct into Duodenum
31. Tricuspid valve – between right atrium and right ventricle
32. Bicuspid valve – between left atrium and left ventricle
33. Semilunar valve – aorta and pulmonary artery
34. Trabeculae corneae – ridges in myocardium ventricle
35. chordae tendinae – modified trabecular connected to cuspid valve
36. SAN – Right atrium – Natural pace maker
37. AVN – between atrium and ventricle
38. Renal pyramid – found in medulla of kidney
39. Renal column of Bertini – cortex extending between pyramid
40. Renal corpuscle – bowman's capsule and glomerulus together
41. Nephron – has filtering corpuscle or renal corpuscle called malpighian body and a renal tubule
42. calyces – projection of renal pelvis
43. Podocytes – visceral layer of Bowman's capsule beginning region of renal tubule
44. Perimysium – sheath covering each fascicle
45. Peritubular capillary bed – efferent arteriole
46. patella – triangular knee bone
47. Bowman's capsule – beginning region of renal tubule, it is a cup with double wall, encloses capillaries
48. Peritubular capillary bed – efferent arteriole
49. JMN – Nephron that extends into medulla of kidney
50. Henle's loop – long in Juxta medullary Nephron
51. endomysium – covering sheath around muscle fibre
52. JMN – Juxta medullary Nephron extends into the medulla of Kidney
53. ctenidia – feather like gill in Mollusca
54. Pivot Joint – between carpals
55. Sterocilia – hair protruding from hair cell of organ of corti
56. Vasa recta – efferent arteriole bundle around the renal tubule
57. Hilum – centre of inner concave surface of kidney
58. Fascicle – bundle of muscle fibre
59. Myofibril – rod like structures of muscle fibre
60. epimysium – connective tissue covering the whole muscle
61. Sarcolemma – covering around plasma membrane
62. Sarcoplasm – cytoplasm of muscle
63. Myoglobin – respiratory pigment of muscle
64. Glycosomes – glycogen granule in muscle
65. Z-disc – inbetween the I band
66. Sarcomere – a segment of myofibril between two z-discs of skeletal muscle
67. Sarcoplasmic Reticulum – Endoplasmic reticulum in muscle
68. T-Tubules – invagination of Sarcolemma
69. myofibril – or Muscle fibre – muscle cell
70. Tropomyosin – protein regulating in Actin
71. Troponin – protein regulating in Actin
72. Clavicle – pectoral girdle, collar bone
73. Scapula – pectoral girdle – shoulder bone
74. Acromion – expanded region of Scapula, clavicle articulates with it
75. glenoid cavity – depression below acromion, head of humerus Articulates
76. axis – second vertebra
77. periosteum – double layer sheath covering bone
78. atlas – first vertebra
79. M-line – dark line bisecting the middle of H-Zone
80. H-Zone – light region middle of A band, clear zone

81. osteoblast-cells-found in periosteum inner layer
82. endosteum – sheath covering internal bone surface
83. ilium – part of coxa – superior flaring region
84. Ischium – part of coxa – curved bar of hip bone (coxa)
85. Pubis – a bone of coxa – v-shaped
86. Pubic symphysis – two halves of pelvic girdle connected in front by it
87. diaphysis – shaft of bone
88. epiphysis – end part of bone
89. Metaphysis – where epiphysis and diaphysis meet
90. epiphyseal plate or growth plate – between epiphyses and diaphysis
91. synarthroses – sutures of skull, immovable joint
92. Amphiarthroses – vertebral column, cartilage joint, slightly Movable
93. Diarthroses – movable joint, synovial fluid
94. Otolith – gelatinous otolithic membrane of Maculae contain calcareous particles called otolith
95. gliding joint – between carpals
96. Nissl's granule – granulated endoplasmic reticulum cyton
97. Axon hillock – cone shaped area of cyton
98. Neurilemma – plasma membrane covering neuron
99. axolemma – plasma membrane covering axon
100. Multipolar Neuron – inter neuron
101. Bipolar Neuron – eye, ear, olfactory region
102. Unipolar Neuron – ganglia of cranial and spinal nerve
103. Piamater – inner layer of brain membrane
104. Duramater – outer layer of brain membrane
105. gyri – folds in cerebrum
106. Sulci – grooves in cerebrum
107. mammillary body – Hypothalamus
108. choroid plexus – Epithalamus
109. Pineal body – Epithalamus, secretes melatonin
110. Rennet gland – excretory system in Aschelminthes
111. Preen gland – only oil gland in birds, base of tail
112. Pineal body – Epithalamus, secretes melatonin
113. Satiety centre – Hypothalamus
114. Corpora quadrigemina – Mid Brain
115. Vermis – Hind Brain
116. Statocysts – organ of balance found in Arthropoda
117. Rathke's pouch – invagination of pharyngeal epithelium forms Adenohypophysis
118. Zona fasciculate – 75%, middle region of cortex of adrenal
119. Zona Reticularis – 10% inner region of Adrenal cortex
120. Zona glomerulosa – 15 – outer region of Adrenal cortex
121. Thyroid – Neck region below Larynx, front of trachea
122. Thymus – located above the heart and behind sternum
123. Septum pellucidum – membrane separating the ventricle I and II
124. foramen of Monro – Inter ventricular foramen, connects ventricle I & II with III
125. aqueduct of Sylvius – connects III ventricle with IV
126. Corpus callosum – nerves connecting the cerebral hemisphere
127. acini – lobules of Thyroid
128. cauda equina – spinal cord lower end – bundle of nerve starting from lower end of spinal cord
129. ciliary glands – base of eyelashes, sebaceous
130. lachrymal gland – upper lateral region of orbit
131. ommatidia – found in compound eye of cockroach – 2000 ommatidia in a eye
132. Canal of Schlemm – Junction between Sclera and Cornea
133. Pupil – aperture of iris
134. Crista ampullaris –sensory area of ampulla found in the semicircular canal
135. Macula lutea – Yellow flat spot at the centre of retina, sharp vision
136. Blind spot – devoid of cones & rods, nerves & blood vessels enter the eye ball at this spot
137. Vestibular system – organ of balance
138. Maculae – equilibrium receptor in Saccule and utricle it has cells with hair, mechano receptor

139. fovea centralis – small depression at the centre of macula lutea, has only cone
140. Organ of Corti – on the basilar membrane in the cochlea
141. Ceruminous gland – external auditory meatus, secretes Cerumen
142. ANF – Atrial Natriuretic factor, secreted by Right atrial cells of Heart
143. Renin – released by JGA by macula densa and cell granules
144. JGA – Juxta Glomerular apparatus – Specialized tissue of Afferent arteriole of Juxta glomerular nephron
145. Gustatory hairs – tongue
146. Krause – thermoreceptors of skin
147. Parathyroid gland – at the back of thyroid gland four lobules
148. Neurohypophysis – Posterior pituitary
149. Adenohypophysis – Anterior pituitary
150. Pars nervosa – neurohypophysis
151. Pancreas – duodenum region
152. Hinge Joint – Knee
153. Arachnoid – median layer of Brain membrane
154. Krause – thermoreceptors of skin
155. flame cell – excretory cells in Platyhelminthes
156. Sella turcica – Pituitary gland is located in it
157. Sphenoid Bone – Sella turcica is found in the sphenoid bone
10. Angiotensin – plasma protein, increases Na<sup>+</sup> Reabsorption
11. Aldosterone – adrenal cortex – causes reabsorption of Na<sup>+</sup>, excretion of K<sup>+</sup> and absorption of water
12. Atrial Natriuretic factor – atrial cell of heart causes Na<sup>+</sup> excretion, lowers blood pressure
13. Acetylcholine – Neurotransmitter, Transmission of impulses at Neuron Junctions
14. Melatonin – Pineal body – regulates sleep – wake cycle
15. Sebum – lubricating fluid – ciliary gland of eye
16. CSF – Choroid plexus – shock absorber – protects brain
17. Lysozyme – destroys bacteria in gastric juice and lachrymal Secretion
18. Tear – lachrymal gland – moistens, protects
19. Growth Hormone – Anterior pituitary – peptide helps in growth
20. TSH (or) Thyrotropin, Thyroid stimulating hormone – Anterior pituitary, glycoprotein, stimulates thyroid to secrete thyroxine
21. ACTH – Anterior pituitary, peptide – stimulates adrenal cortex to secrete glucocorticoids and mineralocorticoids
22. FSH – Anterior pituitary, glycoprotein, regulates gonad Spermatogenesis, Maturation of ovarian follicle
23. LTH – Anterior pituitary – stimulates milk secretion
24. LH – Anterior pituitary, spermatogenesis and ovulation, gonadotropic
25. Vassopressin (or) ADH – Antidiuretic hormone, posterior pituitary peptide, reduces loss of water in urine
26. Oxytocin – posterior pituitary – quick birth of baby, peptide hormone, production of milk
27. melatonin – pineal gland, pigmentation, metabolism, menstrual cycle, defense, sleep wake, circadian rhythm
28. thyro calcitonin – para follicular – c – cells of thyroid gland, poly peptide reduces calcium in blood
29. Parathyroid hormone – parathyroid, peptide, hypercalcemic
30. glucocorticoids – Z.fasciculata and Z.reticularis of adrenal cortex, gluconeogenesis, proteolysis, lipolysis

#### Secretions, organs and functions

1. Thymosin, Thymopoietin, thymulin – Thymus – immunity
2. Gastric juice – gastric gland, protein digestion
3. Hcl – Parietal cell – digestion, activates pepsinogen, destroys Germs
4. Pepsin – Protein digestion
5. Renin – Milk Protein digestion
6. Trypsin – Protein digestion
7. Succus entericus – intestinal juice, digestion, intestinal gland and Brunner's gland
8. Chymotrypsin – breaks peptide bonds at specific region
9. Renin – increases glomerular pressure, JGA

31. cortisol – glucocorticoid, maintains cardiac and kidney function, antiinflammation, increase RBC production stress combat hormone
32. Mineralocorticoids – Z-glomerulosa, regulates water electrolyte Balance
33. Aldosterone – mineralocorticoids – reabsorption of sodium and Water
34. Catecholamines – adrenalin and nor adrenalin – adrenal medulla, fright, flight hormone
35. Insulin –  $\alpha$  cells of Islets of langerhans of pancreas, reduces blood sugar
36. Glucagon –  $\beta$  cell of pancreas, increases blood sugar
37. Testosterone – Leydig cells, male hormone, for appearance of secondary sexual characters and spermatogenesis
38. Erythropoietin – special cells of JGN – JGA cells are involved, Erythropoiesis, Increases RBC production
39. Cholecystokinin – CCK – duodenum, bile secretion is stimulated, fat digestion
40. Secretin – acts on acini of pancreas, causes secretion of bicarbonate and water.
41. Gastric inhibitory peptide GIP – inhibits gastric secretion
42. calcitriol – proximal convoluted tubule of Nephron, active form of vitamin D<sub>3</sub>, absorption of calcium.
43. Gastrin – acts on gastric gland in stomach and causes Hcl production and pepsinogen.
44. Oesterogen – Ovarian follicle female hormone – maturation of reproductive organ, appearance of secondary sexual characters in female, menstrual cycle
45. Progesterone – corpus luteum, prevents uterus contraction, during pregnancy, milk production, formation of placenta.

#### Respiration:

Phylum	Respiratory pigment
Mollusca	Haemocyanin [copper]
Echinodermata	Absence of heart
Annelida	Chlorocruorin and haemoglobin
met haemoglobin	Ferric high%

#### Formed elements – Corpuscles of blood

Blood Corpuscles	Count per cubic m.m
RBC	5 to 5.5 million in men. 4.5 to 5.0 million in women
WBC	6000 to 8000
Platelet	1,50,000 to 3,50,000

#### Larval Stages

Phylum	Larval Stage
Porifera	Parenchymula & amphiblastula
Cnidaria	Planula
Ctenophora	Cydippid – Pleuro brachia
Annelida	Trochophore
Hemichordata	Trochophore
Mollusca	Veligar
Platyhelminthes	Miracidium, redia, cercaria

Phylum	Special features
Porifera	Choanocytes – collar cells
Cnidaria	Cnidoblast, metagenesis
Ctenophora Platyhelminthes	Bioluminescence, poly embryony
Annelida	Metamerism
Arthropoda	Segmentation
Mollusca	Ctenidia, pallium
echinodermata	Autotomy, regeneration

### Excretion

Phylum	Excretory structures
Platyhelminthes	Flame cell
Aschelminthes	Rennet gland
Mollusca	Nephridia
Arthropoda	Coxal, green gland, malphigian tubule
Hemichordata	Single probosis gland
Amphioxus	solenocytes

### Circulatory System

Phylum	Circulatory System
Annelida	Closed type
Arthropoda	Open type
Mollusca	Open system, except in cephalopods eg. squid
Echinodermata	Open type without heart
Hemichordata	Open, dorsal heart

### NO's

Platelet - no nucleus

Mature RBC - Human - no nucleus

Cyton - no centriole

Axon - no golgi apparatus, no Nissl's granules

Yellow spot - No Rods

Blind spot - No Rods and No cones

Echinoderm - no heart

Reptiles - no Henle's loop

WBC	%
Neutrophil	60 - 65%
Eosinophil	2-3%
Basophil	0.5 - 1%
Lymphocyte	28%
Monocyte	1-3%

Blood plasma	7-10%
Haemoglobin	20-25%
Bicarbonate ion form	70%

WBC	Function
Neutrophil	Phagocytic
Eosinophil	Allergic reaction
Basophil	Inflammatory
Lymphocyte	Antibody formation, T, B cells
Monocyte	Phagocytic

### Partial pressure

Region	PO <sub>2</sub>	PCO <sub>2</sub>
Atmosphere	159	0.3
Alveoli	104	40
Tissue	40	45
Vein, or deoxygenated blood	40	45
Artery or oxygenated blood	95	40

Conditions for oxygen transport, oxygen association with Hb-Haemoglobin

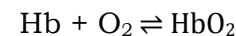
Conditions for O <sub>2</sub> association with Hb in Alveoli	Tissue, condition for O <sub>2</sub> disassociation
↑ elevated - PO <sub>2</sub>	↓ decreased - PO <sub>2</sub>
↓ decreased - PCO <sub>2</sub>	↑ increased - PCO <sub>2</sub>
↓ decreased - Temp	↑ increased - temperature
↓ decreased - H <sup>+</sup> ions	↑ increased - H <sup>+</sup> ions

### Transport of O<sub>2</sub>

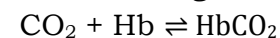
Blood plasma	3%
Haemoglobin	97%

### Transport of CO<sub>2</sub>

Oxyhaemoglobin - HbO<sub>2</sub>



Carbamino Haemoglobin - CO<sub>2</sub>



Male cockroach and structures associated with Reproductive system

Male cockroach organ and structures	Location and function of organs
Testis	4 <sup>th</sup> to 6 <sup>th</sup> segment
terga	7 <sup>th</sup> terga covers 8 <sup>th</sup> terga
Anal style	9 <sup>th</sup> segment
genital pouch	9 <sup>th</sup> and 10 <sup>th</sup> terga dorsally & 9 <sup>th</sup> sterna ventrically
Male accessory gland	Mushroom or utricular gland opens into ejaculatory duct
Seminal vesicle	on the ventral surface of ejaculatory duct vesicle stores sperms
Phallic or conglobate gland	open near gonophore – function uncertain
gonopophysis or phallomeres	chitinous asymmetrical structures help in copulation.
Vas deferens	opens into ejaculatory duct through seminal vesicle
7 <sup>th</sup> sternum has	a pair of gynoalvular plate forming a keel.

Female cockroach and structures associated with Reproductive system

Ovary	2 <sup>nd</sup> to 6 <sup>th</sup> segment
Terga	7 <sup>th</sup> covers 8 <sup>th</sup> and 9 <sup>th</sup>
7 <sup>th</sup> sternum	Boat shaped, 7 <sup>th</sup> , 8 <sup>th</sup> , 9 <sup>th</sup> form the broodpouch or genital pouch
spermathecae	1-pair, in 6 <sup>th</sup> segment
collateral gland	white, branched gland, behind ovary, forms egg case
genital pouch	7, 8, 9 <sup>th</sup> sterna forms – vagina and oothecal chamber
gonapophysis	chitinous structure around genital aperture

Earthworm Male Reproductive parts associated with reproductive system

Structures	Location and function
Testis	10 <sup>th</sup> & 11 <sup>th</sup> segment (2-pairs)
Seminal funnel or ciliary rosettes	10 <sup>th</sup> & 11 <sup>th</sup> segment connected in vas deferens
Vas deferentia	1-pair, long tube, opens in 18 <sup>th</sup> segment, (male aperture)
Penial setae	near male genital aperture, for copulation (1-pair)
Prostrate gland	1-pair (extending between 18 <sup>th</sup> – 19 <sup>th</sup> segment), the secretions cements spermatozoa into spermatophores



Earthworm Female Reproductive structures associated with reproductive system

Reproductive Structures	Location and function
Ovaries	1-pair-(13 <sup>th</sup> segment) finger like projections
Oviduct	Opens ventrally, extending duct of ovary
Female genital pore	Single, 14 <sup>th</sup> segment median
Spermathecae or seminal receptacles	3-pairs lying in 7 <sup>th</sup> , 8 <sup>th</sup> , 9 <sup>th</sup> segment, opens at inter-segmental groove, stores the sperms of other earthworm

External apertures or openings of earthworm

Mouth	Peristomium-1 <sup>st</sup> -segment
Anus	Pygidium-last segment
Dorsal pore	From 10 <sup>th</sup> segment onwards coelomic fluid, flows out and keeps the skin surface moist
Spermatheca	3 pairs of opening-ventro-lateral, inter segmental groove 6/7, 7/8, 8/9
Female genital pore	14 <sup>th</sup> segment, median, single
Male genital pore	1-pair-18 <sup>th</sup> segment, latero ventrally
Nephridiopores	Numerous, throughout the body except, few anterior segments

Nephridia

Types of Nephridia	Location
Pharyngeal or tufted	Paired, tufted, from 5 <sup>th</sup> to 9 <sup>th</sup> segment
Micro nephridia or integumentary nephridia	Lining of body wall from 14 <sup>th</sup> to last segment, intersegmental
Mega Nephridia or Septal Nephridia	19 <sup>th</sup> segment onwards, opens into intestine

Constituent of Blood-Plasma

Water	80-92%
Plasma protein (synthesised in liver)	
1. Albumin	osmotic pressure
2. Globulin	Hormone, Immune
3. Prothrombin	Blood clotting
4. Fibrinogen	Blood clotting
5. Organic (0.1%)	Urea, Ammonia, Glucose, Vitamin
6. Inorganic (0.9%)	Na, Ca, Mg, CO <sub>3</sub> , K

Prostomia – embryonic blasto pore forms the mouth

eg-acoelomate, pseudocoelomate, Schizocoelomate

Deuterostomia – anus formed from blastopore, mouth formed away from blastopore

Acoelomate – no coelom, no body cavity eg: Platyhelminthes

Pseudocoelomate – body cavity not lined by mesoderm, mesoderm forms pouches eg: Aschelminthes

Eucoelom – lined with mesodermal epithelium called peritoneum, two types Schizocoelomate and enterocoelomate

Schizocoelomate – body cavity formed from splits in mesoderm

Enterocoelomate – body cavity is formed by mesodermal pouches

Parazoa – loosely arranged cells, no tissue eg: Sponges

Simple epithelium – consists of squamous, cuboidal, columnar, ciliated and Pseudostratified

Compound epithelium – consists of stratified and Transitional

Stratified epithelium – Keratinized and non keratinized

Transitional → consists of Tight Junction, Adhering Junction and Gap Junction

Connective Tissue

- Loose connective→consists Areolar, Adipose and Reticular
- Dense connective→Regular, Irregular, Elastic
- Special connective→Cartilage, Bones, Blood

Areolar→tissue fluid – reservoir of water and salt

Adipose tissue → white fat and brown fat

White fat → energy, during fasting

Brown fat → heat produced without shivering, many mitochondria

Alveoli -   
 ↳ thin squamous epithelium   
 ↳ Basement membrane   
 ↳ Endothelium

Thin squamous   
 ↳ Type I - thin   
 ↳ Type II - thick - secrete-surfactant prevents the lungs from collapsing

Regulation of Respiration

Respiratory centre - Medulla oblongata, pneumotaxic centre

Pons varoli - responsible for respiratory rhythm, has pneumotaxic centre

Medulla oblongata - respiratory centre for rhythm

Chemosensitive area → close to rhythm centre, sensitive to CO<sub>2</sub>, H<sup>+</sup>

Respiration is not influenced by O<sub>2</sub>

Receptors in aortic arch and carotid artery send signals to rhythm centre

Inspiratory Reserve Volume - Additional volume of air forcefully inspired

Expiratory Reserve Volume - Additional volume of air forcefully expired

Residual - remaining air in lungs after forceful expiration

Inspiratory capacity - total volume of air inhaled after expiration

Expiratory capacity - total volume of air exhaled after normal inspiration

Vital capacity - maximum inspiration continued by maximum expiration

Total lung capacity - total volume of air accommodated in lungs after forceful inspiration

Dead space → air which does not reach gas exchange area

Minute respiratory volume - air moving the respiratory track per minute

Artery	Vein	Capillary
*Thick walled	*thin walls	*thin walled
*non-collapsible	*collapsible	*has single layer of squamous epithelium
*found deep inside body	*found superficially	
*No valve	*has valve, semilunar valve	
*Narrow lumen	*large lumen	*tunica media and elastin fibres absent
*tunica media thick	*tunica media thin	*mixed blood
*carries oxygenated blood	*carries deoxygenated Blood	*walls are guarded by semilunar valves
*high pressure	*low pressure	

Types of Muscle-Skeletal Muscle contraction

Isotonic - \*length of muscle changes   
 \*tension remains constant   
 \*eg. lifting dumbbell

Isometric- \*length of muscle does not change   
 \*tension of muscle changes   
 \*eg. pushing against wall

Oxidative fibres or Red muscle fibres

\*contain many mitochondria   
 \*has high capacity of oxidative phosphorylation   
 \*depends on blood flow for O<sub>2</sub> × nutrients

Glycolytic or white muscle fibre

\*contain less mitochondria   
 \*high concentration of glycolytic enzyme   
 \*stores large quantity of glycogen   
 \*does not have myoglobin so pale white in colour.

Three types of skeletal oxidative muscle fibre

Slow oxidative fibre

\*low rate of myosin and ATP hydrolysis   
 \*can make large amount of ATP   
 \*helps in long distance running

### Fast oxidative fibre

- \*high myosin, ATPase activity
- \*for rapid action
- \*can make ATP in large amount

### Fast glycolytic fibre

- \*have myosin ATPase activity
- \*cannot make ATP
- \*helps in short sprint

### Properties of Skeletal muscle

- \*Excitability/Irritability→ability to contract
- \*Contractibility→ ability to contract or shorten
- \*Conductivity→ stimulus spreading to all parts
- \*Elasticity/Distensibility→ability to return to resting state after stretching

### Skull-cranial & facial bones

#### Skull-22 bones

Cranium-8

Facial-14

#### Facial-14

Paired-(12)

Maxilla-2

Zygomatic-cheek bone(2)

Palatine-2

Lacrimal-2

Nasal Internal-2

Nasal External-2

#### Cranium-8

Paired-(4)

Parietal-(2)

temporal-(2)

#### unpaired(4)

Sphenoid-(1)

frontal-(1)

occipital-(1)

ethmoid-(1)

#### Special bone-u-shaped

hyoid-(1) bone with no joint

#### Structure of contractile protein (myosin, Actin)

\*Myosin –thick

\*meromyosin-protein

\*head, short arm, tail

\*head-heavy meromyosin

\*tail-light meromyosin

\*head-has actin and ATP binding site

#### Actin

\*Actin-thin filaments

\*thin filament composed of two intertwined actin molecule

\*Filamentous Actin → F-actin

\*Globular Actin → G-actin

\*Regulatory protein – tropomyosin and troponin

## Mechanism of Muscle contraction

\* Neuromuscular Junction



\* acetylcholine released



\* open multiple gates of sarcolemma



\* potential travels → T-Tubules



\* releases Ca<sup>+</sup> ions from Sarcoplasmic Reticulum



\* calcium binds with troponin – on thin filament



\* Tropomyosin uncovers the myosin binding sites on thin filament



\* active site exposed to myosin head



\* actomyosin cross bridge is formed



\* by using ATP energy



\* Myosin head rotates 90° angle



\* Power stroke occurs from 90° to 45°



\* Cross bridge is broken



\* The cycle continues and the cross bridge is formed in a different region.

## Contraction State

\* no change in thick & thin filament length

\* Z-disc pulled inwards

\* Thin filament moves towards the M-line

## Relaxed State

\* Z-disc goes back to its position

\* Thin filament moves away from centre. Neurotransmission does not occur in resting state.

\* tropomyosin mask the myosin binding site and the filament are pulled back to relaxed state

## Frank-Starling effect:

States that the critical factor controlling stroke volume is the degree to which the cardiac muscle cells are stretched just before they contract, Frank Starling effect protects the heart from abnormal increase in blood volume.

Baroreceptor: helps to control and maintain-homeostatic control of Arterial pressure. When we get up in the morning from bed and stand, blood goes to lower ends causing decrease in blood pressure – known as orthostatic hypotension.

Orthostatic reflex→ triggers baroreceptors reflex. It increases cardiac output and increases arterial pressure.

Laplace law: states that tension in walls of blood vessel is proportional to blood pressure and vessel radius.

## Regulation of cardiac activity:

\*By nervous and endocrine control

\*neuronal control by sympathetic and parasympathetic

\*Sympathetic→ secretes nor epinephrine and epinephrine from Adrenal medulla

\*Parasympathetic →acetylcholine is secreted which decreases the heart rate

\*vagus – is a parasympathetic nerve, it supplies to SA node and AV Node

\*Natriuretic peptide – causes reduction of pressure and vasodilation

### Regulation of kidney:

\*ADH or vasopressin → helps to reabsorb water from distal convoluted tubule and collecting tubule

\*ADH prevent loss of water.

\* ADH makes the urine concentrated and prevents dilute urine formation.

\*less secretion- of ADH causes diabetes insipidus  
Symptoms (Poly urea, Poly dipsia)

Renin Angiotensin → JGA secretes → Renin → when blood flow is low → Renin → converts plasma protein → Angiotensin I to Angiotensin II → which is synthesized by liver.

Angiotensin II → acts on → kidney, heart, adrenal cortex and Brain

Angiotensin II → makes adrenal cortex to secrete → aldosterone

Aldosterone → causes increased Na<sup>+</sup> reabsorption and excretion of K<sup>+</sup>, in distal convoluted tubule and collecting tubule

Aldosterone causes increase in blood pressure.

Atrial natriuretic factor → secreted by SA Node causes vasodilation and reduces blood pressure and decreases release of Renin and Angiotensin and Aldosterone.

### Cockroach

Exoskeleton – hard plates

Sclerites – hard plates – 3 types

tergites – dorsal hard plates

sternites – ventral plate

Pleurites – lateral side plate

articular membrane – arthroidal membrane

hypognathus-tongue

mandibulate or orthopterus – chewing type mouth part

labrum – upper lip

labium – lower lip

hexapoda – 6 legs

cervicum – neck

segments of leg → coxa, trochanter, femur, tibia, tarsla

elytra or tegmina → protective wings, mesothorax

flight wings → metathorax

gizzard or proventriculus – chitinous plate, teeth

hepatic caecae or enteric caecae → 8 tubes, behind gizzard, (digestive enzymes)

Malpighian tubule → 100-150-yellow, filamentous, excretory behind mid gut

Alary muscle → helps in circulation

Pulsative vesicle – near antenna

Cockroach – heart – 13 chambers

Spiracles or Stigmata – small holes allow air entry

Ostia – opening allowing blood flow

### Earthworm

Chloragogen – intestine wall of earthworm- excretory

typhlosole – dorsal wall of intestine, showing depression

Protandrous – early maturation of sperms

### Taxonomy

R.H. Whittaker – five kingdom classification

Carlwoese – Three kingdom classification

Aristotle → father of classical Taxonomy

Cavalier Smith → Seven Kingdom Classification

Carolus Linnaeus – father of Modern Taxonomy

Carolus Linnaeus – Binomial Nomenclature

Phylogenetic classification – cladistics –based on genetics & evolutionary relationship, phylogenetic tree

Ernst Haeckel – tree diagram – cladogram

John Ray – Species as ultimate unit of Taxonomy

Theophrastus – Father of Botany

Augustin Pyramus de Candolle – coined taxonomy

Archaea – single celled, prokaryote, extremophile, methanogen, Halophiles

Bacteria – circular chromosome, 70s ribosome

Bacteria ↗ Probiotic-beneficial  
↘ Pathogenic → harmful

Eukarya- Eukaryotes – linear chromosome, 80s ribosome

Monotypic genus – only one species – eg Red panda

Polytypic genus – many closely related species

Trinomial Nomenclature – Huxley and Stricklandt

Enaima – Animal with blood

Anaima – Animal without blood

Neo taxonomical tool → Based on electron microscope image

Automated species identification tool – cyber tools

Eg: DAISY, ALIS, ABIS, SPIDA

Ethology – Based on behaviour

e-taxonomic → electronic resource

Molecular taxonomic tool – accurate, authentic

\*DNA Bar coding – genetic marker

\*DNA hybridization –degree of genetic similarity

\*DNA finger printing – unique pattern of DNA

Classical taxonomical tool

→ Taxonomical key, Museum, Zoological park, Marine park, printed

taxonomic tools → manuals

Glomerular Filtration

Glomerular pressure – 55 mm Hg

Colloidal pressure – 30 mm Hg

Capsular pressure – 15 mm Hg

Colloidal pressure + capsular pressure= 30 + 15 =45 mm Hg

Net filtration pressure = Glomerular pressure – Colloidal capsular pressure

N.F.P=55-45=10 mm Hg

N.F.P=10 mmHg

CO - Cardiac output

HR – Heart rate

SV – Stroke volume

CO – HR x SV

EDV – blood collected in ventricular diastole

ESV – blood remaining after ventricular contraction

SV=EDV –ESV

Economic Zoology

Earthworm → farmer's friend, biological indicator of soil fertility

Vermitech – Bioremediation of soil, composting Sultan Ismail

Drilosphere → soil burrowed by earthworm

vermiwash → liquid collected from vermibed

wormery or wormbin → earthworm in fertilizer production

Sericulture – silkworm rearing for silk

diapause egg → sub tropical region

non-diapause –eggs laid in India by silk moth

spinneret – pore- in hypopharynx

trimoulteres, tetra → based on moult

univoltines, bivoltines → based on broods per year

Moriculture – culture of Bombyx mori

Stifling → killing the cocoons

Cooking → soaking cocoons in hot water for 5 10-15 mins to remove gum

Spun silk → silk waste, non reelable

Diseases of silkworm → Pebrine – Nosema bombycis – Protozoan

Flacherie – bacteria, Staphylococcus

Grasserie – viral

White muscardine – fungal

Apiculture – Bee keeping

Nuptial flight → winter season, queen is followed by drones by the pheromone for mating

Royal Jelly – food for only queen

Queen – fertile female, one in a hive

Drone – fertile (haploid) male, derived from unfertilized egg (100's) in number in a hive, king of colony

Worker – sterile female → life span 6 weeks

Propolis – plastic, resin substance, mixing beeswax with, cephalic gland, wax is obtained from pollen grain

Bee wax – secreted by abdomen of worker bee

Arilac – immature lac, lac before swarming

Mature lac – after swarming

Stick lac – with stick

Seed lac – stick and waste dust removed

Shellac – melted lac

hapas → rectangular, trough shaped tanks made of mosquito net cloth, stands on Bamboo poles, for containing different stages of fishes

Natural Breeding – Bundh breed, natural river

Spawning – release of gametes

Spawn collecting net – Shooting Net-Benchijal

hypophysation - removal of pituitary gland and taking the extract  
fingerlings → the grown up fries

fries → young ones newly hatched from egg or seed

Seed – egg of fish

Harvesting – capture of fishes for marketing

Fish oil → liver oil, body oil

Liver oil → Vitamin A and D, from fish liver

Body oil → entire body of fish → rich in Iodine, not fit for human consumption, used to make paint

Fish meal → fish waste after extracting fish oil

Isinglass → collagen from air bladder of certain fish, like cat fish, form gelatin, clearing vinegar

Lingha pearl → best pearls are produced

Pinctada – for pearl culture

Lamellidens → for artificial pearl culture

Nacre → a layer of hard, glossy calcium carbonate secreted by the epithelium of Mantle covering foreign particle, forms the pearl

Cattle disease → rinder pest, foot and Mouth disease, antharox

Spat- free swimming larvae of pearl oyster