

Physiological tables, for the use of students / compiled by Edward B. Aveling.

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by
Edward B. Aveling

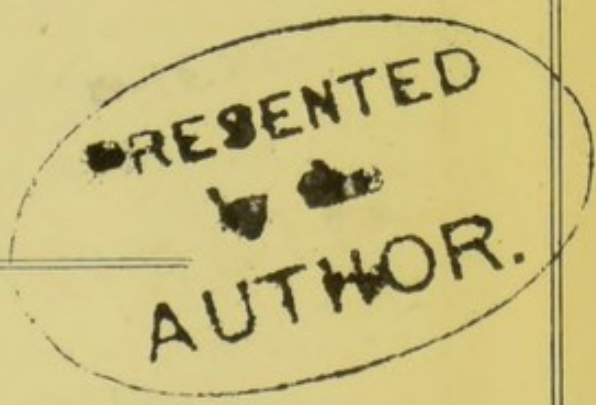
PHYSIOLOGICAL TABLES,

FOR

THE USE OF STUDENTS.

COMPILED BY

EDWARD B. AVELING, D.Sc., F.L.S.



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1877.

INTRODUCTION.

It is hoped that this book may be of use to those who are beginning the study of Physiology, and to those more advanced students who are already teaching the subject.

For the student, the value it may possess will probably lie in the attempt that is made to arrange the facts of Physiology in systematic order. The book is not designed to teach these facts themselves. They should be acquired by the actual dissection and careful investigation of animals or the organs of animals. Failing this—the only true method of acquiring anatomical and physiological knowledge—the books of well-known writers must be read, the utterances of well-known teachers heard. The facts once acquired, they must be grouped; their relationship each to the other recognised. To arrange a number of facts in systematic order is for young thinkers as important as it is difficult. The attempt has been made, in relation to physiological facts, in these Tables. Further, the book may be of use to the student in the recapitulation so essential to the full understanding of any subject. In certain parts of these pages names only occur. Each name should suggest to him many facts. Thus, the mention of the glands met with in the intestinal canal should recall to his mind their position, their structure, their probable function.

To teachers of Physiology it is hoped that this book may be of value. They, more than all others, must have their facts in order. Even those who do not follow the particular plan used herein, may find these Tables useful, in presenting certain facts and analyses to their students, and in showing to those students new words and terms in a printed form. To such as may see fit to follow out more fully the system adopted here, each of these Tables may serve as the foundation of one or more lectures.

It is believed that all the physiological facts, a knowledge whereof is required by the Science and Art Department, South Kensington, and by the ordinary Medical examining bodies, are to be met with in a condensed form in these pages, with the exception of those referring to Reproduction and Development.

LONDON HOSPITAL,

September, 1877.

BIOLOGY	{	VEGETABLE BIOLOGY = BOTANY	{	Anatomy	{	Morphology.
				Physiology.		Histology.
				Classification.		
	{	ANIMAL BIOLOGY = ZOOLOGY ...	{	Anatomy	{	Morphology.
				Physiology.		Histology.
				Classification.		

PLAN.

I. AND II. STRUCTURE { Skeleton.
Tissues.

III. FOOD.

IV. DIGESTION.

V. ABSORPTION.

VI. CIRCULATION.

VII. RESPIRATION.

VIII. SECRETION.

IX. NUTRITION.

X. NERVOUS SYSTEM.

XI. SENSE ORGANS.

XII. MOTOR ORGANS.

XIII. VOICE.

SKELETON.

TRUNK.....

Vertebral Column ..

Cervical or Neck vertebræ

Dorsal or Back vertebræ.....

~~Lumbar or Loin vertebræ~~

Sacrum

Coccyx

Thorax or Chest....

Ribs: 12 on each side

Sternum or Breast-bone

EXTREMITIES

Upper.....

Arch: presenting on each side

Brachium or Arm

Antebrachium or Fore-arm

Limb: each with

Manus or Hand

Lower.....

Arch: presenting on each side

Femur or Thigh.....

Crus or Leg

Limb: each with

Pes or Foot

SKULL.....

Head

Face.....

UNCL

BONES ..

{ In the Throat: supporting the Tongue

{ In the Extremities: sesamoid or tendon bones.....

{ In the Head: *supernumerary*: in the sutures and fontanelles.....

{ In the Ear

	{ ATLAS. AXIS. 3RD, 4TH, 5TH, 6TH CERVICAL. VERTEBRA PROMINENS.	
12 DORSAL : each presenting.....	{ Centrum. Neural Ring. Processes { Spinous. Transverse. Articular.	
5 LUMBAR.		
5 SACRAL.		
4 COCCYGEAL OR CAUDAL.		
{ 7 VERTEBRO-STERNAL: presenting.....	{ Head. Tubercle. Shaft.	
{ 3 VERTEBRO-COSTAL.		
{ 2 FLOATING.		
STERNUM	{ Manubrium. Gladiolus. Xiphoid Cartilage.	
{ CLAVICLE.		
{ SCAPULA	{ Flat portion. Spine. Coracoid process. Head. Tuberosities. Shaft. Condyles.	
HUMERUS		
{ RADIUS.		
{ ULNA.		
SCAPHOID.		
SEMILUNAR.		
CUNEIFORM.		
PISIFORM.		
TRAPEZIUM.		
TRAPEZOID.		
OS MAGNUM.		
UNCIFORM.		
5 METACARPAL.		
14 PHALANGES.		
OS INNOMINATUM	{ Ilium. Ischium. Pubes. Head Trochanters. Shaft. Condyles.	
FEMUR		
{ TIBIA.		
{ FIBULA.		
CALCANEUM.		
ASTRAGALUS.		
CUBOID.		
SCAPHOID.		
INTERNAL CUNEIFORM.		
MIDDLE CUNEIFORM.		
EXTERNAL CUNEIFORM.		
5 METATARSAL.		
14 PHALANGES.		
OCCIPITAL	{ Basi-occipital. Ex-occipital. Supra-occipital. Squama occipitis.	
2 PARIETAL.		
FRONTAL	{ Vertical portion. Orbital portion. Squamous portion. Mastoid process. Petrous portion. Basi-sphenoid. Ali-sphenoid. Pre-sphenoid. Orbito-sphenoid. True ethmoid = descending plate Prefrontals { Cribriform plate. Spongy bones.	
2 TEMPORAL		
SPHENOID.....		
ETHMOID		
{ 2 NASAL.		
{ 2 LACHRYMAL.		
{ 2 SUPERIOR MAXILLARY.		
{ 2 MALAR.		
{ 2 PALATE.		
{ 2 INFERIOR SPONGY.		
VOMER.		
INFERIOR MAXILLARY	{ Dentary portion. Angular portion. Articular portion.	
HYOID.		
PATELLA AND OTHERS.		
WORMIAN BONES.		
OSSICULA AUDITUS.		

TISSUES.....

BONE

Chemical Composition

Structure

FAT OR ADIPOSE TISSUE

Structure

Uses

FIBROUS OR CONNECTIVE TISSUE

Elements

Kinds

CARTILAGE

Elements

Kinds

MUSCLE

Non-striated

Striated

NERVOUS TISSUE.....

Chemical Compositions.....

Cells

Fibres.....

VASCULAR TISSUE

Arteries

Veins

Capillaries.....

EPITHELIUM

Elements

Kinds.....

Animal matter.	Gelatin : 33.3 per cent.
	Calcium Phosphate 51.04.
	Calcium Carbonate 11.3.
Earthy matter.	Calcium Fluoride 2.
	Magnesium Phosphate 1.16.
	Sodium Chloride 1.2.
	Haversian Systems
Compact tissue	Haversian Spaces.
Spongy tissue.	
Medullary cavity.	
Vesicles with oil.	
Blood-vessels.	
Areolar tissue.	
Padding.	
Gives shape.	
Non-conductor.	
Food.	
Fibres	{ White : unbranched : non-elastic : + acetic acid, swell.
	{ Yellow : branched : elastic : + acetic acid, not affected.
Cells	Plasm-cells : nuclei are connective tissue corpuscles.
1. Areolar : white and yellow fibres in nearly equal proportions : the true connective tissue.	
2. Fibrous : white predominate : membranes, fasciae, tendons, ligaments.	
3. Elastic : yellow predominate : vocal cords, intervertebral ligaments.	
Matrix.	
Cells.	
1. Hyaline cartilage.	Matrix homogeneous : articular, rib, nose, larynx cartilages.
2. Fibro-cartilage.	Matrix with white fibres : inter-articular cartilages.
3. Elastic cartilage.	Matrix with yellow fibres : eyelid, ear, epiglottis.
Fibre-cells with nuclei.	
Fasciculi.	
	{ Fibrillae
	{ Dark, doubly-refracting diadiaclasses.
Fibres : each presenting	{ Sarcolemma.
	{ Nuclei.
	{ Light, singly-refracting portions.
Water 75 per cent. in white : 85 in grey matter.	
Albuminoid 7.5 per cent.	
Fats 15 per cent. in white : 5 per cent. in grey	{ Oleo-phosphoric acid.
	{ Olein : margarin : palmitin.
	{ Cholesterin.
	{ Lactic, formic, uric acids.
	{ Inosit.
	{ Kreatin.
Extractives 1 per cent.	{ Sarkin.
	{ Leucin.
	{ Elastin.
	{ Xanthin.
	{ Potassium phosphate 55.24.
	{ Sodium phosphate 22.13.
	{ Iron phosphate 12.3.
	{ Hydrogen phosphate 9.15.
	{ Magnesium phosphate 6.83.
	{ Sodium chloride 4.74.
	{ Silicon dioxide 4.2.
	{ Potassium sulphate 1.64.
	{ Calcium phosphate 1.62.
	{ Apolar.
	{ Unipolar.
	{ Bipolar.
	{ Multipolar.
	{ In grey matter.
	{ In ganglia.
	{ In nerve-ends.
	{ Structure : flat fibres without investment.
	{ Position : in sympathetic system.
	{ Neurilemma.
	{ Medullary sheath.
	{ Axis-cylinder.
	{ Areolar tissue.
	{ Elastic tissue.
	{ Muscular tissue.
	{ Elastic tissue.
	{ Elastic tissue.
	{ Epithelium.
	{ Aparts as those of arteries, but less muscular and less elastic.
	{ Valves.
	{ Areolar tissue.
	{ Elastic tissue.
	{ Vessels.
	{ Nerves.
	{ Basement membrane.
	{ Cells.
	{ Squamous
	{ Simple : serous and synovial membranes.
	{ Stratified : skin.
	{ Columnar : in alimentary canal.
	{ Filiated : in respiratory organs, ventricles of brain.
	{ Glandular or spheroidal : in glands.

FOOD.

INORGANIC ..	Solvent		Water
	Substances dissolved		Sodium Chloride
			Sodium Sulphate
			Sodium Phosphate
			Potassium Chloride
			Potassium Sulphate
			Potassium Phosphate
			Calcium Carbonate
			Calcium Phosphate
			Magnesium Phosphate
ORGANIC	Non-nitrogenous	Carb-hydrates	Iron Oxide
			Silicon Fluoride
			Starch
			Gum
			Amyloid { Cellulose
			Pectin
			Glycogen
			Cane-sugar
			Lactose
			Inosit
	Hydro-carbons..	Fats and Oils..	Fruit-sugar
			Palmitin
			Margarin
			Stearin
			Olein
			Bile-fat
			Brain-fat
			Yolk-fat
			Butyric
			Caproic
	Of C. H. O.	Fat Acids	Capric
			Acetic
			Lactic
			Oxalic
			Malic
			Tartaric
			Racemic
			Citric
			Alcohol
			Ethers
	Of C. and H.	Vegetable Organic Acids	Of turpentine
			Of hops
			Of parsley
			Albumins
			Legumin
			Gluten
			Albumin
			Vitellin
			Syntonin
			Myochrome
	Nitrogenous	Histogenetic....	Globulin
			Fibrin
			Cruorin
			Casein
			Gland substance
			Brain substance
			Gelatin
			Chondrin
			Thein
			Caffein
	Stimulating	Alkaloids as	Theobromin
			Cerebric Acid
			Creatin
			Creatinin
	Stimulating	Extractives as	

FORMULA.	SOURCES.	USES.
$H^2 O$	Liquid parts of food	Dissolves food. Renders it capable of absorption. Facilitates all life-processes. Maintains elasticity of tissues. Basis of blood and secretions.
$Na Cl$ $Na^2 SO_4$ $Na^3 PO_4$ $K Cl$ $K^2 SO_4$ $K^3 PO_4$ $Ca CO_3$ $Ca^3 (PO_4)_2$ $Mg^3 (PO_4)_2$ $Fe O$ $Si F_4$	In solution generally	For blood and secretions.
$C^6 H^{10} O^5$ $C^6 H^{10} O^5$ $C^6 H^{10} O^5$ $C^{32} H^{48} O^{32}$ $C^6 H^{10} O^5$ $C^{12} H^{22} O^{11}$ $C^{12} H^{22} O^{11}$ $C^6 H^{12} O^6$ $C^6 H^{12} O^6$ $C^3 H^5 (C^{16} H^{31} O^3 O^3)$ $C^3 H^5 (C^{17} H^{33} O^3 O^3)$ $C^3 H^5 (C^{18} H^{35} O^3 O^3)$ $C^3 H^5 (C^{18} H^{32} O^3 O^3)$	In solution Potato, rice, sago, in cereal grains. Fruits Cell-walls of plants Succulent vegetables Liver tissue Sugar-cane Milk-sugar Muscle-sugar Fruits	For muscles. For bone. For blood. For hard tissues. Primarily heat-producers. Secondarily tissue-formers.
$C^4 H^8 O^2$ $C^6 H^{12} O^2$ $C^8 H^{16} O^2$ $C^2 H^4 O^2$ $C^3 H^6 O^3$ $C^2 H^2 O^4$ $C^4 H^6 O^5$ $C^4 H^6 O^5$ $C^4 H^6 O^5$ $C^6 H^8 O^7$ $C^2 H^6 O$ $C^2 H^{10} O$ and others $C^{10} H^{16}$ $C^{10} H^{16}$ $C^{10} H^{16}$	Bile Brain Eggs Butter Vinegar Sour milk, fermenting vegetables Rhubarb Apples Grapes Gooseberries, currants Lemon, orange Beer, wine, spirit Wine, ripe fruits Spices	As fats. Stimulating.
$C^{64} H^{88} N^{21} O^{30}$ $C^{55} H^{72} N^{15} O^{98}$ and $S^{21} P^{38}$ $C^{53} H^{78} N^{15} O^{22} S^{12}$ $C^{52} H^{72} N^{15} O^{23} S^{17} P^{102}$ $C^{54} H^{78} N^{16} O^{5}$ and $S^{22} P^{11}$ $C^{52} H^{78} N^{15} O^{23} S^{11}$ $C^{53} H^{78} N^{15} O^{22} S^{11}$ $C^{50} H^{72} N^{18} O^{24}$ $C^{49} H^{66} N^{14} O^{29}$ $C^8 H^{10} N^4 O^2$ $C^8 H^{10} N^4 O^2$ $C^7 H^8 N^4 O^2$ $C^{66} H^{78} N^{23} O^{19} S^9$ $C^4 H^9 N^3 O^2$ $C^4 H^7 N^3 O$	Vegetables generally Seeds of Leguminosæ Seeds of cereals Blood, muscle, nerve, eggs Yolk of eggs Muscle Muscle Blood Milk Gland structures Brain Fibrous tissues, bone Cartilage Tea Coffee Cocoa Brain Muscle, nerve, blood	Primarily tissue-formers. Secondarily heat-producers. Stimulating.

PREHENSION.

MASTICATION

INSALIVATION

DEGLUTITION

CHYMIFICATION

CHYLIFICATION

DEFÆCATION

Teeth

Muscles

Effect

Glands : 3 chief pairs

Secretion = Saliva

Effect

First stage

Second stage

Third stage

Stomach : four coats

Secretion

Effect

Small intestine

Secretions

Effect

Large intestine

Effect

Formula

Eruption

Histology

Primary

Secondary

Comminution of the food.

Parotid : with duct of Steno.

Submaxillary : with duct of Wharton.

Sublingual : with ducts of Rivinianus.

Water 98·81 per cent. Salts 41. Mucus 26. Ptyalin

Solvent and demulcent.

Turns starch to sugar.

Muscles concerned

Nature of the act

Muscles

Nature

Muscles

Nature

Serosus coat

Muscular

Areolar.

Mucous

Gastric juice

Conversion of nitrogenous food-stuff into peptones.

Parts

Coats

Succus entericus

Bile

Pancreatic fluid

Of succus entericus

Of bile

Of pancreatic fluid

Parts

Coats

Expulsion of egesta.

Milk Teeth	i	$\frac{2-2}{2-2}$	c	$\frac{1-1}{1-1}$	m	$\frac{2-2}{2-2}$	
Permanent Teeth	i	$\frac{2-2}{2-2}$	c	$\frac{1-1}{1-1}$	p. m.	$\frac{2-2}{2-2}$	m $\frac{3-3}{3-3}$
Milk Teeth	median incisors 7th month. lateral 9th. c. 18th. 1st m. 12th. 2nd m. 24th.						
Permanent Teeth	m. i. 5-7 years. l. i. 7-9. c. 9-12. 1st p. m. 8-10. 2nd p. m. 10-12. 1st m. 5-7. 2nd 12-14. 3rd 17-25.						
Alveolar Cavity.							
Dentine.							
Enamel.							
Crusta petrosa or Cementum.							

Open the mouth	{	Move the jaw	{	Digastric (ascending part): platysma myoides:
		Fix the hyoid bone		genio-hyoid: mylo-hyoid: external pterygoid.
Close the mouth	{	External		Sterno-hyoid: omo-hyoid: stylo-hyoid:
		Internal		digastric (descending part).
Move the tongue	{	External		Temporal: masseter.
		Internal		External and internal pterygoids.
Massinator or Cheek-muscle.				Hyo-glossus: genio-hyo-glossus: stylo-glossus:
				palato-glossus: superior constrictors.
				Superior and inferior longitudinal: transverse.

8. Albumen + Sodium '17. Fat '05 Loss '12.

Muscles that close mouth: secondary of mastication: tensor palati: levator palati: azygos uvulae: palato-glossi: palato-pharyngei: mylo-hyoid: digastric: sterno-hyoid: thyro-hyoid.

Voluntary.

Superior, middle, inferior constrictors of pharynx: stylo-pharyngeus: palato-pharyngeus.

Involuntary, automatic.

Longitudinal and circular muscles of oesophagus.

Involuntary, reflex.

Of peritoneum.

Longitudinal fibres.

Circular fibres.

Oblique fibres.

Veoli.

Mucous glands.

Salivary glands.

Water 99.44 per cent. Pepsin '32. Salts '22. Hydrogen Chloride '02.

Proxodenum.

Jejunum.

Ileum.

Peritoneum

Muscular

Arterial

Veolar

Valvulae conniventes.

Villi.

Mucous

Glands

Of Lieberkühn.

Of Brunner.

Solitary.

Of Peyer.

Water + 2 to 3.5 per cent. of solids including an organic substance precipitated by alcohol.

Water 90.44. Glycocholic and taurocholic acids, fat and pigment 8. Salts 1.36. Mucus '3.

Water + 1.5 to 6 per cent. of solids, including pancreatin and .5 to 1 per cent. of salts.

Inversion of starch into sugar.

Dilution of nitrogenous food-stuffs.

Emulsion of fats.

Excrementitious.

Stimulating.

Anti-putrescent.

Inversion of starch into sugar.

Emulsion of fats.

Caecum.

Sigmoid.

Rectum.

Peritoneum

Muscular

Arterial

Veolar

Sacculi.

Glands

Simple follicles.

Solitary.

Internal Sphincter.

ABSORPTION.

EXTRINSIC ..

General Absorption

Surfaces

Mucous membrane of alimentary canal.
Mucous membrane of respiratory tract.
Conjunctiva.
Skin.
Serous membranes.
Synovial membranes.
Areolar tissue.
Surfaces of wounds.

Vessels

Blood-vessels.

Lymphatics

Origin

Structure

Terminations

Lymph

Glands

Retia mirabilia.

True glands

Position

Structure

Food Absorption..

Vessels

Blood-vessels.

Lacteals

Origin

Structure

Termination

Chyle

Causes of movement

Glands

Intestinal

Mesenteric

INTRINSIC....

Kinds

Interstitial

Progressive Absorption

Disjunctive Absorption

Resorption

Ulcerative Absorption

Atrophy.
Result of tumors.
Sloughing.
Of effused fluids.
Ulcers.

Agents

Blood-vessels.
Lymphatics.

Superficial.
Deep.

Coats : as in veins, but thinner and weaker.
Valves : as in veins.

Thoracic duct.
Right lymphatic duct.

Constituents	{	Plasma.....	{	Serum.....	{	Water 93·732 per cent.	Albumen 4·2775.	Salts ·775.
				Fibrin.		Fat ·651.	Extractives ·505.	Fibrin ·0595.
				Corpuscles : akin to white blood-corpuscles.				
				Oil-globules, sugar, urea, leucin.				

Chemical Composition	{	Water : albumen : extractives :
	{	a little fat : salts.

Cervical, axillary, bronchial, antebrachial, lumbar, iliac, inguinal, popliteal.

Vessels	{	Afferent.
	{	Efferent.

Capsule.

Cortical part.....	{	Trabeculae and retiform connective tissue.
		Alveoli and lymph-channels.
		Pulp.

Medullary part = plexus of lymph-vessels.

In villi.
As lymphatics.
In receptaculum chyli of thoracic duct.

Constituents	{	Plasma.....	{	Serum	{	Water : albumen : extractives :
				Fibrin.		much fat : salts.
				Corpuscles : akin to white blood-corpuscles.		
				Oil-globules, nuclei, albuminoid spherules, molecular basis.		

Chemical composition	{	Water 90·237 per cent.	Fat 3·601.	Albumen 3·516.
	{	Salts and extractives 2·276.	Fibrin ·37.	

Vis a tergo.
Muscular fibres of villi.
Peristaltic movements of intestine.
Muscular fibres of lacteals and thoracic duct.
Contraction of limb-muscles : valves determine direction.
Vis a fronte.

Solitary.
Agminated or Peyer's.
As lymphatic-glands.

CIRCULATION.

BLOOD	Constituents.....	Plasma	Serum
			Fibrin.
		Corpuscles.....	White.....
			Red
	Chemical composition ..	IN CORPUSCLES.	Water..... 34.4.
			Hæmatin '8375.
			Globulin and envelopes.. 14.111.
			Fat '1155.
			Extractives '13.
			Salts '406.
Fibrin			
Albumen			
Coagulation	Processes	On withdrawal.....	
		2 to 4 minutes	
		5 to 6 minutes	
		8 to 9 minutes	
	Theories.....	15 to 20 minutes	
		Richardson's.....	
		Brücke's and Hunter's	
		Lister's	
ORGANS	Structure	Schmidt's	
		Cavities	
		Valves	
		Histology	
	Heart	Vessels	Extrinsic
			Intrinsic
		Nerves	Excito-motor
			Inhibitory.....
Arteries. Capillaries. Veins.	Sounds.....		
	COURSE OF CIRCULATION		
CAUSES OF CIRCULATION			

Water.		
Albumin.		
Globulin.		
Fats.....	{ Ordinary fats. Cholesterin. Serolin. Fat containing phosphorous.	
Salts.		
Coloring matters.		
Odorous matters.		
Shape	Spherical.	
Size	Average diameter $\frac{1}{125}$ m. m.	
Structure	Granular, thin-walled, nucleated cells.	
Movements	Amœboid.	
Origin.....	From lymph and chyle corpuscles.	
Shape	Biconcave disks.	
Size	Diameter $\frac{1}{126}$ m. m., thickness $\frac{1}{4}$ of diameter.	
Structure	{ Proteid-wall.	
Origin.....	{ Contents (semifluid) Hæmo-globin	{ Hæmatin. Globulin.
	From the white.	
	IN PLASMA.	TOTAL.
	45·145.	79·545.
	—	·8375.
	—	14·111.
	·086.	·2015.
	·197.	·327.
	·4275.	·8335.
	·2025.	·2025.
	3·942.	3·942.
Halitus.		
Formation of film on surface		
Solidification of blood in contact with vessel.		
Coagulation.		
Shrinking.		
Fibrin held in solution by Ammonia, whose evolution determines coagulation.		
Blood tends to coagulate: inhibitory influence of coats of vessels.		
Coagulation not natural: dependent on contact of foreign body.		
Fibrinogen + Globulin = Fibrin.		
Right and left auricle.		
Right and left ventricle.		
Tricuspid.		
Mitral.		
Semilunar	{ Aortic. Pulmonary.	
Coronary.		
Eustachian.		
Nature of muscular fibres.....	Sarcolemma almost wanting: striation not well marked: involuntary.	
Arrangement in auricles	{ Superficial, common to both auricles, transverse. Deep, proper to each auricle, looped or annular.	
Arrangement in ventricles	{ Three outer layers, oblique from right to left. Central transverse layer. Three inner layers, oblique from left to right.	
Veins, entering the heart	{ Superior vena cava. Inferior vena cava. Pulmonary veins.	
Arteries, quitting the heart	{ Aorta. Pulmonary artery.	
Veins = cardiac.		
Arteries = coronary.		
Intrinsic ganglia.		
Sympathetic nerve-fibres.		
Cerebro-spinal fibres through sympathetic.		
Vagus or pneumogastric.		
First: dull, synchronous with heart-beat: due to closing of tricuspid and mitral valves.		
Second: sharp, after the first; due to closing of semilunar valves.		

pulmonary artery and branches: pulmonary capillaries: pulmonary veins: left auricle:

1. Alterations in diameter of capillaries.
2. Alterations of velocity of blood flowing through them.
3. Movement of blood after excision of heart in cold-blooded animals.
4. Emptying of arteries after death.
5. Secretion after death.
6. First movement of blood in embryo towards not from the heart.
7. Fœtus without heart has organs developed.
8. Degeneration of heart during life without much alteration in the circulation.
9. Heart working well, and yet circulation through some part ceases.
10. Asphyxia.

RESPIRATION.

ORGANS	Trachea	{ Cartilaginous rings, incomplete behind. Fibrous coat, connecting rings and investing them on both surfaces. Muscular and elastic fibres. Ciliated mucous membrane.
	Bronchi	As trachea but cartilaginous rings shorter and narrower.
	Bronchial Tubes	As bronchi but cartilages broken up into several pieces.
	Lungs : each presenting {	{ Pleura
		Mediastinum.
		Root of lung, containing
		Lobes made up of lobules each consisting of
		Nerves
MOVEMENTS..	Inspiration	{ Ordinary muscles
		{ Auxiliary
	Expiration	{ Ordinary agents
		{ Auxiliary
	Special Movements.....	{ Sighing
		Snoring
		Yawning
		Coughing
		Sneezing
		Sobbing
		Crying
EFFECTS	On the Air	{ Kinds of air
		{ Alterations
	On the Blood	{ Color
		Temperature.
		Composition.....
ASPHYXIA.....		{ Gases
		Non-arterialization of lung-blood : retardation : arteries gorged : left side of heart distended : respiratory muscles : heart stops from distension and deficiency of stimulus.

leura costalis.
leura pulmonalis.

ronchus.
ulmonary Artery.
ulmonary Vein.
ronchial Artery.
ronchial Vein.
ymphatics.
erves.
eolar Tissue.

erminal branch of bronchial tube.
ir-sac.
ir-cells.
essels.
erves.
eolar tissue.

mpathetic.
nsory Vagus.
 { Phrenic.
otor { Intercostals.
 { Facial.
 { Spinal Accessory.

aphragm.
ternal intercostals.
vatores costarum.
art of internal intercostals.

terior and posterior scaleni, posterior superior serratus, cervicales ascendentes, trapezius, sterno-mastoid, levatores anguli scapulae, rhombus minor, rhombus major, serratus magnus, subclavius, pectoralis major, pectoralis minor, latissimus dorsi.

aphragm.
dominal muscles.
ternal intercostals.
fracostals.
angularis sterni.
asticity of lungs.

oper part of serratus magnus, posterior inferior serratus, quadratus lumborum and erectores spinae.

ow, deep inspiration, mostly through mouth : prolonged expiration.

egular vibrations of soft palate and uvula as air enters or quits nasal cavities and throat.

ep inspiration through mouth : depression of lower jaw : slow expiration : elevation of ribs and scapulae.

ep inspiration : closure of glottis : sudden, violent expiration.

ep, sudden inspiration : fauces, not glottis closed : quick, noisy expiration through nose.

ottis closed : short, convulsive contractions of diaphragm.

nvulsion of expiratory muscles : glottis opening and closing.

e same action as in crying.

nvulsive contraction of diaphragm, glottis closing suddenly in the middle.

idual air.
pplemental.
ial.
mplemental.

mperature raised to 30° — 35° C.

isture increased.

mposition { 5.4 per cent. of Oxygen extracted.
 { 4.3 per cent. of Carbon dioxide evolved.

om purple to scarlet.

crease of water (5 per cent.), fibrin, extractives, salts.
crease of fat and albumin.

0 volumes of venous blood contain 5 volumes Oxygen, 25 Carbon dioxide.

0 volumes of arterial blood contain 10 volumes Oxygen, 20 Carbon dioxide.

onary artery, right side of heart, veins gorged : arteries slowly empty, veins more gorged : brain depressed : paralysis.

SECRETION

GLANDS

- Connected with digestion
- With absorption
- With circulation
- With respiration
- With excretion
- With nervous system
- With sense-organs
- With joints
- With voice-apparatus
- With reproduction

LIVER

- Ligaments
- Lobes
- Structure
- Vessels
- Nerves
- Bile
- Glycogenic function

KIDNEYS

- Structure
- Vessels
- Nerves
- Urine

SKIN

- Sebaceous matter
- Perspiration
- Water vapor
- Carbon dioxide

Mucous glands of mouth : salivary : gastric : intestinal : liver : pancreas.

Lymphatic.

Mesenteric.

Spleen : supra-renal capsules : thymus gland : thyroid body : pituitary body : pineal gland.

Mucous glands of respiratory tract.

Sudoriparous or sweat-glands.

Lungs.

Kidneys.

Glands of Pacchioni.

Organ of touch..... Sebaceous glands.

Organ of smell..... Nasal glands.

Organ of hearing..... Ceruminous glands.

Organ of sight..... Meibomian and lachrymal glands.

Glands of Havers.

Arytenoid, epiglottic, mucous of larynx.

Of male { Testes.
Vesiculæ seminales.
Prostate.
Cowper's glands.
Glands of Littre.
Glandulæ odoriferæ.

Of female { Ovaries.
Uterine.
Glands of Bartholine.
Vaginal.

Mammary.

1. Longitudinal. 2 and 3. Two lateral. 4. Coronary. 5. Round.

1. Right. 2. Left. 3. Quadrangle. 4. Caudate. 5. Spigelian.

erous coat from peritoneum.

fibrous coat.

areolar tissue or Glisson's capsule.

lobules, each containing { Branch of portal vein, branch of hepatic artery, branch of hepatic vein, branch of hepatic duct, lymphatics, nerves, hepatic cells, areolar tissue.

portal vein—dividing into { Interlobular veins, lobular veins, lobular venous plexuses, ending in intralobular veins.

hepatic artery..... Follows portal vein.

hepatic vein { Commences as intra-lobular veins : these join to form sub-lobular : the latter unite to form hepatic.

ymphatics Branches as those of portal vein.

hepatic duct Branches as those of portal vein.

agus.

light phrenic.

ympathetic, from hepatic plexus.

hemical composition { Water 86 per cent. Alkaline glycocholates and taurocholates 7.22. Mucus and coloring matter 2.66. Salts .65. Fat .32. Cholesterin .10.

se See Digestion.

lycogen, $C^6 H^{10} O^5$, convertible into sugar.

ibrous coat.

ortical region..... { Malpighian bodies, each made up of { Capsule : afferent vessel : vascular plexus : efferent vessel.

edullary region { Tubes of Ferrein : convoluted, anastomosing.

Ducts of Bellini forming pyramids : papillæ : calyces : infundibula : pelvis.

enal arteries and veins.

ymphatics.

reters or renal ducts each with .. { Fibro-elastic coat.
Muscular coat of external longitudinal, internal circular fibres } end in bladder.
Mucous coat, with spheroidal epithelium

From sympathetic. 2. From lesser splanchnic.

omposition..... { Water 93—98 per cent. ; 100 parts of solids contain Urea 49.68, Uric Acid 1.61, Extractives, Ammonium Salts, Sodium Chloride 28.95, Alkaline Sulphates 11.58, Alkaline Phosphates 5.96, Calcium and Magnesium Phosphates 1.97.

oproximate amounts per diem.. { Water 16 35½ grms. Urea 33.2 grms. Extractives 10.73 grms. Chlorine 8.2 grms. Phosphoric Acid 3.16 grms. Hippuric Acid 2.23 grms. Sulphuric Acid 2 grms. Uric Acid .554 grms.

ein, saponified fat, cholesterin, an albuminoid, epidermic cells.

ater 97.5 per cent., 2.5 solids = fat, an albuminoid, sudoric with volatile and fatty acids, urea, salts, epidermic cells.

NUTRITION.

FORMS OF NUTRITION	Growth
	Development
	Maintenance
	Reparation
	Secretion.
RELATION OF BLOOD TO NUTRITION.	General Work
	Special Work
PROCESSES	1. Exudation of plasma. 2. Assimilation by tissues. 3. Absorption of some of residual fluid by lymphatics. 4. Absorption of the remainder of residual fluid by venous capillaries. 5. Absorption of products of disintegration of tissues by venous capillaries.
	Hypertrophy } Enlargement Hyperphasia }
MORBID CONDITIONS	Neoplasia : new growth
	Atrophy
	Softening
	Induration
	Degeneration
WORK DONE	Inflammation
	Heat-work, per day
	Internal work
	External work
	Mental work
	Growth : in young

increase in size : in young.	
Growth + Evolution	{ Especially in embryo. After birth, in bones, teeth, genital organs.
Restoration of used tissues by ..	{ Replacement : as in epithelium. Interstitial deposit : as in muscle.
Tissues	{ Connected with physical operations: duration indefinite Enamel. Connected with organic operations: duration definite, limited Blood-corpuscles. Connected with animal operations: duration definite, terminated by use .. Nerve.
of parts formed by replacement..	Epithelium.
of parts of low organization	Bone.
of accessory tissues	Vessels and nerves.
of higher tissues by inferior kinds	Cicatrices.
reproduction of lost parts	Bifid thumbs.
Healing of wounds	{ By immediate union. By first intention. By nucleated blastema, developing into tissue. By secondary adhesion.
Receives materials from food.	
Gives materials to tissues.	
Carries gases.	
Repairs tissues.	
Developes force.	
of white corpuscles	To become red.
of red corpuscles.....	{ Gas-carriers : supply albuminoids to serum : possibly color-matters to secretions : may have special relation to muscle and nerve.
of albuminoids	Tissue-formers : source of albuminoids in secretions.
of fibrin	Coagulation : maintenance of viscosity of blood.
of fat	In formation of new tissues : in secretions : oxidation.
of sugar.....	Oxidation.
of salts	{ Sodium Chloride: in secretions. Calcium Salts : in all growing tissues.
of gases	{ Phosphates and Sulphates : result of muscular and nervous work. Oxygen, to combine with tissue-elements. Carbon dioxide, result of that combination.
Due to increase in size of tissue-elements.	
Due to increase in number.	
Homologous	{ Fatty tumors. Fibrous. Cartilaginous. Osseous.
Heterologous	{ Tubercle. Sarcoma. Cancer.
Wasting of a part or tissue.	
Liquefaction of tissue-elements.	
Deposition of albuminoid or amyloid substance among tissues.	
Substitution of fat for the normal material of the tissue.	
Lessened formative activity of tissues.	
Alteration of blood.	
Formation of pus.	
Depression of vital power.	
Heat, redness, pain, swelling.	
30,600 kilogram-meters	{ Total = 1,044,267 kilogram-meters.
41,180 kilogram-metres	
09,509 kilogram-metres	
.....	

NERVOUS SYSTEM.

GENERAL	Centres	Of grey matter
	Fibres	Of white matter
	Excitability	1. Simple excitability. 2. Conductility. 3. Sensibility.
SYMPATHETIC SYSTEM.....	Structure	Ganglia
	Functions	Nerve branches
	Coats	Presides over the viscera; vaso-motor. Dura mater: fibrous. Arachnoid: serous. Pia mater: vascular.
SPINAL CORD	Structure	External
	Functions	Internal
	Nerves	Conducts
		Centre of reflex action. Arrangement
ENCEPHALON		Roots
		Functions
		Medulla oblongata
		Pons Varolii
		Crura cerebri.
		Brain ganglia
	Structure	Cerebrum
		Cerebellum
	Functions	Of medulla oblongata
		Of pons and crura
		Of brain-ganglia
		Of cerebrum
		Of cerebellum
		1st pair. Olfactory
		2nd pair. Optic
		3rd pair. Motores oculorum
		4th pair. Pathetic
		5th pair. Trigeminal
		6th pair. Abducent
		7th pair
	Nerves	8th pair
		9th pair. Hypoglossal
		Roots
		Branches

Afferent or Sensory.
Efferent or Motor.

Cephalic.....	1. Ophthalmic. 2. Spheno-palatine. 3. Otic. 4. Submaxillary.
Cervical.....	Three.
Dorsal.....	Twelve.
Lumbar.....	Four.
Sacral.....	Five.
Coccygeal.....	One.
Connecting ganglia of the cord.	
Communicating with cerebro-spinal system.	
To arteries, viscera, other ganglia.	
Fissures.....	1. Anterior median: wide, shallow. 2. Posterior median: narrow, deep.
Lines on each side.....	1. Anterior lateral. 2. Posterior lateral. 3. Faintly-marked furrow at back.
Columns on each side.....	Anterior, lateral, posterior, posterior median.
White: external.	
Grey: internal presenting.....	Cornua: commissure: spinal canal.
Sensory impressions by grey matter: decussation in cord. Motor by white: no decussation in cord.	
Cervical 8 pairs. Dorsal 12. Lumbar 5. Sacral 5. Coccygeal 1.	
Anterior: posterior, with ganglion.	
Anterior root, motor: posterior root, sensory.	
Anterior pyramids: lateral tracts and olivary bodies: restiform bodies: posterior pyramids.	
Transverse fibres: longitudinal fibres.	
Thalami optici.	
Corpora striata.	
Corpora geniculata.	
Corpora quadrigemina.	
Olfactory lobes.	
External.....	Fissures..... Lobes..... Convolutions. Corpus callosum. Cortical portion: grey Medullary portion: white Ventricles..... Peduncles..... Divisions..... Longitudinal, Sylvian, of Rolando, internal, perpendicular, Frontal, parietal, temporal, occipital, central. [yellow. Outer pale zone: middle grey: internal reddish- Fibres connecting convolutions. Fibres connecting lobes. Fibres connecting hemispheres. 1st. Right lateral. 2nd. Left lateral. 3rd. Median. 4th. Cerebellar. 5th. In septum lucidum. Superior: to cerebrum. Middle: transverse. Inferior: to medulla oblongata. Right lateral hemisphere. Left lateral hemisphere. Median lobe.

SENSE ORGANS.

CONDITIONS..	Anatomical	Sensory surface : sensory fibres : sensory centre.
	Physiological	Organs normal : arterial blood-supply : active nutrition.
ORGANIC SENSATIONS..	Causal	Objective stimuli : subjective stimuli.
	Of alimentary canal	Relish, repletion, hunger, nausea, indigestion.
	Of circulation	Exhilaration, depression, thirst.
	Of respiration	Freshness, suffocation.
	Of nervous system ..	Exhilaration, depression.
	Of muscular system ..	Repose, injury, fatigue.
	Of temperature	Warmth, cold.
	Stimulus	Solids or moving fluids.
TOUCH	Organs	Cuticle Nails, presenting
		Hairs
	Nerves	Cutis vera
		Sensory nerves of body.
TASTE	Centres	Thalami Optici.
	Stimulus	Sapid liquids and soluble solids.
	Organs	Parts concerned
		Papillae
	Nerves	1. Gustatory of inferior maxillary of 5th. 2. Lingual branch of glossopharyngeal.
	Centres	1. Lateral tract of medulla oblongata. 2. Floor of 4th ventricle.
SMELL	Stimulus	Volatile bodies.
	Organ	Bones
		Meatuses
	Nerves	Mucous membrane
		1. Olfactory nerves. 2. Branches of 5th. 3. Sympathetic.
	Centre	Olfactory lobes.
	Stimulus	Vibrating material bodies.
HEARING	Organ	External ear
		Middle ear
	Nerve	Internal ear
		Auditory of 7th pair : divides into—1. Vestibular. 2. Cochlear.
	Centre	Medulla and floor of 4th ventricle.
	Stimulus	Light-waves set in motion by luminous material bodies.
SIGHT	Organ	Appendages : protective and motor
		Coats
	Nerve	Lenses : bring rays to focus on retina
		Optic or 2nd pair.
	Centres	Corpora quadrigemina, corpora geniculata, thalami optici.

Groove, matrix.

Root, epidermal cells, lunula.

Parts Follicle, root-sheath, root, shaft, point.

Histology Cortex : fibrous part : medulla.

Appendages Muscular fibre : sebaceous glands.

Areolar tissue, vessels, nerves.

Papillæ, Pacinian corpuscles.

Tongue, palate, fauces.

Filiform : fungiform : circumvallate.

pharyngeal of 8th.

Superior, middle, inferior spongy bones.

Superior, middle, inferior.

Regions. 1. Lower, squamous epithelium. 2. Middle, ciliated. 3. Upper, columnar.

Olfactory cells : only in third region.

Pinna Helix, ant-helix, concha, tragus, antitragus.

External auditory meatus Cartilaginous, then osseous.

Muscles Attollens, attrahens, retrahens.

Membrana tympani 1. Epidermal layer. 2. Fibrous and elastic. 3. Epithelial.

Eustachian tube To pharynx : partly bony, partly cartilaginous.

Ossicles Malleus, incus, stapes.

Muscles Tensor and laxator tympani : stapedius.

Mucous membrane Ciliated : no glands.

Osseous portion { Vestibule.
Semicircular canals : vertical, horizontal, oblique.

..... { Cochlea { Modiolus.
Lamina spiralis ending in zona denticulata and habenula perforata
and perforated by helicotrema.
Scala : 1. vestibuli, 2. tympani, 3. media.

..... { Sac and utricle, with otoliths.

Membranous { Semicircular canals.
Membrane of Corti, basilar membrane, rods of Corti, membrana velamentosa,
cells of Claudius.

Fluids Endolymph, perilymph.

eyebrows.

eyelids, each consisting of skin, cartilage, striated and non-striated muscle, conjunctiva.

Muscles Superior, inferior, external, internal recti : superior and inferior oblique.

Lachrymal apparatus Gland, ducts, punctum, canal, sac and nasal duct on each side.

Sclerotic (protective) { Fibrous, opaque part with lamina cribrosa.

..... { Transparent cornea.

..... { Lamina fusca.

..... { Venæ vorticosæ and branching arteries.

..... { Capillary network.

..... { Pigment layer.

Iris Muscles : fibres : vessels : pigment.

Ciliary processes.

Ciliary muscle.

Ciliary ligament.

Ora serrata.

Macula lutea.

Colliculus.

Retina (sensitive) .. { 1. Bacillary : of rods and cones.

..... { 2. Outer granular.

..... { 3. Inner granular.

..... { 4. Vesicular.

..... { 5. Nervous.

..... { 6. Membrana limitans.

..... { 7. Radiating fibres.

aqueous.

crystalline. Capsule, ligament, liquor Morgagni, canal of Petit.

vitreous.

MOTOR ORGANS.

MOTOR ORGANS.	CONTRACTILITY	- Of protoplasm. - Of cilia. - Of muscle.
	STIMULI	- Mechanical. - Thermal. - Chemical. - Electrical. - Vital.
	JOINTS	- Structures entering into a typical joint - Bones. - Cartilages. - Capsule. - Ligaments. - Synovial membrane. - Synovia. - Inter-articular cartilage. - Kinds of joints - Immovable or Synarthroses - Mixed or Amphiarthroses - Movable or Diarthroses
	LEVERS	- Three kinds of levers - First: with fulcrum between power and resistance. - Second: with resistance between power and fulcrum. - Third: with power between resistance and fulcrum. - Examples in human body - First kind. Movement of skull on atlas. - Second kind. Opening of mouth by depression of mandible. - Third kind. Most frequent: raising of mandible: flexing joints.
	MUSCLES	Voluntary.

TABLE XIII.

VOICE.

VOICE.	Parts concerned in production of voice	- Larynx. - Lungs. - Pharynx. - Mouth. - Nasal cavities. - Epiglottis. - Thyroid. - Cricoid.
	Cartilages of Larynx	- Two arytenoid. - Two cornicula laryngis. - Two cuneiform.
	Vocal cords	- False. - True, enclosing the glottis or rima glottidis.
	Ventricles of Larynx	Side cavities above vocal cords.
	Laryngeal sac	Pouch of mucous membrane with many mucous glands.
		Two crico-thyroidei.
		Two crico-arytenoidei postici
	Muscles	- Two crico-arytenoidei laterales - Two thyro-arytenoidei - One arytenoideus
	Nerves	1. Sympathetic. 2. Inferior laryngeal of vagus of 8th pair: supplies all muscles save thyroid. 3. Superior laryngeal of vagus of 8th pair: supplies crico-thyroidal mucous membrane.

	{ Dentate	Between right and left parietal.
	{ Squamous	Temporal and parietal.
	{ Limbous	Parietal and occipital.
	{ False	Superior maxillary and palate.
Pharyngitis		Vomer and ethmoid.
Stomatitis		Teeth and jaw-bones.
		Between vertebræ.
Form or arthrodia		In tarsus and carpus.
Joint or ginglyform		Elbow.
Ball and socket or enarthrodia		Hip.
Ball joints	{ Ring-joint : radius and ulna.	
	{ Between occipital and atlas.	
	{ Between atlas and axis.	

VOICE.

Front and side of cricoid.	Insertions.	{ Inferior and inner border of thyroid.	Actions.	{ Tightens cords.
Posterior surface of cricoid.		{ Outer angle of base of arytenoid.		{ Inner fibres tighten : outer separate cords.
Border of side of cricoid.		{ In front of the last.		{ Relax cords : aid in approximating.
Of thyroid.		{ Base and anterior surface of arytenoid.		{ Relax cords.
Inner surface and exterior of arytenoid.		{ Posterior surface and exterior of arytenoid.		{ Approximate cords.

