

# Medical Terminology Course

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This section comprises the edited notes for a course in medical terminology given at the Dr. W.W. Cross Cancer Institute, Edmonton, Canada.

The glossary and assignment exercises will be found in subsections 18 and 19 respectively.

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The revision of a series of lecture notes, used some years previously, necessitated the search of many well-known reference books to determine the source of material, and where possible, authors were given credit.

The work was organized from existing sources and from the writer's personal experience. Many medical works have been consulted and heavy reliance has been placed on Dorland's Illustrated Medical Dictionary and Taber's Cyclopedic Medical Dictionary. Other books which have been consulted rather extensively are The Standard Nomenclature of Diseases and Operations, published by the American Medical Association, and Essentials of Pathology by Dr. H.J. Van Peenen. All reference material is listed in the bibliography and in footnotes.

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## MEDICAL TERMINOLOGY COURSE

### Introduction

There are important rules which govern the formulation of most medical terms. In this course, medical terms commonly in use in cancer centres will be introduced.

Many medical terms are derived from other languages and everyday English does not always apply. Thus it is important to recognize word elements and their meanings.

In this course, for ease in pronunciation, principal accents are written in capital letters and slashes are used to divide syllables, e.g. co/LOS/to/my.

Some words are pronounced differently in different countries. Some examples are the differing pronunciations of a few rather common words:

abdomen	AB/do/men ab/DO/men
migraine	MI/graine ME/graine
neurasthaenia	NEUR/as/then/ia NEUR/as/thenia

### 1. WORD ELEMENTS

To make medical terminology simpler, terms may be broken down into several smaller words or word elements. The three primary word elements are prefixes, roots and suffixes. Roots, also known as stems, are usually the main parts of the word. Prefixes are word elements which, when combined with a root, alter or augment the meaning. Prefixes precede the root. Suffixes also alter or augment the meaning of a root element and follow the root or stem.

*Examples:*

Root:	content	
New Words:	discontent	prefix = dis
	discontented	suffix = ed
Root:	kind	
New Words:	kindness	suffix = ness
	unkind	prefix = un

The main difference in medical terminology is that most word elements are derived from Latin (L) or Greek (Gr).

#### 1.1 Combined Word Elements

Not all word elements are required to complete medical terms. For example, the word *oliguria* is made up of a prefix and a suffix, *olig* originating from the Greek meaning *few* or *small* and *uria* also Greek pertaining to *urine* (*ur*), thus *oliguria* means that a scanty or small amount of urine is being produced.

Some medical terms combine a prefix and a root: *endoderm*, pronounced EN/do/derm, derived from the Greek root *derm* meaning *skin*, thus, the inside skin layer.

At times the same root may be combined with a suffix: *dermalgia*, pronounced DERM/al/gia, combines *derm* with a Latin suffix *algia* meaning *pain*, thus *dermalgia* means painful skin.

*Bronchoscopy*, pronounced BRONCH/o/scopy, combines the Greek *bronchos* meaning *windpipe* with the Greek *scop* which means to *look at* or *observe*, hence the meaning is to look at the windpipe.

Sometimes two roots are combined to describe a disease or treatment with more accuracy. For example *osteoncus* - (OS/te/oncus). The Greek *osteo* meaning *bone* combines with the Greek root *oncos* meaning *mass* or *tumour*. This word is synonymous with a more common term *osteoma* (OS/te/oma) however *oma* is a Greek suffix pertaining to *tumour*.

A more common example of a term with two roots is *bronchopneumonitis* BRON/cho/pneumon/itis where the Greek root *bronchos* combines with the Greek root *pneumo* meaning *lung*, however a Greek suffix defines the word even further by the addition of *itis*, which means *inflammation of*, thus a word meaning inflammation of the windpipe and lungs.

Note that the adjective *inflamed* - has only one m but the term inflammation, derived from the Latin *inflammere* which means to *flame within* has two m's.

#### 1.2 Word variations

Words formed from several different word elements may add, change or omit certain letters to conform with rules of spelling and pronunciation, for example *derm* (at), *broncho* (s), *oste* (o).

Table 1. Summary of new terms

Word	Pronunciation	Prefixes	Roots	Suffixes
oliguria	O/lig/ur/ia	olig		uria
endoderm	EN/do/derm	end(o)	derm	
dermalgia	DERM/al/gia		derm	algia
bronchoscopy	BRONCH/o/scopy		broncho(s)	scopy
osteoncus	OS/te/oncus		oste(o) +	oncus
osteoma	OS/te/oma		oste(o)	oma
broncho-	BRON/cho/		broncho(s) +	itis
pneumonitis	pneumon/itis		pneumon	

Table 2. Elements of similar spelling or sound

Element	Meaning	Origin	Example	Meaning of Word
ante	before	L.	antepyrctic	<i>before</i> patient becomes febrile
anti	against	Gr.	antipyretic	used <i>against</i> fever
a	negative prefix	L.	adipsia	<i>absence</i> of thirst
ad	towards	L.	adrenal	<i>near</i> the kidney
a, an	negative	L.	anoxaemia	<i>absence</i> of oxygen in blood
ano	anus	L.	Anorectal	pertaining <i>to anus</i> and rectum
ad	towards	L.	Adnexa	appendages or <i>adjunct parts</i>
aden(o)	gland	Gr.	Adenoma	<i>glandular</i> tumour
cyto	cell	Gr.	Cytolymph	hyalin substance in a <i>cell</i>
cysto	bladder	Gr.	Cystolith	<i>bladder</i> stone
di	two	L.	Diamine	containing <i>two</i> amino groups
dia	through	Gr.	Diathermy	heat treatments <i>through</i> the tissues
dis	away from	L.	dislocation	<i>displacement</i> of a part, especially a bone
dys	bad or improper	Gr.	dyslochial	disordered lochial discharge
en	in	Gr.	en cranial	located <i>in</i> the cranium
entero	intestines	Gr.	enterology	study of <i>intestines</i>
gram	record	Gr.	electroencephalogram	<i>record</i> of brain waves
graph	machine	Gr.	electroencephalograph	<i>instrument</i> used to make record
graphy	process	Gr.	electroencephalography	<i>process</i> of making records
haem(at)	blood	Gr.	hemangioma	tumour consisting of <i>blood</i> vessels
hemi	half	Gr.	hemiglossal	involving <i>half</i> the tongue
haemo	blood	Gr.	haemoglobin	oxygen pigment carrying red <i>blood</i> cells
hyper	above	Gr.	hyperchromatosis	<i>increased</i> staining capacity

Table 2. Elements of similar spelling or sound

hypo	below	Gr.	hypochro- mato- sis	<i>fading or disappearance</i> of chromatin from a cell
ile(o)	ileum	L.	ileocaecal	pertaining to the <i>ileum</i> and caecum
ilio	hip bone	L.	iliosacrum	pertaining to the <i>ilium</i> and sacrum
inter	between	L.	intervertebral	<i>between</i> two contiguous vertebrae
intra	inside	L.	intravenous	<i>within</i> the vein
macr(o)	large	Gr.	macrodon- tia	<i>large</i> teeth
micro	small or minute	Gr.	microdon- tia	abnormal <i>smallness</i> of teeth
my(o)	muscle	Gr.	myocyte	a cell of the <i>muscle</i> tissue
myel(o)	marrow	Gr.	myelocyte	bone <i>marrow</i> cell
necr(o)	corpse	Gr.	necrotic	state of tissue <i>death</i>
nephr(o)	kidney	Gr.	nephrotic	<i>kidney</i> condition caused by nephrosis
neur(o)	nerve	Gr.	neurotic	<i>nervous</i> condition
or(al)	mouth	Gr.	oropharyngeal	pertaining to the <i>mouth</i> and pharynx
aur(al)	ear	L.	auralgia	<i>ear</i> pain
ost(eo)	bone	Gr.	osteosclerosis	abnormal hardening of <i>bone</i>
ot(o)	ear	Gr.	otosclerosis	formation of spongy bone in the middle <i>ear</i>
per	through	L.	percutaneous	<i>through</i> the skin
peri	around	Gr.	periglottis	<i>around</i> the tongue
pre	before	L.	precordium	region in <i>front</i> of the heart
py(o)	pus	Gr.	pyogenesis	formation of <i>pus</i>
pyr(o)	fire	Gr.	pyrogen	<i>fever</i> producing substance
(ec)tomy	to remove	Gr.	cystectomy	surgical <i>removal</i> of bladder
(os)tomy	to make a mouth	L. & Gr.	cystostomy	surgical <i>opening</i> into bladder
(o)tomy	to incise or open	Gr.	cystotomy	surgical <i>incision</i> into bladder

Also, many word elements with which you must be familiar are similar in sound or even spelling but have very different meanings (Table 2).

For example, a patient who has advanced carcinoma of the bladder may require a *cystectomy*, however sometimes when temporary drainage of the bladder is required, a *cystostomy* is performed. However, the surgeon who only incises the bladder, for example to remove a stone, and sutures it prior to ending surgery, has *performed a cystotomy*.

## 2. BASIC ANATOMY AND PHYSIOLOGY

### 2.1 Definitions

Anatomy – the science which deals with the structure of the body

Physiology – the science dealing with body functions

### 2.2 Plan of the human body

The *head* contains the cranial cavity which is formed by the skull and encloses the brain.

The *trunk* is composed of the thoracic, abdominal and pelvic cavities.

The *thoracic cavity* is formed by sternum, ribs and thoracic vertebrae. The floor is formed by the diaphragm. The organs or viscera in the thoracic cavity are the heart, lungs, trachea and oesophagus.

The *abdominal cavity* is formed by the vertebral column, and layers of muscle which support the viscera. The viscera in the abdominal cavity are the stomach, small and large intestines, liver, gallbladder, spleen, pancreas, and kidneys.

The *pelvic cavity* is enclosed by the bony pelvis. The viscera in the pelvic cavity are the urinary bladder, organs of reproduction, sigmoid colon and rectum.

The *spinal canal* is continuous with the cranial cavity and lies within the backbone. It encloses the spinal cord.

### 2.3 Anatomical position

The individual is considered to be in the anatomical position when standing erect with arms at the side and palms turned forward.

Apex – top or upper part

Distal – farthest away from the body

Proximal – nearest to the body

Dorsal – back or posterior part of the body

Ventral – front or anterior part of the body

Inferior – lower or under

Superior – upper or higher

Antero (anterior) – in front of

Postero (posterior) – behind

Dextro – to the right of

Levo – to the left of

Latero – to the side of

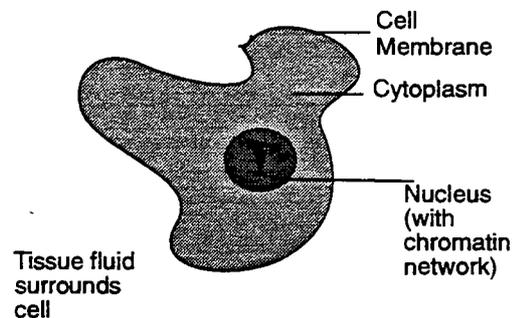
Mes – medi – in the middle of

Opisth – backward

### 2.4 Cell structure

Tissue fluid surrounds cell and all cells are composed of protoplasm.

Diagram 1. Cell structure



#### (1) General properties of cell membrane:

##### (a) Osmosis

materials in solution on one side of a semipermeable cell membrane attract fluid from the other side.

##### (b) Selective permeability

the ability to pass through, e.g. the kidney units (glomeruli) retain certain substances and let others filter through.

##### (c) Diffusion of a gas or liquid

until evenly distributed on both sides of a membrane, e.g. oxygen diffuses from the lung alveoli into the blood and in the tissues from the blood into the cells.

(2) *Process of living cells*

Metabolism – the sum of all physical and chemical changes that take place within an organism.

(a) *Catabolism – breaking up*

(b) *Anabolism – building up*

(3) *Functions of specialized body cells*

(a) *Secretion*

the production of substances from materials in the blood, e.g. glandular cells in the stomach secrete digestive enzymes.

(c) *Contractility*

changing in response to nervous stimulation, e.g. muscle cells contract and relax.

(c) *Conduction*

transfer of an impulse, e.g. nerve cells. The *all or none law*. A stimulus to a nerve or muscle causes it to respond to its greatest extent or not at all. Impulses all travel at the same rate but nerves only respond to a *threshold stimulus*.

## 2.5 Water

Approximately 66% of the body is water, which is contained:

- (1) within the cells
- (2) surrounding the cells (tissue fluid)
- (3) in blood vessels (principal component of blood).

Water has several functions in the body. It is used:

- (1) as a solvent
- (2) for ionisation of acids, bases and salts
- (3) to absorb heat and therefore to regulate temperature
- (4) as a vehicle; permitting exchange, excretion, and secretion through cell membranes.

## 2.6 Electrolytes

Electrolytes are chemicals which carry electrical impulses. Water and electrolyte balance is important. For example, on a hot day we perspire and deplete the salts in our body. The water depletion causes us to feel thirsty, but if we fail to replace the salt also, in severe cir-

cumstances, illness (heat stroke) due to salt loss may occur.

## 2.7 Tissues

When groups of cells (cyto) become specialized in the work they perform in the body, they are called tissues.

There are five main types of tissue:

- (1) *Epithelial tissue* covers the surface of the body and lines cavities. Examples are the skin and lining of the thoracic and abdominal cavities, the pleura and peritoneum. Epithelial cells are packed closely together with little space between.
- (2) *Connective tissue* supports, anchors and holds other tissues together. Examples are ligaments, tendons, cartilage, bone and fat.
- (3) *Muscular tissue* possesses the ability to contract.

There are three types of muscle tissue:

- (a) skeletal (voluntary)
  - (b) smooth (involuntary)
  - (c) cardiac (heart)
- (4) *Nerve tissue* receives and carries sensations to and from the brain and spinal cord from various parts of the body.
  - (5) *Vascular tissue* carries food and oxygen to cells, removes waste, and fights infection. Blood and lymph make up vascular tissues.

Fat, known as adipose tissue, is a connective tissue which:

- (1) serves as a covering under the skin, cushioning and protecting parts exposed to pressure.
- (2) being a non-conductor of heat, prevents too rapid heat loss through the skin.
- (3) supports and protects various organs, for example, the eyes and kidneys.
- (4) fills up space in the tissues affording support to delicate structures such as blood vessels and nerves.
- (5) constitutes an important reserve of food when needed by the body. Bears hibernating can survive only if they have a sufficient fat reserve to last through the period of hibernation.

## 2.8 Organs

Different kinds of tissue form organs (viscera). For example, the stomach is an organ composed of epithelial, connective, muscular, nerve and vascular tissues. Every organ has some special function to perform, working in co-ordination with other organs.

Groups of organs which act together are called *systems*. There are **nine** primary body systems: integumentary, endocrine, musculo-skeletal, respiratory, circulatory, digestive, nervous, urinary, and reproductive.

## 3. INTEGUMENTARY SYSTEM

The integumentary system consists of the skin and mucous membranes. The word integumentary is derived from a prefix and a root. The prefix "in" means just that, and the root from the Latin word *tegere* means to cover.

### 3.1 Epidermis

The epidermis is the thin outer protective layer, however on the soles of the feet or the palms of the hands, the epidermis is thick. The epidermis can be divided into four layers. The *stratum corneum* is composed of keratinized cells with no visible nucleus. The *stratum lucidum* is composed of flattened cells and nuclei are not visible. Where hair is present, there is a thin stratum corneum and the stratum lucidum is usually absent.

In the third layer, or *stratum granulosum*, granules and nuclei can be seen in the cytoplasm. The innermost layer, known as the *stratum germinativum* or Malpighian layer is the part of the skin where new cells are germinated. Young cells which are pigmented contain melanin which protects the underlying tissues.

### 3.2 Dermis

The dermis beneath the epidermis is made up of dense, irregular connective tissue, with dense bundles of fibrous tissue between the cells. In the dermis are found sweat glands, blood and lymph vessels, nerves and nerve endings, hair follicles and sebaceous (sebum = tallow) glands. (Diagram 2).

### 3.3 Sweat glands

Sweat glands are small tubes that run spirally to the surface of the skin from a coiled end deep in the dermis. The opening on the skin is called a pore. Surrounding the end are capillaries from which the gland removes water and waste products. These are forced out on the surface of the skin to form perspiration (L. per = through + spirare, to breathe). Normally the amount perspired in twenty-four hours is approximately one litre.

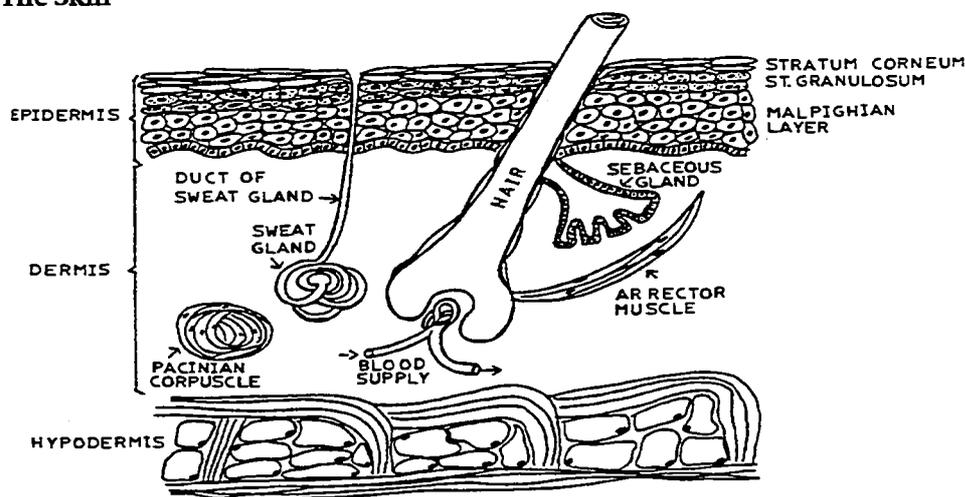
The sweat glands help to regulate body temperature. When the water on the skin evaporates, heat is lost from the body.

### 3.4 Hair

Hair is distributed over most of the body with the exception of the palms of the hands and the soles of the feet. Hairs have their roots in hair follicles. These follicles widen at the base to enclose a capillary tuft which provides nourishment for the growth of hair. If the follicle is damaged, the patient may suffer from alopecia, AL/o/pe/shia (Gr.) or a loss of hair; this may be generalized following some cancer chemotherapy or localized following radiotherapy.

The hair follicle is placed obliquely to the skin and a small muscle (the arrector muscle) is

Diagram 2. The Skin



fastened to the side causing it to stand up in cold or fright. The portion of the hair extending above the skin surface is called the shaft.

### 3.5 Sebaceous glands

The oil or sebaceous glands are small sacs with ducts which usually empty into the hair follicles, although some open directly on the skin surface. The sebaceous glands secrete an oil which lubricates the skin and keeps it soft and pliable and makes the hair glossy.

### 3.6 Nails

Nails are tightly packed cells of the epidermis that protect the finger and toe tips and help in handling and picking up objects.

### 3.7 Functions of skin

- (1) Forms a protective covering over the body.
- (2) Eliminates waste products from the body in the form of perspiration.
- (3) Helps to regulate body temperature (the evaporation of perspiration) while layers of fat serve as insulation
- (4) Provides us with the sensation of touch because of the nerve endings in the dermis.

### 3.8 Signs, symptoms and diseases of the integumentary system

#### Acne vulgaris

simple acne (vulgaris = simple).

#### Carbuncle

(L. Carbunculus = little coal) painful local inflammation of the skin with formation of pus.

#### Cicatrix

scar left by healed wound.

#### Contact dermatitis

inflammation of the skin caused by external irritants such as poison ivy, cosmetics, detergents, sprays, etc.

#### Decubitus ulcers

(decumbero = to lie down) ulcers due to poor circulation

#### Dermatophytosis

athlete's foot (tinea pedis), a fungus infection.

#### Dermoid cysts

benign tissue in a cyst in the skin.

#### Eczema

irregular, dry, itchy and scaly patches of the skin.

#### Erosion

dead epidermis (e = out) (rodere = to gnaw)

#### Erysipelas

(erythro = red) (pella = skin), infection within the skin.

#### Excoriation

(ex = out) (corium = skin) the skin breaks out in a rash.

#### Fissure

(L. fissura) ulcer or crack-like sore.

#### Furuncle

(L. furunculus) a boil.

#### Gangrene

death of tissue caused by interference with blood supply. Associated with diabetes and circulatory disorders.

#### Macule

(L. macula = spot)

#### Mycosis

(mykes = fungus) (osis = condition of) fungal infection of skin or other tissues.

#### Papule

elevated spot (from L. papula = pimple).

#### Paronychia

(Gr. para = beside) (Gr. onyx = claw) infection of marginal structures about the nail.

#### Pediculosis

caused by animal parasites called pediculi or lice in the hair, body or pubic region. Their eggs or nits appear as white specs on hairs.

#### Pruritis

(L. prurire = to itch) (itching) a symptom of some general disease conditions.

#### Psoriasis

(Gr.) a chronic disease characterized by eruptions in circular patches covered with dry, silvery scales.

**Scabies**

(L. *scabere* = to scratch) due to microscopic parasites (*Acarus scabei*) that burrow under the outer layer of the skin.

**Steatoma**

(Gr. *steat* = fat + *oma* = tumour) "wen" or sebaceous cyst.

**Urticaria**

(L. *urtica* = nettles) hives, oedematous raised pinkish areas that itch.

**Varicella**

chicken pox (L. *varicella* = a tiny spot).

**Variola**

smallpox (L. *variola* = a small spot).

**Vesicle**

elevated lesion with fluid (L. *vesica* = a bladder).

**4. THE SKELETAL SYSTEM**

The skeleton consists of a number of bones, held together by bands or ligaments to form joints, which allow movement between them.

**4.1 Structure of bones**

The *periosteum* is a membrane that covers every bone. It contains blood vessels which carry nutrients to the bone cells. In the long bones of the extremities the shaft or *diaphysis* is the hard compact portion, the *epiphysis* or end is spongelike and covered by a shell or harder bone and the *metaphysis* or growing portion lies between them. The *diaphysis* and *epiphysis* do not fuse until growth has ceased. Bone cells multiply rapidly in early years but later on only dead cells are replaced or injured ones are repaired. Bones get harder and more brittle with age. Bones differ in size and shape. Long bones give support, flat bones provide protection for delicate organs and irregular bones allow for more motion. The outer portion of bones is hard, however the hollow inner part is filled with soft marrow (Gr. *myelo* = marrow). Yellow marrow is found in long bones, whereas red marrow is found in the end of long bones as well as in ribs and bodies of the vertebrae. The latter is responsible for the manufacture of red blood cells, some of the white blood cells and platelets.

**4.2 Functions of the bones or skeleton**

The skeleton:

- (1) gives general shape and proportion to the body;
- (2) provides attachment for muscles and forms levers on which the muscles act to move the body;
- (3) forms cavities for the protection of vital organs.

Bones are not always hard. Some originate as cartilage and then become hard. Bones are usually completely hardened by about twenty years of age through the deposit of calcium and phosphorus from food. Some remain as cartilage, however, for example, the end of the nose, the ears and the anterior part of the ribs attached to the sternum.

**4.3 Joints**

Where two bones glide over one another in semi-attachment, *joints* (arthro) are formed. Where the surfaces of the ends of the bones come together they are covered with a thin layer of cartilage. Between them layers of fibrous tissue called *ligaments* are formed. Inside, the cells of the lining of the joint give out a small amount of slippery fluid (*synovial fluid*) which keeps them lubricated and allows free movement. Joints have:

- (1) no movement, for example, the flat bones of the skull;
- (2) slight movement, for example, the bodies of the vertebrae;
- (3) free movement, for example, the joints at the shoulder and hip.

Types of freely movable joints

- (1) *Ball and socket*

A joint in which a rounded head is received into a cup-like socket, for example, the shoulder joint, formed by the head of the humerus and the glenoid cavity of the scapula.

- (2) *Hinge*

Movement is permitted in one plane only, for example, the knee or elbow joints.

- (3) *Pivot*

One bone rotates around another which remains stationary, for example, the first cervical vertebra pivots on the second.

- (4) *Gliding*  
The articulating surface of one bone slides on that of another to a limited extent, for example, joints between the carpal and tarsal bones.

#### 4.4 Kinds of movement

- (1) *Flexion*  
A limb is flexed when it is bent, for example, bending the arm at the elbow.
- (2) *Extension*  
A limb is extended when it is straightened out, for example straightening the arm at the elbow.
- (3) *Abduction*  
Movement away from the midline, for example, raising the arm from the side.
- (4) *Adduction*  
Movement toward the midline, for example, lowering the raised arm to the side.
- (5) *Circumduction*  
Circular movement in which the bone outlines a cone, for example, swinging the arms.
- (6) *Rotation*  
The turning of bones on their axes, for example, rotation of the atlas (1st vertebra) on the axis (2nd vertebra) to turn the head.
- (7) *Supination*  
Moving to the supine position with the arms hanging down and the palms facing forward.
- (8) *Pronation*  
Moving to the prone position with the arms hanging down and the palms facing backwards.
- (9) *Eversion*  
The sole of the foot faces outward.

#### 4.5 The skull

The skull consists of the bones of the *cranium* and of the *face*. They fit together to form a cavity for the protection of the brain. The skull is made up of twenty-two bones closely fitted together without movable joints, with the exception of the lower jaw or *mandible*. This is attached to the skull by a hinge joint on either side that permits movement of the mandible up and down. The upper jaw is called the *maxilla*. It is firmly attached and

does not move. The facial bones form the eye sockets and the nasal and oral cavities.

##### *Bones of the cranium*

Two parietal bones, one occipital bone, and one frontal bone form a covering for the brain. Two temporal bones contain the ear cavities, the organs of balance, and the mastoid cells. One sphenoid bone is located in the centre and forms the base of the skull. One ethmoid bone is found in the roof of the nasal cavity.

##### *Bones of the face*

Two nasal bones form the upper part of the bridge of the nose. One vomer bone divides the nasal cavity. Two inferior turbinate bones in the nostrils form the outer walls of the nasal cavity. Two lacrimal bones form a small part of the medial wall of the eye orbit. Two zygomatic or malar bones form the prominence of the cheek. Two palatine bones form the roof of the mouth. Two maxillae form the upper jaws and one mandible forms the lower jaw.

##### *Sinuses*

Four pairs of cavities in the cranial bones make the skull lighter and return the sound of the voice. Named after the bones in which they lie, there are 2 frontal sinuses, 2 maxillary sinuses, 2 ethmoid sinuses, and 2 sphenoid sinuses.

##### *Sinusitis*

The effect of swollen epithelial tissue which blocks drainage channels and thereby prevents normal secretions in the sinuses

#### 4.6 Vertebral or spinal column

The thirty-three bones comprising the spinal column are called vertebrae. These are divided into five groups according to their distinguishing characteristics.

- (1) *Cervical vertebrae* (7 in number)  
The first, called the *atlas*, forms a joint with the base of the skull and permits the nodding movement; the second called the *axis* permits the side to side movement of the head.

- (2) *Thoracic vertebrae* (12 in number)  
The twelve pairs of ribs are attached to these.
- (3) *Lumbar vertebrae* (5 in number)  
These are large vertebrae that allow free movement to the spinal column.
- (4) *The sacrum*  
The sacrum is a single wedge-shaped bone consisting of *five vertebrae* fused together. It is situated between the two pelvic bones and forms part of the pelvic girdle.
- (5) *The coccyx*  
Situated below the sacrum consists of four small bones fused together.  
Functions of the spine:
  - forms the central support for the body.
  - ensures flexibility of the trunk,
  - protects the spinal cord,
  - absorbs shock,
  - provides attachment for the ribs,
  - supports the weight of the trunk and transmits it to the lower limbs,
  - forms a strong posterior boundary for the thorax and abdomen and helps to maintain erect posture.

The spine normally curves anteriorly and posteriorly. (Diagram 3).

Diagram 3. Curves of the spine

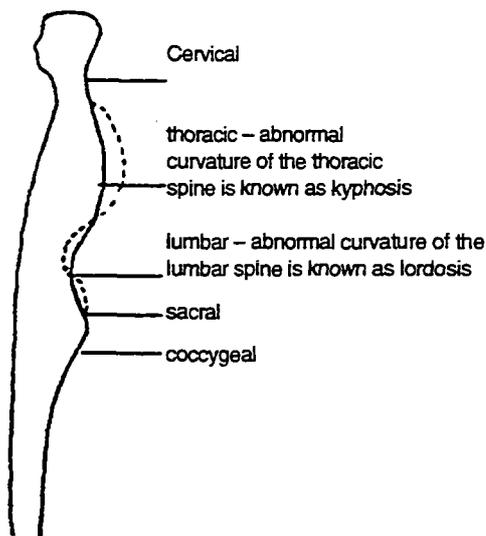
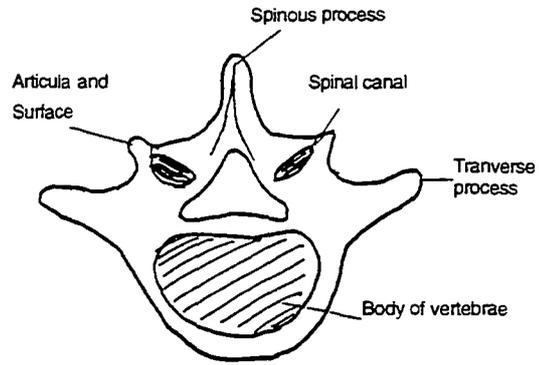


Diagram 4. Vertebra



The flat part of the body of the vertebra bears most of the weight. An arch is formed, providing an opening or spinal canal through which the spinal cord passes (Diag. 4).

Fingerlike extensions called transverse process serve to anchor tendons and ligaments.

Intervertebral discs are plates of cartilage between the vertebrae which make the joints flexible and help to break the shock of any sudden force.

#### 4.7 Ribs and Sternum

There are twelve ribs on each side connected in pairs to the thoracic vertebrae behind and, with the exception of the last two pairs, to the sternum (breast bone) in front. The ribs are not bony throughout their entire length, but at a short distance from the front, cartilage takes the place of bone. The upper seven pairs are called true ribs and are attached by their cartilage directly to the sternum. The lower five pairs are called false ribs. The upper three pairs of false ribs are attached by their cartilage to the rib directly above and thence to the sternum. The last two pairs are unattached to the sternum and are called floating ribs.

The sternum is a long, flat, dagger-shaped bone with the point downwards. Three parts make up the sternum, known as the manubrium, body and xiphoid process.

#### 4.8 Bones

- (1) Bones of the upper extremities

The *scapulae* or shoulder blades are two large flat, triangular bones lying upon the ribs posteriorly. A prominent ridge or spine at the back forms an attachment for back and arm muscles. At the outer and upper part the glenoid cavity receives the rounded head of the humerus.

The *clavicles* are two slender bones which extend horizontally across the upper part of the thorax above the first ribs. They articulate with the scapulae and sternum.

The *humerus* is the bone of the upper arm. It consists of a shaft and two enlarged ends. The proximal end is the smooth rounded head which fits into the glenoid cavity of the scapula. The distal end has bone surface which articulates with the ulna to form the elbow joint.

The *radius and ulna* are parallel bones located in the forearm. The radius extends from the elbow to the wrist on the lateral side. The ulna extends from the elbow to the wrist on the medial side. The radius articulates with the ulna just below the elbow.

The *carpal* bones comprise the wrist, made up of eight bones arranged in two rows of four.

The *phalanges* are the finger bones. Three phalanges comprise the fingers, and two the thumbs.

(2) Bones of the lower extremities

The pelvis is formed by six bones, two ilia, two ischia and two pubic. One of each form two large flat irregular bones (the innominate) that become one when adulthood is reached which, together with the sacrum, constitute the pelvic girdle.

There is a hollow on the outer side of each innominate bone which forms the *acetabulum*, a socket to articulate with the upper end of the femur.

The *femur* is the bone of the thigh. It extends from the acetabulum to the knee. It is the longest and strongest bone of the body. Proximally the smooth rounded head fits into the acetabulum. The neck of the femur is a weak point. It joins the head to the shaft. The distal end of the femur has two bony masses by means of which it articulates with the tibia and patella and forms the knee joint.

The *patella* is a small flat triangular bone placed in front of the knee joint which it serves to protect.

The *tibia and fibula* are parallel bones of the lower leg. The *tibia* or shin bone extends from the knee to the ankle medially. The *fibula* extends from the knee to the ankle laterally.

The seven *tarsal* bones comprise the ankle and are united by ligaments. They are larger and more irregular than the carpal bones. The largest is the heel bone or *calcaneus*.

The *metatarsals* are five long bones that comprise the foot.

The *tarsals* join the metatarsals to form two arches – *longitudinal* and *metatarsal*.

The *phalanges* in the toes resemble those in the hand both in number and general arrangement.

## 5. MUSCULAR SYSTEM

### 5.1 Introduction

The appearance of human muscular tissue is roughly comparable to the lean of butcher's meat. Muscle cells are arranged in fine elastic threads or fibres, wrapped together in bundles. Several bundles make a muscle. Every muscle is covered by a sheath, the ends of which form *tendons* attached to bones.

*Muscles* are attached to bones at the point that will give best leverage. Muscles tend to work in pairs; for some movements groups of muscles are used. Each muscle is connected to the central nervous system by a *motor nerve* which carries messages from the brain, causing the muscle to contract.

*Bursae* are small sacs lined with synovial membrane and are found wherever pressure is exerted by ligaments over moving parts (singular noun – bursa).

### 5.2 Functions of muscles

- (1) The maintenance of erect posture and holding the head, body and extremities in a variety of positions.
- (2) Movements and locomotion, to secure food and shelter and communicate by speech.
- (3) An elastic support for certain organs, for example, the floor of the pelvis is support for the pelvic contents.

### 5.3 Kinds of muscles

- (1) *Voluntary* muscles are under the control of the will and are capable of rapid and complicated movements; for example, walking, talking, or swallowing.
- (2) *Sphincters* are special voluntary muscles which guard body openings.
- (3) *Involuntary* muscles are not under the control of will and are capable of slow and mechanical movement only. They are found in the walls of blood vessels and in most of the internal organs. Cardiac muscle is found only in the heart and is a special form of involuntary muscle. The working of the involuntary muscles is controlled by a special set of nerves known as the *autonomic nervous system*.

### 5.4 Some important muscles

There are 325 muscles in the body – we will consider only a few groups.

- (1) The *diaphragm* lies between abdominal and chest cavities. Contraction and relaxation is part of the respiratory mechanism.
- (2) The *intercostal* muscles are found between the ribs. They assist the respiratory process.
- (3) The *abdominal* muscles are flat bands which stretch from rib to pelvis and support the abdominal organs. There are four sets of abdominal muscles:
  - (a) the internal oblique muscle – ascending;
  - (b) the external oblique muscle – descending;
  - (c) the transversus abdominus – across the abdomen;
  - (d) the rectus abdominus muscle – vertically.

A *hernia* is a protrusion of a portion of the contents of a body cavity. There are weak places where herniae may occur. These are places where blood vessels and other structures normally extend through the muscles.

The *inguinal ring*, *femoral ring*, and *umbilicus* are common sites.

- (4) The *pectoralis* muscles, major and minor are large anterior chest muscles

(L. pectus = breast). The pectoralis major is a large triangular muscle extending to the humerus which draws the arm forward and downward. The pectoralis minor, beneath the pectoralis major extends to the scapula, lowers it, and depresses the shoulder.

Both of these muscles are removed during a radical mastectomy. The mastectomy patient must learn exercises to accommodate the loss of the pectoral muscles.

- (5) The *serratus anterior* (L. serratus = toothed) are the anterior chest muscles arising from the ribs by separate slips. Inserting into the scapula, the muscles elevate the ribs and assist in breathing. The serratus anterior also rotates the scapula.
- (6) The large muscles of the shoulder, posterior chest and back are the *trapezius* and the *latissimus dorsi*. When the trapezius contracts, the head is drawn back and to the side and the scapula is rotated. The latissimus dorsi originating in the thoracic, lumbar and sacral vertebrae and the iliac crest insert into the groove below the biceps on the humerus for adduction and rotation of the arm.
- (7) The paired *gluteal* muscles form the buttocks (Gr. gloutos = buttock) and are called the gluteus maximus, medius and minimus. These muscles insert into the greater trochanter of the femur permitting thigh movement.
- (8) Major muscles associated with the anterior aspect of the thigh are the *quadriceps femoris* (L. quadri = four + ceps from caput = head, thus a four headed muscle) originating in the ischial tuberosity on the pelvis and inserting into the femur. The quadriceps causes extension of the leg.
- (9) In the posterior part of the thigh are the hamstring muscles, including the *gracilis*, *sartorius*, *biceps femoris*, and *semitendinous* muscles which cause flexion of the thigh.

When the sartorius contracts it allows the legs to flex and cross. It is thus named the tailor's muscle (L. sartor =

tailor). The sartorius is the longest muscle in the body.

The gracilis flexes and adducts the leg and adducts the thigh. Originating on the pelvis, it inserts into the medial surface of the shaft of the tibia.

(10) Large muscles of the lower leg and foot

The *tibialis anterior* elevates and flexes the foot. Originating in the upper tibia, it inserts in the ankle and foot bones.

The calf of the leg contains the *gastrocnemius*, the largest muscle which extends the foot and helps to flex the knee or the thigh. Originating on the femur, this muscle inserts by the Achilles tendon into the calcaneus.

Other muscles in the calf of the leg are the *soleus* and *peroneus longus*. The soleus (L. solea = sole of foot) extends and rotates the foot. It inserts along with the gastrocnemius into the Achilles tendon. The peroneus longus extends, abducts and everts the foot.

(11) Large muscles of the shoulder and arm

The deltoid muscle (shaped like the Greek letter *delta*) which moves the upper arm outwards from the body, raising and rotating the arm has its origin in the clavicle and scapula. It is inserted into the shaft of the humerus.

The biceps flexes and supinates the arm. It has two sources of origin, the short head rising from the coracoid process of the scapula and the long head from the scapula above the glenoid fossa. Insertion is into the radius (bi-ceps = two heads).

The triceps muscle acts in opposition to the biceps. It also originates on the scapula but also has two heads coming from the humerus. Inserted into the ulna, it extends the forearm and arm (tri-ceps = three heads).

(12) Muscles in the forearm are used to allow action in the wrist, hand and fingers. For example, the flexor pollicis longus, which allows us to flex our thumb, originates in the radius and inserts into the terminal phalanx of the thumb.

## 5.5 Signs, symptoms and diseases of the musculoskeletal system

Definition: orthopaedics is the special branch of medicine concerned with the preservation and restoration of the functions of the skeletal system.

The following list includes some of the more commonly used terms related to diseases of muscles and bones.

### Achondroplasia

is a congenital anomaly resulting in dwarfism due to abnormally short long bones.

### Dislocation

the ligaments at the joint give away completely and the bone is displaced from its socket.

### Fibrositis

inflammation of fascia and muscle sheaths.

### Fractures

a fracture is a break in a bone. It may be complete or partial. The types of fractures are:

(1) *Simple fracture*, a crack or clean break occurs.

(2) *Compound fracture*, the skin is broken and the bone protrudes through.

(3) *Comminuted fracture*, the bone is broken into several pieces.

(4) *Greenstick fracture*, a bending and cracking of the bone without a complete break, occurs in immature bones of childhood.

### Torticollis or stiff neck

in which the neck muscles are affected. (Tortus = twisted. Collum = neck).

### Kyphosis

is an abnormal curvature of the thoracic spine convexly and posteriorly.

### Legg-Calve Perthes disease

is osteochondritis of the head of the femur.

### Lordosis

abnormal curvature of the lumbar spine convexly and anteriorly.

**Myasthenia gravis**

is exhibited by rapid fatigue of muscles without pain.

**Myositis**

is inflammation of muscles.

**Osteitis deformans**

(Paget's disease) the enlargement and distortion of bones in older age.

**Osteitis fibrosa cystica**

(von Recklinghausen's disease) – bony manifestation caused by hyperparathyroidism.

**Osteoarthritis**

Hypertropic or degenerative arthritis. A disease of older people resulting in gradual wearing out of the joint.

**Osteochondritis**

inflammation of bones and cartilage.

**Osteomalacia**

softening of the bones.

**Osteomyelitis**

inflammation of bone caused by a pyogenic (pusforming) organism. It is most common among children.

**Paralysis**

the control of muscles by the nervous system has been affected. Paralysed muscles gradually atrophy.

**Rheumatoid arthritis**

a chronic disease affecting many joints which results in deformity. It is commonly diagnosed between 20 and 50 years of age.

**Rickets**

the bone hardening process does not proceed normally because of a lack of Vitamin D. The bones get out of shape when weight bearing, and finally harden in the deformed state.

**Scoliosis**

an S-shaped abnormal lateral curvature of the spine.

**Spondylolisthesis**

spondylos = vertebrae, olithesis = forward slipping, a forward slipping of the

lower lumbar vertebrae, usually on the sacrum with pelvic deformity.

**Sprains**

the ligaments that support joints are stretched or

**Tenosynovitis**

inflammation of a tendon sheath.

**6. THE NERVOUS SYSTEM****6.1 Introduction**

The nervous system is the system which provides the integration and control of body processes. It consists of the brain and spinal cord, linked to the peripheral part connected with tissues and organs.

*Sensory* nerve fibres carry messages from tissues and organs to the brain and spinal cord. *Motor* nerve fibres carry messages to tissues and organs, from the brain and spinal cord.

**6.2 Cerebrum**

The cerebrum is the largest part of the human brain. It is made up of two cerebral hemispheres (hemi = half) each of which is divided into lobes. The folds on the surface of the brain are known as *convolutions*. Grey matter forms the outer layer, or *cerebral cortex*. It contains the cell bodies or neurons. The inner white matter is made up of nerve fibres.

The *anterior commissure* is made up of nerve fibres linking the two cerebral hemispheres.

Deep in the substance of the cerebral hemispheres there are additional masses of grey matter which, together with the cerebrum, form the forebrain:

- (1) the *basal ganglia*, concerned with the modification and coordination of voluntary muscle movement;
- (2) the *thalamus*, an important relay centre for sensory fibres on their way to the cerebral cortex; crude sensation and pain may be felt here;
- (3) the *hypothalamus*, contains the centres for the autonomic nervous system.

**6.3 The midbrain**

The midbrain receives impulses from the eye and ear. It serves as a centre for *visual* and *auditory* reflexes. Cranial nerves III and IV stem from the midbrain. The grey matter of the midbrain consists of the bodies of the IIIrd and IVth cranial nerves, and the *red nucleus*.

The midbrain controls skilled muscular movements. The white matter of the midbrain carries sensory and motor fibres, linking the red nucleus with the forebrain, the hindbrain and the spinal cord.

#### Diagram 5. Left cerebral hemisphere

##### External (Lateral) aspect

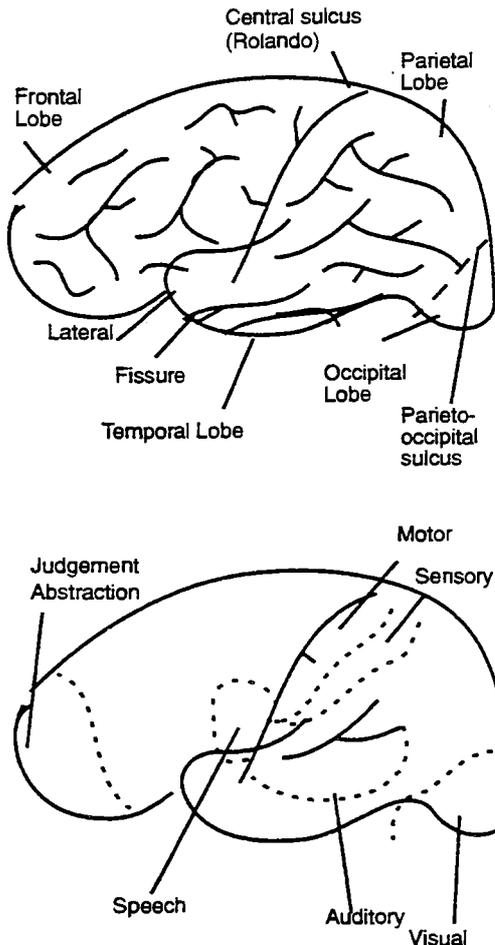
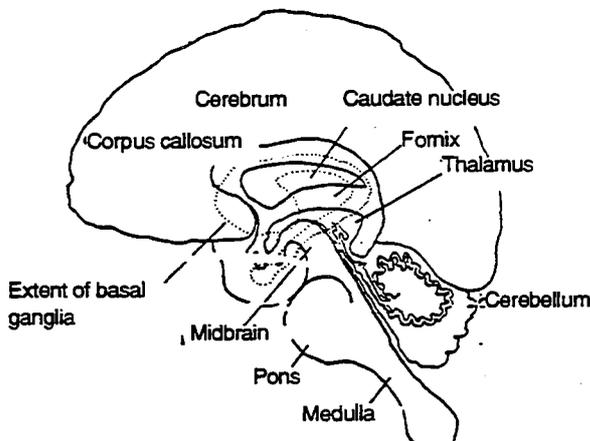


Diagram 6. Mid-Sagittal section-selected structures



#### 6.4 The hindbrain

The *hindbrain* consists of the pons, the cerebellum and the medulla oblongata. The *pons* (L. pons = bridge) bridges the cerebrum and cerebellum. It contains nerve fibres which link the cerebral cortex with the medulla oblongata and the spinal cord (L. medulla = marrow)

The *nuclei* of the cranial nerves V, VI, VII are situated in the pons.

The *medulla oblongata* consists of neurons which form the nuclei of the cranial nerves VIII, IX, X, XI and XII.

The *cerebellum* has centres which are concerned with balance and equilibrium. The function of the cerebellum is to coordinate groups of muscles so that they work together smoothly.

#### 6.5 The spinal cord

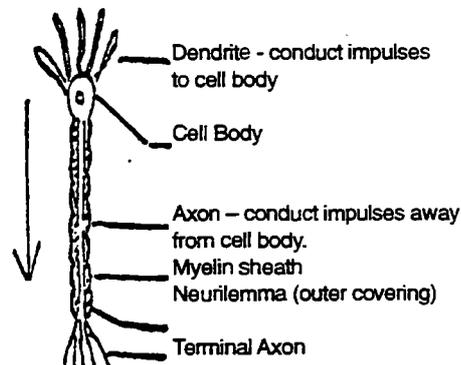
The *spinal cord* extends from the medulla oblongata to the lumbar vertebrae. There are 31 pairs of spinal nerves both motor and sensory. The spinal cord also serves as a reflex centre.

#### 6.6 The nerve cells

The nerve fibres outside the central nervous system in the peripheral nervous system are covered with a *myelin sheath*. An outer thinner covering over this myelin sheath is called *neurilemma*. The presence of the myelin sheath allows the nerve fibre to regenerate. This is a slow process. Nerve tissue in the brain and spinal cord has no myelin sheath and does not regenerate.

#### Diagram 7. Nerve cell

Dendrite – conduct impulses to cell body.



### 6.7 Meninges

Three membranes comprise the *meninges*. The *dura mater* is a thick tough membrane lining the skull. The *pia mater* is a thin tissue covering the outermost layer of brain. The *arachnoid mater* lies between the two; it is a thin covering and contains the blood vessels.

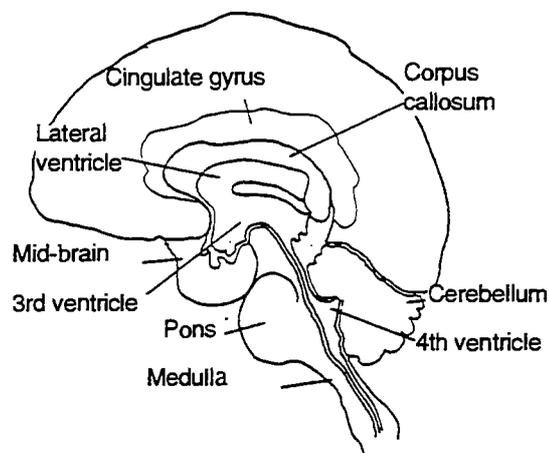
### 6.8 Cerebrospinal fluid

The *cerebrospinal fluid* is produced by the choroid plexus of the two lateral and 3rd and 4th ventricles. It flows from the lateral ventricles through the foramen of Monro to the third ventricle. From the third ventricle it flows through the aqueduct of Sylvius to the fourth ventricle. Leaving the fourth ventricle, it bathes the brain and spinal cord in the *sub-arachnoid space* between the arachnoid and pia mater. It is absorbed by the great venous dural sinuses, especially the *superior sagittal sinus*.

### 6.9 The cranial nerves

The cranial nerves carry impulses to or from the brain.

Diagram 8: Mid-sagittal section showing ventricles



### Bell's palsy

is facial paralysis caused by a lesion of the VIIth cranial nerve.

### 6.10 Peripheral nervous system

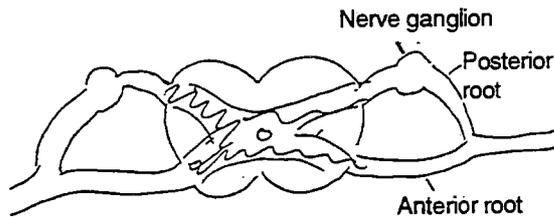
The peripheral nervous system consists of the nerves arising from the spinal cord and running to or from the whole of the body with the exception of areas served by the cranial

Table 3. Cranial nerves

Cranial nerve	Name	Motor function	Sensory function
I	Olfactory		Smell
II	Optic		Sight
III	Oculomotor	All eye muscles except the superior oblique and the external rectus. Also innervates the iris and ciliary body	
IV	Trochlear	Superior oblique m.	
V	Trigeminal	Muscles of mastication	Transmits ordinary sensations from eye, face, sinuses and teeth.
VI	Abducens	External rectus m.	
VII	Facial	Facial muscles, sub-maxillary and sublingual salivary glands	Tactile and taste sensations from the anterior 2/3 of the tongue and the soft palate.
VIII	Acoustic (2 branches) Cochlear Vestibular		
IX	Glossopharyngeal	Pharyngeal muscles and the parotid gland	Tactile and taste sensations from the posterior 1/3 of the tongue, the tonsils, pharynx and the carotid sinuses.
X	Vagus	Heart, lungs, bronchi and digestive tract.	Sensation from the heart, lungs, bronchi, trachea, pharynx, digestive tract and external ear.
XI	Spinal accessory	Sternomastoid, trapezius and constrictor muscles of the pharynx, larynx and soft palate.	
XII	Hypoglossal	Strap muscles of the neck and the tongue muscles.	

nerves and the autonomic nervous system. Peripheral nerves are connected to the spinal cord by two roots: the anterior or motor root and the posterior or sensory root (Diagram 9).

Diagram 9: The Peripheral nerve



The peripheral nervous system is responsible for the innervation of all voluntary muscles (except those controlled by cranial nerves) and the transmission of sensory impulses from the whole of the body (with the exception of the face).

It is largely under conscious (cerebral) control. Division, injury or disease of peripheral nerves thus usually results in both sensory and motor loss. However, as already indicated, eventual recovery is possible providing the nerve is largely intact or the ends of the divided nerve are placed close together.

### 6.11 Autonomic nervous system

The autonomic nervous system controls and regulates the action of glands, the heart and smooth muscle tissue, for example, smooth muscle in the intestines and blood vessel walls.

Autonomic nerves arise at different central nervous system, ranging from the vagus (Xth cranial parasympathetic nerve) to the sacral area of the spinal cord. The autonomic nerves arising from the spinal cord comprise the sympathetic system.

The sympathetic and parasympathetic nerves counterbalance one another.

## 7. THE SPECIAL SENSE ORGANS

### 7.1 The ear

The ear has two main functions, those of hearing and equilibrium (or balance). There are three parts to the ear: the external ear, the middle ear and the inner ear. Each of the three parts serves a definitive function in hearing; however, the inner also functions in balance.

#### The external ear

The *pinna* (L. *pinna* = wing) is made up of cartilage covered by skin. It collects the sound which is transmitted through the *auditory canal*, leading to the *tympanic membrane* or eardrum, (Gr. *tympanon* = drum). The auditory canal contains hairs and *ceruminous* (wax) glands.

#### The middle ear

The middle ear lies in a cavity in the temporal bone. It is connected with the nasopharynx by the Eustachian tube, which opens upon swallowing to allow air to enter the middle ear, thus equalizing pressure on both sides of the tympanic membrane.

There are three small bones in the middle ear called auditory ossicles which are connected to form a small lever between the tympanic membrane and the oval window (*fenestra cochlea*).

The auditory ossicles are named according to their shapes – the malleus, (Latin = hammer), the incus (Latin = anvil), and the stapes (Latin = stirrup). Two small muscles, the tensor tympani connected to the malleus and the stapedius connected to the stapes, contract as a protective mechanism during excessively loud noise.

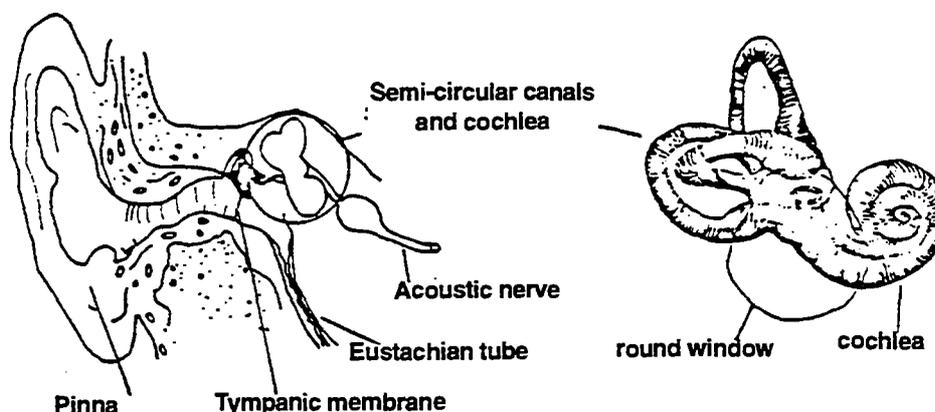
Sound vibrations set the tympanic membrane in motion and move the ossicles. This amplifies and transmits the sound across the middle ear so that the foot plate of the stapes moves backwards and forwards in the oval window which is in contact with the cochlear fluid, in which vibrations are established. These vibrations stimulate receptors in the Organ of Corti, and nerve impulses are sent to the sound centre in the brain.

#### The inner ear

The cochlea (Gr. *Kochlias* = a spiral) is the hearing part of the inner ear. It is a spiral canal containing a receptor for hearing called the *Organ of Corti* to which is attached the cochlear branch of the auditory nerve. It has hair cells which pick up impulses transmitted from the middle ear.

The semicircular canals form the organ of balance. The superior, posterior and lateral semicircular canals each connect by an *ampulla* (L. *ampulla* = a jug) to the *utricle* (L. *utriculus* = a small sac), from which impulses travel to the brain by the vestibular branch of the Vllth cranial nerve.

Diagram 10: The ear in coronal section



## 7.2 The eye

The eye is set in a bony socket, the *orbit*. The visible portion of the eye is covered by a thin transparent membrane called the *conjunctiva*.

- (1) Rectus muscles:
  - the *external rectus* rotates the eyeball outward
  - the *internal rectus* rotates the eyeball inward;
  - *inferior rectus* rotates the eyeball downward;
  - *superior rectus* rotates the eyeball upward
- (2) The *inferior oblique* muscle rotates the eyeball upwards and outwards.
- (3) The *superior oblique* muscle rotates the eyeball downwards and outwards.
- (4) *Levator palpebrae superioris* raises the upper eyelid.
- (5) *Orbicularis oculi*: a muscle which encircles the orbit and closes the eye, and which also compresses the lacrimal (tear) sac.

Other important parts of the eye

### Aqueous humor

the fluid produced in the eye, occupying the anterior and posterior chambers.

### Vitreous humor

a watery substance, resembling aqueous humor contained within the space of the vitreous body (the main body of the eye).

### Fundus oculi

the posterior part, or back of the eye, seen through an ophthalmoscope.

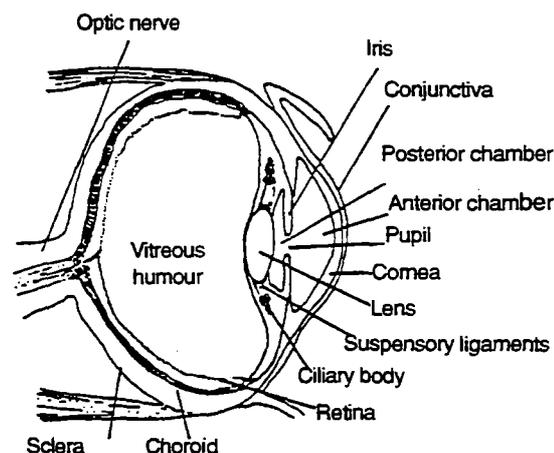
### Fovea centralis

a tiny pit in the center of the *macula lutea* composed of slim elongated cones. It is the area of clearest vision

### Blind spot

The *optic papilla* where the optic nerve leaves the eyeball.

Diagram 11: The eye in sagittal section



## 7.3 Smell

The *olfactory epithelium* located in the superior cleft of the nostrils contains the receptors for smell. These receptors respond to chemical stimuli. The sense of smell is transmitted via the olfactory nerve to the smell centre located in the parietal lobe of the cerebrum .

Table 4. Coats of the eyeball

	Structure	Function
Outer	Sclera, tough fibrous tissue Cornea, transparent Extrinsic muscles attached to sclera	Preserves shape of eyeball Allows passage of light rays Permit and limit eyeball movement
Middle or Vascular Pigmented Coat	Contains arteries and veins. Circular opening at front (pupil) Colored muscular ring – iris – surrounds pupil (intrinsic muscle) Ciliary body Ciliary muscle Suspensory ligament Suspends crystalline lens Choroid – post 5/6 of eyeball, the pigmented vascular coat	Controls size of pupil and amount of light entering eye Produces aqueous humor Contracts and moves forward Alters curvature of lens - rays brought to focus in retina
Inner or nervous coat	Retina – lines back of eye, contains receptors for vision. Rods – dim light Cones – bright and colored light	Light-sensitive layer. Converts light energy to nerve impulses to optic nerve

#### 7.4 Taste

The organ of taste is the *tongue*. There are four types of taste buds, these being sweet, sour, salt and bitter. Substances enter solution and stimulate the *gustatory* cells. Nerve impulses are relayed via the facial and glossopharyngeal nerves to the parietal lobe in the opposite side of the cerebrum.

#### 7.5 Definitions

##### Ophthalmology

a study of disease or conditions of the eye.

##### Ophthalmologist

one who studies the eye and relative diseases and conditions.

##### Otology

a study of the ear.

##### Otorhinolaryngologist

one who specializes in the treatment of diseases or conditions of the ear, nose and throat.

#### 7.6 Signs, Symptoms and diseases of the special sense organs

##### Accommodation

the adjustment of the lens to form a clear image.

##### Achromatopia

colour blindness.

##### Acoustic neuroma

a tumour of the auditory nerve.

##### Astigmatism

irregular curvature of the eyeball.

##### Cataract

opacity of the lens of the eye.

##### Chalazion

small hard tumour similar to sebaceous cyst, on the eyelid.

##### Conjunctivitis

inflammation of the conjunctiva.

##### Diktyoma

a ciliary epithelial tumour.

##### Ectropion

eversion of the eyelid margin, sometimes seen in the elderly.

##### Entropion

inversion of the eyelid margin.

##### Glaucoma

disease of the eye characterized by increase intraocular pressure.

##### Hordeolum

inflammation of sebaceous gland of the eyelid – a sty.

##### Hypermetropia

impairment of near vision. Parallel rays come to focus behind the retina due to a flattening of the globe of the eye or refraction error.

##### Iridocyclitis

inflammation of the iris and ciliary body.

**Malignant melanoma (eye)**

a pigmented mole or tumour arising from the uveal tract.

**Mastoiditis**

inflammation of the mastoid process, generally as an extension of otitis media.

**Meniere's disease**

disturbance in the labyrinth, with sudden onset of tinnitus, deafness, nausea, vomiting and dizziness.

**Myopia**

defect in vision so that objects can only be seen distinctly when very close to the eyes – caused by elongation of the globe of the eye.

**Nystagmus**

involuntary rapid movement of the eyeball.

**Otalgia**

pain in the ear.

**Otitis media**

inflammation of the middle ear.

**Perichondritis (ear)**

inflammation of the skin covering the cartilage of the ear.

**Presbyopia**

defect of vision in advancing age (synonym=farsightedness).

**Retinal detachment**

the retina detaches – usually due to haemorrhage behind the retina from disease or trauma.

**Retinoblastoma**

a tumour arising from the retinal germ cells, a malignant glioma of the retina.

**Strabismus**

the optic axes cannot be directed towards the same object due to lack of muscle coordination (squint).

**Tinnitus**

ringing in the ears.

**Vertigo**

dizziness.

limbs. It returns to the right auricle (atrium) of the heart via the systemic veins.

Food is absorbed, passes into the capillary bed in the digestive tract and is carried by the portal vein to the hepatic or *portal circulation*.

In the *pulmonary circulation*:

blood flows from the right ventricle to the lungs where oxygen is taken up by the blood and carbon dioxide (CO<sub>2</sub>) is given off. The blood then returns to the left auricle (atrium).

**8.2 The heart**

The heart has four chambers which are lined with *endothelium (endocardium)*. It has thick walls of muscle called *myocardium*. Heart muscle is supplied with blood from the coronary arteries that branch off from the aorta.

The heart is enclosed in a two-layered membrane, the *pericardium*. A thin film of fluid separates the layers of the pericardium.

The *cardiac muscles* of the atria are completely separated from the cardiac muscle of the ventricle by a ring of fibrous tissue at the atrio-ventricular groove. (A-V groove). Extensions from this ring form the *heart valves*. A-V valves are attached by thin *chordae tendinae* to extensions of cardiac muscle called the *papillary muscles*. The *papillary muscles* contract when the ventricles contract. They pull on the chordae so that the valve flaps cannot be everted, therefore in health, blood can flow in one direction only.

The human heart is really a double pump. The right atrium receives blood from the body tissues with its oxygen supply diminished via the inferior and superior vena cava. This blood passes into the right ventricle which pumps it to the lungs via the pulmonary arteries to obtain a fresh oxygen supply. The blood received back from the lungs via the pulmonary veins passes via the left atrium to the left ventricle, which pumps it to the rest of the body via the aorta.

**8.3 The cardiac cycle**

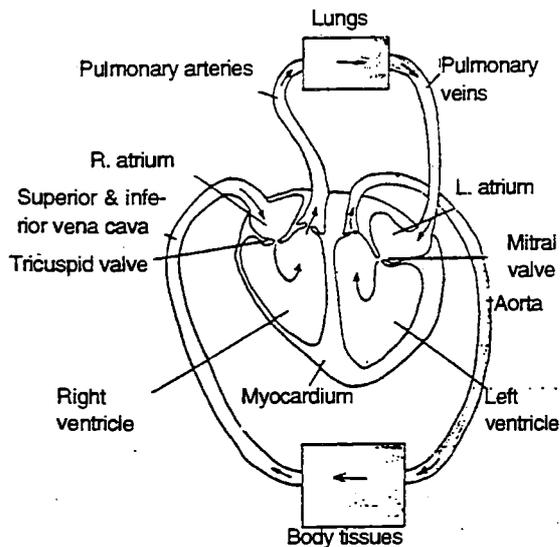
The cardiac cycle consists of *diastole* and *systole*. In diastole, there is a period of relaxation

**8. CARDIOVASCULAR SYSTEM****8.1 The circulation**

The *systemic circulation*:

flows from the left ventricle to the aorta and thence via other arteries to the capillary beds in the head, neck, trunk and

**Diagram 12: Pictorial representation of blood circulation**



when first the atria then the ventricles fill. In *systole* there is a period of contraction. Auricular systole causes the ventricles to be completely filled and stretched which is followed by ventricular systole when the semilunar valves are forced open and blood is ejected into the pulmonary artery and the aorta simultaneously. The semilunar valves prevent backflow from the pulmonary artery and the aorta.

#### 8.4 Heart sounds

The A-V valve flaps close at the beginning of ventricular systole, causing the first heart sound. The semilunar valves close at the beginning of ventricular diastole, causing the second heart sound. Heart *murmurs* will be heard if blood is forced forward through narrowed valves or leaks backwards through incompetent valves.

#### 8.5 Origin and conduction of the heart beat

The rhythmic contraction of the heart is called the heart beat. The impulse to contract is generated rhythmically in specialized NODAL TISSUE in the wall of the right atrium, the SINO-AURICULAR NODE (the pacemaker).

The wave of excitation spreads throughout the muscles of both atria which then contract.

The heart beat is not transmitted from the auricles to the ventricles directly. The impulse

from the auricular muscles is picked up by another mass of nodal tissue, the atrio-ventricular node and relayed by Purkinje tissue, in the Bundle of His and its branches lying beneath the endocardium on the interventricular septum to the muscles of both ventricles which then contract together, while the atria are relaxing.

An electrocardiograph records the electrical changes in heart muscle caused by contraction and relaxation.

Although the heart initiates its own impulse to contract, the body's changing needs are controlled by nervous impulses discharged from controlling centres in brain and spinal cord. Sympathetic nerves increase the rate and force of the heart beat. The parasympathetic nerves slow the heart and reduce the force of contraction.

#### 8.6 Blood vessels

Beginning at the heart, the blood is pumped into elastic arteries, then to muscular arteries. From arteries the body has a system of arterioles like branches on a tree which end in capillaries which surround body cells. Venous blood is transferred back from the capillaries into venules which unite to form muscular veins that empty into the great veins and thence to the heart. Only from capillaries can blood give up food and oxygen to tissues and receive waste products and carbon dioxide from tissues.

#### 8.7 Coats of blood vessel walls

- (1) *Tunica intima*
  - endothelium
  - internal elastic lamina
- (2) *Tunica media*
  - smooth muscle
  - fibrous tissue
  - external elastic lamina
- (3) *Tunica adventitia*
  - fibrous tissue

#### 8.8 Blood pressure

The pressure within the aorta is highest as the blood leaves the left ventricle at the end of systole and lowest as the blood drains into the right auricle at the end of diastole.

Arterial blood pressure is measured in man by means of a *sphygmomanometer*.

### 8.9 The pulse

As blood is pumped from the heart during systole, the distention and increase in pressure which starts in the aorta passes along the whole arterial system as a wave – the *pulse wave*.

### 8.10 Venous return

- (1) Adequate blood volume and adequate tone of smooth muscle in blood vessel walls is essential for normal venous return of blood to the heart
- (2) Unidirectional valves are present in muscular veins to prevent backflow of blood in the system.
- (3) The cardiac pump exerts a residual force which is imparted by the heart's contraction.
- (4) Contractions of skeletal muscles help to squeeze veins and move blood towards the heart
- (5) Respirations act as a pump by the creation of negative intrathoracic pressure which creates a suctioning pull in the veins in the thorax, and the descent of the diaphragm increases the intra-abdominal pressure which forces blood upwards in the abdominal veins.
- (6) Gravity allows blood to drain from the head and neck.

### 8.11 Signs, symptoms and diseases of the cardiovascular system

#### Angina pectoris

pain felt in the centre of the thorax on exertion due to anoxia of the myocardium.

#### Arteriosclerosis

a condition marked by loss of elasticity, thickening and hardening of the arteries.

#### Atherosclerosis

a lesion of large and medium-sized arteries with deposits of yellowish plaques in the intima (lipid material).

#### Cardiac hypertrophy

enlargement of the heart tissue.

#### Cerebral vascular accident

broken blood vessel in the cerebrum.

#### Congenital pulmonary stenosis

born with a narrowing of the opening between the pulmonary artery and the right ventricle.

#### Coronary occlusion

a blockage of a coronary artery, cutting off blood supply to a portion of the heart.

#### Coronary sclerosis

a hardening of the coronary arteries.

#### Coronary thrombosis

a thrombus formation in a coronary artery.

#### Dextrocardia

location of the heart in the right hemithorax often with accompanying transposition of abdominal viscera.

#### Endocarditis

inflammation of the endothelium lining the heart.

#### Haemopericardium

blood in the pericardial sac.

#### Hypertension

high blood pressure.

#### Hydropericardium

an abnormal accumulation of serous fluid in the pericardial cavity.

#### Myocardial infarction

the formation of a dead area in the heart muscle due to interruption of blood supply.

#### Myocarditis

inflammation of the muscular walls of the heart.

#### Pericarditis

inflammation of the lining around the heart.

#### Phlebothrombosis

thrombus formation in a vein generally due to stasis.

#### Thromboangiitis obliterans (Buerger's disease)

an obliterative disease of the blood vessels of the extremities leading to ischaemia and gangrene.

#### Thrombophlebitis

inflammation of a vein with thrombus formation.

#### Varicose veins

enlarged and tortuous veins.

## 9. BLOOD AND THE BLOOD-FORMING ORGANS

### 9.1 Composition of the blood

In the adult, the average amount of blood is 5 litres or approximately 7.7% of the body weight. The blood plasma comprises approximately 55% of the blood. It is almost clear, a straw-coloured fluid of which approximately 90% is water (Table 5).

### 9.2 Cells in the blood

There are three main types of blood cells, red blood cells, white blood cells and platelets (Table 6).

### 9.3 Blood coagulation

Blood does not normally clot within healthy blood vessels. When vascular tissues are damaged, blood undergoes a series of changes which result in clot formation:

The platelets cling to the intersections of the fibrin threads. Adhesions form, the clot shrinks with the expression of serum.

### 9.4 Haematopoiesis – blood formation

Various substances taken in the diet (including iron and other minerals, vitamin B12 and protein) are absorbed (vitamin B12 only in the presence of an intrinsic factor secreted by the gastric mucosa) and taken to the liver. Here vitamin B12 is stored and

released to the general circulation as required as a haematopoietic factor which stimulates the production of red cells (erythropoiesis) in the red bone marrow. Other factors necessary for erythropoiesis include iron, and thyroid hormone. The red cells circulate for 120 days and are then broken down (probably in the spleen) to release iron for further use. Haemoglobin without iron is excreted as bile pigments via the liver.

The various mechanisms responsible for producing white blood cells (except lymphocytes) in the red bone marrow are less well understood.

### 9.5 Blood groups

Present in the plasma of some individuals are antibodies which can cause agglutination (the clumping together) and subsequent haemolysis (breakdown) of the red blood cells received in blood transfusions.

When such reactions occur, the bloods are said to be incompatible. Clumps of cells may block small blood vessels in the lungs or brain causing serious complications. Haemolysis may result in the passage of haemoglobin via the kidneys into the urine, and may lead to kidney failure and death.

The type of antigen present in the red blood cells of the donor's blood, which reacts with the antibodies in the plasma of the recipient help to identify four blood groups (Table 7)

**Table 5. Substances in the blood plasma**

Substance		Associated functions
Plasma proteins (6-7%) (formed chiefly in liver)	Serum albumin 4%	To exert osmotic pressure of 25-30 mm Hg Carries iron and copper. Associated with antibody production.
	Serum globulin 2.7%	
	Fibrinogen 0.3 %	The precursor of <i>fibrin</i> which forms the framework of blood clot.
Regulatory and protective proteins	Hormones Antibodies Enzymes	Chemical messengers from endocrine glands. Important in immunity. Catalysts in chemical reactions.
Inorganic substances (electrolytes) (0.9 %)	Sodium, potassium, calcium, chlorides, bicarbonates, iodine and iron	Fluid and electrolyte balance, body development and function.
Organic substances	Waste material – urea, uric acid, xanthine, creatine, creatinine, ammonia Nutritive materials - amino acids, glucose, fats and cholesterol	Products of tissue activity, transported from the tissues to the kidney and skin for excretion. Absorbed from the gut, are transmitted to the tissues for utilization and storage.
Respiratory gases	(O <sub>2</sub> ) Oxygen (CO <sub>2</sub> ) Carbon dioxide	Small amounts of oxygen remain in solution; carbon dioxide in solution as bicarbonate is carried to the lungs for expiration.

Table 6. Blood cells

Cell name	Normal number/mm <sup>3</sup>	Nucleus	Function
Red blood cell (or corpuscle)	4.5 - 6.0 × 10 <sup>6</sup> per mm <sup>3</sup>	None	Oxygen and carbon dioxide transport.
White blood cell (or corpuscle)	5,000 - 10,000 per mm <sup>3</sup>	Granular: - neutrophil - eosinophil  - basophil Non Granular: - monocyte - lymphocyte	Body defence against bacteria. Play a role in allergic reactions Useful in heparin formation.  Body defence against bacteria. Important in antibody formation.
Platelet	200,000 - 800,000 per mm <sup>3</sup>	None	Play an important role in blood clotting

Diagram 13. Blood coagulation

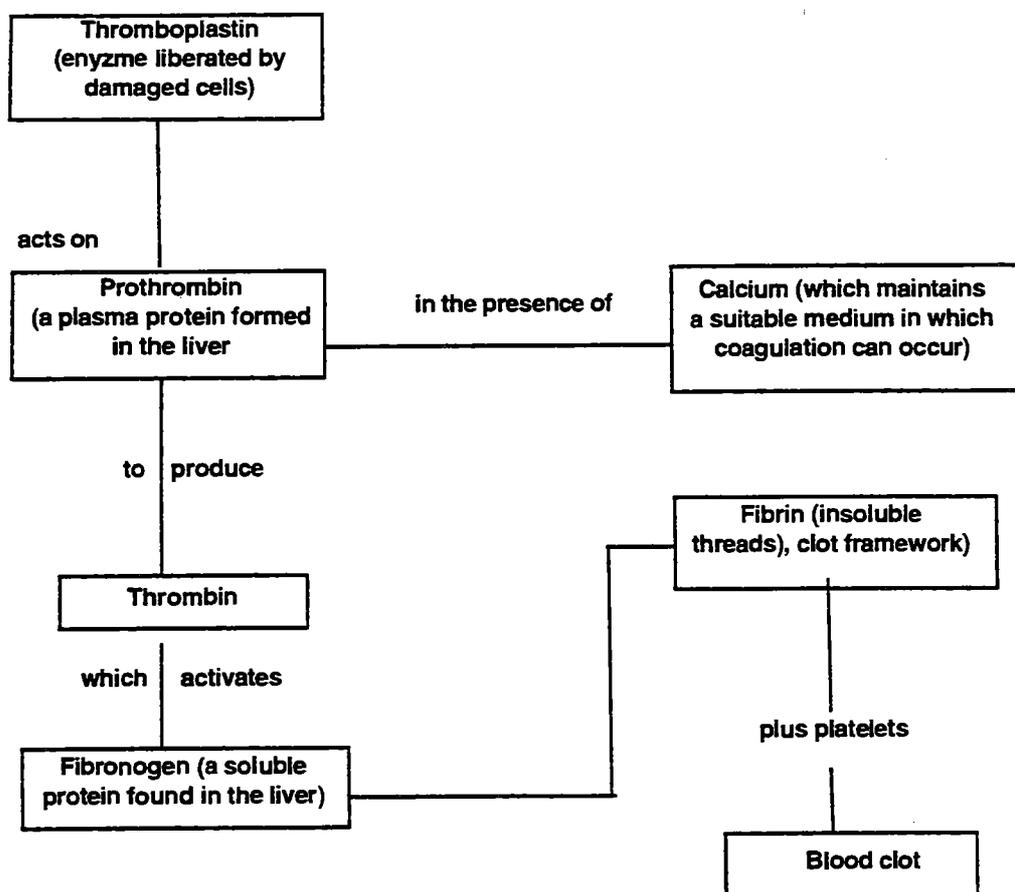


Table 7. Blood Groups

Blood type	Antigen	Antibody
O	None	Anti A & B (universal donor) (can receive only O)
A	A	Anti B (can receive A or O)
B	B	Anti A (can receive B or O)
AB	A and B	None (universal recipient) (can receive A, B, AB or O)

### 9.6 Rhesus factor

The Rhesus factor may be absent or present in an individual's blood. Eighty-five percent of people are Rh positive, that is, they have the Rh antigen. Rh negative persons have no Rh antigen.

If the Rh antigen is transfused to an Rh negative person, the production of anti-Rh factor (antibody) is stimulated. Should more Rh antigen be transfused, the Rh antigen combines with the anti-Rh antibody reacting to cause *agglutination and haemolysis*.

If a mother who is Rh negative has anti-Rh antibodies present in her blood, and is carrying a foetus who is Rh positive, the transfer of antigens - antibodies between the maternal and foetal circulations can cause agglutination of the blood cells in the foetus. This destruction of foetal erythrocytes is a condition known as *erythroblastosis foetalis* or haemolytic disease of the newborn.

### 9.7 Lymphatic system

All cells are bathed by tissue fluid, which diffuses from the capillaries. Some of this fluid returns to the capillaries, some drains into thin walled *lymphatic vessels*. The fluid which takes this route is then known as *lymph*, which is similar to plasma but contains less protein.

A network of lymphatic vessels drains the tissue spaces throughout the body, with the exception of the central nervous system. In the case of the larger vessels, lymph is filtered through *lymph nodes*. Afferent lymphatic vessels pour their lymph into a reticular framework of loose sinus tissue in the lymph nodes. Here macrophages, (large cells) ingest foreign

material or harmful bacteria. Lymph nodes manufacture *lymphocytes* which produce globulin associated with antibody formation and immunity reactions. Efferent lymphatic vessels receive lymph after it has passed through the lymph nodes. Valves within the vessels prevent backflow. Lymphatic vessels unite to form larger and larger vessels into the blood via the superior vena cava.

There are other lymphoid tissues in the body. The thymus gland, the tonsils, adenoids, and spleen are examples. Lymph nodules exist in the mucous membranes of the intestinal tract and lungs. Aggregated nodules in the small intestine form patches of lymphoid tissue known as Peyer's patches. The latter may be 5-7 cm, 2-3 inches long.

The lymphatic tissue of the body forms an important part of the body's defence against invading organisms and their toxins. These act as antigens stimulating antibody formation which can subsequently destroy or neutralize the antigen.

### 9.8 The spleen

The spleen is a vascular organ weighing about 200 grams. It is situated on the left side of the abdomen, behind the stomach and above the kidney. The splenic artery and vein and their branches terminate in arterioles that are surrounded by collections of lymphatic tissue (white pulp) which produce lymphocytes. The red pulp is a framework of reticular tissue which acts as a reservoir for blood. Phagocytic cells destroy worn out red blood cells and other foreign particles. During foetal life, the spleen forms both red and white blood cells.

## 9.9 Signs, symptoms, diseases of the haematopoietic system

### (1) Anaemia

Anaemia is a decrease in the amount of circulating red blood cells and/or the total red blood cell haemoglobin. (Normal = 14–15 g per 100 ml of blood). Microcytic - hypochromic anaemia - occurs if iron stores are inadequate, also seen in *chronic* blood loss anaemia.

#### Macrocytic anaemia

an arrest in the formation of mature red blood cells, accompanied by megaloblasts (large and nucleated) found mainly in bone marrow, caused by deficiencies of dietary protein, folic acid, vitamin B12 and/or the intrinsic factor.

#### Pernicious anaemia

a form of macrocytic anaemia caused by lack of intrinsic factor. It is macrocytic, hyperchromic with some megaloblasts, with a high degree of anisocytosis and poikilocytosis. It is accompanied by bone marrow *hyperplasia*.

#### Normochromic - normocytic anaemias

are secondary to other diseases, for example, chronic renal disease, or can occur if the erythropoietic tissue in the bone marrow is crowded out, either by fibrosis (myelofibrosis), or bone formation (osteosclerosis), or metastatic cancer. It also occurs in diseases of the haemopoietic system such as lymphomas or multiple myeloma.

#### Aplastic anaemia

is a complete failure of the bone marrow to undergo erythropoiesis. It is usually accompanied by *leucopenia*. Its cause may be drug toxicity.

#### Haemolytic anaemia

involves *lysis* of normal red cells due to antibodies, drugs or poisons, or as a secondary result of other conditions, such as *lymphoma*, *lupus erythematosus*, or chronic *lymphocytic leukemia*.

Words to Note:

#### anisocytosis

cells vary markedly in size;

#### poikilocytosis

cells vary markedly in shape;

#### haemochromatosis

deposition of haemosiderin in parenchymal cells;

#### haemosiderosis

iron found in macrophages, due to blood transfusion and increased haemolysis.

### (2) Myeloproliferative disorders

**Agranulocytosis** is caused by toxins or poisons. Thrombocytopenia (a decrease in the number of circulating platelets) accompanies bone marrow depression and a decrease in *polymorphonuclear* cells is noted.

**Polycythaemia vera** involves bone marrow proliferation with an increase in the production of red cells, white cells and platelets causing increased blood volume, increased blood viscosity and may lead to heart failure.

**Leukaemia** involves the overproduction and liberation of neoplastic white cells; if monocytes, monocytic leukaemia, if lymphocytes, lymphatic leukaemia; if polymorphonuclear elements, myeloid leukaemia.

Leukaemia may be acute or chronic. Monocytic leukaemia is generally acute.

**Acute leukaemia** is commonly lymphoblastic in childhood and myelogenous in young adults. The precursor cells are primitive cells called blasts.

#### Chronic myelogenous leukaemia

The predominant immature neoplastic white cell is the myelocyte. It mainly affects patients between 25 and 60 years of age. The spleen characteristically is greatly enlarged.

#### Chronic lymphocytic leukaemia

Cells present in the peripheral blood are largely mature lymphocytes. The disease generally occurs in older people, 55–80 years of age. Lymphocyte infiltration may be found in all viscera but especially in bone marrow, liver, spleen and lymph nodes. Lymph nodes are enlarged as are the liver and spleen (hepatosplenomegaly)

## (3) Reticuloendothelial malignancies

**Giant follicular lymphoma**

confined to lymph nodes and spleen, causing enlargement, with compression but not obliteration of the sinusoids and reticuloendothelial stroma. The capsule of the lymph node is not usually invaded.

**Lymphosarcomas**

are primary malignant lesions of lymphatic tissue, lymph nodes and spleen. Neoplastic cells are not usually found in peripheral blood smears.

**Lymphocytic lymphosarcoma**

the entire lymph node, follicle and stroma, is replaced by a dense mass of lymphocytes which appear normal. The capsule is invaded with spread to neighbouring fat and other viscera, especially the liver and bone marrow.

**Lymphoblastic lymphosarcoma**

the lymphocytes are enlarged, with primitive nuclei, an increased amount of cytoplasm and invasion is aggressive.

**Reticulum cell sarcoma**

here, mesenchymal cells with abundant cytoplasm and indented nuclei spread rapidly to all body organs.

Although still used in the ICD, the terms lymphosarcoma and reticulo-sarcoma are increasingly becoming obsolete, being replaced by the generic term

**Non-Hodgkin lymphoma.**

Within this grouping various types are distinguished according to the predominant histological cell type:

*Lymphocytic* - well differentiated

*Lymphocytic* - poorly differentiated

*Histiocytic*

*Mixed lymphocytic and histiocytic*

Each type is further divided into Nodular and Diffuse categories. All nodular types have a relatively good prognosis, as does the diffuse lymphocytic well differentiated type.

**Hodgkin's disease**

differs from the other lymphomas in that the infiltrate is *pleomorphic*, that is, it contains cells of many different types, and occurs in younger age groups.

**Multiple myeloma**

is a malignancy of the bone marrow where abnormal plasma cells (myeloma cells) occur sometimes in many small areas throughout the marrow (ribs, vertebrae, skull). Myeloma causes dysproteinaemia which can be diagnosed by a test for Bence Jones protein in the urine and myeloma proteins in the blood.

**10. RESPIRATORY SYSTEM****10.1 Introduction**

All living cells must obtain oxygen and dispose of carbon dioxide. There are two different types of respiration, internal and external.

Internal or cellular respiration is the exchange of gases between the tissue cells and their fluid environment. External respiration is the exchange of gases between the lung alveoli (singular - alveolus) and the external environment. This is accomplished by the respiratory system.

The respiratory passages comprise the nose, larynx, trachea and bronchi.

The lungs are housed in the thoracic cage to which the respiratory muscles the intercostals, and the diaphragm are connected.

**10.2 Transportation of respiratory gases**

Oxygen in a small amount remains in solution in the blood plasma. A large amount of oxygen enters into loose chemical combination with the haemoglobin in the red blood cells. Carbon dioxide also exists in small amounts in solution in plasma, mostly as bicarbonate and a small amount is linked to the haemoglobin in red blood cells.

**10.3 Pulmonary circulation**

The blood lacking its full amount of oxygen and containing an excess of carbon dioxide is pumped into the pulmonary artery. From the pulmonary artery, the blood enters the right or left lung and eventually enters a capillary which lies adjacent to an air sac (alveolus). Here by perfusion the blood becomes saturated with oxygen from the air in the alveolus and gives off excess carbon dioxide. It then leaves the capillary, and progresses through larger veins until it enters one of the four large pulmonary veins which carry blood to the left atrium. It will be noted that the pulmonary veins and venules are the only veins which carry oxygenated blood.

## 10.4 Air pathways

### (1) *The nose*

The entry to the nose is called the nares, or nasal orifices.

The *nasal septum* forms the medial wall and is composed of the *vomer* bone, the *perpendicular plate* of the *ethmoid* and cartilage.

The lateral walls of the nasal cavities are formed by three *turbinates* or *conchae* which project into the nasal cavity. The lateral space below each concha is called a *meatus*. The superior and medial conchae are part of the *ethmoid* bone. Four pairs of paranasal sinuses and two nasolacrimal ducts open into the lateral wall.

The *olfactory mucosa* provides the sense of smell and is situated in the roof of the nasal cavity.

The mucous membrane lining the nasal cavities serves to warm, moisten and filter the air we breathe.

### (2) *The pharynx*

There are three parts of the pharynx, the nasopharynx, the oropharynx and the laryngopharynx. The Eustachian tube from the middle ear enters the nasopharynx. The oropharynx lies posterior to the oral cavity. The laryngopharynx connects with the larynx, or voice box.

### (3) *The larynx*

The *larynx* is a cartilaginous bow-like structure located in the neck. Posterior to the thyroid gland is the thyroid cartilage. The *cricoid cartilage* which is shaped like a signet ring, with the broad part lying posteriorly is inferior to the thyroid cartilage. The *epiglottis* is a leaf-like structure located at the entrance of the larynx, which closes off the entrance on swallowing. Two arytenoid cartilages, shaped like small pyramids facilitate speech. Two other small paired cartilages, associated with the *arytenoid* cartilages are named the *cuneiform* and the *corniculate cartilages*.

Vocal cords lie between the thyroid and arytenoid cartilages. The arytenoid cartilages move to separate or approximate the vocal cords. The opening between the vocal cords, through which air

passes into the trachea, is called the *glottis*. When the cords are slack, there is a wide slit; in quiet respirations, air moves in and out soundlessly. When the cords are taut, the slit is narrowed so that sound is produced when air is expelled from the lungs.

The mouth, nose, sinuses, throat and chest act as resonators; they affect the quality and volume of speech while the lips, tongue and teeth convert the sounds into speech.

The muscles of the larynx are supplied by two pairs of nerves, both branches of the vagus (Xth cranial nerve), called the superior laryngeal and recurrent or *inferior laryngeal* nerves. The recurrent laryngeal nerve lies very close to the inferior thyroid arteries. Nerve damage during thyroid surgery can result in speech impairment.

### (4) *The trachea*

The trachea, approximately 11 cm, 4.5 inches long, is located in the lower part of the neck and the upper part of the thorax, anterior to the oesophagus. It is protected by cartilage in the shape of incomplete rings.

### (5) *The bronchi and alveoli*

The main bronchi branch inferiorly from the trachea, one entering each lung. Overlapping plates of cartilage give support to the bronchi. Each bronchus branches into smaller tubes called bronchioli and finally ends in the terminal bronchioles. The respiratory bronchioles branch into alveolar ducts which lead to the alveolar sacs, where respiration takes place. The alveoli are part of the lung tissue.

## 10.5 The lungs and pleura

The lungs differ in shape; the right lung has three *lobes*, the left has two lobes. Each lung has an apex, a base, a *costal* surface and a mediastinal surface. on the mediastinal surface, there is an opening called a *hilus* through which pass the blood vessels, bronchi, nerves and lymphatics. These structures are bound together with connective tissue and are called the root of the lung.

Apart from the blood vessels responsible for transporting gases to and from

the lung, the lung tissue also requires a blood supply. The blood vessels supplying lung tissue are the *bronchial arteries* which branch off from the aorta carrying oxygenated blood, via the root of the lung. The bronchial veins drain into the innominate and axygos veins and eventually back to the superior vena cava.

The pleural cavity is made up of two layers; it is a potential space only. The visceral layer of the pleura is the outermost covering of the lung and it reflects to adhere to the innermost part of the chest wall and diaphragm where it is called the parietal (L. *paries* = wall) pleura. The entire pleural cavity contains only a small amount of serous fluid for lubrication purposes in health.

#### 10.6 Nerve control of the respiratory system

The lungs are innervated by the autonomic nervous system. Parasympathetic fibres cause constriction of smooth muscle tissue, while sympathetic fibres cause dilation.

In normal breathing, the respiratory rate and rhythm are influenced rhythmically by the *Hering-Breuer* reflex without any conscious muscular exertion.

The most important factor which regulates the activity of the respiratory centre is the level of carbon dioxide in the blood. An increase in the level will stimulate the respiratory rate; a decrease in CO<sub>2</sub> in the blood will depress the respiratory centre in the medulla.

#### 10.7 Signs, symptoms and diseases of the respiratory system

##### **Anthracosis**

a condition of the lungs due to coal dust inhalation.

##### **Asthma**

paroxysmal dyspnoea accompanied by adventitious sounds caused by spasm of the bronchial tubes or swollen mucous membranes.

##### **Atelectasis**

lack of air in the lungs.

##### **Bronchiectasis**

destructive dilation of bronchi secreting large amounts of pus.

##### **Bronchitis**

inflammation of the bronchial mucous membrane.

##### **Bronchogenic carcinoma**

malignancy believed to arise from bronchial epithelial tissue and synonymous with carcinoma of lung.

##### **Common cold**

synonymous with *coryza* – an acute catarrhal inflammation of the nasal mucous membranes.

##### **Croup**

a disease characterized by suffocative and difficult breathing, laryngeal spasm and sometimes membrane formation.

##### **Dyspnoea**

difficulty in breathing.

##### **Emphysema**

overdistention of alveoli and smaller bronchial tubes with air. Results in dyspnoea, cough, expectoration characterized by short inspiration, prolonged expiration.

##### **Empyema**

pus in the pleural cavity.

##### **Epistaxis**

nosebleed.

##### **Hamartoma**

a benign tumour due to new growth of blood vessels, may be found as a symptomless coin lesion in the lung.

##### **Hay fever**

an allergic disease of mucous passages of the nose and upper air passages induced by external irritation.

##### **Influenza**

acute infection often involving catarrh of the respiratory tract.

##### **Laryngitis**

inflammation of the larynx with *aphonia*.

##### **Lobar pneumonia**

inflammation of lungs involving specific lobes.

**Pleurisy**

inflammation of the pleura (synonym - pleuritis).

**Pneumoconiosis**

a condition of the lung due to inhalation of dust particles (Gr. pneumon conis (dust)+ osis (disease)).

**Pneumonia**

inflammation of the lungs with exudate into the lung tissue.

**Pneumothorax**

a collection of air or gas in the pleural cavity.

**Pneumonitis**

inflammation of the lung.

**Rhinitis**

inflammation of the nasal mucosa (Gr. rhin = nose).

**Siderosis**

disease of the lungs caused by inhalation of metallic dust (Gr. sidero = iron or steel)

**Silicosis**

a condition caused by the inhalation of small particles of stone or stone dust (L. silic = flint).

**Sinusitis**

inflammation of the accessory nasal sinuses.

**Tonsillitis**

(L. tonsilla = almond) – inflammation of the faucial tonsils.

**Tracheo-oesophageal fistula**

abnormal opening between the trachea and oesophagus.

**Tuberculosis**

a specific inflammatory disease caused by the tubercle bacillus characterized by *caseous* granulomatous infiltration.

**Wegener's granulomatosis**

involves bronchi, trachea, nasopharynx and lung-causing dissolution and necrosis of vessels, alveoli and bronchi, severe pneumonitis, *haemoptysis* and death.

**11. DIGESTIVE SYSTEM****11.1 Introduction**

This chapter deals with the *alimentary* canal and its associated glands. The function of the digestive system is to:

- *ingest* food and fluids;
- *secrete* enzymes which break large molecules into simpler units;
- *digest* or condense food by chemical and mechanical means;
- *absorb* soluble substances and water into the circulatory system;
- *reject* undigested particles (excretion).

**11.2 The mouth**

The roof of the mouth is formed by the hard palate and the soft palate which end in the *uvula*, a small soft structure hanging from the free edge of the soft palate, in the midline above the root of the tongue. Upon swallowing, it prevents food or fluid from refluxing into the nasal cavity.

The tongue is a muscular organ. The surface of the tongue has tiny projections called *papillae* which contain nerve endings for taste sensation. The frenulum is a fold of mucous membrane which attaches the underside of the tongue to the floor of the mouth.

The mouth is kept moist by secretions from the salivary glands, the parotid, submandibular, and sublingual glands.

The *fauces* are arches on each side where the mouth meets the pharynx. The two arches are the *glossopalatine* arch anteriorly and the *pharyngopalatine* arch posteriorly, known as the tonsillar fauces.

Digestion in the mouth involves both mechanical and chemical processes. *Mastication* is under voluntary control, salivation is controlled by the autonomic nervous system. Saliva consists of ptyalin, water, and mucin. Ptyalin is an enzyme which begins the process of splitting starch from dextrose to maltose (a simple sugar). Mucin is a thick secretion which lubricates the food and helps swallowing.

**11.3 The oesophagus**

The *oesophagus* is a muscular tube about 25 cm in length, which conveys food and fluid to the stomach.

There are four layers comprising the oesophagus. The inner *mucosal* lining is stratified

squamous epithelium. The *submucosal layer* contains glands which secrete lubricant. The muscle coats of the oesophagus consist of an inner circular and an outer longitudinal coat. The upper 1/3 of the oesophagus has striated skeletal muscle. The middle 1/3 is mixed skeletal and smooth muscle, while the lower one third is smooth muscle. The outermost coat of the oesophagus is made up of *connective tissue*. Except during the passage of food, the oesophagus is flattened and closed.

The *cardiac sphincter* separates the oesophagus and the stomach.

#### 11.4 The stomach

The lesser curvature is located superiorly; the greater curvature, on the inferior surface; the fundus extends above the oesophagogastric junction; the body is the largest part of the stomach and pyloric portion is the narrow part which connects with the duodenum at the pyloric sphincter. The mucosal lining has special glands for the secretion of gastric juices. The outer wall of the stomach has three smooth muscle coats, longitudinal (outer), circular (medial) and oblique (internal).

The functions of the stomach are to:

- (1) Absorb water, alcohol and glucose into the blood stream;
- (2) Secrete gastric enzymes – for example; rennin to clot milk; lipase to initiate the splitting of fats; pepsinogen, which in the presence of hydrochloric acid forms pepsin to begin protein breakdown;
- (3) To secrete hydrochloric acid (HCl) which kills bacteria and changes some minerals to salts which are suitable for absorption in the intestine (example, calcium and iron);
- (4) The gastric mucosa also produces the intrinsic factor which is necessary for the absorption of vitamin B12;
- (5) The pyloric glands secrete an alkaline mucus to neutralize the HCl.
- (6) The strong muscular action of the stomach churns the food into a semi-liquid substance and forces it through the pyloric sphincter into the duodenum.

#### 11.5 The pancreas

The *pancreas* is a large gland lying across the posterior abdominal wall. It has two types of secretions, enzymic and hormonal. It is composed of the head, body and tail. The head of

the pancreas is cradled in the curve of the duodenum.

The exocrine duct from the pancreas joins with the common bile duct to form the *ampulla of Vater* which empties into the duodenum through the *sphincter* of Oddi.

The exocrine or pancreatic enzymes serve to:

- a) neutralize acid from the stomach (water and alkaline salts);
- b) split fats (lipase);
- c) split starch to maltose (amylase);
- d) split proteins (trypsinogen plus enterokinase; produces *trypsin* for this purpose);
- e) complete protein digestion (peptidase).

The endocrine or internal secretions are produced by the islets of Langerhans. The hormones insulin and glucagon are absorbed by capillaries which carry these hormones to the blood stream for systemic circulation.

#### 11.6 The liver and gallbladder

The *liver* is situated in the upper right quadrant of the abdominal cavity, directly under the diaphragm. It consists of four lobes, the right, left, quadrate and quadrangular. A fissure of the liver, known as the porta hepatis permits hepatic arteries, the portal vein, the hepatic duct, nerves and lymphatics to enter and leave the liver.

The *gallbladder* is a pear-shaped hollow organ, approximately 2.5 cm, 1 inch in diameter and 5 cm, 2 inches long. It consists of fundus, body and a cystic duct which joins with the hepatic duct to form the *common bile duct*. It is composed of inner mucosa, smooth muscle and an outer layer of connective tissue.

Bile is secreted continuously by the liver. It is stored and concentrated in the gallbladder and periodically, following the ingestion of fat, the gallbladder contracts discharging bile into the duodenum to aid fat digestion. Bile acts to emulsify fats, to activate the pancreatic enzyme *lipase* and to promote the fat absorption.

Some bile pigments are reabsorbed from the digestive tract to be recycled as bile. Some bile pigments enter the general circulation and are transformed to *urobilinogen* and *urobilin* and are subsequently excreted in the urine. Stercobilin gives the *faeces* its brown pigmentation. Clay coloured stools are an indication of biliary obstruction.

### 11.7 The small intestine

The small intestine is a long muscular tube approximately 6 m, twenty feet long, comprising the *duodenum* 25–30 cm, 10–12 inches, the *jejunum*, approximately 2.4 m, 8 feet, and the *ileum* approximately 3.6 m, 12 feet.

Four layers comprise the small intestine. The outer serous coat of peritoneum is a delicate membrane, the *mesentery* which suspends the intestines to the posterior abdominal wall. The mesentery carries the mesenteric arteries and veins as well as lymphatic vessels which empty into mesenteric lymph nodes, then into the thoracic duct. The muscular coat consists of circular and longitudinal smooth muscles which cause peristalsis by segmental contraction. The submucous layer contains blood vessels and fibrous tissue. The mucous coat is characterized by *villi* which provide an enormous absorptive surface. The crypts of Lieberkühn secrete an alkaline enzyme known as *succus entericus*.

In the small intestine, amino acids, sugars, minerals, glycerol, some fatty acids and vitamins are absorbed. Glycerides and some fatty acids and fat-soluble vitamins are absorbed into the lacteals. Digestion and absorption of food are usually complete by the time the residue reaches the ileocaecal valve.

### 11.8 The large intestine

The large intestine is approximately 1.8 m, six feet, in length. It comprises the caecum, appendix, ascending colon, transverse colon, descending colon and sigmoid colon.

The outer serous coat consists of peritoneum which carries blood and lymph vessels and nerves. There are two muscular coats. The circular inner muscular coat covers the entire length of the colon; the longitudinal coat consists of three bands of muscle tissue. The submucous coat lies between the muscular and mucous layer. The mucous membrane of the colon is epithelial tissue supplied with numerous capillaries for the absorption of water. Goblet cells secrete mucus.

The main function of the colon is to absorb water and salts thereby conserving the body's fluids and drying the faeces to a normal consistency. Faeces are stored in the sigmoid colon until defecation.

### 11.9 The rectum and anus

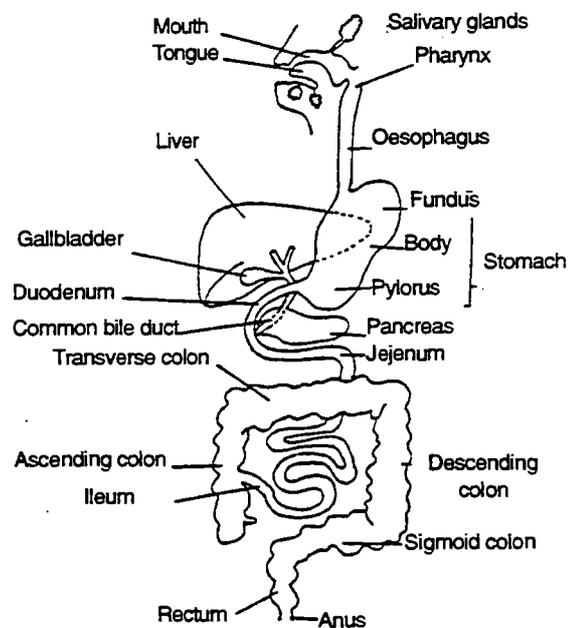
The *rectum* is a pouch with *transverse* folds while the anus has *longitudinal* folds. There are two anal sphincters, the internal sphincter consisting of smooth muscle, while the external sphincter consists of voluntary muscle.

### 11.10 The peritoneum

The *peritoneum* covers the viscera, known as *visceral peritoneum*, and lines the abdominal cavity known as *parietal peritoneum*.

The *greater omentum* hangs from the greater curvature of the stomach like an apron. The *lesser omentum* is a double fold of peritoneum which connects the lesser curvature of the stomach to the surface of the liver.

### Diagram 14. The digestive system



### 11.11 Signs, symptoms, conditions and diseases of the digestive system

#### (1) Oral cavity:

##### Herpes simplex fever

blisters in the skin about the lips.

##### Leukoplakia

hyperkeratosis with epithelial atrophy, found on mucosa of gums, tongue and inner cheek.

##### Mucoepidermoid carcinoma

salivary gland neoplasm, contains masses of mucus.

- Parotid gland tumour**  
usually mixed tumours, dense masses of small cells interspersed with mucus, which can be cartilaginous and later may calcify. May recur or spread.
- Periodontitis**  
chronic inflammation of the gums.
- Peritonsillar abscess**  
an abscess in the connective tissue of the tonsil.
- Pyorrhoea alveolaris**  
a purulent inflammation of the dental periosteum.
- Squamous cell carcinoma**  
invades locally and metastasizes to lymph nodes, common in lips, tongue and oral cavity.
- Tonsillitis**  
inflammation of the tonsil(s).
- Vincent's stomatitis**  
inflammation of the oral mucosa with large ragged superficial ulcers (synonym – Vincent's angina).
- (2) **Oesophagus:**
- Oesophageal varices**  
varicose veins that may cause haematemesis.
- Functional dysphagia**  
difficulty in swallowing without obvious cause.
- Squamous cell carcinoma**  
obstructs the oesophagus causing dysphagia. Local growth involves the mediastinum.
- (3) **Stomach:**
- Adenocarcinoma stomach**  
often presents as an ulcer with a hard, rolled, firm white edge – infiltrates – may involve the muscle wall.
- Dyspepsia**  
indigestion.
- Gastric polyp**  
large projection overgrown with epithelium arranged around stalk which carries blood vessels and lymphatics - may be premalignant.
- Gastritis**  
inflammation of the stomach, acute or chronic.
- Leiomyoma**  
benign tumour of muscle layer of stomach.
- Leiomyosarcoma**  
may arise from leiomyoma, well differentiated – metastasizes late.
- Pectic ulcer**  
a localized ulcer of the visceral mucosa which may cause bleeding (haematemesis) or perforation.
- (4) **Pancreas:**
- Adenocarcinoma pancreas**  
a mucus-producing tumour often with recognizable glands.
- Cystic fibrosis**  
generalized abnormality of the secreting glands such as those that manufacture mucus and sweat. The pancreas and lungs are involved. The mucus is thick and sticky and the sweat glands have a high concentration of salt. When the lungs are affected, bronchitis occurs, resulting in persistent cough, wheezing, dyspnoea, and emphysema. When the pancreas is affected there is marked disturbance of the bowel, and glandular cells lining other organs may be affected.
- Diabetes**  
a disease where the islets of Langerhans in the pancreas fail to produce sufficient insulin.
- Islet cell adenoma**  
causes oversecretion of gastrin. Most are benign, however some are invasive and metastasize.
- Pancreatitis**  
acute inflammation of the pancreas.
- (5) **Liver and gallbladder:**
- Acute catarrhal jaundice**  
synonymous with infectious hepatitis.
- Cholangitis**  
inflammation of the common bile duct.
- Cholecystitis**  
inflammation of the gallbladder.

**Cholelithiasis**

presence of stones in the gallbladder.

**Cirrhosis of liver**

fibrosis of the liver.

**Hepatoma**

primary tumour of the liver.

**Hepatitis**

inflammation of the liver. Different types include infectious hepatitis, serum hepatitis.

**Jaundice**

yellow skin and sclera due to liver cell changes and obstruction causing bile pigment, bilirubin, to be diffused into the blood.

**Obstructive biliary disease**

may be due to intrahepatic or extrahepatic obstruction to bile flow.

**Portal hypertension**

increased blood pressure in the portal venous system, a complication of cirrhosis of the liver.

(6) **Small intestine:****Adenocarcinoma**

rare, but if they occur, are usually polypoid or fungating lesions in the duodenum.

**Bacterial enteritis**

inflammation of the intestine caused by bacteria, such as *Escherichia coli* or *Shigella*.

**Coeliac disease**

a juvenile form of idiopathic sprue.

**Duodenal ulcer**

a peptic ulcer of the duodenum.

**Enteritis**

any inflammatory condition of the small intestine.

**Idiopathic sprue**

atrophy of the intestinal villi, usually in the jejunum, with thinning mucosa - causes malabsorption syndrome.

**Obstruction**

of the intestine causes distention of the viscus above the lesion and collapse distal to the lesion. Peristalsis and vomiting are stimulated.

**Paralytic ileus**

complete absence of peristaltic motility.

**Parasitic diseases**

common infestations such as the pinworm, *Trichinella spiralis* (from pork), beef tapeworms (*Taenia saginata*) or pork tapeworm (*Taenia solium*).

**Peritonitis**

inflammation of the peritoneum may be caused by rupture of an abdominal organ.

**Regional enteritis**

or Crohn's disease - necrosis and ulceration, usually involving the ileum, but it may spread to the jejunum or colon. Marked scarring may cause partial bowel obstruction.

**Steatorrhoea**

fatty stools.

**Volvulus**

a twisting of the mesentery causing obstruction of the blood supply and mechanical blockage of the lumen of the intestine.

(7) **Large intestine:****Adenocarcinoma of colon**

epithelial in origin, involving the caecum, sigmoid and rectum predominantly.

**Adenomatous polyp**

usually benign, and isolated.

**Appendicitis**

inflammation of the appendix.

**Carcinoid tumour of appendix**

usually benign - adenocarcinoma of the appendix is rare, colloid in nature. If it ruptures, the peritoneal cavity is filled with jelly-like substance (pseudomyxoma peritonei).

**Diverticulosis**

outpouching of mucosa from the lumen due to defective musculature (diverticulitis) with subsequent inflammation.

**Familial polyposis**

large numbers of polyps throughout the lumen of the colon, premalignant in nature, genetic in origin.

**Infarction**

death of part of the colon due to obstruction of the blood supply to the area.

**Ulcerative colitis**

an ulcerative disease of the colon characterized by violent diarrhoeic episodes with blood and mucus in the watery stool – a premalignant condition.

(8) Anus:

**Imperforate anus**

congenital absence of an anal orifice.

**Haemorrhoids**

varicose veins of the anus.

**Squamous cell carcinoma**

may develop from the squamous epithelium of the rectum.

(9) Mesentery:

**Fat necrosis**

benign inflammatory condition - small numerous white lesions in mesentery.

**Panniculitis**

(L. pannus = cloth) inflammation of the fatty portion of the panniculus adiposus, the superficial fasciae with fat in its areolar substance.

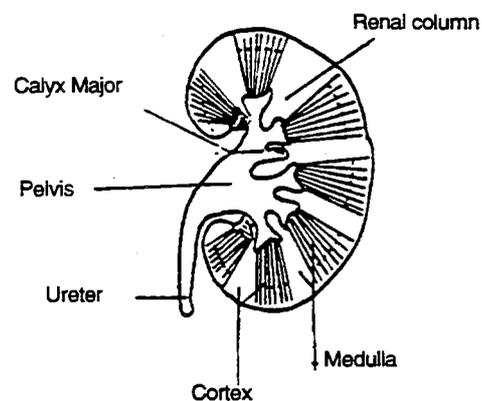
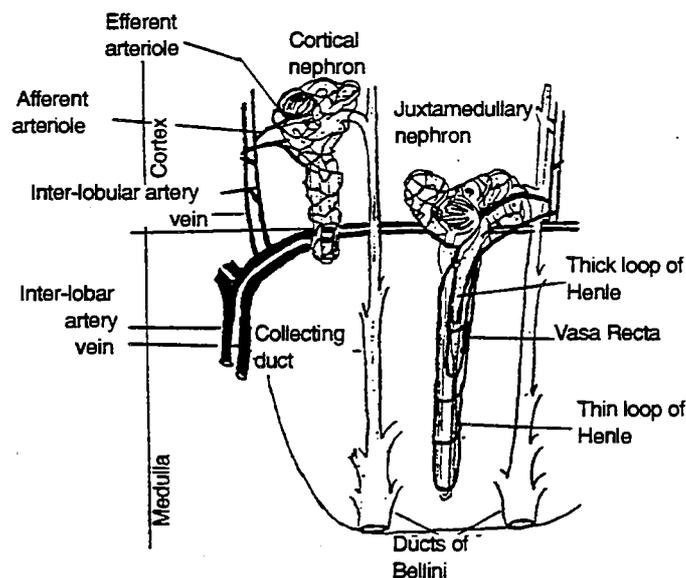
**12. URINARY SYSTEM****12.1 Introduction**

The urinary system, consisting of two kidneys, two ureters, a urinary bladder and a urethra, is part of the excretory system of the body, which also includes the respiratory, integumentary and digestive systems.

**12.2 The kidney**

The kidneys excrete waste products of metabolism and toxic substances from the body. They help maintain the fluid and electrolyte balance.

Each kidney is located laterally to the spinal column, in the upper part of the abdomen. They are retroperitoneal, embedded in a mass of fatty tissue, which is surrounded by a fibrous covering called renal fascia.

**Diagram 15: The kidney****Diagram 16: Nephron unit**

## (1) The renal circulation

Approximately 25% of the output from the left ventricle is distributed, in each cardiac cycle, to the kidneys for *filtration*. The renal artery which branches from the aorta after several subdivisions (Diagram 16) end in a cluster of capillaries to form the *glomerulus*. All the glomeruli lie in the kidney cortex.

The glomerulus is surrounded by a closed end of a long tortuous renal tubule, the *nephron*. This closed end is named *Bowman's capsule*.

Blood leaving the glomerulus flows to a secondary capillary network around the tubules of its own nephron before draining into a vein.

## (2) The nephron

The nephron (Diagram 16) or renal tubule, consists of Bowman's capsule, the proximal convoluted tubule, a loop called "Henle's loop", the distal convoluted tubule and the collecting tubules which empty into the renal pelvis at the calyx of the kidney.

The kidney has approximately one million nephrons.

## (3) Formation of urine

Through the capillaries of the glomeruli approximately 120 ml of water and salts are filtered from the blood each minute. Cells and plasma proteins are too large to pass through the capillary membranes into the renal tubule in a healthy nephron.

The filtrate contains glucose, salt, urea, uric acid, potassium, phosphates, sulfates, etc. in approximately the same proportions as blood plasma. However, the body must retain certain of these substances for fluid and electrolyte balance. Thus, as the filtrate passes along the tubule of the nephron, the filtrate is concentrated and essential substances are returned to the circulation via the second capillary network which surrounds the tubule.

Most of the water is reabsorbed into the *proximal convoluted tubules*. Essential or "high threshold" substances are also reabsorbed here, including glucose, sodium chloride and amino acids,

unless their concentration in the body is too high.

"Medium threshold" substances such as potassium may be reabsorbed but may be *secreted* in the *distal convoluted tubule*. Additional water is reabsorbed in the *distal convoluted tubule* and partly in the collecting tubules.

The urine passes out through the collecting tubules at a rate of approximately 1.0 ml per minute, so that in health we excrete about 1.5 litres of urine per day.

## 12.3 The ureters

Each kidney is connected to the urinary bladder by a ureter. These muscular tubes are about ten inches (25 cm) in length, beginning at the renal pelvis.

The wall of the ureter has three layers, an outer fibrous coat, a middle *smooth muscle* layer which propels urine along the ureter and an inner *mucous membrane*.

## 12.4 The urinary bladder

The urinary bladder is a hollow muscular organ which serves as a reservoir for urine. It lies in the pelvis behind the pubic bone.

Three openings mark off a triangular area. These are the two ureters and the urethra. The *trigone* is smooth, even when the bladder is empty and the remainder of the smooth muscle is in folds.

The bladder has three layers, with the exception of the superior and posterior aspects which are covered by peritoneum. These are a *fibrous* outer layer, a *smooth muscle* layer and a mucous membrane lining the cavity. The adult urinary bladder has a capacity of 300-350 ml.

## 12.5 The urethra

The urethra is a membranous tube which conveys urine to the exterior.

The proximal end consists of a circular smooth muscle known as the internal sphincter. It is controlled by the autonomic nervous system. The *external sphincter* is a circular striated muscle which is under voluntary control.

*Female urethra*

The female urethra is approximately 4-5 cm, 1.5-2 inches long, the external sphincter being located midway in the urethra.

**Male urethra**

The male urethra has three parts. The prostatic part which passes through the prostate gland is approximately 2.5 cm, one inch, long, the membranous part, which comprises the external muscular section, approximately 2.5 cm, 1 inch long and the penile part, 10-15 cm, 4-6 inches long.

**12.6 Some constituents of urine****Urea**

a nitrogenous waste product of protein metabolism, urea is formed in the liver and enters the kidneys through the blood stream.

**Uric acid**

is formed from the breakdown of nucleoproteins.

**Creatinine**

is a nitrogenous waste product derived from the breakdown of body tissues, the amount in the urine is not influenced by the amount of dietary protein.

**Ammonia**

as sodium is removed from the filtrate back into the blood stream ammonia is formed.

**Salts**

the amount of salt excreted depends on the amounts ingested in the diet.

**12.7 Common tests – urinary system**

- (1) **Urinalysis**  
chemical or microscopical analysis of urine.
- (2) **Cystometrography**  
the graphic recording of the pressure exerted at varying degrees of filling of the urinary bladder.
- (3) **Cystoscopy**  
direct visual examination of the urinary tract with an endoscope (Cysto + skopein (Gr.) = to examine).
- (4) **Intravenous pyelogram**  
dye is injected into the blood stream. This dye is excreted by the kidneys. X-rays of the kidney and ureter are taken following the injection of dye.
- (5) **Retrograde pyelogram**  
here the contrast media (dye) is injected into the renal pelvis via the ureter, prior to roentgenography.

**12.8 Signs, symptoms, conditions and diseases of the urinary tract****Acute oliguria**

Damage to the nephron resulting in anuria and rapidly developing uraemia. It may be caused by poisons or incompatible blood transfusions, and is also seen in traumatic shock.

**Acute urethritis**

May be of venereal origin formation – may cause stricture formation

**Congenital anomalies**

Kidneys may be absent, have double ureters, fused ureters or none, or placed ectopically in the abdominal cavity or pelvis.

**Cystitis**

Inflammation of the urinary bladder may be due to infection, trauma or urethral obstruction.

**Glomerulonephritis**

Lesions in the glomeruli with nephritis. Symptoms and signs: haematuria, headache, dysuria, lethargy, hypertension, and periorbital oedema. (May be acute or chronic in nature).

**Haematuria**

Blood in the urine.

**Hydronephrosis**

A collection of urine in the renal pelvis owing to obstructed outflow.

**Incontinence – (urinary)**

Loss of sphincter control due to cerebral or spinal lesions.

**Malignant tumours of the kidney**

- (1) **Adenocarcinoma**  
spreads commonly to lung and bones. May be cured by early resection. May also be called hypernephroma as its structure may resemble that of the cortical tissue of the adrenal gland.  
Transitional cell carcinomas of the pelvis also occur.
- (2) **Wilms' tumour or embryoma** (Infancy).

**Nephrolithiasis**

Stone formation which may be due to endocrine abnormalities or following pyelonephritis. When the stone fills the renal pelvis and projects into the calyces, it is known as a *stag-horn calculus*.

**Nephroptosis**

Prolapse or downward kidney displacement.

**Perinephric abscess**

An abscess in the tissue immediately surrounding the kidney.

**Polycystic kidney disease**

Numerous cysts form in the kidney, exerting pressure on normal tissue, causing atrophy and loss of function in the affected area.

**Pyelonephritis**

(Gr. pyelo = pelvis + nephros = kidney + itis = inflammation). Inflammation of the kidney substance and pelvis, acute or chronic.

**Renal calculi**

Stone in the kidney causing paroxysmal *renal colic*.

Primary – without inflammation prior to formation.

Secondary – developing alkaline urine due to inflammation. (Syn. nephrolithiasis).

**Transitional cell carcinoma**

Common neoplasm of bladder. May also occur in the ureter with obstruction of urinary flow causing hydronephrosis and uraemia. Occasionally occurs in the renal pelvis.

**Uraemia**

A toxic condition due to urinary constituents in the blood, due to suppression or deficient excretion of urine for any cause.

**Urinary retention**

Failure to expel urine from the bladder.

**Urinary suppression**

Failure of the kidneys to produce urine.

**13. REPRODUCTIVE SYSTEM****13.1 Introduction**

Living things perpetuate their species by reproduction. The asexual method is not a common process in organisms. Certain very primitive forms of life multiply by this method which is also known as fission.

In humans, as in all higher forms of life, the sexual method or union of two sex cells (known as gametes) is the method of reproduction. The male and female gametes are symbolically designated as male, or female. These gametes are produced in gonads. The union of the male sperm with the female ovum is known as fertilization. Other functions of the gonads are to produce the male

and female sex characteristics, such as voice, shape, bone structure, distribution of body hair, etc.

**13.2 The male reproductive system****The testis**

The testes are two oval glands which produce large numbers of spermatozoa. They are suspended below the groin in a sac of skin and muscle called the scrotum.

They also produce the male sex hormone. The sperm is a microscopic cell with a whip-like tail and it swims very rapidly in the semen. Millions of sperm are found in one drop of seminal fluid.

**The epididymis**

The epididymis is the tube along which the sperm cells travel from the testes. This tube is 20 feet (6 metres) long but very tiny. It lies coiled along the top and the side of the testis.

**The seminal duct (vas deferens)**

The seminal duct leads from the epididymis. The seminal duct passes through the inguinal canal into the abdominal cavity and continues over the top and down the posterior surface of the bladder.

**The seminal vesicles**

The seminal vesicles are pouches which secrete fluid and also store spermatozoa. The ducts which lead from them join the seminal ducts and pass through the prostate.

**The prostate gland**

The prostate is a musculo-glandular organ about the shape and size of a horse chestnut. It lies just below the urinary bladder. The prostate produces a secretion which is added to the seminal fluid. This increases the motility of the sperm. As the duct leaves the prostate gland, it joins the urethra from the bladder. An enlarged prostate presses on the urethra, stopping a normal flow of urine.

**The bulbourethral (or Cowper's) glands**

The bulbourethral glands which lie just distal to the prostate add a thin lubricant viscid secretion.

**The penis**

The penis is a cylindrical shaped organ located externally. It is made up of cavernous tissue with cavern-like spaces. During sexual excite-

ment blood fills these spaces, changing the soft, limp penis to an enlarged rigid organ.

#### The foreskin (prepuce)

At the end of the penis is a fold of loose skin which forms the foreskin or prepuce. Circumcision, or cutting away of the foreskin, is frequently performed on babies to prevent infection or irritation.

### 13.3 The female reproductive system

#### *External genitalia*

The external genitals or vulvar parts comprise the:

- (a) *Mons pubis*, which is a prominence of fibrous and adipose tissue located in front of the symphysis pubis. It is enclosed by skin. At puberty, a thick growth of hair covers the mons pubis.
- (b) *Labia majora*, which are two liplike folds of skin extending down from the mons pubis towards the anus;
- (c) *Labia minora*, which are two thin hairless liplike folds found between the labia majora;
- (d) *Clitoris*, which is a small organ (a vestige of the male penis) covered by mucous membrane. It is located at the upper junction of the outer and inner labia;
- (e) *Vestibule*, which is the triangular-like flat space enclosed by the labia minora. The vaginal orifice is found in the lower part of the vestibule, while the urethral orifice lies directly superior to the vaginal orifice;
- (f) *Hymen*, which is a thin fold of mucous membrane which usually closes the vaginal orifice in a virgin. It varies greatly in shape and extent and is largely obliterated by sexual intercourse or childbirth;
- (g) *Perineum*, which is the tissue situated between the vaginal orifice and the anus.

The internal genitals are:

#### The vagina

The vagina is a flattened tube about 3 inches (8 cm) long. It opens into the vulva externally. At its upper end, the cervix or lower portion of the uterus projects into it. The inner surface of the vagina is moistened by a fluid which is

secreted from glands within the walls. The vagina has three functions. These are to:

- (a) receive the male organ during intercourse;
- (b) serve as an outlet for uterine secretions;
- (c) form part of the birth canal through which the baby passes during normal delivery

#### The uterus

The uterus is a hollow, pear-shaped muscular organ about three inches (8 cm) long, located in the centre of the pelvic cavity, posterior to the bladder and anterior to the rectum. It has three parts, the fundus, the body and the neck (cervix). During pregnancy, it expands many times its original size. Lined by a specialized mucous membrane called the endometrium, the uterus functions to protect and nourish the growing foetus and to expel the foetus at the time of delivery.

Strong ligaments hold the uterus in position. These are two broad ligaments, two cardinal ligaments as well as one anterior and one posterior ligament.

#### The ovary

The ovaries are two greyish white puckered glands about the size of an almond, which lie one on either side of the pelvic cavity, just below the brim of the pelvis. Their functions are to:

- (a) produce female germ cells: (the ova, singular = ovum);
- (b) secrete hormones that help regulate reproduction;
- (c) produce female sex hormones for the development of female characteristics. There are many ova in various stages of development in the ovaries and one ovum is usually discharged every 28 days from the menarche (11–14 years) to the menopause. The ovaries consist of connective tissue covered with a specialized epithelium in which are embedded thousands of *Graafian follicles*. The Graafian follicle matures to produce an ovum. Upon maturation the Graafian follicle ruptures, discharging the ovum into the pelvic cavity. This act is called *ovulation*.

### The fallopian tubes

The fallopian tubes are two thin muscular tubes which open into the uterus at its upper corners. At the proximal end, the tubes have hairlike projections (fimbria) which open into the pelvic cavity near the ovaries. The function of the fallopian tubes is to carry the ova from the ovaries to the uterus. Fertilization normally takes place within these tubes.

#### 13.4 Signs, Symptoms, Conditions and Diseases of the Reproductive System

**Balanitis** is an inflammation of glans penis.

**Carcinoma of the cervix** is usually squamous cell. The symptoms are leukorrhoea and vaginal spotting or bleeding.

**Carcinoma in situ of the cervix** is a pre-invasive stage of the natural history of carcinoma of the cervix detected by the pap smear.

**Chancre** is the primary lesion of syphilis.

**Chorionepithelioma** (endometrium) is malignant, actively invading trophoblasts.

**Congenital anomalies** in the lower urinary tract are epispadias, hypospadias and congenital vulvular stricture.

**Cryptorchism** is a developmental defect characterized by failure of the testis to descend into the scrotum.

**Cystocele** is a pouch-like protrusion of the bladder wall towards the vaginal orifice.

**Dilatation and curettage of the uterus** is usually done for diagnostic purposes, or incomplete abortion or retained products of conception.

**Ectopic pregnancy** is an extra-uterine pregnancy, often occurring in the Fallopian tube (ectopic from the Greek *ektopos* or displaced).

**Endometriosis** is a seeding of peritoneum with tissue which more or less resembles endometrium, the symptoms tend to be cyclic paralleling menstrual periods.

**Endometritis** is an inflammation of the endometrium usually associated with inflammation of the Fallopian tubes and referred to as pelvic inflammatory

disease, (P.I.D.). It may be due to gonorrhoea or post abortal infection.

**Epididymitis** is an inflammation of the epididymis.

**Fibroadenoma of breast** is a benign tumour, usually occurring in young women. It is firm and relatively mobile on palpation (breast mouse).

**Fibrocystic disease of the breast** is the development of cystic spaces characterized by an overgrowth of fibrous tissue.

**Fibroid tumours** of the uterus arise from muscle tissue.

**Gynaecomastia** is excessive development of the (male) mammary glands.

**Gynaecologist** is a physician who specializes in treatment of the genital tract in women.

**Gynaecology** is a branch of medicine concerned with the genital tract in women.

**Hydatidiform mole** is a hydropic degeneration of the placenta which turns into grape-like fluid filled vesicles.

**Hydrocele** is a collection of fluid in the sac surrounding the testis.

**Leiomyoma** is a tumour of the muscular wall of the uterus, usually benign, but can become malignant (leiomyosarcoma).

**Mastitis** is inflammation of breast tissue.

**Orchitis** is inflammation of a testis.

**Ovarian cysts** are usually simple and benign (though they may reach a large size).

#### Special types are:

- (a) *Serous cystadenoma* - approximately 1/3 are malignant, seeding onto the peritoneal surface causing *ascites*.
- (b) *Pseudomucinous cystadenoma* - secretes a jelly like material into the peritoneum.

#### Ovarian carcinoma

The classification is complex, terms used include serous, mucinous, endometrioid, clear cell, epithelial and undifferentiated.

**Phimosis** (**phimos** = a muzzle) is the tightening of the foreskin so that it cannot be drawn back over the glans penis.

**Prostatic hypertrophy** is benign hyperplasia – proliferation of prostatic stroma and glands encroaches on the bladder neck and urethra. If severe, urinary retention results.

**Prostatitis** is inflammation of the prostate gland.

**Rectocele.** The rectum pouches upward, pushing the vaginal wall in front of it.

**Salpingitis** is acute inflammation of the fallopian tubes.

**Spermatocele** is cystic dilatation of epididymis.

**Sterility** is the inability to procreate.

#### Testicular neoplasms

- (a) *Seminoma*
- (b) *Embryonal carcinoma* – often a mixed lesion, spreads early.
- (c) *Choriocarcinoma* – highly malignant.
- (d) *Teratoma* – contains diverse tissues.

#### Uterine bleeding

- (a) *Menorrhagia* – excessive uterine bleeding.
- (b) *Metrorrhagia* – uterine bleeding occurring at irregular intervals.
- (c) *Menometrorrhagia* – excessive menses at irregular intervals.
- (d) *Amenorrhoea* – lack of menses

**Vaginitis** is inflammation of the vagina. General causes include gonorrhoea, *Trichomonas vaginalis*, and *Candida albicans* (common in diabetes and pregnancy).

**Varicocele** is varicosities of the spermatic vein.

**Vulvitis** is inflammation of the vulva.

## 14. THE ENDOCRINE SYSTEM

### 14.1 Introduction

The endocrine system is a series of ductless glands which manufacture an internal secretion. These internal secretions (or hormones) are absorbed directly by the blood stream.

There are eight important glands or groupings in the body, each with its own distinct function but all bearing an inter-relationship with each other.

The islets of Langerhans of the pancreas are part of the endocrine system. They have

already been described in sub-section 11.5, while the endocrine functions of the ovaries and testis were described in section 13.

### 14.2 The pituitary gland

The pituitary gland is controlled by the thalamus. Located at the base of the brain behind the eyes, it is the size of a pea but controls all secretions of hormones within the body. The pituitary gland has two lobes. Each lobe has definite functions.

The functions of the anterior lobe are to produce:

- (a) adrenocorticotrophic hormone (ACTH)
- (b) thyroid stimulating hormone (TSH)
- (c) parathyroid stimulating hormone
- (d) gonad stimulating hormones
- (e) follicular stimulating hormones
- (f) luteinizing hormone
- (g) somatotrophic hormone (STH)

The function of the posterior lobe is to produce:

- (a) pitocin (pituotrin) and also
- (b) provide an antidiuretic function

### 4.3 The thyroid gland

The thyroid gland, shaped like a bow necktie, is located over the larynx and on either side of the trachea. It produces the hormone thyroxin which helps control the rate of body metabolism. Iodine is required to produce thyroxin.

*Hypothyroidism* is caused by insufficient thyroxin in the body. In childhood, the condition is known as *cretinism*; in the adult as *myxedema*.

*Hyperthyroidism* is caused by the overproduction of thyroxin. Symptoms of hyperthyroidism are overactivity and underweight.

### 14.4 The parathyroid glands

There are four parathyroid glands located intimately posterior to the thyroid gland; there is, however, little correlation between their functions. Each parathyroid is about the size of a grain of rice.

Their function is to secrete a hormone, parathormone, which maintains the calcium level in the body at a normal level of 9–11 mg%.

In the kidney, parathormone controls the excretion of phosphorus. In bone, parathormone mobilizes calcium and phosphorus. It

can also increase the absorption of calcium from the intestinal tract.

An excess of *parathormone* causes *Von Recklinghausen's disease* (osteitis fibrosa cystica) when calcium and other salt is taken from the bones. Pathological fractures may result.

#### 14.5 The pineal gland

The *pineal gland* is located in the brain. Its function is unknown.

#### 14.6 The adrenal glands

There are two adrenal glands, the size of the last digit of the little finger, located at the upper poles of the kidneys (ad-renal).

The adrenal *medulla* produces *adrenaline*, a stress hormone used in emergency situations.

The *adrenal cortex* produces cortisone which regulates salts in the body, and aldosterone which promotes sodium retention and potassium loss in the urine. The adrenal cortex also produces male and female hormones.

#### 14.7 Other hormones

The stomach wall secretes a hormone called *gastrin* which stimulates the blood vessels and secretions of the stomach glands.

The upper part of the small intestine secretes a hormone called *secretin* which stimulates the pancreas and causes the gall bladder to contract.

The *placenta* produces chorionotrophic hormones which help to maintain pregnancy.

#### 14.8 Endocrine tumours

Tumours of the endocrine glands, if well differentiated, may produce hormones which may be effective, tend to be unregulated, and may or may not be excessive. Benign tumours are more likely to be functional than malignant. Tumour size does not necessarily dictate the degree of functional activity.

#### 14.9 Signs, symptoms, conditions and diseases of the endocrine system

##### Acromegaly

(Gr. akron = extremity; megale = great) - a condition characterized by hyperplasia of the extremities: the nose, jaws, fingers and toes.

##### Adenomas of anterior pituitary

- (a) acidophilic - increased STH (somatotrophic hormone) produces gigantism or acromegaly;
- (b) basophilic - increased ACTH production, cause of Cushing's syndrome, q.v.;

- (c) chromophobe - inactive tumour of pituitary.

##### Adenomatous goitre

enlargement of the thyroid caused by adenoma.

##### Addison's disease

caused by hypofunction of the adrenal glands, characterized by bronze-like pigmentation of the skin, weakness progressing to prostration, anaemia, hypotension.

##### Aldosteronism

caused by adrenal cortical adenoma with an increase in the amount of aldosterone, resulting in electrolyte and fluid imbalance.

##### Athyreosis

the absence or inadequate functioning of the thyroid gland; (a - neg. + thyroid = thyroid + osis).

##### Craniopharyngioma

(Rathke's pouch tumour) - a tumour arising from the cell rests derived from the *hypophyseal stalk*.

##### Cretinism

congenital lack of thyroxin.

##### Cushing's syndrome

hypertrophy of basophil cells in the anterior pituitary, marked by adiposity of face, neck and trunk, kyphosis, amenorrhoea (in females), impotence (in males), dusky complexion, hypertension, polycythaemia and muscle weakness.

##### Diabetes insipidus

a posterior pituitary disorder due to a decrease in antidiuretic hormone (ADH). *Polydipsia* and *polyuria* are symptoms.

##### Follicular carcinoma of the thyroid

malignant cystlike tumour of thyroid gland, filled with a colloid substance.

##### Fröhlich's syndrome

(dystrophia adiposogenitalis) defective genital development related to tumours of the anterior pituitary.

##### Gigantism

excessive size and stature, due to hyperpituitarism.

**Goitre**

an enlargement of the thyroid gland.

**Hypoparathyroidism**

a condition produced by defective action of the parathyroids or their removal; disturbed calcium metabolism, fall in serum calcium resulting in tetany.

**Hashimoto's thyroiditis**

(synonym = struma lymphomatosa) a progressive disease of the thyroid gland with replacement by lymphoid and fibrous tissue.

**Iatrogenic Cushing's disease**

caused by the administration of corticosteroids.

**Myxoedema**

caused by hypothyroidism; (Gr. myxa = mucus; iodema = swelling) - a condition characterized by a dry waxy type of swelling and distinctive facial changes, i.e. swollen lips and thickened nose.

**Phaeochromocytoma**

a small vascular tumour of adrenal medulla associated with hypertension.

**Simmond's disease (panhypopituitarism)**

a condition characterized by decreased growth, decreased basal metabolic rate, loss of *libido* and sexual infantilism, caused by non-functioning of the anterior pituitary - premature senility - also known as hypophysial *cachexia*.

**Thyroiditis**

inflammation of the thyroid gland.

**15. PHARMACOLOGY****15.1 Classification of medications**

Medication is one of the most effective methods of treating many diseases. Drugs act in two basic ways:

- (1) They may destroy or render harmless cells that are normally not part of the body, either derived from normal body constituents or external microorganisms, which enter the body and cause disease. Drugs acting in this way tend to be called chemotherapeutic drugs.
- (2) They may act on cells that are normally part of the body and stimulate or depress normal body functions in such

a way that the nature or course of the disease is altered. These drugs are called "pharmacodynamic drugs".

Drugs are used in all types of medical care and are commonly grouped according to the disease or symptom they treat or the body function they effect. It is important that you are familiar with the most common groups of medications. However, some drugs because they affect different parts of the body, or different functions, can be used to treat a number of different diseases. The charts on the next few pages describe the major drug categories for treating non-cancer diseases. They are not complete lists of categories, nor do they include all the possible uses for each drug.

**15.2 Chemotherapeutic drugs**

The term chemotherapy can be particularly confusing to a records officer in a cancer clinic, as in general medical practice it is used to define a group of drugs used to treat microorganisms causing disease. The same term "chemotherapy" is used for the groups of drugs that are used in anti-cancer chemotherapy, and to avoid confusion the words "*anti-cancer*" should as far as possible always be used to distinguish these drugs. A list of such drugs used for cancer is given in Appendix 2.1 (Ch. 2). In this section only chemotherapy used to treat other diseases is considered. Microorganisms are by definition too small to be seen without a microscope, and include viruses, bacteria, fungi, protozoa, rickettsiae and spirochetes. Many of these can be destroyed by drugs. The most common groups of chemotherapeutic drugs are as follows:

- (a) **Antiseptics:** these are chemical agents that inhibit growth and development of microorganisms, but do not necessarily kill them. The term is usually restricted to chemical agents used outside the body and examples are: mercurochrome and boric acid.
- (b) **Disinfectants:** these are chemical agents that kill harmful microorganisms; again these are generally used outside the body. Examples include: phenol, formaldehyde and alcohol.
- (c) **Antibiotics:** these are chemical substances produced by microorganisms that prevent the growth of, or destroy, other microorganisms. Examples

- include: penicillin, streptomycin, erythromycin, the tetracyclines and ampicillin.
- (d) **Sulfonamides:** these are chemical substances that weaken susceptible bacteria. They are commonly called "sulfa drugs." Examples include: sulfadiazine and sulfisoxazole.
  - (e) **Tuberculostatics:** these are drugs that inhibit the growth of tubercle bacteria. Examples include: isoniazid, paraaminosalicylic acid (PAS) and ethionamide.

**15.3 Pharmacodynamic drugs**

Diseases may be caused by the malfunction of an organ or a body part. Pharmacodynamic drugs serve either to depress specific body functions or to stimulate them. The tables that follow list drugs commonly used for various conditions of different body systems.

**15.4 Names of drugs**

The chemical name is a precise description of the chemical constitution of a drug. The generic name is usually proposed by the company that has developed the drug. It is

**Table 8. Drugs that affect the nervous system**

Category	Comment	Examples
<b>Stimulants</b>	Used to counteract depression	Amphetamines
<b>Analgesics</b>	Given for relief of pain without loss of consciousness	
1. Narcotic analgesics	Habit-forming analgesics	Morphine, Codeine, Demerol Darvon
2. Non-narcotic analgesics	Not usually habit-forming; no important action outside analgesia	Aspirin, ACC's, ASA
3. Analgesic-antipyretics	In addition to pain-relieving this group reduces fever	
<b>Hypnotics and sedatives</b>	Exert a depressant effect on the nervous system. Hypnotics produce sleep; when used in smaller doses they are called sedatives.	
1. Barbiturates	Can produce addiction	Phenobarbital, secobarbital, pentobarbital
2. Non-barbiturate hypnotics		Paraldehyde, chloral hydrate
<b>Tranquillizers</b>	Do not produce stupor even in large doses	Reserpine, Thorazine Meprobamate
<b>Anaesthetics</b>		
1. General	Produces loss of sensation, accompanied by loss of consciousness	Nitrous oxide, cyclopropane
2. Basal	Used as an adjunct to inhalation anaesthesia or alone for minor procedures	Sodium pentothal
3. Local		Novocain, xylocaine

**Table 9. Drugs that affect the endocrine system**

Category	Comment	Examples
<b>Insulins</b>	Used in treating diabetes mellitus	Regular Insulin, Protamine Zinc Insulin (PZI), Isophane Insulin (NPH)
<b>Oral hypoglycaemics</b>	Chemicals taken by mouth to lower the blood sugar	Orinase, Diabinese, DBI
<b>Corticosteroids</b>	Used in inflammatory conditions	Cortisone, Hydrocortisone, Prednisone

**Table 10. Drugs that affect the respiratory system**

Category	Comment	Examples
<b>Antitussives</b>	Given to relieve cough	Codeine
<b>Expectorants</b>	Aid in the expulsion of sputum	Potassium iodine

**Table 11. Drugs that affect the gastrointestinal system**

Category	Comment	Examples
<b>Antacids</b>	Counteract the acidity of the gastric contents	Amphojel, Gelusil
<b>Antiemetics</b>	Stops vomiting and relieves nausea	Compazine, Dramamine
<b>Cathartics</b>	Aid in the production of a bowel movement	Milk of Magnesia, Castor Oil, Cascara Sagrada
<b>Antidiarrheals</b>	Cause reduction in bowel movements	Paregoric
<b>Antispasmodics</b>	Relieves spasms of the digestive tract	Lomotil

**Table 12. Drugs that affect the circulatory system**

Category	Comment	Examples
<b>Cardiotonics</b>	Improves the tone of myocardium	Digoxin
<b>Diuretics</b>	Increase the flow of urine	Diuril
<b>Vasoconstrictors</b>	Increase the tone of blood vessels	Adrenalin
<b>Vasodilators</b>	Dilate the blood vessels	Nitroglycerin, apresoline
<b>Anticoagulants</b>	Inhibit blood clotting	Heparin, dicumarol

**Table 13. Pharmaceutical abbreviations**

Name	Abbreviation	Name	Abbreviation
Ampules	Amp.	Oil	Ol.
Capsules	Caps.	Ointment	Ung.
Compound	Comp.	Pills	Pil.
Elixir	Elix.	Powder	Pulv.
Emulsion	Emul.	Solution	Sol.
Enteric-coated	E.C.	Spansules	Spans.
Extract	Ext.	Suppository	Supp.
Fluid extract	Flidext.	Syrup	Syr.
Liniment	Lin.	Tablets	Tab.
Liquid	Liq.	Tincture	Tr., Tinct.
Lotion	Lot.	Troches, lozenges	Troch.
Mixture	Mit.		

then processed through the World Health Organization. Many hospitals require their pharmacies to label all medications with their generic name. It is never capitalized.

The trade or brand name is the special name given to a drug by each company manufacturing it.

Most pharmaceutical preparations are indicated by an abbreviation

## 16 PATHOLOGY

### 16.1 Introduction

Pathology is the branch of medicine concerned with the study of changes in cell structure and function as a result of disease.

Causes of disease usually fall under one of two general headings:

1. Predisposing causes;
2. Specific or immediate causes.  
i.e. a weak and malnourished person will more readily succumb to pneumonia than one who is healthy and able to resist an invasion of bacteria; in this case the state of health was a predisposing cause, the bacteria the immediate cause.

### 16.2 The body's response to injury

Inflammation, the most common of all body reactions to injury, is a local reaction of body cells.

Injury may be produced by trauma, foreign bodies, chemicals, electricity, heat, cold, pathogenic micro-organisms or pathogens, radiation.

In a simple inflammatory process such as a surgical incision, the blood supply to the area is increased. White blood cells and serum leave the blood stream and surround the injured part. When no pathogens are present inflammation subsides; the white blood cells devour dead cells (phagocytosis) and return to the blood stream. Excess fluid is reabsorbed, the wound edges grow together and healing occurs.

When inflammation is caused by pathogenic organisms, the same defensive reaction starts. After leaving the blood stream, the leukocytes (white blood cells) try to kill invading organisms. Antitoxins and antibodies are two important immune substances which are carried to the area by the blood. If immune substances and leukocytes are strong enough to kill the organisms, inflammation begins to disappear. When the body's resistance is too weak, or the pathogens are too virulent, many tissue cells or leukocytes are killed. A collection of dead tissue cells, bacteria and dead white cells is called pus. The process of pus

formation is called suppuration. The body attempts to build a wall of white blood cells and tissue around the pus. This collection of pus surrounded by a wall is known as an abscess or a boil. Infectious particles which escape are picked up by the lymphatic system. When these reach the lymph nodes, specialized cells within the nodes try to render the bacteria harmless.

Local symptoms of inflammation are redness and swelling due to the increased blood supply plus heat and pain.

General symptoms of inflammation are fever, increased pulse and respiration rate, headache, dry skin, flushed cheeks, increased white blood cell count and malaise.

### 16.3 Specific causes of disease

**Congenital:** congenital diseases result from an abnormal development during foetal life and are apparent at birth or soon thereafter.

**Injuries to tissues:** physical injury is known as trauma. Chemical injuries are detrimental to the body's cells and tissues.

**Parasites:** are organisms which live in or on another animal, depending on the host for nourishment.

**Deficiency diseases:** result from inadequate intake of essential nutrients or from the body's failure to properly utilize essential nutrients. The most common are vitamin deficiencies e.g. scurvy, rickets, pellagra.

**Degenerative diseases:** are due to deterioration in the function of organs from atrophy or even necrosis (death of tissues). The term is usually restricted to diseases of old age for which no specific cause has been determined, for example arterial disease such as hardening of the arteries (arteriosclerosis).

**Infection:** bacteria and viruses are the most common causative agents in infections. Bacteria are microorganisms, tiny living bodies visible only through a microscope. Micro-organisms capable of producing disease in humans are called pathogens. Those which are usually not harmful to cells and tissues are called nonpathogenic organisms.

**Pathogenic bacteria** are divided into groups according to their shape:

- a) Cocci (round) e.g. streptococcus, staphylococcus, pneumococcus;
- b) Bacilli (rod-shaped) e.g. shigella, Escherichia coli, pseudomonas, Salmonella typhi;
- c) Spirochetes (spiral or corkscrew) - syphilis.

The manner in which bacteria arrange themselves is also a means of classifying them. Some grow in pairs (diplococci); some in chains (streptococci); and some in clusters (staphylococci).

Some bacteria produce toxins which are poisonous substances.

**Viruses** are extremely small, living pathogenic organisms. An electron microscope is usually required to see them. Virus-caused diseases can spread very rapidly and produce epidemics.

Examples of virus infections which affect the skin are smallpox, measles, and chickenpox. Poliomyelitis, rabies and encephalitis (sleeping sickness) are virus-caused diseases which affect the central nervous system. Viruses attack the respiratory system. They produce the common cold, influenza and viral pneumonia.

**Allergies** are reactions employing defense mechanisms closely related to immunity.

**Neoplasms** are literally new growths. They may be benign or malignant. Benign neoplasms should not be thought of as completely harmless. They may grow so large as to cause damage to nearby tissues and organs.

Malignant growths are referred to as cancers. The cells of a malignant growth interfere with and sometimes destroy the cells of normal tissue; they may spread to other parts of the body from their original site as a "metastasis".

### Tumour classification (Table 14)

A carcinoma is a malignant change of epithelial cells located in the skin, mucous and serous membranes; for example, adenocarcinoma.

A sarcoma is a cancer of connective tissue, e.g. bone cartilage, fat, tendons. For example, an osteosarcoma is a malignancy of the bone. A liposarcoma is a malignancy of fatty tissue.

**Table 14. Classification of neoplasms**

Tissue of origin	Benign	Malignant
<b>1. Epithelial neoplasms</b>		
a) Surface epithelium (Squamous and transitional epithelium)	Papilloma	Basal cell carcinoma Squamous cell carcinoma Transitional cell carcinoma
b) Glandular epithelium - liver - sweat glands	Adenoma Hepatoma Hidradenoma	Adenocarcinoma Hepatocarcinoma Hidradenoid carcinoma
<b>2. Connective tissue neoplasms</b>		
a) Fibrous tissue - adult - embryonal	Fibroma Myxoma	Fibrosarcoma Myxosarcoma
b) Cartilage	Chondroma	Chondrosarcoma
c) Bone	Osteoma	Osteosarcoma (osteogenic)
d) Fat	Lipoma	Liposarcoma
e) Blood vessels	Hemangioma	Hemangiosarcoma
f) Lymph vessels	Lymphangioma	Lymphangiosarcoma
g) Smooth muscle	Leiomyoma	Leiomyosarcoma
h) Striated(skeletal muscle)	Rhabdomyoma	Rhabdomyosarcoma
<b>3. Haematopoietic tissue neoplasms</b>		
a) Lymphoid tissue	None recognized	Lymphomas a) Hodgkin's disease b) Lymphosarcoma c) Follicular lymphoma d) Reticulum cell sarcoma
b) Granulocytic tissue	None recognized	Myelogenous leukaemia
c) Erythrocytic tissue	Polycythemia vera	
d) Plasma cells	Plasmacytoma	Multiple myelomas
<b>4. Neural tissue neoplasms</b>		
a) Glial tissue	Glioma (rare)	Gliosarcoma
b) Meninges	Meningioma	Meningeal sarcoma
c) Peripheral neurons	Ganglioneuroma	
d) Primitive neurons	None recognized	Neuroblastoma
e) Retina	None recognized	Retinoblastoma
f) Adrenal medulla	Phaeochromocytoma	None recognized
g) Nerve sheath	Neurilemmoma	Neurilemmal sarcoma
<b>5. Neoplasms of more than one tissue</b>		
a) Breast	Fibroadenoma	Cystosarcoma phylloides
b) Embryonic kidney		Wilm's tumor
c) Multipotent cells	Teratoma	Teratocarcinoma
<b>6. Neoplasms which do not fit into one of the other groups easily</b>		
a) Melanoblasts	Pigmented naevus	Malignant melanoma
b) Placenta	Hydatidiform mole	Chorioepithelioma
c) Ovary	Serous cystadenoma	Serous cystadenocarcinoma Endometroid carcinoma
d) Testis	Interstitial cell Sertoli tumour	Seminoma Embryonal carcinoma
e) Thymus	Thymoma	Malignant thymoma

The type of cell of a tumour is also important. **Anaplasia** is the loss of normal cellular differentiation or organization. **Desmoplasia** means that excessive fibrous tissue formation is present in the tumour stroma. **Metaplasia** indicates a change in the type of adult cell to one not normally present in a tissue. **Dysplasia** is an abnormal, atypical cellular proliferation which is not a tumour.

Malignant tumours are further classified according to their cellular grade. Tumours are often graded numerically into five grades, the lowest number implying the lowest degree of malignancy.

### Mitosis

Normal cells usually exhibit less than one mitosis per thousand cells, whereas malignancies may have as many as twenty mitotic cells per thousand cells.

### Metastases

Usually routes of spread of tumour cells are via lymphatic and blood vessels as emboli, via serous cavities (pleura and peritoneum), or through the spinal fluid.

Tumour cells may lodge in lymph nodes and grow in the regional node, invading the pulp and stroma.

When transported by the blood stream, cells from an organ which normally drain into the portal vein system tend to lodge in the liver, whereas cells from organs which drain into systemic veins usually cause secondary lung metastases. However malignant cells seem to be able to pass through the lungs, thus metastases commonly occur in the brain, bones and also in the liver from tumours draining into systemic veins (presumably via the hepatic artery).

Vascularity is an important factor in the ability of a tumour to metastasize.

### 16.4 Common symptoms of illness

**Temperature:** Fever is elevated temperature, a defence reaction of the body during an infection.

**Pulse:** The pulse beat differs in individuals depending upon age, activity and the need of the body cells for oxygen. It increases in fever. A notable increase in the rate of the heart beat is called *tachycardia*. A slowing of the pulse

rate is known as *bradycardia* (below 60 beats per minute).

**Respiration:** *Dyspnoea* (difficult breathing) may be accompanied by cyanosis, a bluish tint to the skin, most noticeable around the lips and fingernails. *Apnoea* is the absence of respirations. *Orthopnoea* is a symptom where the patient cannot breath except in the upright position.

**Oedema:** (Edema) is a swelling of a part of the body due to a collection of excess fluid in tissues.

**Pulmonary oedema:** results from a collection of fluid within the lungs.

**Dehydration:** Drying up of the cells due to an excessive loss of fluids.

**Nausea:** Is a feeling of discomfort in the stomach region with an urge to vomit. Extreme nausea is usually accompanied by emesis (vomiting).

**Diarrhoea:** Is the passing of frequent or watery stools or both.

**Convulsions:** May appear in many diseases especially with extremely high temperatures in childhood.

### 16.5 Clinical laboratories

NOTE: The normal levels given in this section may differ from those in your own laboratory. Please check your own laboratory normal levels and amend accordingly.

#### 1. Urine

- Routine urinalysis
- Colour
- Characteristics - amount, odour, transparency
- Reaction (pH)
- Specific gravity (sp. gr.) 1.015-1.025
- Proteins (albumin)
- Sugar - glucose
- Acetone
- Diacetic acid
- Microscope (Micro) for
- Red blood cells (RBC)
- White blood cells(WBC)
- Bacteria (Bact.)
- Crystals - XIs (Amorphous)
- Casts

Table 15a. Clinical analysis: urine

Examination	Abbreviation	Normal
Ammonia	NH <sub>3</sub>	20-70 meq/L/24 h
Catecholamines		
Culture and sensitivity	C & S	
Haemoglobin	Hgb	Negative
Porphyrins		Under 100 g
Urea		10 -15 g.
Urobilinogen		Less than 4.0 mg/24 h
17-Ketogenic steroids		5-15 mg/24 h
17-Ketosteroids		Men : 8-25 mg/24 h Women: 5-18 mg/24 h

## 2. Blood

Table 15b. Clinical analysis: blood

Examination	Abbreviation	Normal
Erythrocytes	RBC Eryths	4,500,000-5,000,000/cu mm
Leukocytes	WBC Leukos	5,000-10,000/cu mm
Differential count:		
Myelocytes	Myelos	Negative
Lymphocytes	Lymphos	25-33%
Monocytes	Monos	2-6%
Neutrophils	Neutros	60-70%
Eosinophils	Eos	1-3%
Basophils	Basos	0.5-1%
Reticulocytes	Retics	0.5-1.5% RBC
Platelets		150,000-400,000/cu mm
Haemoglobin	Hb Hgb	Male : 14-17 g Female: 12-15 g
Haematocrit	Hct	Male : 40-54% Female : 35-45%
Acid phosphatase		0-2 UI/100 ml
Alkaline phosphatase		50 I.U.
Plasma proteins:		
Albumin - globulin ratio	AG ratio	4:3
Albumin		4 g/100 ml
Globulin		3 g/100 ml
Total proteins		7 g/100 ml
Amylase		Less than 50 u/100 ml
Anti streptolysin titre	AST	150 u/ml serum
Bilirubin		0.5-1.5 mg%
Bleeding time		1-3 min
Blood urea nitrogen	BUN	10-20 mg%
Bromsulphalein	BSP	45 min retention less than 5%
Calcium	Serum Ca.	10 mg%
Electrolytes:		
Total CO <sub>2</sub>	CO <sub>2</sub>	24-26 meq/L

Table 15b. Clinical analysis: blood

Examination	Abbreviation	Normal
Chlorides	Cl	95-105 meq/L
Potassium	K	3.5-5.5 meq/L
Sodium	Na	140 meq/L
Cholesterol (varies with age)		150-250 mg%
Circulation time (arm-tongue)		9-16 s
Creatinine		1.0-2.0 mg%
Erythrocyte sedimentation rate	ESR (Wintrobe)	Male : 10 mm/h
Female: 15 mm/h		
Fasting blood sugar	FBS	80-105 mg%
Glucose tolerance test		
(at 1-1+ and 2 h)		160 140 120 mg%
Lee White clotting time		6-10 min
Phosphorus		3.5 µg %
Protein bound iodine	PBI	4-8 µgm%
Prothrombin time		12-15 sec
Serum glutamic oxalacetic transaminase	SGOT	40 units
Creatinine clearance		95-105 ml/min/1.73 cu mm
Uric acid		4-6 mg%
Venereal disease research laboratory (Wasserman)	VDRL	Negative
Lactodehydrogenase	LDH	160 I.U.
Cortisol - 8:00 a.m.		16-32 µg%
- 8:00 p.m.		8-16 µg %

## 3. Miscellaneous specimens

Table 15c. Clinical analysis: miscellaneous specimens

Examination	Abbreviation	Normal
<b>Stool:</b>		
Culture and sensitivity	C & S	Up to 5 g/24 h
Fat	O & P	Up to 1+
Guaiac		-
Mucus		-
Ova and parasites		
<b>Gastric analysis:</b>		
Guaiac		Negative
<b>Sputum:</b>		
Culture and sensitivity	C & S	Negative
<b>Vomit:</b>		
Guaiac		Negative
<b>Cerebrospinal fluid:</b>		
Protein	CFS	15-45 mg%
Glucose		40-60 mg%
Cells		Up to 5/cu mm
Pressure		150-250 mm H2O
Culture		Negative

**17 SURGICAL PROCEDURES****17.1 Incision**

*Incision* - cutting into

(o)tomy	tomos – cutting
(o)stomy	stoma – mouth
centese	kentesis – puncture

(1) *Otomy* – to cut into

(a) *Exploratory*

Laparotomy (lapara – the flank),

- opening the peritoneal cavity for exploratory purposes

(b) *Removal of foreign bodies*

Accidental

Therapeutic

Pathological – e.g. removal of calculi

(c) *Division for investigation*

Transection of muscle - tendons - nerves

(d) *Discission*

Needling of lens

(e) *Decompression*

Craniotomy

(f) *Re-opening*

Examples of *otomy* procedures:

**Choledochotomy**

incision of the common bile duct

**Chordotomy**

division of tracts of the spinal cord

**Craniotomy**

procedure on the cranium in which the skull is opened

**Cystotomy (suprapubic)**

cutting into the bladder by an incision just above the pubic symphysis

**Enterotomy**

opening the small intestine for exploration

**Episiotomy**

incision of the perineum for obstetrical purposes

**Lithotomy**

removal of a stone by cutting into an organ

**Nephrolithotomy**

incision of the kidney to remove a renal calculus

**Pyelolithotomy**

removal of a calculus from the renal pelvis

**Pyloromyotomy**

(Ramstedt procedure, Fredet-Ramstedt procedure) – operation (for congenital stenosis of pylorus) in which the thickened pylorus is incised: down to the mucosa

**Thoracotomy**

incision through the chest wall

**Tracheotomy**

formation of an artificial opening into trachea

(2) *Ostomy* – to cut to form an opening

Examples of *ostomy* procedures:

**Cholecystogastrostomy**

anastomosis between the gallbladder and the stomach to relieve obstruction to the flow of bile

**Cholecystojejunostomy**

anastomosis between the gallbladder and the jejunum

**Cholecystostomy**

incision to drain the gallbladder

**Choledochostomy**

formation of an opening in the common bile duct

**Colostomy**

establishment of an artificial opening into the colon, e.g. colostomy, transverse – bringing a loop of the transverse colon onto the abdominal wall, and making an opening in this loop

**Enterostomy**

artificial formation of a permanent opening into the small intestine (either an ileostomy or a jejunostomy)

**Gastroenterostomy**

creation of an opening between the stomach and intestines

**Gastrojejunostomy**

an anastomosis between the stomach and the jejunum

**Gastrostomy**

an opening in the stomach for the introduction of food

**Jejunostomy**

insertion of a tube into the jejunum

**Nephrostomy**

drainage of the renal pelvis through the kidney substance

**Oesophagogastronomy**

an anastomosis between the oesophagus and the stomach

(3) *Centesis* – puncture or aspiration

- (a) Aspiration – of free fluid
- (b) Puncture – thoracentesis, paracentesis
- (c) Trephination – of cornea

Examples of centesis procedures:

**Cul-de-sac aspiration**

drainage of an abscess in the posterior cul-de-sac through the vagina

**Paracentesis**

puncture of a cavity for drainage, e.g. paracentesis abdominis

**Thoracentesis**

tapping through the chest wall for the removal of fluids

**17.2 Excision**

Suffixes:

ectomy	Gr. ektome	a cutting out
exeresis	Gr. exairesis	removal

- (1) *Ectomy* – to cut out
  - (a) **Partial, Subtotal**
    - (i) Resection – subtotal gastrectomy
    - (ii) Biopsy – bios – life – ophis – vision
    - (iii) Guttering – of bone
    - (iv) Saucerization – of bone
    - (v) Curettage – curette – spoon-shaped instrument
  - (b) **Complete, Total**
    - (i) Radical excision           Mastectomy  
radix – root
    - (ii) Obliteration                Varicose veins

- obliterare – to efface (close lumen)
- (iii) Avulsion of                fingernail,  
avellere - to tear away   scalp
- (iv) Extraction                 of cataract  
trahere - to draw
- (v) Enucleation                whole cleaning  
nucleus - nux (nut)        shelling out eye
- (vi) Evisceration               (eye) (leaving  
  sclera)
- viscera - bowels –  
                                      insides
- (vii) Epilation - pilus – hair
- (viii) Ablation Ab - from     of a tumour  
                                      latus detached

Examples of *ectomy* procedures:

**Abdomino-aortic aneurysm resection**

ligation and resection of an aneurysm of the abdominal aorta; a Teflon graft is inserted.

**Abdominoperineal resection**

resection of the rectum and anus, with formation of a permanent colostomy.

**Adenoidectomy**

removal of adenoid tissue.

**Colectomy**

left (Mikulicz procedure)  
removal of a portion of the colon in a multiple-stage operation with resection of tumour.

partial (with end-to-end anastomosis)  
resection of a segment of the colon with direct suture of the two ends.

right

- a) Ileocolostomy, end-to-side anastomosis – resection of terminal ileum and ascending colon with anastomosis between them
- b) Side-to-side anastomosis  
the stumps of the terminal ileum and transverse colon are closed

**Dilation and curettage**

dilating or stretching the cervical canal for the purposes of exploration and scraping the uterine cavity with a curette.

**Embolectomy**

removal of a blood clot from an artery.

**Enucleation**

removal of an organ, tumour, or other body completely.

**Evisceration**

removal of the viscera or the contents of a cavity.

**Fistulectomy**

excision of a fistula.

**Gastrectomy, subtotal**

removal of a large part of the stomach.

**Gastrectomy, total**

removal of all of the stomach.

**Haemorrhoidectomy**

excision of haemorrhoids.

**Hydrocelectomy**

operation for the removal of a hydrocele.

**Hysterectomy, complete, and bilateral salpingo-oophorectomy**

removal of the entire uterus, cervix, tubes and ovaries.

**Hysterectomy**

- a) abdominal – removal of the uterus through an abdominal incision.
- b) complete (or total) – removal of the body and cervix of the uterus
- c) Porro – subtotal hysterectomy following caesarean section.
- d) subtotal or supracervical – removal of the uterus, leaving the cervix uteri in place.
- e) vaginal – removal of the uterus through the vagina.

**Laminectomy**

removal of the posterior arches of the vertebrae in order to expose the spinal cord.

**Lobectomy**

excision of one or more lobes of the lung.

**Mastectomy, radical**

removal of a breast, all of the axillary contents, the pectoralis minor and major muscles.

**Mastectomy, simple**

removal of a breast without the pectoral muscles.

**Mastoidectomy, radical**

removal of the infected bone of the mastoid process.

**Nephrectomy**

removal of a kidney.

**Nephrectomy, partial**

removal of part of a kidney.

**Nephrectomy, transperitoneal**

removal of kidney through an abdominal incision.

**Oophorectomy**

removal of an ovary.

**Oophorectomy, partial**

removal of part of an ovary.

**Orchectomy, Orchidectomy, Orchiectomy**

removal of testicle.

**Pelvic exenteration**

removal of all pelvic viscera, hysterectomy, cystectomy with colostomy, and ureteral transplant.

**Pilonidal cyst, excision of**

removal of a pilonidal cyst (a cyst containing hairs behind the anus).

**Pneumonectomy**

removal of an entire lung.

**Prostatectomy, perineal**

removal of the prostate through a perineal incision.

**Prostatectomy, retropubic**

removal of the prostate anteriorly without going through the bladder.

**Prostatectomy, suprapubic**

removal of prostate above the pubis and through the urinary bladder.

**Prostatectomy (transurethral resection)**

removal of obstructing tissue in small portions by means of an electrotome introduced into the urethra.

**Salpingectomy**

removal of a fallopian tube.

**Salpingo-oophorectomy**

removal of a tube and ovary.

**Saphenous vein, excision of**  
ligation and excision of the saphenous vein.

**Sequestrectomy**  
excision of a necrosed piece of bone.

**Splenectomy**  
excision of the spleen.

**Sympathectomy**  
transection of the sympathetic nervous pathways.

**Thyroidectomy, partial**  
removal of a part of the thyroid gland.

**Thyroidectomy, total**  
removal of the thyroid gland.

**Tonsillectomy**  
removal of the tonsils.

**Varicocele, excision of**  
excision of varicose veins of the spermatic cord.

### 17.3 Exeresis

To strip out. Example of *exeresis* procedures:

**Neuroexeresis**  
operation of tearing out of a nerve; synonym = *neurexairesis*

### 17.4 Amputation

**Amputation**  
cutting off

**Disarticulation**  
at a joint

**Dismemberment**  
through a bone

Examples of *amputation* procedures:

**amputation**  
of an extremity

**Circumcision**  
removal of the prepuce or foreskin.

**Hallux valgus**  
removal of the large bunion over the proximal great toe joint.

### 17.5 Introduction

Intro = within, ducere = to draw or lead

1) *Injections*  
serum, air, radio-opaque substance, dye (jacere = to throw).

2) *Transfusion*  
whole blood, plasma, serum (fundare = to pour).

3) *Implantation*  
radon.

4) *Insertions*  
radium, wire, nails, pins, tampons, catheters, tubing, drains.

Examples of *introduction* procedures:

#### Myelography

a gas or a radiopaque liquid is injected into the subarachnoid space, usually in the lumbar area.

#### Pneumoencephalography

visualization of the brain after injection of air or gases into the ventricles (Ventriculography).

#### Retrograde aortography

insertion of dye through a catheter into abdominal aorta via the femoral artery.

#### Pneumothorax artificial

introduction of air into the pleural cavity to produce pulmonary collapse.

### 17.6 Endoscopy

Endo = inside, scopy = to examine

Examples of *endoscopy* procedures:

#### Cystoscopy

direct visual examination of the interior of urinary bladder through a cystoscope.

#### Cystoscopy and retrograde pyelography

cystoscopy and radiography of the renal pelvis and ureter through dye introduced into catheters in the ureter.

#### Laryngoscopy

examination of the interior of the larynx.

**Oesophagoscopy**

direct visualization of the oesophagus through the oesophagoscope.

Others include:

Bronchoscopy, Gastroscopy, Otoscopy, Peritoneoscopy, Proctoscopy, Rhinoscopy, Thoracoscopy, Tracheoscopy, Urethroscopy.

**17.7 Repair**

Repair (plastics – to form)

Plasty	Ostomy	Desis	Pexy
(form)	(a mouth)	(a binding)	(a fixing)

(1) *Plasty* – a repair or reform

*Ostomy* – anastomosis – gastroenterostomy

*Desis* – fusion – of a joint – arthrodesis – stabilization

*Pexy* – fixation – gastropexy – suspension – hysteropexy

Examples of *repair* procedures:

**Anastomosis**

joining of two ends of small intestine; three methods: end-to-end, end-to-side lateral.

**Colpoperineoplasty**

repair of the perineum and posterior vaginal wall.

**Colpoplasty**

anterior repair of the anterior vaginal wall.

**Grafts, skin**

skin which is detached from its original position and transplanted to another part of the body.

- (a) Thin grafts  
Thin split graft (Ollier-Thiersch).
- (b) Thick grafts  
Multiple small grafts, pinch graft, thick split graft, full thickness graft, or pedunculated flap grafts.

**Manchester procedure**

anterior-posterior vaginal repair and cervical amputation.

**Pyloroplasty**

surgical repair of the pylorus.

**Salpingoplasty and implantation**

re-establishment of the patency of the fallopian tubes.

**Tracheloplasty**

repair of the cervix in which there is laceration or erosion

(2) *Desis*

Example: *Epiphysiodesis*

repair of epiphysial separation due to injury.

*Fusion operation of the knee*

arthrodesis planned to induce body ankylosis.

*Fusion operation of the spine*

arthrodesis to unite several vertebrae.

(3) *Pexy*

Examples:

*Hysteropexy*

suspension of the uterus to correct displacement.

*Nephropexy*

fixation of the kidney.

*Orchiopexy, Orchidopexy, Orchiorrhaphy*

suturing of an undescended testicle in the scrotum.

**17.8 Destruction**

breaking down

*Clasis* – fracturing and refracturing – osteoclasis

*Tripsy* – crushing – neurotripsy

*Lysis* – to free – from adhesions – enterolysis

Also:

**Cauterization**

sealing off bleeding points by heat.

**Fulguration**

destruction of ulcerated tissue by electricity.

**Debridement**

cleaning out dirty wounds and lacerations.

**Diathermy**

heating cells of tissues to point of destruction.

Example of *destruction* procedures:

*Phrenic nerve operation*

when the phrenic nerves are divided, crushed, or injected paralysis of the corresponding side of the diaphragm is produced.

**17.9 Suturing**

(Gr. *rhaphe* – a seam)

**Colporrhaphy, anterior**

repair of the anterior vaginal wall.

**Colporrhaphy, posterior**

repair of the posterior vaginal wall.

**Colpotomy, posterior**

drainage of an abscess through the vagina.

**Herniorrhaphy**

repair of a hernia.

**Perineorrhaphy**

stitching of the perineum.

**Saphenous vein, high ligation of**

ligation of the saphenous vein in the groin for varicosities of the saphenous system.

**Trachelorrhaphy**

stitching of a torn cervix uteri.

**17.10 Manipulation****Manipulation (handling)**

Tasis                    a stretching

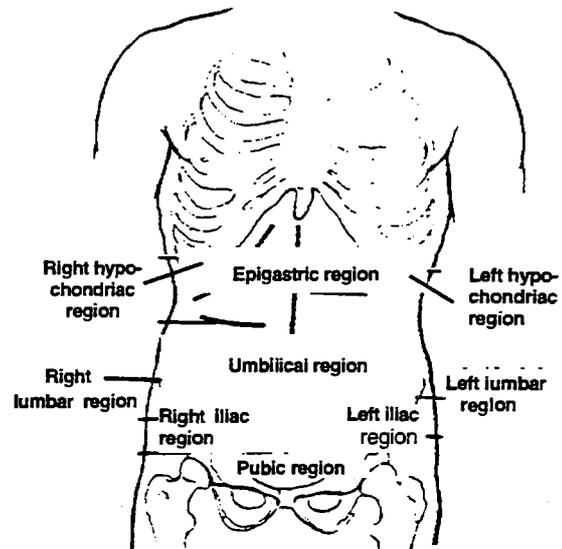
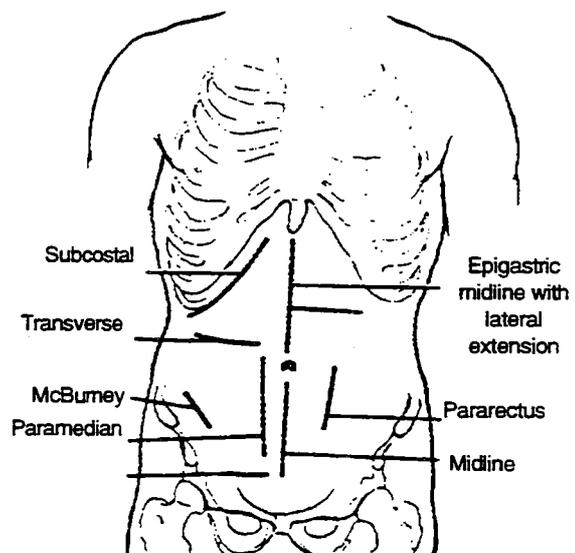
Ectasia                ek – out, tasis – stretched

Tasis – of muscle – myotasis

Ectasia – dilatation – gastrectasis

Closed reduction

application of plaster cast

**Diagram 17. Abdominal regions****Diagram 18. Usual abdominal incisions**

**18 GLOSSARY**

**18.1 Introduction**

The following list of word elements is arranged alphabetically. A hyphen preceding a word element denotes a suffix. A more complete listing can be found in **Dorland's Illustrated Medical Dictionary(1)**.

Pronounce each word as if you were learning a new language.

(1) Dorland's Illustrated Medical Dictionary, (London: W.B. Saunders Company, 1988)

**18.2 Elements**

<u>Word Element</u>	<u>Refers to or Means</u>	<u>Example</u>	
A-, AN-	without, lack of, absent, deficient	aseptic anoxia	a/SEP/tic an/OX/ia
AB-, ABS-	from, away	abduction absent	ab/DUCT/ion ABS/ent
AD-	near, toward	adnexia	ad/NEX/ia
ADENO	gland	adenoma	ad/en/O/ma
AERO	air	aerobic	aer/O/bic
ALB	white	albuminuria	al/BU/min/UR/ia
-ALGIA, -ALGESIA	pain	neuralgia	neur/AL/gia
AMBI-	both	ambliopia	am/bi/OP/ia
ANGIO	vessel (blood or lymph)	angiography	an/gi/OG/raphy
ANO	anus	anoscopy	A/no/scopy
ANTE-	before	antepartum	an/te/PART/um
ANTI-	against	antibiotic	an/ti/BI/o/tic
ARTERIO	artery	arteriogram	ar/ter/i/O/gram
ARTHRO	joint	arthrodesis	ar/thro/DE/sis
-ASTHENIA	weakness	neurasthenia	neur/as/THE/nia
AUTO-	self	autogenous	au/TO/gen/ous
BI-	two, twice	bipolar	BI/po/lar
BRADY-	slow	bradylexia	brad/y/LEX/ia
BRONCHO	bronchus	bronchogenic	bron/CHO/gen/ic
CARDIO	heart	pericardium	per/i/CAR/di/um
-CELE	tumour, swelling, hernia, sac	hydrocele	HYD/ro/cele
-CENTESIS	puncture	paracentesis	par/a/cen/TE/sis
-CEPHALO	head	hydrocephalic	hy/dro/CEPH/a/lic
CHOLE	gall	cholelithotomy	chol/e/lith/O/tomy
CHOLECYSTO	gallbladder	cholecystostomy	choleXcys/tost/o/my
CHOLEDOCHO	common bile duct	choledochotomy	chol/E/doch/o/tomy
CHONDRO	cartilage	chondrosarcoma	chon/DRO/sarc/oma
-CIDE	kill	germicial	GERM/i/CI/dal
CIRCUM-	around	circumrescent	cir/CUM/cre/scent
-CISE	cut	incise	in/CISE
COLO	colon	colectomy	co/LECT/om/y

<u>Word Element</u>	<u>Refers to or Means</u>	<u>Example</u>	
COLPO	vagina	colpodynia	col/PO/dy/nia
CONTRA	against	contraindicant	con/tra/IN/di/cant
COSTO	rib	costochondral	COS/to/CHON/dral
CRANIO	skull	cranium	CRA/ni/um
CYANO	blue	cyanosis	cy/an/OS/is
CYSTO	urinary bladder	cystometrogram	CYS/to/MET/ro/gram
CYTO	cell	leukocyte	LEUK/o/cyte
DE-	down, from	debrider	de/BREDE
DENTI	tooth	dentist	DEN/tist
DERMO DERMATO	skin	dermatologist	derm/a/TOL/o/gist
DI-	two	diatomic	di/a/TOM/ic
DIA-	through, between, across	diaphragm	di/a/PHRAGM
DIS-	apart	dislocate	dis/lo/CATE
DYS-	painful, difficult, disordered	dysphagia	dys/PHAG/ia
ECTO-	outer, on the outside	ectoderm	ec/TO/derm
-ECTOMY	surgical removal	laminectomy	lam/in/ECT/o/my
-EMESIS	vomiting	hyperemesis	hy/per/em/E/sis
-EMIA	blood	anemia	an/E/mi/a
ENCEPHALO	brain	encephalitis	en/ceph/a/LI/tis
ENDO-	within, inner, on the inside	endoderm	EN/do/derm
ENTERO	intestine	gastroenterostomy	gas/tro/EN/ter/ os/ tomy
EPI	above, over	epichondyle	ep/i/CHON/dyle
ERYTHRO	red	erythrocyte	er/yth/RO/cyte
-AESTHESIA	sensation	anaesthesia	an/aes/THE/si/a
EX-	out	extropion	ex/TRO/pion
FEBR	fever	febrile	FEB/rile
FIBRO	connective tissue	fibrocystic	FI/bro/cyst/ic
GASTRO	stomach	gastrectomy	gas/TRECT/o/my
-GENE, -GENIC	production, origin	osteogenic	os/TEO/gen/ic
GLOSSO	tongue	glossitis	gl/oss/I/tis
GLUCO, GLYCO	sugar, sweet	glycolysis	GLY/co/ly/sis
-GRAM	record	pneumsencephalo- gram	Pneum/o/en/CEPH/ a/lo/gram
-GRAPH	machine	electrocardiograph	e/lec/tro/CARD/ i/o/ graph
-GRAPHY	practice, process	lymphography	lymph/OG/ra/phy

<u>Word Element</u>	<u>Refers to or Means</u>	<u>Example</u>	
GYNAE	woman	gynaecological	gy/nae/COL/o/gi/cal
HAEMA, HAE-MATO, HAEMO	blood	haematocrit	haem/at/O/crit
HEMI-	half	hemiparesis	hem/i/PAR/e/sis
HEPA, HEPATO	liver	hepatitis	hep/a/TI/tis
HERNI	rupture	herniorrhaphy	her/ni/ORRH/a/phy
HISTO	tissue	histology	his/TOL/o/gy
HYDRO-	water	hydrocele	hy/dro/CELE
-MANIA	insanity	kleptomaniac	klep/to/MAN/iac
MAST	breast	mastitis	mas/TI/tis
MEGA-	large	megacolon	MEG/a/CO/lon
MEN	month	menstrual	men/stru/AL
MESO	middle	mesoderm	MES/o/derm
-METRE	measure	kilometer	kil/OM/e/ter
METRO	uterus	metropstosis	met/rop/TO/sis
MICRO-	small	microphage	MIC/ro/phage
MONO-	single, one	mononuclear	MON/o/nuc/lear
MUCO	mucous membrane	mucinoid	mu/cin/OID
MYELO	spinal cord, bone marrow	myeloblast	my/el/o/BLAST
MYO	muscle	myoblastoma	my/O/blast/O/ma
NARCO	sleep	narcolepsy	nar/CO/lep/sy
NASO	nose	nasopharyngeal	nas/o/PHA/ryn/geal
NECRO	death	necrosis	NEC/ros/is
NEO-	new	neoplastic	NE/o/plas/tic
NEPHRO	kidney	nephrosis	ne/PHRO/sis
NEURO	nerve	neurology	neu/ROL/o/gy
NON	no, not	nonantigenic	non/AN/ti/gen/ic
HYPER-	over, above, increased, excessive	hyperthyroid	hy/per/THY/roid
HYPO-	under, beneath, decreased	hypothyroid	hy/po/THY/roid
HYSTER	uterus	hysterotomy	hys/ter/OT/o/my
-IASIS	condition of	nephrolithiasis	neph/RO/lith/l/a/sis
ICTERO	jaundice	icterus index	IC/ter/us in/DEX
ILEO	ileum (part of small intestine)	ileostomy	il/e/OS/tom/y
ILIO	ilium (bone)	iliococcygeal	il/i/o/COCC/y/gea
INTER-	between	interstitial	inter/STIT/ial
INTRA-	within	intravenous	in/tra/VEN/ous
-ITIS	inflammation of	gastritis	gast/RI/tis
LAPARO	abdomen	laparoscopy	la/par/O/scop/y
-LEPSY	seizure, convulse	epilepsy	EP/i/lep/sy

<u>Word element</u>	<u>Refers to or means</u>	<u>Example</u>	
LEUKO	white	leukoplakia	leu/ko/PLAK/ia
LIPO	fat	liposarcoma	lip/O/sar/co/ma
LITH	stone, calculus	ureterolithiasis	ur/E/ter/o/lith/i/a/sis
-LYSIS	loosen, dissolve	hemolysis	hem/OL/y/sis
MACRO-	large, long	macrophage	MAC/ro/phage
MAL-	bad, poor, disordered	malodorous	mal/O/dor/ous
OCULO	eye	oculomotor	O/cu/lo/mo/tor
-OLOGY	study of	gerontology	GER/ont/OL/o/gy
-OMA	tumour	myoma	my/O/ma
OOPHOR	ovary	oophoritis	oo/phor/I/tis
OPHTHALMO	eye	ophthalmologist	oph/THAL/mol/o/gist
-OPIA	vision	myopia	my/O/pi/a
ORCHI	testicle	orchidectomy	ORCH/i/dec/tom/y
-ORRAPHY	to repair a defect	colporrhaphy	colp/OR/raph/y
ORTHO-	straight	orthodontist	orth/o/DONT/ist
-OSCOPY	look into, see	panendoscopy	pan/en/DOS/co/py
-OSIS	condition of	cirrhosis	cirrh/O/sis
OSTEO	bone	osteotomy	os/te/O/to/my
-OSTOMY	surgical opening	cecostomy	cec/ost/o/my
OTO	ear	otolaryngology	OT/o/lar/nyg/O/log/y
-OTOMY	incision, surgical cutting	cystotomy	cyst/OT/o/my
PARA-	alongside of	pararenal	par/a/REN/al
PATH	disease	pathogenic	pa/THO/gen/ic
PED (Latin) foot	pedalgia	PED/al/gia	
PED (Greek) child	pediatrician	pe/di/AT/ric/ian	
-PENIA	too few	thrombocytopenia	throm/bo/cyt/o/PEN/i/a
PERI	around, covering	periosteum	pe/ri/OS/te/um
-PEXY	to sew up in position	orchidopexy	OR/chid/O/pex/y
PHARYNGO	throat	pharyngitis	pha/RYN/gi/tis
PHLEBO	vein	phlebotomy	phle/BO/to/my
-PHOBIA	fear, dead	claustrophobia	claus/tro/PHO/bi/a
-PLASTY	operative revision	mammoplasty	MAMM/o/plas/ty
PLEGIA	paralysis	hemiplegia	hem/i/PLE/gi/a OR hem/i/PLA/gia

<u>Word element</u>	<u>Refers to or means</u>	<u>Example</u>	
-PNEA	breathing	dyspnoea	dys/p/NE/a (p silent)
PNEUMO	air, lungs	pneumothorax	pneu/MO/thor/ax
POLY-	much, many	polycythaemia	po/ly/cy/THE/mia
POST-	after	postoperative	post/OP/er/a/tive
PROCTO	rectum	proctoscope	proc/TO/scope
PRE-	before	prevention	pre/VEN/tion
-PTOSIS	falling	nephroptosis	neph/ROP/to/sis
-PYELO	pelvis of kidney	pyelonephrosis	py/el/o/neph/RO/sis
PYO	pus	pyodermia	py/o/DERM/ia
PYRO	heat, temperature	antipyretic	an/ti/PY/ret/ic
RENAL	kidney	adrenal	ad/REN/al
RETRO	behind, backward	retroperitoneal	ret/ro/PER/i/ton/eal
-RHAGE	haemorrhage, flow	haemorrhagic	HEM/or/rhag/ic
-RHoEA	flow	dysmenorrhoea	dys/MEN/orrh/ea
RHINO	nose	rhinoplasty	rhi/NO/plas/ty
SALPINGO	oviduct	salpingogram	sal/pin/GO/gram
SEMI-	half	semilunate	sem/i/LUN/ate
SEPTIC	poison, infection	antiseptic	an/ti/SEP/tic
STOMATO	mouth	enterostomal	en/ter/O/STO/mal
SUB-	under	subnormal	sub/NOR/mal
SUPER	above	supraclavicular	su/pra/CLAV/ic/ul/ar
-THERAPY	treatment	radiotherapy	RA/dio/THER/a/py
-THERMY	heat	thermometer	ther/MO/meter
THORACO	chest	thoracentesis	thor/a/CENT/e/sis
THROMBO	clot	thrombophlebitis	throm/BO/phleb/i/tis
THYRO	thyroid gland	thyrotoxicosis	thy/RO/tox/i/cos/is
TRANS-	across	transabdominal	trans/ab/DOM/in/al
URO	urine	urology	UR/o/lo/gy
-URIA, -URIC	condition of, presence in urine	albuminuria	AL/bum/in/ur/ia
UNI	one	unilateral	u/ni/LAT/er/al
VASO	blood vessel	vasodilator	vas/o/DI/lat/or

## 19 ASSIGNMENTS FOR MEDICAL TERMINOLOGY COURSE

Using your glossary or a medical dictionary, break the following words down into prefixes, roots and suffixes, and write the meaning of the word:

	<u>Prefix</u>	<u>Root</u>	<u>Suffix</u>	<u>Meaning</u>
1. antenatal				
antepartum				
antipyretic				
ante mortem				
antibiotic				
antihistimine				
antidote				
anticoagulant				
2. adenectomy				
adenocarcinoma				
adrenaline				
adermia				
anaerobe				
amenorrhoea				
anaemia				
analgesia				
anaesthesia				
angioma				
anoxia				
anovesical				
asepsis				
3. cytology				
cytocide				
cytolysis				
cystocele				
cystoplasty				
cystitis				
4. diacidic				
diataxia				
diathermy				
diuretic				

	<u>Prefix</u>	<u>Root</u>	<u>Suffix</u>	<u>Meaning</u>
5. dysmenorrhoea				
dysuria				
dysarthria				
dyspnoea				
disarticulate				
disinfect				
dislocate				
6. endocranial				
endoderm				
enterolith				
enteropathy				
encapsulate				
engorgement				
environment				
enthalpic				
7. haemoglobin				
haemolith				
haematuria				
haematemesi				
hemipia				
haemialgia				
8. hypertension				
hyperventilate				
hyperthermia				
hypotension				
hypoventilate				
hypothermia				
hypodermic				
9. Ileus				
ileitis				
ileostomy				
ilium				
iloinguinal				
iliac crest				

	<u>Prefix</u>	<u>Root</u>	<u>Suffix</u>	<u>Meaning</u>
10. intervaginal				
interrenal				
intertubular				
intraabdominal				
intracranial				
intrathoracic				
11. macrodactyly				
macropodia				
macroglossia				
macrycyte				
microdactyly				
microcyte				
microlith				
microorganism				
microscope				
12. myelocele				
myeloma				
myelocyte				
myoma				
myocele				
myocarditis				
13. necropsy				
necrotomy				
nephrotis				
nephrolith				
neuritis				
neuroma				
14. otitis				
otolith				
otogenous				
osteitis				
osteoma				
osteopathy				
15. perfusion				
perception				
pericardium				

	<u>Prefix</u>	<u>Root</u>	<u>Suffix</u>	<u>Meaning</u>
perirenal				
periangitis				
peridental				
precordial				
precancerous				
16. pyonephrosis				
pyoderma				
pyometritis				
pyrotoxin				
pyrometer				

**Integumentary system assignment**

<u>Root</u>	<u>Meaning</u>	<u>Medical term</u>	<u>Meaning of term</u>
Cutis	Skin	Subcutaneous	
Derma	Skin	Epidermis	
Diaphoreo	Perspiration	Diaphoretic	
Onychia	Nail	Paronychia	
Papilla	Nipple	Papillary	
Pilus	Hair	Depilation	
Trichos	Hair	Trichophobia	

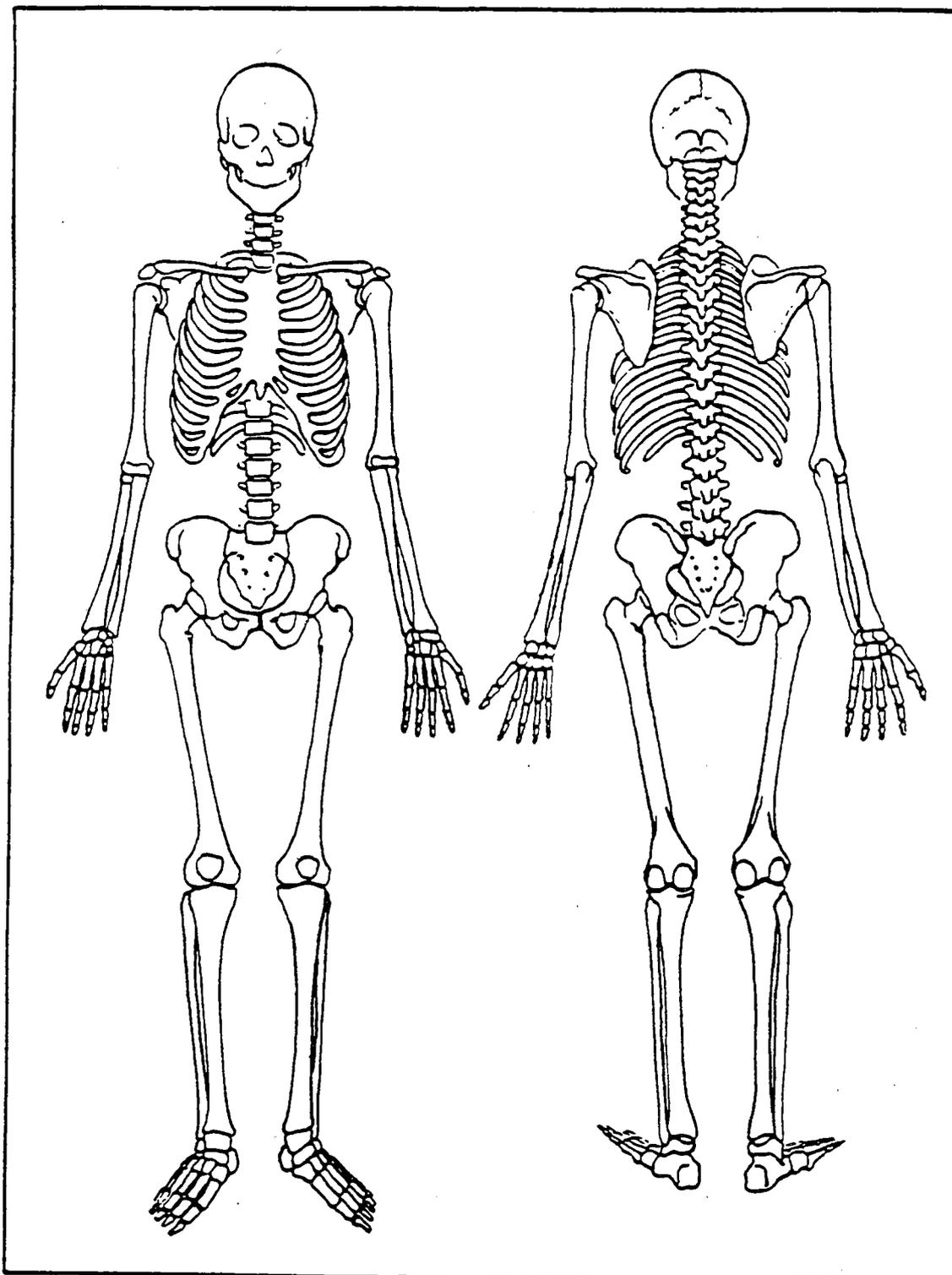
**Skeletal system assignment**

On Diagram 19 label the following:

Joints: Ball and socket joint, hinge joint, pivot joint.

Bones:	Parietal	Clavicle
	Occipital	Humerus
	Frontal	Radius
	Temporal	Ulna
	Mandible	Carpus
	Cervical vertebrae	Metacarpus
	Thoracic vertebrae	Patella
	Lumbar vertebrae	Tibia
	Sacrum	Fibula
	Ilium	Tarsus
	Ischium	Calcaneus
	Scapula	

Because all physicians rely heavily on accuracy and baseline data, a sound knowledge of radiological terminology is essential. The dictionary homework relative to the skeletal system is therefore lengthy, however, time spent in becoming familiar with the words will be well worth the effort.

**Diagram 19: The skeleton**

**Dictionary homework**

**Words to note:** Pertaining to appendicular skeleton

Acromion –  
 Appendicular –  
 Astragalus –  
 Capitate –  
 Cephalad –  
 Condyle –  
 Coracoid –  
 Coronoid –  
 Cuneiform –  
 Ensiform –  
 Gladiolus –  
 Hamate –  
 Lunate –  
 Manubrium –  
 Meniscus –  
 Navicular –  
 Nucleus pulposus –  
 Obturator –  
 Olecranon –  
 Pisiform –  
 Plantar –  
 Popliteal –  
 Scaphoid –  
 Sesamoid –  
 Styloid –  
 Talus –  
 Trapezium –  
 Triquetrum –  
 Trochanter –  
 Tuberosity –  
 Unciform –  
 Volar –  
 Xiphoid –

**Words to note:** pertaining to skull

Acoustic –  
 Ala (Alea) –  
 Apophysis –  
 Asterion –  
 Basalis –  
 Bregma –  
 Canthus –  
 Carotid –  
 Choana –  
 Clinoid –  
 Cornu –  
 Coronal –  
 Cribriform –

Crista Galli –  
 Glabella –  
 Hyoid –  
 Hypophysis –  
 Infundibulum –  
 Lambdoid –  
 Opisthion –  
 Palpebral –  
 Petrous –  
 Pterion –  
 Pterygoid –  
 Ramus –  
 Stephanion –  
 Styloid –  
 Vomer –  
 Zygomatic –

**Words to note:** pertaining to vertebral column and thoracic cage

Bifid –  
 Cornu –  
 Epistropheus –  
 Homologous –  
 Imbricate –  
 Lamina –  
 Odontoid –  
 Piriformis –  
 Scalene –  
 Sulcus –

## Musculoskeletal system assignment

(Dictionary Assignment)

<u>Word</u>	<u>Medical Term</u>	<u>Definition</u>
Joint	Synarthrodial	
Bursa (small sac between moving parts)	Bursectomy	
Wrist	Metacarpal	
Head	Encephalitis	
Hand	Chiroplasty	
Cartilage	Chondrolysis	
Coccyx	Coccygectomy	
Rib	Intercostal	
Hip	Coxodynia	
Finger	Dactylomegaly	
Ligament	Desmorrhexis	
Diaphragm	Diaphragmatic hernia	
Movement	Kinetosis	
Skull	Cranioplasty	
Muscle	Intramuscular	
Marrow	Myelogenous	
Muscle	Myoblastoma	
Mucus	Myxadenoma	
Shoulder	Omohysid	
Bone	Osteosarcoma	
Fibula	Peroneus	
Foot	Talipes	
Foot	Pediatrist	
Vertebrae	Spondylopathy	
Tendon	Tenosynovitis	

## NERVOUS SYSTEM ASSIGNMENT

<u>Word</u>	<u>Notes</u>
convolution	
cerebrum	
cortex	
neurone	
ganglion	
thalamus	
commissure	
corpus striatum	
medulla	
cerebellum	
myelin	
neurilemma	
dura-mater	
pia-mater	
arachnoid	
axon	
cisterna magna	
cisterna pontis	
saggital	
autonomic	
cauda equina	
neurologist	
aphasia	
chordotomy	
hydrocephalus	
astrocytoma	
epilepsy	
cerebral palsy	
cerebral sclerosis	
Niemann-Picks disease	
Ataxia telangiectasia	
meningitis	
hemi-paresis	
glioma	
medulloblastoma	
ependymoma	
oligodendroglioma	
meningioma	
neurofibroma	
neurosurgeon	

## Special sense organs assignment

Dictionary homework

<u>Word</u>	<u>Derivation</u>	<u>Meaning</u>
acoustic		
uveal tract		
gustatory		
tarsus		
olfactory		
sclera		
cochlea		
retina		
eustachian		
limbus		
labyrinth		
lens		
mastoid		
lacrimal		
tympanic		
iris		
aqueous		
cornea		
canthus		
conjunctiva		
choroid		
vitreous		

## Cardiovascular system assignment

<u>Root</u>	<u>Meaning</u>	<u>Example</u>	<u>Definition</u>
Angeion	Vessel	Angiogenesis	
Aorte	Aorta	Aortectasia	
Arteria	Artery	Arteriography	
Cardia	Heart	Endocardium	
Phlebo	Vein	Phlebothrombosis	
Vena	Vein	Venesection	
Sphygmos	Pulse	Sphygmomanometer	
Aden	Gland	Adenocarcinoma	
Haema	Blood	Haemoglobin	
Splen	Spleen	Splenomegaly	

### Blood and blood forming organs assignment

<u>Word</u>	<u>Root</u>	<u>Meaning</u>
afferent		
agglutination		
agglutinin		
agglutino-		
aplastic		
efferent		
erythroblast		
erythropoiesis		
haemolysis		
haematopoiesis		
incompatible		
leukopoiesis		
lymph		
lymphocyte		
myeloblast		
myeloid		
normoblast		
normochromic		
precursor		
reticulocyte		
reticuloendothelial		
trabeculae		
megaloblast		
myeloma		
intrinsic factor		
hyperplasia		
polymorphonuclear		
polycythaemia		
pleomorphic		
vera		
myelogenous		
hepatomegaly		
splenomegaly		
metastases		
myelophthisic		
thrombocytopenia		
lymphoma		
lymphosarcoma		
dysproteinaemia		

## Respiratory system assignment

<u>Root</u>	<u>Meaning</u>	<u>Example</u>	<u>Definition</u>
Bronch	Bronchus	Bronchoscopy	
Pectus	Chest	Pectus excavatum	
Phren	Diaphragm	Phrenicectomy	
Pneumon	Lung	Pneumonitis	
Rhin	Nose	Rhinostenosis	
Thorax	Chest	Thoracotomy	
Trachea	Windpipe	Tracheoplasty	

## Dictionary homework

<u>Word</u>	<u>Meaning</u>
alveolus	
aphonia	
arytenoid	
bronchiole	
bronchus	
caseous	
catarrh	
concha	
corniculate	
coryza	
cricoid	
cuneiform	
dyspnoea	
epiglottis	
epistaxis	
glottis	
haemoptysis	
hilus	
larynx	
lung	
meatus	
mediastinal	
nares	
nasolacrimal	
olfactory	
osmosis	
pharynx	
pleura	
septum	
sinus	
trachea	
turbinates	

## Digestive system assignment

<u>Root</u>	<u>Meaning</u>	<u>Example</u>	<u>Definition</u>
Amygdale	Tonsil	Amygdaloid fossa	
Cheilos	Lip	Cheilostomatoplasty	
Chole	Bile	Cholelithasis	
Chylos	Chyle	Chyluria	
Colon	Colon	Colostomy	
Copros	Excrement	Copremesis	
Dipsa	Thirst	Dipsomania	
Emesis	Vomiting	Haematemesis	
Enteron	Gut	Enterostatis	
Gaster	Stomach	Gastrectomy	
Glossa	Tongue	Glossitis	
Glottis	Glottis (a part of voice box)	Epiglottis	
Hepato	Liver	Hepatomegaly	
Ileos	Ileum	Ileocaecal	
Larynx	Larynx	Laryngectomy	
Mesoenteron	Mesentery	Mesenteritis	
Odont	Tooth	Odontologist	
Oesophagos (Esophagus)	Gullet	Osophagitis	
Orexis	Appetite	Anorexia	
Phagein	Swallowing	Dysphagia	
Pharynx	Pharynx	Pharyngeal	
Proktos	Anus or Rectum	Proctodynia	
Pyloros	Pylorus	Pylorostenosis	
Stoma	Mouth	Stomatitis	
Tonsilla	Tonsil	Tonsillitis	

**Medical terminology assignment: Digestive system**

## Dictionary homework

<u>Word</u>	<u>Root</u>	<u>Meaning</u>
Absorb		
Alimentary		
Ampulla		
Annular		
Antrum		
Anus		
Appendix		
Areola		
Assimilate		
Bilirubin		
Buccal		
Cecum		
Chyle		
Colon		
Common bile duct		
Crypts of Lieberkühn		
Cystic duct		
Duct		
Duodenum		
Dysphagia		
Emesis		
Epiploic		
Excretion		
Fauces		
Faeces		
Frenulum		
Fundus		
Fungating		
Gastroenterologist		
Gastroenterology		
Glossopalatine		
Glucagon		
Haematemesis		
Haemorrhoids		
Hiatus		
Hyperglycemic		
Hyperkeratosis		
Ileocaecal		
Ileum		
Ingest		
Insulin		
Islets of Langerhans		
Jejunum		
Lacteal		
Mastication		
Meckel's diverticulum		

<u>Word</u>	<u>Root</u>	<u>Meaning</u>
Mesentery		
Mucin		
Omentum		
Palate		
Pancreas		
Parietal		
Parotid		
Peristalsis		
Pharyngopalatine		
Plica		
Polypoid		
Porta hepatis		
Ptyalin		
Pylorus		
Rugae		
Salivary		
Salivation		
Scirrhous		
Secrete		
Sphincter of Oddi		
Stercobilin		
Sublingual		
Submandibular		
Succus entericus		
Urobilin		
Urobilinogen		
Uvula		
Vermiform		

### Urinary system assignment

<u>Root</u>	<u>Meaning</u>	<u>Example</u>	<u>Definition</u>
Cystitis	Bladder	Cystotomy	
Nephros	Kidney	Nephrectomy	
Pyelos	Kidney/Pelvis	Pyelogram	
Ren	Kidney	Adrenal	
Urina	Urine	Polyuria	
Vesicula	Vesicle	Intravesicular	

### Urinary system medical terminology

#### Dictionary Homework

<u>Word</u>	<u>Meaning</u>
Afferent	
Arcuate	
Azotaemia	
Bowman' capsule	
Calculus	
Calyces	
Convolutod	
Cortex	
Creatinine	
Cystitis	
Cystocele	
Cystometrogram	
Dysuria	
Efferent	
Filtration	
Glomerulus	
Haematuria	
Henle's loop	
Hilum	
Hydronephrosis	
Incontinent	
Intravesicular	
Nephron	
Nephroptosis	
Oliguria	
Parenchymatous	
Pelvis	
Penile	
Perinephric	
Polyuria	
Postpartum	
Renal fascia	
Retention	

<u>Word</u>	<u>Meaning</u>
Retrograde	
Retroperitoneal	
Suppression	
Synthesis	
Transitional	
Trigone	
Urea	
Uraemia	
Ureter	
Urethra	
Venereal	
Vesical	
Void	

**Reproductive system assignment**

<u>Root</u>	<u>Meaning</u>	<u>Example</u>	<u>Definition</u>
Colpos	Vagina	Colpomyotomomy	
Didymoi	Epididymis (small body lying above testes)	Epididymitis	
Genos	Genesis	Genetics	
Hymen	Hymen	Hymenectomy	
Hystera	Womb/Uterus	Hysteromyoma.	
Kleitoris	Clitoris	Clitoriditis	
Metra	Womb/Uterus	Metrorrhagia	
Oophorein	Ovary	Oophorectomy	
Orchis	Testicle	Orchidectomy	
Salpinx	Fallopian tube	Salpingectomy	
Sperma	Semen	Spermicide	
Uterus	Uterus	Uteropexy	

## Reproductive system medical terminology

### Dictionary homework

<u>Word</u>	<u>Meaning</u>
abortion	
amenorrhoea	
amitosis	
areola	
atrophicus	
bulbouretral	
cavernous	
cervix uteri	
clitoris	
corpora cavernosa	
corpus luteum	
dysmenorrhoea	
ectopic pregnancy	
endometrium	
epididymis	
estrogen	
fertilization	
fimbria	
foreskin	
gamete	
gonad	
Graafian follicle	
hymen	
hyperplastic	
inguinal	
labia	
lactation	
menorrhagia	
menopause	
menstruation	
metrorrhagia	
mons pubis	
myometrium	
nulliparous	
ostium abdominale	
ovary	
oviduct	
ovulation	
ovum	
parametrium	
penis	
perineum	
prepuce	
progesterone	
prostate	

<u>Word</u>	<u>Meaning</u>
puberty	
scrotum	
semen	
seminal vesical	
spermatozoa	
testis	
tunica vaginalis	
uterus	
vagina	
vas deferens	
vestibule	
vulva	
zygote	

**Endocrine system assignment**

<u>Root</u>	<u>Meaning</u>	<u>Example</u>	<u>Definition</u>
Carotis	Carotid	Carotid gland	
Gone	Gonad	Gonadotrophic	
Pinea	Pineal	Pinealopathy	
Pituita	Pituitory	Pituitrin	
Thymos	Thymus	Thymectomy	
Thyreos	Thyroid	Thyroadenitis	
Galact	Milk	Galactemia	
Mamma	Breast	Mammary gland	
Mastos	Breast	Mastitis	
Thel	Nipple	Thelalgia	

**Endocrine system medical terminology**

Dictionary Homework

<u>Word</u>	<u>Root(s)</u>	<u>Meaning</u>
androgen		
cachexia		
cell rests		
chromaffin		
cortex		
diabetes		
endocrinology		
estrogen		
exophthalmos		
gastrin		

<u>Word</u>	<u>Root(s)</u>	<u>Meaning</u>
glucosuria		
gonad		
glycosuria		
hormone		
hypophyseal		
hypotension		
iatrogenic		
insular		
intracranial		
libido		
medulla		
morbid		
myxoedematous		
parenchyma		
placenta		
polydipsia		
polyphagia		
prostration		
secretion		
somatotrophic		
testosterone		
tetany		
thyroxin		
vascular		

## Pathology assignment

### Dictionary homework

<u>Signs and symptoms</u>	<u>Meaning</u>
Cephalalgia	
Diplopia	
Tinnitus	
Epistaxis	
Rhinorrhoea	
Dyspnoea	
Haemoptysis	
Palpitation	
Oedema	
Syncope	
Dysphagia	
Aerophagia	
Borborygmus	
Nausea	
Haematemesis	
Jaundice	
Constipation	

<u>Signs and symptoms</u>	<u>Meaning</u>
Diarrhoea	
Pruritis	
Frequency	
Tenesmus	
Incontinence	
Enuresis	
Nocturia	
Polyuria	
Dysuria	
Haematuria	
Impotence	
Amenorrhoea	
Dysmenorrhoea	
Metrorrhagia	
Paraesthesia	
Skin eruptions macular papular desquamating	
Pigmentation	
Petechiae	
Telangiectasia	
Atheroma	
Cicatrix	
Verrucae (Verruca)	
Naevi (Naevus)	
Hirsute	
Alopecia	
Cerumen	
Auricular topi	
Ptyalism	
Gingivitis	
Pyorrhoea	
Parulis	
Stridor	
Aphonia	
Bruit	
Gynaecomastia	
Tachypnoea	
Bradypnoea	
Dyspnoea	
Orthopoea	
Apnoea	
Ascultation	
Rales	
Bradycardia	
Tachycardia	
Aneurysm	

<u>Signs and symptoms</u>	<u>Meaning</u>
Pulse - dorsalis pedis - posterior tibial	
Condylomata	
Introitus	
Retroversion	
Retroflexion	
Ankylosis	
Crepitus	
Flaccid	
Spastic	
Romberg test	
Cremasteric	
Euphoria	
Necropsy	
Oncology	
Forensic medicine	
Idiopathic etiology	
Degeneration	
Infiltration	
Amyloidosis	
Metastatic calcification	
Calcinosis	
Ochronosis	
Melanomata	
Porphyryns	
Hyperaemia	
Pyknosis	
Karyorrhexis	
Karyolysis	
Caseation	
Rubor	
Calor	
Dolor	
Intermitotic	
Postmitotic	
Aplasia	
Hypoplasia	
Atrophy	
Metaplasia	
Dyplasia	
Hyperplasia	
Hypertrophy	
Neoplasia	
Carcinogen	
Papilloma	
Anaplasia	

## REVIEW MEDICAL TERMINOLOGY ASSIGNMENT

Prefixes which indicate location, direction and tendency

	<u>Prefix</u>	<u>Meaning</u>	<u>Example</u>	<u>Meaning of example</u>
1.	Ab	)	Abduction	
	Apo	)From, away from	Apoplexy	
	De	)	Detract	
2.	Ad	To, near, toward	Adrenal	
3.	Ambi	Both	Ambidextrous	
4.	Amphi	)	Ampitheatre	
		) On both sides		
	Ampho	)	Amphogenic	
5.	Ana	Up, apart, across	Anabolism	
6.	Ante	)	Antenatal	
	Pre	)Before	Precancerous	
	Pro	)	Prognosis	
7.	Anti	)	Antispasmodic	
	Contra	)Against	Contraindication	
	Counter	)	Counterbalance	
8.	Cata	)Down	Catabolism	
9.	Circum	)	Circumference	
		)Around		
	Peri	)	Pericardium	
10.	Co	)	Co-ordination	
	Com	)	Compound	
	Con	)With, together	Congenital	
	Sym	)	Symbiosis	
	Syn	)	Synarthrosis	
11.	Dia	)	Diaphoresis	
	Per	)Through	Percutaneous	
	Trans	)	Transhepatic	
12.	Di	)	Diarthrosis	
		) Apart from		
	Dis	)	Disarticulation	
13.	E	)	Enucleate	
	Ec	)Out from	Eczema	
	Ex	)	Exhale	
14.	Ect	)	Ectopic	
	Exo	)Outside	Exogenous	
	Extra	)	Extravasation	
15.	Em	)	Empyema	
	En	)	Encapsulated	
		) In		
	Im	)	Impacted	
	In	)	Inspiration	

	<u>Prefix</u>	<u>Meaning</u>	<u>Example</u>	<u>Meaning of example</u>
16.	End	)	Endocardium	
	Ento	) Within	Entopic	
	Intra	)	Intravenous	
17.	Epi	Upon	Epicondyle	
18.	Infra	)	Inframamary	
	Hypo	) Under	Hypodermic	
	Sub	)	Subelavian	
19.	Inter	Between	Intercostal	
20.	Intro	Into	Introduction	
21.	Meta	Change	Metaplasia	
22.	Para	Beside	Paranasal	
23.	Post	After	Postoperative	
24.	Re	Again	Recurrence	
25.	Retro	)	Retroflexion	
		) Backward		
	Re	)	Relapse	
26.	Super	)	Superimpose	
		) Above		
	Supra	)	Suprapubic	
27.	Ultra	Excessive	Ultrasonic	
<b>Negative prefixes</b>				
1.	A	)	Apnoea	
		) Without		
	An	)	Anaesthetic	
2.	Im	)	Immature	
		) Not		
	In	)	Incurable	
<b>Pseudoprefixes denoting number and measurement</b>				
1.	Uni	)	Unilateral	
		) One		
	Mono	)	Monocyte	
2.	Bi	)	Bifocal	
	Bin	) Two	Binocular	
	Di	)	Dichromatic	
3.	Ter	)	Tertiary	
		) Three		
	Tri	)	Trigone	
4.	Quadra	)	Quadriceps	
		) Four		
	Tetra	)	Tetragenous	
5.	Quinque	)	Quintuplet	
		) Five		
	Pent(a)	)	Pentose	
6.	Sex	)	Sextipara	
		) Six		
	Hex(a)	)	Hexadactylism	

	<u>Prefix</u>	<u>Meaning</u>	<u>Example</u>	<u>Meaning of example</u>
7.	Sept	)	Septan	
		) Seven		
	Hept(a)	)	Heptose	
8.	Octa	Eight	Octogenarian	
9.	Nonagen	)	Nonan	
		) Nine		
	Novem	)	Novemlobate	
10.	Dec	)	Decigram	
		) Ten		
	Dec(a)	)		
11.	Cent	)	Centimetre	
		) Hundred		
	Hect(o)	)	Hectogram	
12.	Milli	)	Millimetre	
		) Thousand		
	Kilo	)	Kilogram	
13.	Demi	)	Demilune	
	Semi	) Half	Semicircular	
	Hemi	)	Hemiplegia	
14.	Multi	)	Multinodular	
		) Many		
	Poly	)	Polycythaemia	
15	Super	)	Supernumerary	
	Per	)	Pertussis	
		) More		
	Hyper	)	Hyperaemia	
	Extra	)	Extrasystole	
16.	Sub	)	Subnormal	
		) Less		
	Hypo	)	Hypocrinism	
<b>Prefixes denoting colour</b>				
1.	Albumin	)	Albuminuria	
	Alb	)	Albinism	
	Luc	) White		
	Leuc	)	Leucitis	
	Leuk	)	Leukaemia	
2.	Aure	Golden	Auriginous	
3.	Ciner	)	Cinerea	
		) Grey		
	Polio	)	Poliomyelitis	
4.	Chlor	)	Chlorophyll	
	Glauc	) Green	Glaucoma	
	Verdin	)	Verdohaemoglobin	
5.	Cirr	)	Cirrhosis	
	Lutein	) Yellow	Corpus luteum	
	Xanth	)	Xanthopsis	

6.	Rube	)	Rubella	
		) Red		
	Erythr	)	Erythrocyte	
7.	Cyan	) Blue	Cyanosis	
	Indigo	)	Indigouria	
8.	Purpur	) Purple	Purpura	
	Porphyr	)	Porphyrin	
9.	Melan	Black	Menanoma	

### Miscellaneous pseudo-prefixes

Prefix	Meaning	Example	Meaning of example
Aniso	Unequal	Anisocytosis	
Atel	Imperfect	Atelectasis	
Blast	Germoblast	Blastomycosis	
Brachy	Short	Brachygnathia	
Brady	Slow	Bradycardia	
Cry	Cold	Cryosurgery	
Crypt(o)	Hidden	Cryptorchidism	
Cyt	Cell	Cytology	
Fibr	Ropelike	Fibroma	
Gyn	Woman	Gynaecology	
Hetero	Different	Heterogeneous	
Hydr	Water	Hydronephrosis	
Leio	Smooth	Leiomyoma	
Lith	Stone	Cholelithiasis	
Micr	Small	Microscope	
Morph	Form	Morphology	
Myc	Fungus	Mycoplasma	
Neo	New	Neoplasm	
Olig	Few	Oliguria	
Onc	Tumour	Oncology	
Pachy	Thick	Pachyderm	
Pan	All	Pan hysterectomy	
Pseudo	False	Pseudocyst	
Py	Pus	Pyorrhoea	
Scirr	Hard	Scirrhus	
Scolio	Crooked	Scoliosis	

<u>Prefix</u>	<u>Meaning</u>	<u>Example</u>	<u>Meaning of example</u>
Sten	Contracted	Stenosis	
Tachy	Fast	Tachycardia	
Toxi	Poison	Toxicology	
Troph	Nourishment	Thyrotropic	
Vas	Vessel	Vasospasm	

**Suffixes**

<u>Suffix</u>	<u>Meaning</u>	<u>Example</u>	<u>Meaning of Example</u>
oma	New growth	Carcinoma	
algia	Pain	Neuralgia	
atresia	Without opening	Proctatresia	
blast	Germ	Myeloblast	
cele	Swelling	Hydrocele	
cide	Killer	Germicide	
cleisis	Closure	Enterocleisis	
clysis	Injection	Hypodermoclysis	
cyst	Sac of fluid	Dacrocyst	
cyte	Cell	Leukocyte	
dynia	Pain	Pleurodynia	
ectasis	Expansion	Atelectasis	
emesis	Vomiting	Haematemesis	

<u>Suffix</u>	<u>Meaning</u>	<u>Example</u>	<u>Meaning of example</u>
aemia	Blood	Anaemia	
itis	Inflammation	Iritis	
lith	Stone	Fecolith	
ogy	Study of	Biology	
malacia	Softening	Osteomalacia	
orexia	Appetite	Anorexia	
pathy	Disease	Adenopathy	
penia	Poor	Thrombopenia	
plasia	Formation	Aplasia	
pnoea	Breathing	Dyspnoea	
ptosis	A falling	Nephroptosis	
orrhagia	Bursting forth	Metrorrhagia	
rrhoea	Flow	Diarrhoea	
spasm	Contraction	Pylorospasm	
stasis	Position	Metastasis	
uria	In the urine	Haematuria	