

4+

BASIC ELEMENTS OF A MEDICAL WORD

Student Objectives

Upon completion of this chapter, you will be able to do the following:

1. Define and provide several examples of word roots, combining forms, suffixes, and prefixes.
2. Divide medical words into their component parts.
3. Describe how medical words are formed.
4. Explain the rules for building medical words.

To analyze medical words, the student needs to identify the four elements that may be used to form words as said in 1.

WORD ROOTS

The main part or stem of a word is called a **word root (WR)**. A WR is usually derived from the Greek or Latin language and frequently indicates a body part. Most medical words have one or two roots.

Examples of Word Roots

Greek Word	Word Root	Meaning
kardia (heart)	cardi	_____
gaster (stomach)	gastr	_____
hepat (liver)	hepat	_____
nephros(kidney)	nephr	_____
osteon(bone)	oste	_____

COMBINING FORMS

The **combining form (CF)** is a WR plus a vowel, usually an « o ». Like the WR, the CF usually indicates a body part. In this text, a CF will be listed as word root/vowel (e.g. cardi/o)

Examples of Combining Forms

Word Root	+	Combining Vowel	=	Combining Form	Meaning
cardi		o		cardi/o	heart
gastr		o		gastr/o	stomach
arthr		o		arthr/o	joint
derm		o		derm/o	skin
cyt		o		cyt/o	cell
cephal		o		cephal/o	head

cerebr o cerebr/o brain

Try to learn the CF rather than WR because the CF makes many words easier to pronounce

SUFFIXES

A suffix is a word ending. In the words tonsill/itis and tonsill/ectomy, The suffixes are –itis (inflammation) and –ectomy(excision, removal). Changing a suffix gives medical words a new meaning. In medical terminology a suffix usually indicates a procedure, condition, disease, or part of speech. Many suffixes are derived from Greek and Latin words.

Examples of Suffixes

Combining Form	+	Suffix	=	Medical Word	Meanin^g
arthr/o (joint)		-centesis (puncture)		arthrocentesis	puncture of a joint
thorac/o (chest)		-tomy (incision)		thoracotomy	incision of the chest
gastr/o (stomach)		.megaly (enlargement)		gastromegaly	enlargement of the stomach
erythr/o (red)		-cyte (cell)		erythrocyte	red blood cell
cyt/o (cell)		-logy (study)		cytology	study of a cell

PREFIXES

A **prefix** is a word element located at the beginning of a word. When a medical word contains a prefix, the meaning of the word is changed. The prefix usually indicates a number, time, position, direction, color, or negation .

Examples of Prefixes

Prefix	+	Word Root	+	Suffix	=	Medical Word	Meaning
hyper (excessive)		therm (heat)		-ia (condition)		hyperthermia	condition of excessive heat
intra (in, within)		muscul (muscle)		-ar (relating to)		intramuscular	within the muscles
macro (large)		gloss (tongue)		-ia (condition)		macroglossia	condition of a large tongue
micro		card		-ia		microcardia	« of a small heart

BASIC RULES FOR BUILDING AND DEFINING MEDICAL WORDS

There are two basic rules for building medical words.

Rule 1 A WR is used before a suffix that begins with a vowel

Word Root	+	Suffix	Medical Word	Meaning
scler/ (hardening)		osis (abnormal condition)	sclerosis	abnormal condition of hardening

Rule 2 a combining vowel is used to link a WR to a suffix that begins with a consonant and to link a

word root to another word root.

colon/o + scope = colonoscope instrument to view the colon
(colon) (instrument to view)

Words with more than one root are **Compound Words**

oste/ o/ chondr/ o/ + itis = osteochondritis inflammation of bone and cartilage
(bone) (cartilage) (inflammation)
oste/ o/ arthr/ + itis = osteoarthritis inflammation of bone and joint
(joint)

Defining Medical Words

There are three basic steps for defining medical words.

- . First, define the suffix, or last part of the word.
- . Second, define the prefix, or first part of the word
- . Last, define the middle of the word

gastr/o enter/ itis
stomach intestin inflammation
(2) (3) (1)

Read as follows:

1. Inflammation (of) (suffix)
2. Stomach (and) (first part of the word)
3. Intestine (middle)

PRONUNCIATION GUIDELINES

ae and **oe** only the second vowel is pronounced

bursae, pleurae,

c and **g** are given the soft sound **s** and **j** before **e**, **i** and **y**
cerebrum, circumcision, gingiva, gigantism

e and **es** when forming the final letter or letters of a word are often pronounced as separate syllables

syncope, systole

ch is sometimes pronounced **k**

cholesterol, cholemia, trachea

i at the end of a word (to form a plural) is pronounced «eye»

bronchi, fungi, nuclei

ps (at the beginning) is pronounced **s** as in psychology

SUFFIXES

A suffix is a word element placed at the end of a word or stem, which serves to form a new word. Similarly, by adding a suffix to a medical word a new word is formed. Medical terminology has a

multitude of suffixes which are derived either from Greek or Latin. The suffix **-algia** in the word arthralgia (pain in joint) is of Greek origin. The suffix **-itis** in bronchitis (inflammation of bronchi) is of Latin origin

There are two general rules for building new medical words by using suffixes.

1. Suffixes that begin with a vowel are added directly to the word root.

WR	+	SUFFIX	=	MEDICAL WORD
laryng	+	itis	=	laryngitis

my	+	algia	=	myalgia
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2. When the suffix begins with a consonant, usually a connecting vowel **o** is placed between the word root and the suffix. Thus a combining form of a medical word is obtained.

WR	+	O	+	SUFFIX	=	MEDICAL WORD
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nephr	+	o	+	tomy	=	nephrotomy
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nephr	+	o	+	pexy	=	nephropexy
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SURGICAL PROCEDURE SUFFIXES

a) Incision

-ectomy(surgical removal, excision)

appendectomy, hemorrhoidectomy

-centesis(surgical puncture)

amniocentesis – surgical perforation of the uterus, pericardiocentesis

-stomy (forming an opening)

bronchostomy

-tome (instrument to cut)

osteotome

-tomy to cut into

gastrotomy

b) plastic operations

-desis (bindig, stabilization)

arthrodesis- surgical fixation of a joint

-rrhaphy (suture)

splenorrhaphy – surgical repair of the spleen

-pexy (fixation ,suspension)

splenopexy – surgical fixation of a mobile spleen

- **plasty** (plastic repair, formation)

rhinoplasty – a plastic surgical operation on the nose

c) Refracturing, loosening, crushing

-clasis (to break down, refracture)

osteoclasia

-lysis (loosen, free from adhesions, distruction)

enterolysis – the operative division af adhesions between loops of intestine or between the intestine and abdominal wall, litholysis distruction of stones (dissolution)

-tripsy ((to crush)

neurotripsy – surgical crushing of a nerve, lithotripsy

DIAGNOSTIC AND SYMPTOMATIC SUFFIXES

-algia (pain)
 myalgia, dorsalgia, gastralgia
-cele (hernia , swelling)
 nephrocele, cystocele, rectocele
-dynia (pain)
 splenodynia , otodynia
-ectasis (dilatation, expansion)
 bronchiectasis
-emia (blood condition)
 leukemia
-gen (beginning, origin)
 pathogen- any disease –producing microorganism
-gram (a writing, record)
 cardiogram
-graph (to write , record)(
 cardiograph – an instrument
-iasis (condition, formation of, presence of)
 nephrolithiasis – a condition marked by the presence of renal calculi(stones)
-sis (state of , condition)
 Prognosis (foreknowledge)
-itis (inflammation)
 nephritis
-logy (study of)
-malacia(softening)
 osteomalacia
-megaly (enlargement)
 acromegaly – enlargement of the extremities
--oid (resemble) sličiti
 rheumatoid – resembling rheumatism
-osis (abnormal condition)
 neurosis – mental disorder
-pathy (disease)
 adenopathy – enlargement of the glands
-penia (decrease, deficiency)
 erythropenia – deficiency in the number of erythrocytes
-phagia (eating)
 polyphagia – excessive eating
-plegia (paralysis, stroke)
 paraplegia – paralysis of the legs, para means to,at or from the side of
-phobia (morbid fear)
 claustrophobia
-rrhea (discharge, flow)
 diarrhea
-sclerosis (hardening)
 arteriosclerosis
-scope (instrument to visually examine)
 gastroscope
-scopy (examination, view)
 gastroscopy – inspection of the interior of the stomach

SUFFIXES: ADJECTIVE ENDINGS

The adjective endings that mean **pertaining to** (koji se odnosi na) are:

-ac-cardiac
-al-carpal
-ary- hereditary
-ical- physiological

- ous-serous
- tic-mycotic
- ic – splenic

SUFFIXES : NOUN ENDINGS

- coccus** – bacteria
streptococcus (berry shaped bacteria)
- cyte** (cell)
leukocyte
- ole** (little, small)
arteriole
- trophy** (development)
hypertrophy – increase in size not in number
- ule** (little, small)
venule – little vein
- ia** (abnormal condition, an unhealthy state)
pneumonia – inflammation of the lungs

PREFIXES

A prefix is a word element located at the beginning of a word. Substituting one prefix for another alters the meaning of a medical word. Many medical words contain a prefix.

Consider the terms **eu/pnea** and **dys/pnea**. **Eupnea** means breathing that is normal; **dyspnea** Means breathing that is painful or difficult.

The prefix **eu-** means good, normal; the prefix **dys-** means bad , painful, difficult

Prefix		Word Root		Suffix		Medical Word	Meaning
pre (before)	+	nat (birth)	+	al (pertaining to)	=	prenatal	pertaining to (the period) before birth
peri (around)	+	nat (birth)	+	al (pertaining to)	=	perinatal	pertaining to (the period) around birth
post	+	nat	+	al	=		

Prefixes of position

Prefix	Meaning	Example	Pronunciation
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ante-		ante/cubit/al elbow
pre -	before, in front	pre/operative
pro-		pro/ot/ic ear

epi-	above, upon	epi/derm/is skin
hypo -		hypo/derm/ic
infra -	under, below	infra/pub/ic pubis relating to
sub-		sub/nas/al nose pertaining to
inter-	between	inter/cost/al ribs
medi-		medi/al
meso-	middle	pertaining to meso/derm
post-	after, behind	post/nat/al
retro-	backward, behind	retro/peritone/al peritoneum

Prefixes of Number

Prefix	Meaning	Example	Pronunciation
bi-	two	bi/later/al side relating to	
di-		di/plegia paralysis	
dipl-	double, twofold	dipl/opia vision	
diplo-		diplo/cocci spherical bacteria	diplo'koksai
hemi-	half	hemi/plegia (one side) paralysis	
semi-		semi/circul/ar circle	
hyper-	excessice , above normal	hyper/glyc/emia	
macro-	large	macro/cephaly head	
micro-	small	microscope	
mono-	one	mono/nucle/ar	
uni-		uni/para to bear (offspring)	
multi-	many, much	multi/para	
poly-		poly/phobia fear(s)	
primi-	first	primi/gravida pregnancy	

quadri-	four	quadri/plegia
tri-	three	tri/ceps heads

Prefixes of Negation

a-	without, not	a/mast/ia breast condition
an-		an/esthes/ia sensation condition
im-	no, not	im/potency
in-		in/sane sound

Prefixes of Direction

ab-	from , away from	ab/norm/al
ad-	toward	ad/stern/al

Prefixes of Direction (Continued)

Prefix	Meaning	Example	Pronunciation
circum-	around	circum/or/al	
peri-		mouth peri/oste/itis bone	
ec-	out, out from	ec/top/ia	
ex-		place condition ex/cise to cut	
dia-	through, across	dia/rrhea	
trans-		flow trans/fusion a pouring	
ecto-		ecto/derm	
exo-	outside, outward	exo/trop/ia	
extra-		turning condition extra/ocul/ar	
endo-	in, within	endo/cardi/um	
intra-		intra/muscul/ar	
super-		super/sensitive	
supra-	above, excessive	sensation supra/ren/al	

Other Prefixes

anti-	against	ant/bacteri/al
contra-		contra/ception conceiving
brady-	slow	brady/card/ia
dys-	bad, painful,difficult	dys/peps/ia digestion
tachy-	rapid	tachi/pnea
hetero-	different	heterosexual
homo-	same	homo/sexual

mal-	bad	mal/nutrition food substances
pan-	all	pano/phob/ia
pseudo-	false	pseudo/plegia
syn-	union	syn/arthr/osis joint abnormal condition
eu-	good, normal	eu/pnea

PLURAL SUFFIXES

Singular	Plural	Rule	Singular	Plural
a	ae	Retain the a and add e	pleura	pleurae
ax	aces	Drop the x and add ces	thorax	thoraces
en	ina	Drop the en and add ina	lumen	lumina
is	es	Drop the is and add es	diagnosis	diagnoses
ix ex	ices	Drop ix and ex and add ices	appendix apex	appendices apices
on	a	Drop the on and add a	ganglion	ganglia
um	a	Drop the um and add a	bacterium	bacteria
us	i	Drop the us and add i	bronchus	bronchi
y ma	ies mata	« y « ies Retain the ma and add mata	deformity carcinoma	deformities carcinomata

EXERCISES

1. Complete the following

- Word beginnings are called _____.
- Word endings are called _____.
- The foundation of a word is called _____.
- A vowel linking a suffix and a root or two roots is called the _____.
- The combination of a root and a combining vowel is known as the _____.

2. Give the meaning to the entire medical term.

- adenoma

3. Identify the prefixes in the following terms and give the meaning of the entire term

- pericarditis
- retrogastric
- hypodermic
- triceps
- diarrhea
- circum renal
- bradycardia
- tachypnea

4. Give the meaning of the following combining forms

- aden/o _____
- leuk/o _____
- cephal/o _____
- arthr/o _____
- cerebr/o _____
- cyt/o _____
- oste/o _____
- dermat/o _____
- bi/o _____
- nephro/o _____

5. Give the prefixes for the following English terms

- surrounding _____
- across _____

3. complete, through _____ 4. above _____
 5. before _____ 6. inside, within _____
 7. excessive _____ 7. behind _____
 9. below, under _____ 10. no, not, without _____
- 6. Build medical terms**
1. blood mass (tumor) _____ 2. inflammation of a gland _____
 3. pertaining to across the stomach _____ 4. head pain _____

1.

THE BODY AS A WHOLE

Cells

The cell is the fundamental unit of all living things (animal or plant). A cell is alive – as alive as you are. It breathes, takes in food, and gets rid of wastes. It also grows and reproduces. And in time it dies

Similarity in cells

All cells are similar in that they contain a gelatinous substance composed of water, protein, sugar, acids, fats, and various minerals. This substance is called **protoplasm**. Several parts of every cell are :

1. **Cell membrane.** This structure surrounds and protects the internal environment of the cell, determining what passes in and out of the cell.
2. **Nucleus.** The nucleus is the controlling structure of the cell. It controls the way a cell reproduces and contains genetic material. All the material within the nucleus is called **nucleoplasm**.
3. **Chromosomes.** These are 23 pairs of thin strands (vlakna) of genetic material (DNA) located within the nucleus. Chromosomes contain regions known as **genes** which determine our hereditary make up.
4. **Cytoplasm.** Cytoplasm is all the protoplasmic material outside the nucleus. It contains
 - a) **mitochondria**- small bodies which carry on the production of energy in the cell by burning food in the presence of oxygen. This process is called **catabolism**. During catabolism complex food materials are broken down into simpler substances and energy is released.
 - b) **Endoplasmic reticulum** – a series of canals within the cell. Some canals contain small bodies called **ribosomes** which help make substances (proteins) for the cell. This building up process is called **anabolism**.

Difference in cells

Cells are different, or specialized, throughout the body to carry out their individual functions. They are also different in shape. **Cytology** is a study of the cell.

TISSUES

A tissue is a group of similar cells working together to do a specific job. A **histologist** is one who specializes in the study of tissues. Some type of tissues are: **epithelial tissue, muscle tissue, connective tissue, and nerve tissue.**

ORGANS

These are structures composed of several kinds of tissue. For example stomach is composed of muscle

tissue, nerve tissue, and glandular epithelial tissue. The medical term for internal organs is **viscera** (singular – viscus).

SYSTEMS These are groups of organs working together to perform complex functions.

BODY CAVITIES

A body cavity is a space within the body which contains internal organs.

Cranial . Thoracic. Abdominal. Pelvic. Spinal. The cranial and spinal cavities are considered **dorsal** body cavities. The thoracic, abdominal, and pelvic cavities are considered **ventral**

body cavities. Within the thoracic cavity there is another smaller cavity called **the mediastinum**

The thoracic and abdominal cavities are separated by a muscular partition called the **diaphragm**

Anatomical division of the abdomen

1. **Hypochondriac** regions (upper lateral regions beneath the ribs)

2. **Epigastric** region (region of the stomach)

3. **Lumbar** regions (two middle lateral regions)

4. **Umbilical** region(region of the navel or umbilicus)

5. **Inguinal** regions (lower lateral regions)

6. **Hypogastric** region (lower middle region, below the umbilicus)

Anatomical division of the back

1. **Cervical** - Neck region . There are 7 cervical vertebrae (C1-C7)

2. **Thoracic** - Chest region. There are 12 thoracic vertebrae(T 1 – T12)

3. **Lumbar** - Loin or flank region L1-L5

4. **Sacral** - Five bones S1-S5

5. **Coccygeal** – The coccyx (tailbone) is a small bone composed of 4 fused (srašten) pieces.

You must know the difference between **the spinal column and the spinal cord.**

Positional and directional terms

Afferent - conducting toward a structure

Efferent - conducting away from a structure

Anterior - front of the body

Posterior - back of the body

Central - pertaining to the center

Deep - away from the surface

Superficial – near the surface

Distal - away from the beginning of a structure

Proximal - pertaining to the beginning of a structure

Inferior (caudal) – away from the head

Superior (cephalic) – pertaining to the head, above another structure

Lateral - pertaining to the side

Medial - pertaining to the middle or nearer the median plane

Supine - lying on the back

Prone - lying on the belly (abdomen)

A **plane** is an imaginary flat surface. There are three planes of the body: **frontal , sagittal , and transverse** planes.

INTEGUMENTARY SYSTEM - SKIN

I Introduction

The skin and its accessory organs (hair, nails, and glands) are known as the **Integumentary system** of the body. Integument means covering, and the skin is the outer covering for the body. It is ,however, more than a simple body covering. This complex system of specialized tissues contains glands that secrete several types of fluids, nerves that carry impulses, and blood vessels that aid in the regulation of the body temperature. The following paragraphs review the many important functions of the skin.

First, as a protective membrane over the entire body, the skin guards the deeper tissues of the body against excessive loss of water, salts, and heat and against invasion of pathogens and their toxins. Secretions from the skin are slightly acidic in nature, and this contributes to the skin's ability to prevent bacterial invasion.

Second, the skin contains two types of glands that produce important secretions. These glands under the skin are the **sebaceous** and the **sweat** glands. The sebaceous glands produce an oily secretion called **sebum**, and the sweat glands produce a watery secretion called **sweat**. **Sebum** and sweat are carried to the outer edges of the skin by ducts and excreted from the skin through openings or pores. Sebum helps to lubricate the surface of the skin, and sweat helps to cool the body as it evaporates from the skin surface.

Third, nerve fibers located under the skin are receptors for sensations such as pain, temperature, pressure, and touch. Thus, the adjustment of an individual to his or her environment is dependent on the sensory messages relayed to the brain and spinal cord by the sensitive nerve endings in the skin

Fourth, several different tissues in the skin aid in maintaining the body temperature (thermoregulation). Nerve fibers coordinate thermoregulation by carrying messages to the skin from heat centers in the brain that are sensitive to increases and decreases in body temperature. Impulses from these fibers cause blood vessels to dilate (širiti se) to bring blood to the surface and cause sweat glands to produce the watery secretion that carries heat away.

STRUCTURE OF THE SKIN

Epidermis – a thin cellular membrane layer.

Dermis - dense, connective tissue layer

Subcutaneous tissue- thick, fat-containing tissue

Epidermis

The epidermis is the outermost, totally cellular layer of the skin. It is composed of **squamous epithelium**. Epithelium is the covering of both the internal and the external surfaces of the body. Squamous epithelial cells are flat and scale-like (luskav). In the outer layer of the skin, these cells are arranged in several layers (**strata**) and are called **stratified squamous epithelium**.

The epidermis lacks blood vessels, lymphatic vessels, and connective tissue, and is therefore dependent on the deeper dermis (also called **corium**) layer and its rich network of capillaries for nourishment. In fact, oxygen and nutrients seep out of the capillaries in the dermis, pass through tissue fluid, and supply nourishment to the deeper layers of the epidermis.

The deepest layer of the epidermis is called the **basal layer**. The cells in the basal layer are constantly growing and multiplying and give rise to all the other cells in the epidermis. As the basal layer cells divide, they are pushed upward and away from the blood supply of the dermal layer by a steady stream of younger cells. In their movement toward the most superficial layer of the epidermis, called the **stratum corneum** (rožnati sloj) the cells flatten, shrink, lose their nuclei, and die, becoming filled with a hard protein material called **keratin**. The cells are then called **horny cells**. Finally, within 3-4 weeks after beginning as a basal cell in the deepest part of the epidermis, the keratinized cell is sloughed off (ljušti se) from the surface of the skin. The epidermis is thus constantly renewing itself, cells dying at the same rate at which they are replaced.

The basal layer of the epidermis contains special cells called **melanocytes**. Melanocytes form and contain a black pigment called **melanin** that is transferred to other epidermal cells and gives colour to the skin. The number of melanocytes in all races is the same but the amount of melanin within each cell accounts for the colour differences among the races. The presence of melanin in the epidermis is vital for protection against the harmful effects of ultraviolet radiation, which can manifest itself as skin cancer. Individuals who are incapable to form melanin at all are called **albino** (white).

Melanin production increases with exposure to strong ultraviolet light, and this creates a suntan, which is a protective response. When the melanin cannot absorb all the ultraviolet rays, the skin becomes sunburned and inflamed. Over a period of years, excessive exposure to sun can tend to cause wrinkles and even cancer of the skin.

Dermis (Corium)

The dermis layer is composed of blood and lymph vessels and nerve fibers, as well as the accessory

organs of the skin, which are the hair follicles, sweat glands, and sebaceous glands. To support the elaborate system of nerves, vessels, and glands, the dermis contains connective tissue cells and fibers that account for the extensibility of the skin.

The dermis is composed of interwoven elastic and **collagen** fibers. Collagen is a fibrous protein material found in bone, cartilage, tendons, and ligaments, as well as in the skin.

Subcutaneous Layer

The subcutaneous layer of the skin is another connective tissue layer; it specializes in the formation of fat. **Lipocytes** (fat cells) are predominant in the subcutaneous layer, and they manufacture and store large quantities of fat. Functionally, this layer of the skin is important in protection of the deeper tissues of the body and as a heat insulator.

ACCESSORY ORGANS OF THE SKIN

1. Hair

Hair is distributed all over the body, except for the bottom of the feet (soles) and the palms of the hands. The roots of the hair lie in follicles, or pockets of epidermal cells situated in the corium. At the bottom of the follicle is a loop of capillaries enclosed in a covering called the **papilla**. The cluster of epithelial cells lying over the papilla reproduces and is responsible for the eventual formation of the hair shaft – a visible part of the hair. As long as these cells remain alive, hair will regenerate even though it is cut or plucked or otherwise removed. Hair is kept soft and flexible by sebaceous glands which secrete varying amounts of oily sebum into the upper part of the hair follicle located near the surface of the skin. The growth of hair is similar to the growth of the epidermal layer of the skin: deep lying cells in the hair root produce horny cells which move upward through the hair follicles which hold the hair fibers.

2. Nails

Nails are hard keratin plates covering the dorsal surface of the most distal phalanges of each finger and toe. They are composed of horny cells that are cemented together tightly and can extend indefinitely unless cut or broken. The nails grow in much the same way as the hair. The nail bed, like the hair root, is situated in the corium. The pink colour of the nails is due to their translucent (providan) quality which allows the underlying vascular tissue to show through.

The semilunar (half moon) white region of the base of the nails is called **lunula**. It has a whitish appearance because the vascular tissue underneath does not show through. The narrow band of epidermis that extends from nail wall onto the surface is called the **cuticle** or eponichium (onych means nail).

The average growth rate for fingernails is around 1mm per week and it is somewhat slower for the toe nails. The major function of the nails is to protect the tips of the fingers and toes from bruises or other kinds of injuries.

3. Glands

a) Sebaceous Glands

The sebaceous glands produce an oily secretion called the **sebum** and are located in the corium layer of

the skin. These glands are filled with cells, the centers of which are saturated with fatty droplets. As these cells disintegrate they yield (ispuštati) the sebum. They are closely associated with hair follicles and their ducts open into the hair follicle through which the sebum is released. The acidic nature of sebum helps destroy harmful organisms on the surface of the skin and, thus, prevents infection. Sebaceous glands are present over the entire body except the soles of the feet and palms of the hands.

b) Sweat Glands

Sweat glands are also called sudoriferous glands (sudor – sweat). They are located deep in the corium and are found on almost all body surfaces. They collect fluid containing water, salt and waste products from the blood and carry it away in canals that end in pores on the skin surfaces, where it is deposited as sweat.

Sweat or perspiration helps regulate body temperature because cooling of the skin occurs when sweat evaporates. The odor produced when sweat accumulates on the skin is due to action of bacteria on the sweat.

DISORDERS OF THE SKIN

1. Cutaneous lesions

A lesion is a pathological or traumatic alteration of tissue. The following terms describe common skin lesions.

macule - non palpable, discolored(especially reddened) flat spots or patches(examples : measles, rash, flat moles, freckles)

papule – small , solid, circumscribed raised areas of skin (warts, pimples)

wheal - vascular eruption of the skin often characterized by smooth , slightly elevated, edematous area that is redder or paler than the surrounding skin usually accompanied by itching(examples: allergic reactions to insect bites, hives)

vesicle – circumscribed collections containing serous fluid (blisters) Examples : burns, dermatitis, scabies, smallpox.

bullae(singular- bulla) are large blisters.

pustule - circumscribed collection of pus (gnoj)

polyp – a mushroom- like growth extending on a stalk from the surface of mucous membrane

ulcer – an open sore or erosion of the skin or mucous membrane

cyst – a closed pouch or sac containing fluid or semisolid material.

fissure – a groove (brazda, žlijeb) or cracklike sore resembling ulcers

SYMPTOMS AND PATHOLOGICAL SKIN CONDITIONS

acne- a chronic inflammatory disease of the sebaceous glands and hair follicles of the skin

acne vulgaris (ordinary) – is the common variety of acne. It is characterized by the formation of

blackheads(comedones, sing. comedo)

albinism – absence of pigment in the skin, hair and eyes.

athlete's foot – a fungus infection of the skin, also called **tinea pedis**

basal cell carcinoma – malignant tumor of the basal layer of the epidermis. It is a slow-growing tumor and usually occurs on the upper half of the face, near the nose , and is nonmetastasizing.

burns – thermal injuries to the outer surface of the body. They are usually classified into three types: first,second and third degree burns.

cellulitis - . A spreading infection, especially of the subcutaneous tissue

chloasma – **also called melasma** -pigmentary skin discoloration, usually those occurring in yellowish-brown patches or spots , usually during pregnancy

cicatrix – scar left by a healed wound.

decubitus ulcer (bed-sore)- ulcers occur over bony areas that have been subjected to pressure against a hard external object such as a bed.

dermatitis – an inflammation of the skin

ecchymosis – a bruise or purple spot on the skin caused by escape of blood

eczema – a chronic moist dermatitis. It is a common allergic reaction in children.

exanthematous viral disease – eruption (exanthem) of the skin due to a viral infection(measles, German measles and chickenpox

gangrene – death of tissue associated with loss of blood supply.

hemangioma – an area in which the blood vessels form an abnormally excessive network in the skin.

impetigo – bacterial inflammatory skin disease marked by isolated vesicles, pustules, and crusted over lesions

keratosis – thickened areas of the epidermis

leukoplakia – white, thickened patches on mucous membrane tissue of the tongue or cheek

melanoderma – abnormal brown or black pigmentation of the skin

melanoma – cancerous tumor composed of melanocytes

nevus; nevi – congenital proliferation of blood vessels or pigmented cells on the skin surface(moles and hemangiomas)

onychia – inflammation of the nail bed
pemphigus – blistering eruptions affecting the skin and mucous membrane
petechiae – small, purplish, hemorrhagic spots on the skin; smaller versions of echymosis
pruritus – itching
scabies – a contagious parasitic infection of the skin with intense pruritus
psoriasis – a discrete pink or dull red lesion surmounted by characteristic silvery scaling
scleroderma – a chronic disease of the skin caused by infiltration of fibrous or scar tissue into the skin
squamous cell carcinoma – malignant tumor of epithelial cells of the epidermis
tinea – any fungal skin disease
urticaria – hives
vitiligo – loss of pigment in the areas of the skin (milk – white patches)
verruca – epidermal growth caused by a virus (wart)

COMBINING FORMS AND SUFFIXES

adip/o - fat - adipose - fatty
 caus/o - burn, burning - causalgia - intensely unpleasant burning sensation
 cauter/o - heat, burn - electrocautery - an apparatus for surgical dissection using heat
 cutane/o - skin - subcutaneous -
 derm/o - skin - epidermis -
 dermat/o - skin - dermatitis -
 diaphor/o - profuse sweating - diaphoresis - profuse sweating
 erythem/o - redness - erythema - redness of the skin
 hidr/o - sweat - anhidrosis - absence or severe deficiency of sweating
 ichthy/o - scaly, dry - ichthyosis – a hereditary condition in which the skin is dry
 kerat/o - hard, horny tissue - keratosis - any horny growth
 seb/o - sebum - seborrhea - excessive secretion from sebaceous glands
 squam/o - scale-like - squamous epithelium - platelike epithelium
 steat/o - fat - steatoma - a cystic collection of sebum in a s. gland - sebaceous cyst
 trich/o - hair - trichomycosis - any disease of the hair due to infestation by a fungus
 ungu/o - nail subungual -
 xanth/o - yellow - xanthoma - nodules develop under the skin owing to excess lipid deposits
 xer/o - dry - xeroderma - this is a mild form of ichthyosis
 -derma - skin - pyoderma - a purulent skin disease – containing pus

MUSCULOSKELETAL SYSTEM

1. Introduction

The musculoskeletal system includes the bones, muscles, and joints. Each has several important functions in the body. **Bones** ,by providing the framework around which the body is constructed, protect and support our internal organs. Also, by serving as points of attachment for muscles, bones assist in body movements.

The inner core of the bones is composed of hematopoietic tissue (red bone marrow manufactures blood cells), while other parts are storage areas for minerals necessary for growth, such as calcium and phosphorus.

Joints are the places where bones come together. Several different types of joints are found within the body.

Muscles , whether attached to bones or to internal organs and blood vessels, are responsible for movement.

2. Bones

Formation

Bones are complete organs, chiefly composed of connective tissue called **osseous** (bony) tissue plus a rich supply of blood vessels and nerves. Osseous tissue is a dense connective tissue that consists of **osteocytes** (bone cells) surrounded by a hard, intercellular substance filled with calcium salts.

During fetal development, the bones of the fetus are composed of cartilage tissue, which resembles osseous tissue but is more flexible and less dense because of a lack of calcium salts in its intercellular spaces. As the embryo develops, the process of depositing calcium salts in the soft, cartilagenous bones occurs, and continues throughout the life.

The gradual replacement of cartilage and its intercellular substance by immature bone cells and calcium deposits is called **ossification** (bone formation)

Osteoblasts are the immature osteocytes that produce the bony tissue that replaces cartilage during ossification. **Osteoclasts** (-clast means to break) are large cells that function to reabsorb, or digest, bony tissue. Osteoclast (also called bone **phagocytes**) digest dead bone tissue from the inner sides of bones and thus enlarge the inner bone cavity so that the bone does not become overly thick and heavy. When a bone breaks, osteoblasts lay down the mineral bone matter (calcium salts) and

osteoclasts remove excess bone debris (smooth out the bone). The formation of bone is dependent to a great extent on a proper supply of calcium and phosphorus to the bone tissue. These minerals must be taken into the body along with a sufficient amount of vitamin D. Vitamin D helps the passage of calcium through the lining of the small intestine and into the bloodstream. Once calcium and phosphorus are in the bones, osteoblastic activity produces an enzyme that causes the formation of a calcium-phosphate compound giving bone its characteristic hard quality.

Not only are calcium and phosphorus part of the hard structure of bone tissue, but calcium is also stored in bones and small quantities are present in the blood. If the proper amount of calcium is lacking in the blood, nerve fibers are unable to transmit impulses effectively to muscles; heart muscle becomes weak and muscles attached to bones undergo spasms. The necessary level of calcium in the blood is maintained by the parathyroid gland, which secretes a hormone to release calcium from bone storage. Excess of the hormone (caused by tumor or other pathological processes) will raise blood calcium at the expense of the bones, which become weakened by the loss of calcium

Structure

Bones all over the body are of several different types. **Long bones** are found in the thigh, lower leg, and upper and lower arm. These bones are very strong, are broad at the ends where they join with other bones, and have large surface areas for muscle attachment.

Short bones are found in the wrist and ankle and have small, irregular shapes. **Flat bones** are found covering soft body parts. These are the shoulder bone, ribs, and pelvic bones. **Sesamoid bones** are small, rounded bones resembling a grain of sesame in shape. They are found near joints; the knee cap is the largest example of this type of bone.

The shaft, or middle region, of a long bone is called **diaphysis**. Each end of a long bone is called an **epiphysis**. The epiphyseal line or plate represents an area of cartilage tissue which is constantly being replaced by new bony tissue as the bone grows. Cartilage cells at the edges of the epiphyseal plate form new bone and this is responsible for the lengthening of bones during childhood and adolescence. The plate calcifies and disappears when the bone has achieved its full growth.

The periosteum is a strong, fibrous, vascular, membrane that covers the surface of a long bone, except at the ends of the epiphysis. Bones other than long bones are completely covered by the periosteum. Beneath the periosteum is the layer of osteoblasts which deposit calcium-phosphorus compounds in the bony tissue. The ends of long bones are covered by a thin layer of cartilage called **articular cartilage**.

Compact (cortical) bone is a layer of hard, dense tissue that lies under the periosteum in all bones and chiefly around the diaphysis of long bones. Within the compact bone is a system of small canals containing blood vessels that bring oxygen and nutrients to the bone and remove waste products such as carbon dioxide. These channels are called **Haversian canals**. Compact bone is tunneled out in the shaft of the long bones by a central **medullary cavity** which contains **yellow bone marrow**. Yellow bone marrow is chiefly composed of fat cells.

Cancellous bone, sometimes called **spongy bone**, is much more porous and less dense than compact bone. The mineral matter in it is laid down in a series of separated bony fibers called a spongy latticework or **trabeculae**. It is found largely in the epiphyses of long bones and in the middle portion of most other bones. Spaces in cancellous bone contain **red bone marrow**. This marrow, as opposed to yellow marrow which is fatty tissue, is richly supplied with blood and consists of immature and mature blood cells in various stages of development.

In an adult, the ribs, pelvic bone, sternum (breastbone) and vertebrae, as well as the epiphyses of long bones, contain red bone marrow within cancellous tissue. The red marrow in the long bones is plentiful in young children, but decreases through the years and is replaced by yellow marrow.

Processes and depressions in bones

Bone processes are enlarged tissues which normally extend out from bones to serve as attachments for muscles and tendons

1. **bone head** – rounded end of a bone separated from the body of the bone by a neck
2. **tubercle** (kvržica, tuberkulum) – small, rounded process for attachment of tendons and muscles
3. **trochanter**(kvrga) – large process on the femur for attachment of muscle
4. **tuberosity** (hrapavost) – large, rounded process for attachment of muscles or tendons
5. **condyle** (čvor, kondil)- rounded, knuckle-like process at the joint

Bone depressions are the openings or hollow regions in a bone which help to join one bone to another and serve as passageways for blood vessels and nerves

1. **fossa** (jama) – depression or cavity in or on a bone
2. **foramen** (otvor) – opening for blood vessels and nerves
3. **fissure** (pukotina, fisura) – a narrow, deep slitlike opening
4. **sulcus** (brazda, žlijeb) – a groove or furrow
5. **sinus** (zaton, sinus) – cavity within a bone

Cranial bones

1. **frontal bone** (čeona kost) – forms the forehead and bony sockets that contain the eyes
2. **parietal bone** (tjemena kost) – there are two parietal bones which form the roof and upper part of the sides of the cranium
3. **temporal bone** (sljepoočna kost) – two temporal bones form the lower sides and base of the cranium. Each bone encloses an ear and contains a fossa for joining with the mandible.
4. **occipital bone** (zatiljna kost) – forms the back and base of the skull and joins the parietal and temporal bones, forming a suture. The inferior portion of the occipital bones has an opening called **foramen magnum** through which the spinal cord passes.
5. **sphenoid bone** (klinasta kost) – this bat-shaped bone extends behind the eyes and forms part of the base of the skull.
6. **ethmoid bone** (rešetnica, etmoidna kost)- this thin, delicate bone is composed primarily of spongy, cancellous bone.)It supports the nasal cavity and forms part of the orbits of the eyes

Facial bones

All of the facial bones ,except one, are joined by sutures so they are immovable. The mandible(lower jaw bone) is the only movable facial bone

The facial bones are:

1. **nasal bones**

2. **lacrimal bones** (lacrim/o = tear)
3. **maxillary bones**(upper jaw bones)
4. **mandibular bone (mandible)**
5. **zygomatic bones** (sponične kosti)- form the the high portion of the cheek
6. **vomer** (raonik , vomer)- forms the lower portion of the nasal septum

Sinuses, or air cavities, are located in specific places within the cranial and facial bones to lighten the skull and warm and moisten air.

Vertebral column and structure of vertebrae

The vertebral or spinal column is composed of 26 bone segments, called vertebrae, which are arranged in five divisions from the base of the skull to the tailbone(coccyx)

The first seven bones, forming the neck bone are the cervical (C1-C7) vertebrae.

The second set of 12 vertebrae are known as thoracic (T1-T12 or D1-D12) or dorsal vertebrae.

These vertebrae articulate with the 12 pairs of ribs

The third set of five vertebral bones are the lumbar(L1-L5) vertebrae. They are the strongest and the largest of the backbones. The **sacrum** is a slightly curved , triangularly shaped bone. At birth it is composed of five separate segments; these gradually become fused in the young child.

The **coccyx is the tailbone**. It is a fused bone formed from four small coccygeal bones

A vertebra is composed of an inner, thick, disk-shaped portion called **vertebral body** . Between the vertebrae are **cartilagenous disks** which help to provide flexibility and cushion most of the shocks to the vertebral column.

The **vertebral arch** is the posterior part of the vertebra, and consists of a **spinous process, transverse processes and laminae**.

Bones of the thorax, pelvis and extremities

Bones of the thorax

1. **clavicle** – collar bone ; a slender bone connecting the breastbone to each shoulder bone
2. **scapula**- shoulder bone; two flat triangular bones, one on each dorsal side of the thorax
3. **sternum**- breastbone ; a flat bone extending down midline of the chest
4. **ribs**- there are 12 pairs of ribs. Ribs 1-7 are called **true ribs**. They join with the sternum anteriorly and with the vertebral column in the back. Ribs 8-10 are called **false ribs**. In the back they join with the vertebral column but join the seventh rib anteriorly. Ribs 11-12 are the **floating ribs** because they are completely free at their anterior extremity.

Bones of the arm and hand

5. **humerus**- upper arm bone
6. **ulna** –medial lower arm bone
7. **radius**- lateral lower arm bone
8. **carpals**- wrist bones
9. **metacarpals**- these are five radiating bones to the fingers
10. **phalanges**- (sing. phalanx) – finger bones, each finger (except the thumb) has three phalanges a **proximal, middle and distal phalanx**.

Bones of the pelvis

11 pelvic girdle- hip bone is composed of three pairs of fused bones : the **ilium, ischium and pubis**

Bones of the leg and foot

12. **femur**- thigh bone 13. **patella**- kneecap 14. **tibia** – larger of two lower bones of the leg
15. **fibula** – smaller of two lower leg bones 16. **tarsals**- ankle bones 17. **metatarsals** – lead to the phalanges of the toes 18. **Phalanges of the toes**.

Joints

A joint (articulation) is a coming together of two or more bones. Some joints are immovable, such as the **suture joints** between the skull bones. Other joints, such as those between the vertebrae, are partially movable. Most joints, however, allow considerable movement. These freely movable joints are called **synovial joints**. Examples of synovial joints are **the ball and socket type**(hip joint; the head of the femur fits into the acetabular fossa of the ilium) and **hinge type** (elbow, knee, and ankle joints) The bones in a synovial joint are separated by a joint capsule composed of fibrous cartilage tissue. Ligaments(fibrous bands, or sheets, of connective tissue) often anchor the bones together around the joint capsule to strengthen it. The surface of the bones at the joint is covered with a smooth cartilage surface called the **articular cartilage**. **The synovial membrane** lies under the joint capsule and lines the **synovial cavity** between the bones. **The synovial fluid** contains water and nutrients which nourish as well as lubricate the joints so that friction on the articular cartilage is minimal.

Bursae

Bursae are closed sacs of synovial fluid lined with a synovial membrane. They are formed in the spaces between **tendons**(connective binding bones to muscles), and bones. Bursae lubricate these areas where friction would normally develop close to the joint capsule. Some common bursae locations are at the elbow joint (**olecranon bursa**) , knee joint (**patellar bursa**) , and shoulder joint (**subacromial bursa**).

Muscles

Types of muscles

There are three types of muscles in the body, **Striated muscles** , also called **voluntary** or **skeletal** muscles, are the muscle fibers that move all bones, as well as the face and eyes. We have conscious control over the activity of this type of muscle. Striated muscle fibers(cells) have a pattern of dark and light bands, or fibrils, in their cytoplasm. A delicate membrane called **sarcolemma** surrounds each skeletal muscle fiber. Fibrous tissue that envelops muscles is called **fascia**. **Smooth muscles** , also called **involuntary** or **visceral** muscles, are those muscle fibers which move our internal organs such as digestive tract, blood vessels, and secretory ducts leading from glands.. We have no conscious control over these muscles. They are called „ smooth“ because they have no dark or light fibrils in their cytoplasm. While skeletal muscle fibers are arranged in bundles, smooth muscle forms sheets of fibers as it wraps around tubes and vessels. **Cardiac muscle** is striated in appearance but like smooth muscle in its action. Its movement cannot be consciously controlled.

Actions of skeletal muscles

Skeletal (striated) muscles are the muscles that move the bones of our body. When a muscle contracts, one of the bones to which it is joined remains virtually stationary as a result of other muscles that hold it in place. The point of attachment of the muscle to the stationary bone is called the **origin** (beginning) of that muscle. The point of junction of the muscle to the bone that moves is called the **insertion** of the muscle. Near the point of insertion, a muscle narrows and is connected to the bone by way of a tendon.

Muscles can perform a variety of actions. Some of the terms used to describe those actions are:

Flexion – Decreasing the angle between two bones; bending a limb.

Extension – Increasing the angle between two bones; straightening out a limb.

Abduction – Movement away from the midline of the body.

Adduction – Movement toward the midline of the body.

Rotation – Circular movement around an axis.

Dorsiflexion – Decreasing the angle of the ankle joint so that the foot bends backward.

Plantar flexion – Extending the foot toward the ground, pointing the toes.

Supination – Facing upward.

Pronation – Facing downward

Torsion – A rotary movement of the trunk; twisting.

Pathological conditions of the skeletal system and fractures

ankylosing spondylitis – chronic , progressive arthritis with stiffening of joints, primarily of the spine.

arthritis – inflammation of joints

bunion – abnormal prominence with bursal swelling at the metatarsophalangeal joint near the base of the big toe.

bursitis – inflammation of bursae

Ewing’s sarcoma – malignant bone tumor

exostosis – bony growths(benign tumors) arising from the surface of the bone.

fracture – sudden breaking if a bone. **Closed fracture** – a bone is broken but there is no open wound in the skin. **Open fracture**- a broken bone with an open wound in the skin. **Greenstick fracture**- the bone is partially broken and partially bent, as when a green stick breaks. Treatment of fractures involves **reduction** which is the restoration of the fracture to its normal position. There is a **closed reduction** which is manipulative, and an **open reduction** which requires an incision. A **cast** is applied to fractures to immobilize the injured area

dislocation – displacement of a joint from its place. Dislocation must be reduced and then immobilized

gouty arthritis(gout) – inflammation of joints caused by excessive uric acid in the body. A joint chiefly affected is the big toe.

osteoarthritis – chronic inflammation of bones and joints due to degenerative changes in cartilage

osteoporosis – decrease in bone density; thinning and weakening of bones due to loss of calcium salts.

osteomyelitis – inflammation of the bone and bone marrow due to a pyogenic infection.

sprain – trauma to a joint, with pain, swelling, and injury to ligaments

slipped disc – protrusion of an intervertebral disc.

rickets(rachitis) – inflammation of the spinal column. It is primarily a disease of infancy and childhood when bones are forming but fail to receive calcium and phosphorus into the bloodstream from the intestines

Spinal disorders

Because of various conditions, the normal curvature of the spine may become abnormally bent or slope away. **Scoliosis** – a lateral curvature; **kyphosis** – hunchback; **lordosis** – is a forward curvature of the lumbar spine

Pathological conditions of the muscular system

Amyotrophic lateral sclerosis – movement disorders(muscles atrophy) with degeneration of nerves in the spinal cord and lower region of the brain.

Muscular dystrophy – a group of inherited diseases characterized by progressive weakness and degeneration of muscle fibers.

Myasthenia gravis – lack of muscle strength marked by paralysis

Polymyalgia rheumatica – muscle pain primarily of the shoulder and pelvis, with absence of arthritis and signs of muscle distress (tegoba, bol).

Combining forms and suffixes

myel/o	bone marrow	myelopoiesis _____
orth/o	straight	prthopedics _____ Ped/o means child
spondyl/o	vertebra	spondylosis _____
-blast	embryonic or immature cell	osteoblast _____
-clast	to break	osteoclast _____
-listhesis	slipping	spondylolisthesis _____

-physis	to grow	epiphysis_____ -
calcane/o	heel bone	calcaneal_____
malleol/o	malleolus	maleolar_____ -
perone/o	fibula	peroneal_____
* ankylo/o	stiff	ankylosis_____
arthr/o	joint	arthroplasty_____
		arthrotomy_____
		hemarthrosis_____
		hydrarthrosis_____
chondr/o	cartilage	achondroplasia_____
		chondroma_____
		chondromalacia_____
ten/o	tendon	tenorrhaphy_____
		tenosynovitis_____
tendin/o	tendon	tendonitis_____
-desis	to bind	arthrodesis_____
- stenosis	Tie together narrowing	spinal stenosis_____
leiomy/o	smoothe muscle	leiomyoma_____
myos/o	muscle	myositis_____
plant/o	sole of the foot	plantar flexion_____
rhabdomy/o	skeletal muscle	rhabdomyosarcoma_____
-asthenia	lack of strength	myasthenia gravis_____
-throphy	development	athrophy_____
	Nourishment	

Prefixes

ab-	away from	abduction_____
ad-	toward	adduction_____
dorsi-	back	dorsiflection_____
poly-	many, much	polymyalgia_____

Exercises

Complete the following sentences

1. Bones are composed of bony connective tissue called _____ tissue.
2. Bone cells are called _____.
3. The bones of a fetus are composed mainly of _____.
4. During bone development, immature bone cells called _____ produce bony tissue.
5. Large bone cells called _____ digest bone tissue to shape the bone and smooth it out.
6. Two mineral substances necessary for proper development of bones are _____.
7. The shaft of a long bone is _____.
8. The ends of a long bone are _____.
9. Red bone marrow is found in spongy or _____ bone.
10. Yellow bone marrow is composed of _____-tissue.

Give the medical names of the following bones:

Sholder blade_____ ; upper arm bone- _____ ;
 Breastbone- _____ ; thigh bone _____
 Finger bones- _____ ; hand bones- _____.
 Medial lower arm bone- _____ ; collar bone- _____ ;
 Wrist bones- _____ ; backbone- _____
 _____ Smaller of two lower leg bones- _____ ;midfoot
 bones- _____ ,hree parts of the pelvis are:
 _____ , _____ , _____ .

GASTROINTESTINAL SYSTEM

Functions

The gastrointestinal system is also called the **digestive** or **alimentary** system. It begins with the mouth or the oral or buccal cavity where food enters the body, and terminates at the anus where solid waste

materials leave the body.

The functions of the digestive system are threefold:

First, complex food material taken into the mouth must be digested, or broken down, mechanically and chemically, as it travels through the gastrointestinal tract. Digestive **enzymes** speed up chemical reactions and help in the breakdown (digestion) of complex nutrients. Complex proteins are digested into simpler **amino acids**; complicated sugars are reduced to simple sugars, such as **glucose**; and large fat molecules(**triglycerides**) are broken down to **fatty acids** and glycerol.

Second, the digested food must be **absorbed** into the bloodstream by passing through the walls of the small intestine. In this way, valuable nutrients such as sugars and amino acids, can travel to all the cells of the body. Cells then catabolize(burn) nutrients in the presence of oxygen to release energy stored within the food. Cells also use amino acid nutrients to anabolize(build) large protein molecules needed for growth and development. Although the walls of the small intestine also absorb fatty acids and glycerol, these nutrients enter lymphatic vessels. Digested fats eventually enter the bloodstream as lymph vessels join with blood vessels in the upper chest region.

The third function of the digestive system is the **elimination** of the **solid waste** materials that cannot be absorbed into the bloodstream. The large intestine concentrates these solid wastes, called **feces**, and the wastes pass out of the body through the anus.

ANATOMY AND PHYSIOLOGY

The alimentary canal begins with the oral cavity, or mouth.

The **cheeks** form the walls of the oral cavity, and the **lips** surround the opening to the cavity.

The **hard palate** forms the anterior portion of the roof of the mouth, and the muscular **soft palate** lies posterior to it. **Rugae** are irregular ridges in the mucous membrane covering the anterior portion of the hard palate. Hanging from the soft palate is a small, soft tissue called the **uvula**. The word uvula means little grape. The structure functions to aid in producing sounds and speech.

The **tongue** extends across the floor of the oral cavity, and muscles attach it to the lower jaw bone. It moves food around during **mastication** (chewing) and **deglutition** (swallowing). **Papillae** , small raised areas on the tongue, contain taste buds that are sensitive to the chemical nature of foods and allow discrimination(razlikovanje) of different tastes as food moves across the tongue.

The **tonsils** are masses of lymphatic tissue located in depressions of the mucous membranes on both sides of the oropharynx(part of the throat near the mouth). They act as filters to protect the body from the invasion of microorganisms and produce lymphocytes, which are white blood cells able to fight disease.

The **gums** are made of fleshy tissue and surround the sockets of the **teeth**. The teeth that are located in front of the oral cavity, the **incisors** and **cuspids**, cut and tear the food into small pieces. The teeth located in the rear of the mouth are called **molars**. They further crush and grind the food into finer particles. Teeth are covered by hard **enamel**, which gives them a white and smooth appearance. The enamel is the hardest substance in the body. Beneath the enamel is the main structure of the teeth, the **dentin**. It is yellowish and is composed of bony tissue which is softer than enamel.

Dentin is surrounded by a thin layer of modified bone called **cementum**. In the innermost part of the tooth is the **pulp**, a soft, delicate layer, which stores the nerves and blood vessels of the tooth, The teeth are embedded in pink fleshy tissue known as gums or **gingiva**.

Three pairs of **salivary glands** surround the oral cavity. These exocrine glands produce a fluid called **saliva** that contains important digestive **enzymes**. Saliva is released from **the parotid gland, submandibular gland and sublingual gland**.

After the food is chewed, it is formed into a round, sticky mass called a **bolus**. The bolus is pushed by the tongue from the mouth into the **pharynx**. The pharynx is a muscular tube which serves as a common passageway for air from the nasal cavity to the larynx, as well as food going from the mouth to the **esophagus**. The pharynx is divided into three major sections:

1. The nasopharynx or epipharynx(the throat behind the nose)

2. The oropharynx or mesopharynx(the throat behind the mouth)
3. The laryngopharynx or hypopharynx(the throat above the larynx)

The laryngopharynx is further divided into two tubes; one which leads to the lungs, called **the trachea**, and one which leads to the stomach, called the **esophagus** .

A small flap of tissue, the **epiglottis**, covers the trachea. The main function of the epiglottis is to prevent food from entering the trachea

The esophagus , meaning swallowing (phag/o) inward (eso-), is a 9 to 10 inch muscular tube extending from the pharynx to the stomach. Rhythmic contractions of muscles in the wall of the esophagus propel food to the stomach. It is called **peristalsis** .The process is like squeezing a marble through a rubber tube.

Food passes from the esophagus into **the stomach**. The stomach is composed of an upper portion called **the fundus**, a middle section known as the **body**, and a lower portion, the **antrum**. Rings of muscles called **sphincters** control the openings into and out of the stomach. The **lower esophageal sphincter (cardiac sphincter)** relaxes and contracts to move food from the esophagus into the stomach. The **pyloric sphincter** allows food to leave the stomach when it is ready.Folds in the mucous membrane lining the stomach are called **rugae**. The rugae contain digestive glands that produce the enzyme **pepsin** and **hydrochloric acid** .

The role of the stomach is to prepare food chemically and mechanically so that it can be received in the small intestine for digestion and absorption into the bloodstream.

The small intestine(small bowel) extends for twenty feet (6 meters) from the pyloric sphincter to the first part of the large intestine. It has three parts. The first section is the **duodenum** , only one foot in length (30 cm) , which receives food from the stomach as well as **bile** from the **liver** and **gallbladder** and pancreatic juices from the **pancreas** . Enzymes and bile help to digest food before it passes into the second part of the small intestine, the **jejunum** , about 8 feet long. The jejunum connects with the third section, the **ileum** , about 11 feet long. The ileum attaches to the first part of the large intestine. Millions of tiny, microscopic projections called **villi** line the walls of the small intestine. The tiny capillaries in the villi absorb the digested nutrients into the bloodstream and lymph vessels.Most of the absorption takes place in the ileum.

The large intestine extends from the end of the ileum to the anus, It is divided into six parts: cecum, ascending colon, transverse colon, descending colon, sigmoid colon, and rectum. The large intestine is a continuation of the gastrointestinal tube and is attached to the ileum by ileocecal valve. This valve is composed of sphincter muscles that serve to close the ileum at the point at which the small intestine is connected to the colon.

The large intestine has an average diameter of two and one-half inches and is approximately five feet long. The **cecum** is the first two or three inches of the large intestine. It is a pouch on the right side. Attached to the cecum is a wormlike(or vermiform) projection- **the appendix** , which performs no function in the digestive tract and only causes problems when infected.

The large intestine receives the fluid waste products of digestion and stores these wastes until they can be released from the body. Because the large intestine absorbs most of the water within the waste material, the body can expel solid **feces** (stools). Defecation is the expulsion or passage of feces from the body through the anus.

Three important additional organs of the digestive system are the liver, pancreas, and gallbladder. Although food does not pass through these organs, each plays a crucial role in the proper digestion and absorption of nutrients.

Liver

The liver is the largest glandular organ in the body. It is located beneath the diaphragm in the right upper quadrant of the abdominal cavity. The liver produces so many vital functions that the human organism cannot survive without it.

1. **Produces bile** , which is used in the small intestine to emulsify and absorb fats. Bile is a thick, yellowish brown, sometimes greenish fluid. It contains cholesterol, bile acids, and several bile pigments. One of these pigments is called bilirubin. Bilirubin is a waste product of hemoglobin destruction.

2. Removes glucose from blood , which it synthesizes and stores as glycogen(starch) in liver cells. This is called **glycogenesis** .
3. **Stores vitamins**, such as B12, A, D,E, and K.
4. **Breaks down** or transforms some toxic products into less harmful compounds.
5. **Maintains normal level of glucose in the blood.**
6. **Destroys old erythrocytes** and ingests bacteria and foreign particles from the blood by phagocytes.
7. **Produces various blood proteins** , such as prothrombin and fibrinogen, which aid in the clotting of blood(coagulation).

Pancreas

The pancreas secretes and produces pancreatic juices that help break down all types of food during the digestive process. These juices empty into the pancreatic duct and eventually are absorbed by the small intestine. Insulin is another hormone that is secreted by the pancreas and exerts major control over carbohydrate metabolism or the utilization of sugar in the body. Insulin is produced by the cells located within the tissue called **the islands of Langerhans** . The pancreas is both an exocrine and endocrine organ.

Gallbladder

The gallbladder serves as the storage area for bile. It is a pear shaped sac under the liver. During the process of digestion, when there is a need for some bile, gallbladder releases it into the duodenum through the **common bile duct**. Bile is also drained from the liver through the **hepatic ducts**. The hepatic ducts connect with **the cystic duct** from the gallbladder and form the common bile duct.

COMBINING FORMS ,SUFFIXES, AN TERMINOLOGY

Parts of the body

Combining form	Meaning	Terminology
an/o	anus	perianal
append/o	appendix	appendectomy
appendic/o	appendix	appendicitis
bucc/o	cheek	buccal mucosa
cec/o	cecum	cecal
celi/o	belly, abdomen	celiac
cheil/o	lip	cheilosis
cholecyst/o	gallbladder	cholesystectomy
choledoch/o	common bile duct	choledochotomy
col/o	colon	colostomy
colon/o	colon	colonic
dent/i	tooth	dentibuccal

enter/o	intestines, usually small intestine	enterocolitis
gloss/o	tongue	hypoglossal
hepat/o	liver	hepatoma
labi/o	lip	labial
lapar/o	abdomen	laparoscopy
lingu/o	tongue	sublingual
odont/o	tooth	orthodontist(orth/o = straight)
or/o	mouth	oral(stomat/o also means mouth)
pancreat/o	pancreas	pancreatitis
proct/o	anus and rectum	proctologist
rect/o	rectum	rectocele
sialaden/o amyl/o	salivary gland starch	sialadenitis amylase
chol/e	bile, gall	cholelithiasis (lith/o means stone or calculus)
chlorhydr/o	hydrochloric acid	achlorhydria(absence of gastric juice)
gluc/o	sugar	gluconeogenesis (new sugar is made)
glyc/o	sugar	hyperglycemia
lip/o	fat, lipid	lipoma
lith/o	stone	cholecystolithiasis
sial/o	saliva, salivary	sialolith
steat/o	fat	steatorrhea – fats are improperly digested and appear in the feces
-ase	enzyme	lipase
-chezia	defecation	hematochezia – bright red blood is found in the feces
- iasis	abnormal condition	choledocholithiasis
-prandial	meal	postprandial

Pathology of the digestive system

symptoms

anorexia	Lack of appetite(-orexia = appetite)
ascites	Abnormal accumulation of fluid in the abdomen
borborygmus	Rumbling or gurgling noises produced by the movement of gas, fluid or both in the gastrointestinal tract
constipation	Difficult, delayed elimination of feces.
diarrhea	frequent, loose, watery stools.
dysphagia	Difficulty in swallowing.
flatus	Gas expelled through the anus.
jaundice	Yellow-orange coloration of the skin
melena	Black stools. Feces containing blood.
nausea	Unpleasant sensation in the stomach and a tendency to vomit.

Pathological conditions

Oral cavity and teeth

aphthous stomatitis	Inflammation of the mouth with small ulcers(aphtho means ulcer)
dental caries	Tooth decay.
herpetic stomatitis	Inflammation of the mouth by infection with the herpesvirus.
oral leukoplakia	White plaques or patches on the mucosa of the mouth.
periodontal disease	Inflammation and degeneration of gums.

gastrointestinal tract

achalasia	Failure of the lower esophagus sphincter to relax (-chalasia means relaxation)
anal fistula	Abnormal tube-like passageway near the anus.
colonic polyposis	Polyps protrude from the mucous membrane of the colon.
colorectal cancer	Adenocarcinoma of the colon or rectum ,or both.
Chron disease	Chronic inflammation of the intestinal tract.
diverticula	Abnormal side pockets in the intestinal wall .

dysentery	Painful, inflamed intestines.
esophageal varices	Swollen veins in the distal portion of the esophagus.
gastroesophageal reflux disease	Solids and fluids return to the mouth from the stomach.
hemorrhoids	Swollen veins in the rectal region
hernia	Protrusion of an organ or part through the muscle normally containing it.
ileus	Failure of peristalsis.
ulcer	Open sore or lesion of epithelial tissue.
ulcerative colitis volvulus	Chronic inflammation of the colon with the presence of ulcers. Twisting of the intestine upon itself.

URINARY SYSTEM

When foods like sugars and fats which contain particles of carbon, hydrogen, and oxygen, combine with oxygen in cells, the waste produced are gases called carbon dioxide(carbon and oxygen) and water (hydrogen and oxygen) in the form of vapor. These gases are removed from the body by exhalation through the lungs

Foods composed of protein are more complicated than sugars and fats. They contain carbon, hydrogen, and oxygen plus nitrogen and other elements. The waste that is produced when proteins combine with oxygen is called **nitrogenous waste** , and it is more difficult to excrete (to separate out) from the body than are gases like carbon dioxide and water vapor. The body cannot efficiently put the nitrogenous waste into a gaseous form and exhale it, so it excretes it in the form of a soluble (dissolved in water) waste substance called **urea**. The major function of the urinary system is to remove urea from the bloodstream so that it does not accumulate in the body and become toxic.

Urea is formed in the liver from ammonia, which is derived from the breakdown of simple proteins (amino acids) in the body cells. The urea is carried in the bloodstream to the kidneys, where it passes with water, salts, and acids out of the bloodstream and into the kidney tubules as **urine** .

Besides removing urea from the blood, another important function of the kidney is to maintain the proper balance of water, salts, and acids in the body fluids. Salts such as **sodium** and **potassium** and some acids are known as **electrolytes**. Electrolytes are necessary for the proper functioning of muscle and nerve cells. The kidneys adjust the amount of water and electrolytes by secreting some substances into the urine and holding back others in the bloodstream for use in the body.

The kidneys also act as endocrine organs. Examples of the kidney's endocrine function include the secretion of **renin**, a substance important in the control of blood pressure, and **erythropoietin** – a hormone that regulates the production of red blood cells.

The kidneys also secrete an active form of vitamin D, necessary for the absorption of **calcium** from the intestine. In addition, hormones such as insulin and parathyroid hormone are degraded and extracted from the bloodstream by the kidney.

Anatomy of the major organs

The organs of the urinary system are two **kidneys** , two **ureters** , the **urinary bladder** , the **urethra**, and the external opening called urethral or urinary **meatus**.

The kidneys are bean-shaped organs situated behind the abdominal cavity(retroperitoneal) on either side of the vertebral column in the lumbar region of the spine. They are fist-sized and weigh 4 to 6

ounces each (15-20 dags) . The kidney consists of an outer **cortex** region and an inner **medulla** region. The depression on the medial border of the kidney, through which blood vessels and nerves pass, is called the **hilum** .

Two **ureters** are muscular tubes lined with mucous membranes. They convey urine in peristaltic waves from the kidneys to the urinary bladder.

The **urinary bladder** is a hollow , muscular, distensible sac in the pelvic cavity. It serves as a temporary reservoir for urine. The **trigone** is a triangular space at the base of the bladder where the ureters enter and the urethra exits.

The **urethra** is a membranous tube through which urine is discharged from the urinary bladder. The process of expelling (**voiding**) urine through the urethra is called **micturition**. The female urethra is about 1 and a 1/2 inches long. The male urethra is about 8 inches long .

How the kidneys produce urine

Blood enters each kidney from the aorta by way of the right and left **renal arteries** . After the renal artery enters the kidney (at the hilum) , the artery branches into smaller and smaller arteries . The smallest arteries are called **arterioles** , and these are located throughout the cortex of the kidney. Each arteriole in the cortex of the kidney leads into a mass of very tiny, coiled and intertwined smaller blood vessels called **capillaries**. The collection of capillaries is called a **glomerulus**. There are about one million glomeruli in the cortex region of each kidney.

The kidneys produce urine by a process of **filtration**. As blood passes through the many glomeruli, the walls of each glomerulus are thin enough to permit water, salts, sugar, and urea (with other nitrogenous wastes such as **creatinine** and **uric acid**) to leave the bloodstream. These materials are collected in a tiny, cup-like structure called a **Bowman capsule**, which surrounds each glomerulus. The walls of the glomeruli prevent large substances such as proteins and blood cells from filtering into the Bowman capsule. These substances remain in the blood and normally do not appear in urine.

Attached to each Bowman capsule is a long, twisted tube called a **renal tubule**.As water, sugar, salts, urea, and other wastes pass through the renal tubule, most of the water, all of the sugar, and some salts return to the bloodstream through tiny capillaries surrounding each tubule. This **reabsorption** ensures that the body retains essential substances such as sugar, water, and salts. The final process in the formation of urine is the **secretion** of some substances from the bloodstream into the renal tubule. Most are waste products of metabolism that become toxic if allowed to accumulate in the body. This is the method by which acids, drugs, and potassium are eliminated in urine.

Thus only wastes, water, salts, acids, and some drugs remain in the renal tubule. Each renal tubule, now containing urine (95% water, 5% urea, creatinine, salts, acids and drugs), ends in a larger collecting tubule.

Thousands of collecting tubules lead to the **renal pelvis**, a basin-like area in the central part of the kidney. Small, cup-like regions of the renal pelvis are called **calices** or **calyces** (sing. calix or calyx) The renal pelvis narrows into the **ureter** , which carries the urine to the **urinary bladder** where the urine is temporarily stored. The exit area of the bladder to the **urethra** is closed by sphincters that do not permit urine to leave the body.

TERMINOLOGY

STRUCTURES

Combining Form	Meaning	Terminology	Meaning
cali/o calic/o	calyx(calyx)	caliectasis caliceal	
cyst/o	urinary bladder	cystitis cystectomy cystostomy	
glomerul/o	glomerulus	glomerular	
meat/o	meatus	meatal stenosis meatotomy	
nephr/o	kidney	nephropathy nephrolithotomy	
pyel/o	renal pelvis	pyelolithotomy	
ren/o	kidney	renal transplantation	
trigon/o	trigone	trigonitis	
ureter/o	ureter	ureterolithotomy	
vesic/o	urinary bladder	vesicoureteral reflux	

SUBSTANCES AND SYMPTOMS

albumin/o	albumin	albuminuria
azot/o	nitrogen	azotemia
dips/o	thirst	polydipsia
lith/o	stone	nephrolithiasis
noct/i	night	nocturia
olig/o	scanty(oskudan)	oliguria

py/o	pus	pyuria	
-tripsy	to crush	lithotripsy	
ur/o	urine(urea)	uremia	
Combining Form	Meaning	Terminology	Meaning
urin/o	urine	urinary incontinence	
-uria	urination, urine condition	dysuria hematuria	

PATHOLOGICAL TERMINOLOGY

glomerulonephritis	inflammation of the kidney glomerulus
interstitial nephritis	inflammation of the renal interstitium(connective tissue that lies between the renal tubules)
nephrolithiasis	kidney stones(renal calculi)
nephrotic syndrome	a group of syndromes caused by excessive protein loss in the urine(also called nephrosis)
polycystic kidneys	multiple fluid filled sacs(cysts) within and upon the kidney
pyelonephritis	inflammation of the renal pelvis and renal medulla
renal cell carcinoma	cancerous tumor of the kidney in adulthood
renal failure	failure of the kidney to excrete urine
renal hypertension	high blood pressure resulting from kidney disease
Wilms tumor	malignant tumor of the kidney occurring in childhood

URINARY BLADDER

bladder cancer	malignant tumor of the urinary bladder
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ASSOCIATED CONDITIONS

diabetes insipidus	inadequate secretion or resistance of the kidney to the action of antidiuretic hormone (ADH) Two main symptoms of this condition are polydipsia and polyuria
diabetes mellitus	inadequate secretion or improper utilization of insulin Major symptoms of diabetes mellitus are glycosuria, hyperglycemia, polyuria, and polydipsia.

OTHER PROCEDURES

cystoscopy

is the visual examination of the urinary bladder by means of a cystoscope

dialysis

Waste materials such as urea are separated from the bloodstream when the kidney can no more function(**hemodialysis, peritoneal dialysis**)

FEMALE REPRODUCTIVE SYSTEM

I Introduction

Sexual reproduction is the union of the nuclei of the female sex cell(**ovum**) and the male sex cell (**sperm**) that results in the creation of a new individual. The ovum and sperm cell are specialized cells differing primarily from normal body cells in one important way. Each sex cell(also called a **gamete**) contains exactly half the number of chromosomes that a normal body cell contains. When the nuclei of ovum and sperm cell unite, the cell produced receives half of its genetic material from its female parent and half from its male parent; thus it contains a full, normal complement of hereditary material.

Gametes are produced in special organs called **gonads**. The female gonads are the **ovaries** , and the male gonads are the **testes**. An ovum, after leaving the ovary, travels down a duct(**fallopian tube**) leading to the **uterus**(womb). If **coitus (copulation, sexual intercourse)** has occurred , and sperm cells are present in the fallopian tube, union of the ovum and sperm may take place. The union is called

fertilization. The **embryo**(called the **fetus** after the second month) then begins a 40-week period of development (**gestation, pregnancy**) within the uterus.

The female reproductive system consists of organs that produce **ova** and provide a place for the growth of the embryo. In addition, the female reproductive organs supply important hormones that contribute to the development of female secondary sex characteristics (body hair, breast development, structural changes in bones and fat).

Ova mature and are released from the ovaries from the onset of **puberty** (beginning of the fertile period when secondary sex characteristics develop) to **menopause** (cessation of fertility and diminishing of hormone production) . Women are born with all the eggs that they will possibly release. However, it is not until the onset of puberty that the eggs mature and leave the ovary. If fertilization occurs at any time between puberty and menopause, the fertilized egg may grow and develop within the uterus. Various hormones are secreted from the ovary and from a blood-vessel-filled organ (**placenta**) that grows in the wall of the uterus during pregnancy. If fertilization does not occur, hormone changes result in the shedding of the uterine lining, and bleeding, or **menstruation** , occurs.

The hormones of the ovaries that play important roles in the process of menstruation and pregnancy, and in the development of secondary sex characteristics, are **estrogen** and **progesterone**. Other hormones that are responsible for the functions of the ovaries, breasts and uterus , are secreted by the **pituitary gland**, which is located behind the bridge of the nose at the base of the brain.

Gynecology is the study of the female reproductive system (organs, hormones, diseases); **obstetrics** is a specialty concerned with pregnancy and the delivery of the fetus; and **neonatology** is the study and treatment of the newborn child.

Organs of the female reproductive system

The female reproductive system consists of internal and external organs of reproduction. The internal or essential organs of reproduction are the ovaries, fallopian tubes, uterus, and **vagina** or birth canal. The external genitalia include the labia majora, labia minora, clitoris, vestibule of the vagina and Bartholin's glands. The external genitalia are known as **vulva**.

The **ovaries** are a pair of small, almond- shaped organs located in the lower abdomen. The **fallopian tubes** lead from each ovary to the **uterus**, which is a muscular organ situated between the urinary bladder and the rectum. Midway between the uterus and the rectum is a region in the abdominal cavity known as the **cul-de-sac**. This region is often examined for the presence of cancerous growths.

The **vagina** is a tube extending from the uterus to the exterior of the body. **Bartholin's glands** are two small, rounded glands on either side of the vaginal orifice. These glands produce a mucous secretion that lubricates the vagina. The **clitoris** is an organ of sensitive, erectile tissue located anterior to the vaginal orifice and in front of the urethral meatus. The clitoris is similar in structure to the penis in the male.

The region between the vaginal orifice and the anus is called the **perineum**. The perineum can be torn in a childbirth and cause injury to the anus, so the obstetrician often cuts the perineum before delivery. This incision is called an **episiotomy**. The perineum is then sewn together (repaired) after childbirth.

Within each ovary are thousands of small sacs called **graafian follicles**. Each graafian follicle contains an **ovum** . When an ovum is mature, the graafian follicle ruptures to the surface and the ovum leaves the ovary. The release of the ovum from the ovary is called **ovulation**. The ruptured follicle fills with blood, and then with a yellow, fat-like material. It is then called the **corpus luteum**.

Near each ovary is a duct, about 13-14 cm long called a fallopian tube. Collectively, the fallopian tubes, ovaries, and supporting ligaments are called the **adnexa** (accessory structures – privjesci)of the uterus. The egg, after its release from the ovary, is caught up by the finger-like ends of the fallopian tube. These ends are called **fimbriae**. The tube itself is lined with small hairs that, through their motion, sweep the ovum along. It usually takes an ovum 5 days to pass through the fallopian tube.

It is within the fallopian tube that fertilization takes place if any sperm cells are present. If coitus takes

place near the time of ovulation and no contraception is used, there is a high likelihood that sperm cells will be in the fallopian tube when the egg cell is passing through it. If coitus hasn't taken place, the ovum remains unfertilized and, after a day or two, disintegrates.

The fallopian tubes, one on either side, lead into the **uterus**, a pear-shaped organ with muscular walls and a mucous membrane lining filled with a rich supply of blood vessels. The rounded upper portion of the uterus is the **fundus**, and the larger, central section is the **corpus** (body). The specialized epithelial mucosa of the uterus is the **endometrium**; the middle, muscular layer is the **myometrium**, and outer, membranous tissue layer is the **perimetrium (uterine serosa)**. A serosa is the outermost coat or layer of an organ that is in the abdomen or thorax.

The narrow, lower portion of the uterus is the **cervix** (meaning neck). The cervical opening leads into a 3-inch-long tube called the vagina, which opens to the outside of the body.

The breasts (Accessory Organ of Reproduction)

The breasts are two **mammary glands** located in the upper anterior region of the chest. They are composed of **glandular tissue**, containing milk glands, that develop in response to hormones from the ovaries during puberty. The breasts also contain **fibrous** and **fatty tissue**, special **lactiferous** (milk-carrying) **ducts**, and **sinuses** (cavities) that carry milk to the opening, or nipple. The breast nipple is called the **mammary papilla**, and the dark-pigmented area around the mammary papilla is called the **areola**

During pregnancy, the hormones from the ovaries and the placenta stimulate glandular tissue in the breast to their full development. After **parturition** (giving birth), hormones from the pituitary gland stimulate production of milk (**lactation**).

MENSTRUATION AND PREGNANCY

The beginning of menstruation at the time of puberty is called **menarche**. Each menstrual cycle is divided into 28 days.

If fertilization does occur in the uterine tube, the fertilized egg travels to the uterus and implants in the uterine endometrium. The corpus luteum in the ovary continues to produce progesterone and estrogen, which support the vascular and muscular development of the uterine lining

The **placenta**, a vascular organ, now forms within the uterine wall. The placenta is derived from maternal endometrium and from the **chorion**, the outermost membrane that surrounds the developing embryo. The **amnion** is the innermost of the embryonic membranes, and it holds the fetus suspended (lebdjeti) in an amniotic cavity surrounded by a fluid called the **amniotic fluid**. The amnion and the fluid are sometimes known as the "bag of water", which usually ruptures (breaks) during labor.

The maternal blood and the fetal blood never mix during pregnancy, but important nutrients, oxygen, and wastes are exchanged as the blood vessels of the baby (coming from the umbilical cord) lie side by side with the mother's blood vessels in the placenta.

The placenta produces its own hormone as it develops in the uterus. This hormone is called **human chorionic gonadotropin – HCG** (or pregnancy hormone) and it stimulates the corpus luteum to continue producing hormones until about the third month of pregnancy, when the placenta itself takes over the endocrine function and releases estrogen and progesterone

During the early stages of pregnancy, the future child grows at an extremely rapid rate. The mother's body must undergo profound changes to support this organism. The muscles of the uterus grow, vaginal secretions change, the blood volume expands, the work of the heart increases, the mother gains weight, the breasts prepare for lactation and other adjustments are made throughout the mother's body.

The average duration of pregnancy or the gestation period is about 280 days, or nine calendar months. The events of menstruation and pregnancy are dependent not only upon hormones from the ovary, but also on hormones from the pituitary gland. These pituitary gland hormones are **follicle-stimulating hormone** (FSH) and **luteinizing hormone** (LH). These two hormones stimulate the development of the ovum and ovulation. After ovulation, LH in particular influences the maintenance of the corpus luteum and its production of estrogen and progesterone.

Labour or childbirth is the physiologic process by which the fetus is expelled from the uterus. It occurs in three stages: (1) opening or dilation of the cervix is the time from the onset of labor to complete dilation of the cervix (about 10 cm); (2) the second stage is called the expulsion stage during which the

baby must be pushed through and out of the vagina; (3) the third stage is the stage of separation and expulsion of the placenta; in this final stage the placenta detaches itself from the uterine wall and is expelled.

Although serious complications rarely develop during labor following a normal and regularly controlled pregnancy, they can occur and must be watched for. One possible complication is a breech birth, which is defined as presentation of the fetal buttocks or feet during labor(**partus agrippinus**). If the obstetrician cannot correct the situation by manipulation, a **cesarian section** (C-section) will be required.

Another possible complication requiring a C-section occurs when the fetus is too large to be delivered through the pelvic outlet or when the pelvis is abnormally small. However, the most frequent cause for C-section is **dystocia** (abnormal or difficult childbirth) due to cephalopelvic (or fetopelvic) disproportion.

COMBINING FORMS SUFFIXES AND PREFIXES

amni/o	amnion	amniocentesis _____ -
cervic/o	cervix	endocervicitis _____
chori/o	chorion	choriogenesis _____
chorion/o	chorion	chorionic _____
colp/o	vagina	colposcopy _____
culd/o	cul-de-sac	culdocentesis _____
episi/o	vulva	episiotomy _____
galact/o	milk	galactorrhea _____
gynec/o	woman, female	gynecomastia _____
hyster/o	uterus, womb	hysterectomy _____
mamm/o	breast	mammary _____
mast/o	breast	mastitis _____
men/o	menses	amenorrhea _____
metr/o metri/o	uterus	metrorrhagia _____
nat/i	birth	neonatal _____
o/o	egg	oogenesis _____

oophor/o	ovary	bilateral oophorectomy_____--
salping/o	fallopian tubes	salpingectomy_____
Suffixes		
-arche	beginning	menarche_____
-cysis	pregnancy	pseudocycsis_____
-parous	to bear	primiparous_____
-tocia	labor, birth	dystocia_____
-version	act of turning	cephalic version_____

PATHOLOGY

carcinoma of the cervix - Malignant cells within the cervix (cervical cancer)

cervicitis - inflammation of the cervix

carcinoma of the endometrium – malignant tumor of the uterus

endometriosis – endometrial tissue is found in abnormal locations

fibroids – benign tumors in the uterus

ovarian carcinoma – malignant tumor of the ovary

ovarian cysts – collections of fluid within a sac (cyst) in the ovary

pelvic inflammatory disease – inflammation in the pelvic region ; salpingitis

carcinoma of the breast – malignant tumor of the breasts (arising from milk glands and ducts)

fibrocystic disease – small sacs of tissue and fluid in the breast

abruptio placentae – premature separation of the implanted placenta

choriocarcinoma – malignant tumor of the pregnant uterus

ectopic pregnancy – implantation of the fertilized egg in any site other than the normal uterine location

placenta previa – placental implantation over the cervical os (opening) in the lower region of the

uterine wall

preeclampsia – abnormal condition of pregnancy characterized by high blood pressure, proteinuria, and edema

down syndrome – chromosomal abnormality results in mental retardation

erythroblastosis fetalis – hemolytic disease in the newborn cause by a blood group incompatibility

hydrocephalus – accumulation of fluid in the spaces of the brain

pyloric stenosis – narrowing of the opening of the stomach to the duodenum

CLINICAL TESTS, PROCEDURES, AND ABBREVIATIONS

Clinical tests

Pap smear - Microscopic examination of stained cells from the vagina and cervix.

pregnancy test - Blood or urine test to detect the presence of HCG human chorionic gonadotropin

mammography - X-rax imaging of the breast

aspiration - withdrawal of fluid from a cavity or sack

cauterization – process of burning a part of the body

conization – removal of a cone-shaped section of the cervix

cryosurgery – use of cold temperatures to destroy tissue.

dilation (dilatation) and curettage (D&C) – widening o the cervix and scraping of the endometrium of the uterus.

exenteration – removal of internal organs

tubal ligation – blocking the fallopian tubes to prevent fertilization.

abortion – spontaneous or induced termination of pregnancy

amniocentesis – surgical puncture of the amnioitic sac to withdraw amniotic fluid

pelvimetry – measurement of the dimensions of the maternal pelvis

MALE REPRODUCTIVE SYSTEM

Introduction

The male sex cell, the **spermatozoon** (sperm cell), is microscopic and relatively uncomplicated cell, composed of a head region, which contains nuclear hereditary material(chromosomes), and a tail region, consisting of a **flagellum** (hair-like process) that makes the sperm motile, somewhat resembling a tadpole(punoglavac).The sperm cell contains relatively little food and cytoplasm, for it needs to live only long enough to travel from its point of release from the male to where the egg cell lies within the female(fallopian tube).Only one spermatozoon out of approximately 300 million sperm cells that may

be released during a single **ejaculation** (ejection of sperm and fluid from the male urethra) can penetrate a single ovum and produce fertilization of the ovum.

If more than one egg is passing down the fallopian tube when sperm are present, multiple fertilizations are possible, and twins, triplets, quadruplets, and so forth may occur. Twins resulting from the fertilization of separate ova by separate sperm cells are called **fraternal twins** .Fraternal twins , developing *in utero* with separate placentas, can be of the same sex or different sexes and resemble each other no more than ordinary brothers and sisters. Fraternal twinning is hereditary; a gene is carried by the daughters of mothers of twins.

Identical twins are formed by the fertilization of a single egg cell by a single sperm. As the fertilized egg cell divides and forms many cells, it somehow splits and each part continues separately to undergo further division, each producing an embryo. Identical twins are always of the same sex and are very similar in form and feature.

The organs of the male reproductive system are designed to produce and release billions of spermatozoa throughout the lifetime of a male from puberty onward. In addition, the male reproductive system secretes a hormone called **testosterone** . Testosterone is responsible for the production of the bodily characteristics of the male,(such as beard, pubic hair, and deeper voice) and for the proper development of male gonads(**testes**) and accessory organs (**prostate gland** and **seminal vesicles**) that secrete fluids to ensure lubrication and viability of sperm.

Anatomy

The male gonads consist of a pair of **testes** , also called testicles, that develop in the abdomen at about the level of kidneys before descending during embryonic development into the **scrotum** , a sac enclosing the testes on the outside of the body.

The scrotum exposes the testes to a lower temperature than that of the rest of the body. This lower temperature is necessary for the maturation and development of sperm (**spermatogenesis**).

The interior of a testis is composed of a large mass of narrow, coiled tubules called the **seminiferous tubules**. These tubules contain cells that manufacture spermatozoa. The seminiferous tubules are the **parenchymal tissue** of the testis, which means that they perform the essential work of the organ (formation of sperm). Other cells in the testis, called **interstitial cells** , manufacture an important male hormone, **testosterone**.

All body organs contain parenchyma. They also contain supportive, connective, and framework tissue, and sometimes muscle. This supportive tissue is called **stroma(stromal tissue)**.

As soon as the sperm cells are formed, they move through the seminiferous tubules and are collected in ducts that lead to a large tube at the upper part of each testis. This is the **epididymis**. The spermatozoa mature and become motile in the epididymis and are temporarily stored there. An epididymis runs down the length of each testicle (the coiled tube s about 16 feet = 5m long) and then turns again and becomes a narrow, straight tube called the **vas deference** or **ductus deference** . The vas deference is about two feet long and carries the sperm up into the pelvic region at the level of the urinary bladder, merging with ducts from the **seminal vesicles** to form the **ejaculatory duct** leading toward the urethra. Each vas deference is cut and tied off when a **sterilization** procedure called a **vasectomy** is performed.

The seminal vesicles, two glands located at the base of the bladder, open into the ejaculatory duct as it joins the urethra. They secrete a thick, sugary, yellowish substance that nourishes the sperm cells and forms much of the volume of ejaculated **semen**. Semen is a combination of fluid and spermatozoa(sperm cells account for less than one percent of the semen volume) that is ejected from the body through the urethra. In the male the genital orifice combines with the urinary opening.

At the region where the vas deference enters the urethra is the **prostate gland** .The prostate gland secretes a thick fluid that, as part of semen, aids the motility of the sperm. This gland is also supplied with muscular tissue that aids in the expulsion of sperm during ejaculation. **Cowper (bulbourethral) glands** are just below the prostate gland and also secrete fluid into the urethra.

The **penis** is composed of erectile tissue and at its tip expands to form a soft sensitive region called the **glans penis** . Ordinarily , a fold of skin called the **prepuce** or **foreskin**, covers the glans penis. **Circumcision** is the process whereby the foreskin is removed.

Combining forms and terminology

andr/o

male

androgen_____

balan/o	glans penis	balanitis _____
cryo/o	cold	cryogenic surgery _____
crypt/o	hidden	cryptorchism _____
gon/o	seed	gonorrhea _____
hydr/o	water, fluid	hydrocele _____
orch/o, orchi/o orchid/o	testis	orchiectomy _____
terat/o	monster	teratoma _____
varic/o	varicose veins	varicocele _____
vas/o	vessel, duct	vasectomy _____
zo/o	animal life	azoospermia _____
test/o	testis , testicle	testicular _____ The term testis originates from a Latin term meaning whiteness.

Disorders and pathological conditions of the Male Reproductive System

adenocarcinoma of the prostate - Malignant tumor of the prostate. This is the most common cause of cancer in men over 50 years of age. Radical prostatectomy along with radio therapy to treat metastases, is a common method of treatment.

benign prostatic hyperplasia (hypertrophy) – Overgrowth of the glandular tissue of the prostate. The prostate enlarges decreasing the lumen of the urethra.

cryptorchism – Undescending testicles. Orchiopexy is performed to bring the testis into the scrotum.

epispadias; epispadia – congenital opening of the male urethra on the upper surface of the penis.
hypospadias – lower surface

phimosis – Narrowing (stricture) of the opening of the prepuce over the glans penis

carcinoma of the testis – Malignant tumor of the testis

varicocele – Swolen, enlarged, herniated veins near the testicles. This condition is often associated with oligospermia (scarcity of spermatozoa in the semen).

Sexually Transmitted Infections STI

chlamydial infection – Bacteria (*Chlamydia trachomatis*) invade the urethra and reproductive tract of men and the vagina and cervix of women.

gonorrhoea – Inflammation of the genital tract mucous membranes caused by infestation with gonococcus.

herpes genitalis – Infection of the skin and mucosa of the genitals, caused by the herpes simplex virus (HSV).

syphilis (lues) – Chronic STI caused by a spirochete (spiral-shaped bacterium)

trichomoniasis – Infestation of the genitourinary tract of either sex, caused by *Trichomonas vaginalis*, a one-celled organism.

Laboratory tests

PSA test – Measures prostate-specific antigen in the blood

semen analysis – Ejaculated fluid is examined microscopically

Clinical procedures

Castration – surgical excision of testicles or ovaries; **circumcision** – surgical procedure to remove the prepuce of the penis; **digital rectal examination** – finger palpation through the anus to examine the prostate gland ; **vasectomy** – bilateral removal of a part of the vas deference

RESPIRATORY SYSTEM

Introduction

We usually think of **respiration** as the mechanical process of breathing which is for the most part unconscious exchange of air between the lungs and the external environment. This exchange of air at the lungs is also called **external** breathing or respiration. In external respiration oxygen is inhaled (inhaled air contains about 21 % oxygen) into the air spaces (sacks) of the lungs and immediately passes into tiny capillary blood vessels surrounding the air spaces. Simultaneously, carbon dioxide, a gas produced when oxygen and food combine in cells, passes from the capillary blood vessels into the air spaces of the lungs to be exhaled (exhaled air contains about 16 per cent oxygen).

While external respiration occurs between the outside environment and the capillary bloodstream of the lungs, **internal respiration** is the exchange of gases at the cells within all the organs of the body. In this process, oxygen passes out of the bloodstream and is carried by the blood back to the lungs to be exhaled.

Anatomy and physiology of respiration

Air enters the body through the **nose** and passes through **the nasal cavity** , which is lined with a mucous membrane and fine hairs (**cilia**) to help filter out foreign bodies, as well as to warm and moisten the air. **Paranasal sinuses** are hollow air-containing spaces within the skull that communicate with the nasal cavity. They, too, have a mucos membrane lining and function to provide the lubricating fluid mucus, as well as to lighten the bones of the skull and help produce sound.

After passing through the nasal cavity, the air next reaches the **pharynx (throat)** . There are three divisions of the pharynx. The **nasopharynx** is the first division, and is the nearest to the nasal

cavities. It contains the **pharyngeal tonsils**, or **adenoids**, which are collections of lymphatic tissue. They are more prominent in children, and if enlarged, can obstruct air passageways. Below the nasopharynx and closer to the mouth is the second division of the pharynx, the **oropharynx**. The **palatine tonsils**, two rounded masses of lymphatic tissue, are located in the oropharynx. The third division of the pharynx is the **laryngopharynx**. It is in this region that the pharynx divides into two branches the **larynx (voice box)** and the **esophagus**.

The esophagus leads into the stomach and carries food to be digested. The larynx contains the vocal cords and is surrounded by pieces of cartilage for support. The thyroid cartilage is the largest and is commonly referred to as the Adam's apple. Sounds are produced as air is expelled past the vocal cords, and the cords vibrate. The tension of the vocal cords determines the high or low pitch of the voice.

A leaf-shaped structure in the larynx, the **epiglottis**, seals off the air passage to the lungs during swallowing. This structure insures that food or liquids do not obstruct the flow of air and thus cause the individual to choke. The epiglottis is attached to the root of the tongue and acts like a lid over the larynx.

On its way to the lungs, air passes from the larynx to the **trachea (windpipe)**, a vertical tube about 4 and 1/2 inches long and one inch in diameter. The trachea is kept open by 16-20 C-shaped rings of cartilage separated by fibrous connective tissue that stiffen the front and sides of the tube.

In the region of the **mediastinum**, the trachea divides into two branches called **bronchial tubes**, or **bronchi** (sing: bronchus). Each bronchus leads to a separate **lung** and divides and subdivides into smaller and finer tubes, somewhat like the branches of a tree.

The smallest of the bronchial branches are called **bronchioles**. At the end of the bronchioles are clusters of air sacks called **alveoli** (singular: **alveolus**). Each alveolus is made of a one-cell layer of epithelium. The very thin wall allows for the exchange of gases between the alveolus and the **capillary** that surrounds and comes in close contact with it. The blood that flows through the capillaries accepts the oxygen from the alveolus and deposits carbon dioxide into the alveolus to be exhaled.

Each lung is enveloped in a double-folded membrane called the **pleura**. The outer layer of the pleura, nearest the ribs, is the **parietal pleura**, and the inner layer, closest to the lungs, is the **visceral pleura**. The pleura is moistened with a serous (thin, watery fluid) secretion that facilitates the movements of the lungs within the chest (thorax).

The two lungs are not quite mirror images of each other. The right lung, which is the slightly larger of the two, is divided into three **lobes** and the left lung is divided into two lobes. It is possible for one lobe of the lung to be removed without damage to the rest, which can continue to function normally. The uppermost part of the lung is called the **apex**, and the lower area is the **base**. The **hilum** or **hilus** of the lung is the midline region where blood vessels, nerves, lymphatic tissue, and bronchial tubes enter and exit the region.

The lungs extend from the collarbone to the **diaphragm** in the thoracic cavity. The diaphragm is a muscular partition that separates the thoracic from the abdominal cavity and aids in the process of breathing. The diaphragm contracts and descends with each **inhalation (inspiration)**. The downward movement of the diaphragm enlarges the area in the thoracic cavity and reduces the internal air pressure, so that air flows into the lungs to equalize the pressure. When the lungs are full, the diaphragm relaxes and elevates, making the area in the thoracic cavity smaller, and thus increasing the air pressure within the thorax. Air then is expelled out of the lungs to equalize the pressure; this is called **exhalation (expiration)**.

Pathway of air from the nose to the capillaries of the lungs

NOSE
I
NASAL CAVITY AND PARANASAL
SINUSES
I
PHARYNX
I
LARYNX
I
TRACHEA
I
BRONCHI

I
BRONCHIOLES
I
ALVEOLI
I
LUNG CAPILLARIES
(bloodstream)

COMBINING FORMS, SUFFIXES, AND TERMINOLOGY

<u>Combining form</u>	<u>Meaning</u>	<u>Terminology</u>
capn/o	carbon dioxide	hypercapnia _____ _____
coni/o	dust	pneumoconiosis _____ _____
cyan/o	blue	cyanosis _____ _____
lob/o	lobe of the lung	lobectomy _____ _____
orth/o	straight, upright	orthopnea _____ _____
ox/o	oxygen	hypoxia _____ _____
pector/o	chest	expectoration _____ _____
phon/o	voice	dysphonia _____ _____
phren/o	diaphragm	phrenic nerve _____ _____
pneum/o	lung, air	pneumothorax _____ _____
pneumon/o	“	pneumonitis _____ _____
pulmon/o	“	pulmonary _____ _____
rhin/o	nose	rhinoplasty _____ _____
spir/o spirometer _____	breathing	_____
tel/o	complete	atelectasis _____ _____
thorac/o	chest	thoracic _____ _____

Suffixes

-ema	condition	empyema _____
-osmia	smell	anosmia _____
-pnea	breathing	apnea _____
-ptysis	spitting	hemoptysis _____
-sphyxia	pulse	asphyxia _____
-thorax	chest, pleural cavity	hemothorax _____

DIAGNOSTIC AND PATHOLOGICAL TERMS

auscultation	Listening to sounds within the body.
percussion	Tapping on a surface to determine the difference in the density of the underlying structures.
pleural rub	Sound of pleural surfaces rubbing against each other.
rales (crackles)	Abnormal crackling sound heard during inspiration when there is fluid, pus, or blood in the alveoli .
sputum	Material expelled from the chest.
stridor	A strained, high-pitched, noisy sound made on inspiration .
wheezes	Musical sounds usually heard during expiration as in asthma or bronchitis.

Pathological terms

croup	Acute respiratory syndrome in children and infants.
diphtheria	Acute infection of the throat and upper respiratory tract.
epistaxis	Nosebleed.
pertussis	Bacterial infection of the pharynx, larynx, and trachea. Known as whooping cough.
asthma	Spasm and narrowing of bronchi.
bronchiectasis	Chronic dilation of a bronchus.
bronchogenic carcinoma	Cancerous tumors arising from a bronchus; lung cancer
chronic bronchitis	Inflammation of the bronchi that persists for a long time.
cystic fibrosis	Inherited disease of exocrine glands that leads to airway obstruction.

Lung Disorders

atelectasis	Incomplete expansion of alveoli
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emphysema	Hyperinflation of air sacs.
pneumoconiosis	Abnormal condition caused by dust in the lungs.
pneumonia	Acute inflammation and infection of alveoli

CARDIOVASCULAR SYSTEM

The cardiovascular system is composed of the heart, and blood vessels. The heart is a hollow muscular organ lying in the mediastinum, the center of the thoracic cavity located between the lungs. It pumps blood to body cells through a vast network of blood vessels. Blood returns to the heart, again through blood vessels, to begin the cycle again.

Three major types of vessels, **arteries**, **capillaries**, and **veins**, carry blood throughout the body. Each type of vessels differs in structure, depending on its function.

Arteries carry blood from the heart to body tissues and organs. Blood is propelled through arteries by the pumping action of the heart. Consequently, arterial walls are thick and muscular and capable of expanding to accommodate the surge of blood that results when the heart contracts. The surge of blood felt in the arteries when blood is pumped from the heart is referred to as a **pulse**. Arterial blood (except for that found in the pulmonary artery) contains a high concentration of oxygen. It appears bright red and is said to be **oxygenated**. Oxygenated blood travels to smaller vessels called **arterioles** (little arteries) and finally to the smallest vessels, the **capillaries**.

Capillaries are microscopic vessels that join the arterial system with the venous system. Although seemingly the most insignificant of the three vessel types because of their microscopic size, the capillaries are functionally the most important. Capillary walls are composed of a single layer of cells. The thinness of their walls and differences in pressure make it possible for substances, including gases, to pass quite readily into and out of the vessels. Consequently, the primary function of the vascular system, that of providing cells with vital products and removal of waste products, occurs at the capillary level. The vast number of capillaries makes their combined diameter so great that blood flows through them very slowly. The slow movement of blood through capillaries allows sufficient time for delivery of vital products and removal of waste from the surrounding tissues.

Veins return blood to the heart. They are formed from smaller vessels called **venules** (small veins), which develop from the union of capillaries. Because the extensive network of capillaries throughout the body absorbs the propelling pressure exerted by the heart, blood in the veins use other methods to return to the heart, including:

- Skeletal muscle contraction
- Gravity
- Respiratory activity
- Valves

Valves are small structures within veins that prevent the backflow of blood. Valves are especially important for returning blood from the legs to the heart because blood must travel a long distance against the force of gravity to reach the heart.

Blood carried in the veins (except for the blood in the pulmonary veins) contains a low concentration of oxygen(deoxygenated) with a corresponding high concentration of carbon dioxide. Deoxygenated blood takes on a characteristic purple colour.

The heart has three distinct tissue layers and is contained in a sac called **pericardium**.

- The **endocardium**, a serous membrane that lines the four chambers of the heart and its valves and is continuous with the arteries and veins.
- The **myocardium**, the muscular layer of the heart

- The **epicardium** , the outermost layer of the heart

The heart is divided into four chambers: **right atrium, right ventricle, left atrium, and left ventricle**. The two upper chambers, the atria, collect blood; the two lower chambers, the ventricles, pump blood from the heart. The right side of the heart provides for the oxygenation of blood (pulmonary circulation), and the left side is responsible for the transportation of blood to body systems (systemic circulation).

Deoxygenated blood returns to the heart by way of two large veins: the **superior vena cava**, which collects and carries blood from the upper part of the body; and the **inferior vena cava**, which collects and carries blood from the lower part of the body. The superior and inferior venae cavae (plural) deposit deoxygenated blood into the upper right chamber of the heart, the right atrium. From the right atrium, blood passes through the **tricuspid valve** to the right ventricle. During contraction of the ventricle, the tricuspid valve prevents a backflow of blood to the right atrium. When the heart contracts blood leaves the right ventricle by way of the **left pulmonary artery and right pulmonary artery** and travels to the lungs. On the way back oxygenated blood is carried to the heart by way of the **pulmonary veins**. They deposit blood in the left atrium. From here blood passes through the **bicuspid (mitral) valve** to the left ventricle. Upon contraction of the heart, the oxygenated blood leaves the left ventricle through the largest artery of the body, the **aorta**. Within the aorta is a valve called the **aortic semilunar valve** that permits blood to flow in only one direction- from the left ventricle to the aorta . The aorta branches into many smaller arteries that carry blood to all parts of the body. Some arteries derive their names from the organs or areas that they vascularize. For example, the splenic artery vascularize the spleen, and the renal artery vascularize the kidneys.

It's important to recognize that oxygen present in the blood passing through the chambers of the heart, cannot be used by the myocardium. Instead, an arterial system composed of the coronary arteries branches from the aorta and provides the myocardium with its own blood supply.

Conduction system of the heart

Within the heart is specialized cardiac tissue known as **conductive tissue**. Its sole function is the initiation and propagation (širenje) of contraction impulses. It consists of four masses of highly specialized cells:

- **Sinoatrial node (SA)**
- **Atrioventricular node (AV)**
- **Bundle of His(AV bundle)**
- **Purkinje fibers**

The SA node, located in the upper portion of the right atrium, possesses its own intrinsic rhythm. Without being stimulated by external nerves, it has the ability to initiate and propagate each heartbeat, thereby setting the basic pace for the cardiac rate. For this reason the SA node is known as the **pacemaker** of the heart.

Impulse transmission through the conduction system generates weak electrical currents that can be detected on the surface of the body. These electrical impulses can be recorded on an instrument called an **electrocardiograph**.

Blood pressure

Blood pressure measures the force exerted by blood against the arterial walls during two phases of a heartbeat: the contraction phase, called **systole**, when the blood is forced out of the heart; and the relaxation phase, called **diastole**, when the ventricles are filling with blood.

Combining forms and terminology

angi/o	vessel	angiogram _____
ather/o	yellowish plaque	atherosclerosis _____

brachi/o	arm	brachial artery _____
cardi/o	heart	cardiomegaly _____
coron/o	heart	coronary arteries _____
cyan/o	blue	cyanosis _____
ox/o	oxygen	hypoxia _____
phleb/o	vein	phlebotomy _____
sphygm/o	pulse	sphygmomanometer _____
steth/o	chest	stethoscope _____ auscultation – listening with a stethoscope
vas/o	vessel	vasoconstriction _____
vascul/o	vessel	vascular

Pathological Conditions: The Heart and Blood Vessels

arrhythmias	Abnormal heart rhythms
1 heart block	Failure of proper conduction of impulses
2 flutter	Rapid but regular contractions of atria or ventricles (up to 300 beats)
3 fibrillation	Rapid, random, ineffectual, and irregular contractions of the heart (350 beats or more per minute)
congenital heart disease	Abnormalities in the heart at birth
1 coarctation of the aorta	Narrowing of the aorta
2 patent ductus arteriosus (PDA)	A small duct between the aorta and the pulmonary artery, which normally closes after birth, remains open (patent).
3 septal defects	Small holes in the septa between the atria or the ventricles
4 tetralogy of Fallot/fa-lou/	A congenital malformation of the heart involving four distinct defects 1 Pulmonary artery stenosis 2 Ventricular septal defect 3 Shift of the aorta to the right 4 Hypertrophy of the right ventricles
congestive heart failure	The heart is unable to pump its required amount of blood

coronary artery disease (CAD)	Disease of the arteries surrounding the heart
atherosclerosis	The deposition of fatty compounds on the inner lining of the coronary arteries
thrombotic occlusion	Blocking of the coronary artery by a clot
ischemia	Blood flow is decreased or stopped
necrosis	Death of a part of an organ
infarction	The area of dead myocardial tissue
myocardial infarction – heart attack - MI	
angina pectoris	An episode of chest pain
coronary artery bypass grafting or CABG graft – transplant	Surgical treatment of CAD
endocarditis	Inflammation of the inner lining of the heart caused by bacteria
hypertensive heart disease	High blood pressure affecting the heart
mitral valve prolapse(MVP)	Improper closure of the mitral valve when the heart is pumping blood
murmur	An extra heart sound, heard between normal beats.
pericarditis	Inflammation of the membrane surrounding the heart.
rheumatic heart disease	Heart disease caused by rheumatic fever
Blood vessels	
aneurysm	Local widening of an artery
peripheral vascular disease	Blockage of blood vessels(arteries) in the lower extremities
Raynaud phenomenon / rei 'nou/	Short episodes of pallor and numbness in the fingers and toes.
varicose veins	Abnormally swollen and twisted veins, usually in the legs

BLOOD SYSTEM

I Introduction

The primary function of blood is to maintain a constant environment for the other living tissues of the body. Blood transports foods, gases, and wastes to and from the cells of the body. Food, digested in the stomach and small intestine, passes into the bloodstream through the lining cells of the small intestine. Blood then carries these nutrients to all body cells. Oxygen enters the body through the air sacs of the lungs. Blood cells then transport the oxygen to cells throughout the body. Blood also helps remove the waste products released by cells. It carries gaseous waste (such as carbon dioxide) to the lungs to be exhaled. It carries solid waste such as urea, to the kidneys to be expelled in the urine. Blood transports chemical messengers called hormones from their sites of secretion in glands, such as the thyroid or pituitary, to distant sites where they regulate growth, reproduction, and energy production. Finally, blood contains proteins and white blood cells that fight infection, and platelets (thrombocytes) that help the blood to clot.

II Composition and Formation of Blood

Blood is composed of **cells**, or formed elements, suspended in a clear, straw-colored liquid called **plasma**. The cells constitute 45 percent of the blood volume and include **erythrocytes** (red blood cells), **leucocytes** (white blood cells), and **platelets** or **thrombocytes** (clotting cells). The remaining 55 percent of blood is plasma, a solution of water, proteins, sugar, salts, hormones, and vitamins.

Cells

Beginning at birth all blood cells originate in the marrow cavity of bones. Both the red blood cells that carry oxygen and the white blood cells that fight infection arise from the same blood-forming or hematopoietic **stem cells** (hematoblast). Under the influence of proteins in the bloodstream and bone marrow, stem cells change their size and shape to become specialized, or **differentiated**. In this process, the cells change in size from large (immature cells) to small (mature forms) and the cell nucleus shrinks (in red cells, the nucleus actually disappears).

Erythrocytes

As a red blood cell matures (from erythroblast to erythrocyte), it loses its nucleus and assumes the shape of a biconcave disk. This shape allows for a large surface area so that absorption and release of gases can take place. Red cells contain the unique protein **hemoglobin**, composed of **heme** (iron-containing pigment) and **globin** (protein). Hemoglobin enables the erythrocyte to carry oxygen. The combination of oxygen and hemoglobin produces red color of blood.

Erythrocytes originate in the bone marrow. A hormone called **erythropoietin** (secreted by the kidney) stimulates their production (-poiesis means formation). Erythrocytes live and fulfil their role of transporting gases for about 120 days in the bloodstream. After this time cells (called **macrophages**) in the spleen, liver, and bone marrow destroy the worn out erythrocytes. Two to ten million red cells are destroyed each second, but they are constantly replaced, the number of circulating cells remain constant (4 to 6 million in a drop of blood).

Macrophages break down erythrocytes and the hemoglobin within them into their heme and globin portions. The heme releases iron and decomposes into a yellow/orange pigment called bilirubin. The iron in hemoglobin is reutilized to form new red cells or is stored in the spleen, liver, or bone marrow. Bilirubin is excreted into bile by the liver, and from bile it enters the small intestine, where it is excreted in the stool. Its color then turns brown in the stool.

Leucocytes

White blood cells (7000 to 9000 cells per L) are less numerous than erythrocytes, but there are five types of mature leukocytes: three polymorphonuclear granulocytic leukocytes (basophil, neutrophil, and eosinophil) and two mononuclear agranulocytic leukocytes (monocytes and lymphocytes)

The **granulocytes** or **polymorphonuclear leukocytes**, are the most numerous (about 60 percent).

Basophils containing dark staining granules that stain with a basic (alkaline) dye. The granules contain heparin (an anticlotting substance) and histamine(a chemical released in allergic responses).

Eosinophils contain granules that stain with eosin, a red acidic dye.**Neutrophils** contain granules that are neutral; they do not stain intensely with either acidic or basic dye. Neutrophils are **phagocytes** (phag/o means to eat or swallow) that accumulate at sites of infection, where they ingest and destroy bacteria.

Mononuclear (containing one large nucleus) leukocytes do not have large numbers of granules in their cytoplasm, but they may have a few granules. These are **lymphocytes** and **monocytes**. Lymphocytes are made in lymph nodes and circulate both in the bloodstream and in the parallel circulatory system, the lymphatic system.

Lymphocytes play an important role in the **immune** system that protects the body against infections. They can directly attack foreign matter and , in addition, make **antibodies**, which neutralize and can lead to the destruction of foreign **antigens** (bacteria and viruses). Monocytes are phagocytic cells that also fight diseases.

Platelets

Platelets or thrombocytes, are formed in red bone marrow from giant cells with multilobed nuclei called **megakaryocytes** . Tiny fragments of a megakaryocyte break off to form platelets. The main function of platelets is to help blood to clot.

Plasma

Plasma, the liquid part of the blood, consists of water, dissolved proteins, sugar, wastes, salts, hormones, and other substances. The four major plasma proteins are **albumin, globulins, fibrinogen, and prothrombin** (the last two are clotting proteins).

Albumin maintains the proper proportion of water in the blood.

Globulins are another part of blood containing plasma proteins. These are alpha, beta, and gamma globulins. The gamma globulins are **immunoglobulins**, which are antibodies that bind to and sometimes destroy antigens (foreign substances). Immunoglobulins are separated from other plasma proteins by **electrophoresis**. In this process, an electric current passes through a solution of plasma. The different proteins in plasma separate as they migrate at different speeds to the source of the electricity.

Plasmapheresis (-apheresis means to remove) is the process of separating plasma from cells and then removing the plasma from the patient. In plasmapheresis the entire blood sample is spun in a centrifuge machine, and the plasma, being lighter in weight than the cells, moves to the top of the sample.

III Blood Groups

Transfusions of “whole blood” (cells and plasma) are used to replace blood lost after injury, during surgery, or in severe shock. A patient who is severely anemic and needs only red blood cells will receive a transfusion of packed red blood cells. Human blood falls into four main groups: A, B, AB, and O. There are harmful effects of transfusing blood from a donor of one blood group into a recipient who has blood of another blood group. Therefore, before blood is transfused, both the blood donor and the blood recipient are tested to be certain that the transfused blood will be compatible with the recipient.

Each of the blood groups has a specific combination of factors called **antigens** and **antibodies**. Blood group antigens are inherited, and antibodies are acquired by six months of age after exposure to antigens. The antigen and antibody factors of blood groups are

Type A, containing **A antigen** and **anti-B antibody**

Type B, containing **B antigen** and **anti-A antibody**

Type AB, containing **A and B antigens** and **no anti-A or anti-B antibodies**

Type O, containing **no A or B antigens** and **both anti-A and anti-B antibodies**

The problem in transfusing blood from a type A donor into a type B recipient is that A antigens (from

the A donor) will react adversely with the anti-A antibodies in the recipient's type B bloodstream. The accidental adverse reaction is hemolysis, or breakdown (raspadanje) of blood cells. Intravascular hemolysis may lead to **disseminated intravascular coagulation (DIC)**, a serious coagulopathy. Similar problems can occur in other transfusions if the donor's antigens are incompatible with the recipient's antibodies.

People with type O blood are known as universal donors because their blood contains neither A nor B antigens. Those with type AB blood are known as universal recipients because their blood contains neither anti-A nor anti-B antibodies.

Besides A and B antigens, many other antigens are located on the surface of red blood cells. One of these is called **Rh factor** (named because it was first found in the blood of a rhesus monkey). The term Rh-positive refers to a person who is born with the Rh antigen on her or his red blood cells. An Rh-negative person does not have the Rh antigen. There are no anti-Rh antibodies normally present in the blood of an Rh-positive or an Rh-negative person. However if Rh-positive blood is transfused into an Rh-negative person, the recipient may, but not always, begin to develop antibodies that would cause hemolysis of Rh-positive blood if another transfusion were to occur subsequently.

The same reactions occur during pregnancy if the fetus of an Rh-negative woman happens to be Rh-positive. This situation is an example of an antigen-antibody reaction.

IV Blood Clotting

Blood clotting or **coagulation**, is a complicated process involving many different substances and chemical reactions. The final result is the formation of a **fibrin clot** from the plasma protein **fibrinogen**.

Platelets are important in beginning the process following injury to tissues or blood vessels. The platelets clump or aggregate, at the site of injury. Then in combination with a protein tissue factor, other clotting factors and calcium promote the formation of a fibrin clot. One of the clotting factors is clotting factor VIII. It is missing in some people who are born with hemophilia. Other hemophiliacs are missing factor IX. The fibrin threads form the clot by trapping red blood cells and platelets and plasma. Then the clot retracts into a tight ball, leaving behind a clear fluid called serum. Normally, clots (thrombi) do not form in blood vessels unless the vessel is damaged or the flow of blood is impeded. Anticoagulant substances in the bloodstream inhibit blood clotting, so thrombi and emboli (floating clots) do not form. **Heparin**, produced by tissue cells (especially in the liver), is an anticoagulant.

V Combining forms, suffixes and terminology

chrom/o	color	hypochromic _____
eosin/o	red, rosy, dawn	eosinophil _____
is/o	same, equal	anisocytosis _____
morph/o	shape, form	morphology _____
myel/o	bone marrow	myelogenous _____
phag/o	eat, swallow	phagocyte _____
poikil/o	varied, irregular	poikilocytosis _____
sider/o	iron	sideropenia _____
sphere/o	globe, round	spherocytosis _____
Suffixes		
-apheresis	removal	plasmapheresis _____
-blast	immature	erythroblast _____
-cytosis	cell	macrocytosis _____

-lytic	pertaining to destruction	thrombolytic therapy _____
-oid	resembling	myeloid _____
-penia	deficiency	granulocytopenia _____
-phage	eat, swallow	macrophage _____
-philia	attraction for (an increase in cell numbers)	eosinophilia _____
-phoresis	carrying, transmission	electrophoresis _____
-poiesis	formation	erythropoiesis _____
-stasis	stop, control	hemostasis _____

VII Pathological Conditions

Diseases of red blood cells

Anemia

Deficiency of erythrocytes or hemoglobin

The most common type of anemia is **iron-deficiency anemia**

- 1. aplastic anemia** Failure of blood cell production due to aplasia (absence of development, formation) of bone marrow cells.
 - 2. hemolytic anemia** Reduction of red cells due to excessive destruction.
 - 3. pernicious anemia** Lack of mature erythrocytes caused by inability to absorb vitamin B 12 into the body.
 - 4. sickle cell anemia** A hereditary condition characterized by abnormal shape of erythrocytes and by hemolysis.
 - 5. thalassemia** An inherited defect in the ability to produce hemoglobin, usually seen in persons of Mediterranean background.
- hemochromatosis** Excess iron deposits throughout the body.
Hepatomegaly, skin pigmentation, diabetes, and cardiac failure may occur

polycythemia vera General increase in red blood cells (erythremia)

Disorders of blood clotting

- hemophilia** Excessive bleeding caused by hereditary lack of one of the protein substances (factor VIII or IX) necessary for blood clotting.
- purpura** Multiple pinpoint hemorrhages and accumulation of blood under the skin.

Diseases of White Blood Cells

- leukemia** An increase of cancerous white blood cells
1. Acute myelogenous (myelocytic) leukemia (AML)
 2. Acute lymphocytic leukemia (ALL).
 3. Chronic myelogenous leukemia (CML)
 4. Chronic lymphocytic leukemia (CLL)

All forms of leukemia are treated by chemotherapy.

granulocytosis Abnormal increase in granulocytes in the blood.

mononucleosis An infectious disease marked by increased number of leukocytes and enlarged cervical lymph nodes.

Diseases of Bone Marrow Cells multiple myeloma Malignant neoplasm of bone marrow.

Endocrine glands -Combining forms, Suffixes, Prefixes

Andr/o	male	androgen – produced by the testis in males and adrenal Cortex in males and females.
Calc/o	calcium	hypercalcemia _____
Crin/o	secrete	endocrinologist _____
Dips/o	thirst	polydipsia _____
Estr/o	female	estrogenic _____
Gluc/o	sugar	glucagon – agon means to assemble or gather together
Glyc/o	sugar	hyperglycemia _____ -
Home/o	sameness	homeostasis - stasis means to control.
Kal/I	potassium	hypokalemia _____
Myx/o	mucus	myxedema – mucus-like material accumulates under the skin.
Natr/o	sodium	hyponatremia _____
Phys/o	growing	hypophysectomy _____
Somat/o	body	somatotropin _____
Toc/o	childbirth	oxytocin -oxy means swift, rapid

Suffixes

-agon	assemble, gather	
-in; -ine	a substance	epinephrine _____
-tropin	stimulating the function of	adrenocorticotropin
-uria	urine condition	glycosuria _____

Abnormal conditions

Thyroid gland

Enlargement of the thyroid gland is **goiter**. **Endemic goiter** occurs in certain regions and peoples where there is a lack of iodine in the diet.

Another type of goiter is **nodular** or **adenomatous goiter**, in which hyperplasia occurs as well as nodules and adenomas.

Hyperthyroidism

Overactivity of the thyroid gland. The most common form of this

Condition is thyrotoxicosis of Graves disease (resulting from autoimmune processes). **Exophthalmos** (protrusion of the eyeballs)

Hypothyroidism **Underactivity of the thyroid gland.**

Myxedema This is advanced hypothyroidism in adulthood. Atrophy of the gland occurs

Cretinism Extreme hypothyroidism during infancy during infancy and childhood leads to a lack of normal physical and mental growth .

Neoplasms
thyroid carcinoma **Cancer of the thyroid gland**

Parathyroid Glands

Hyperparathyroidism **Excessive production of parathormone.**

Hypercalcemia occurs as calcium leaves the bones and enters the bloodstream, where it can produce damage to the kidneys and heart. Kidney stones can occur as a result of hypercalcemia.

Hypoparathyroidism **Deficient production of parathyroid hormone.**

Hypocalcemia results as calcium remains in bones and is unable to enter the bloodstream. This leads to muscle and nerve weakness with spasms of muscles, a condition called **tetany**.

Adrenal cortex

adrenal virilism **Excessive output of adrenal androgens.**

Adrenal hyperplasia or more commonly adrenal adenomas or carcinomas can cause **virilization** in adult women. Symptoms include amenorrhea, hirsutism, acne, and deepening of the voice.

Cushing syndrome **A group of syndromes produced by excess cortisol from the adrenal cortex.**

A number of signs and symptoms occur as a result of increased glucocorticoids, including obesity, moon-like fullness of the face, excess deposition of fat in the thoracic region of the back, (so-called buffalo hump), hyperglycemia, hypertension, hypokalemia, osteoporosis virilization, and hypertension.

Addison disease **Hypofunctioning of the adrenal cortex.**

Mineralocorticoids and glucocorticoids are produced in deficient amounts Hypoglycemia, hyponatremia, fatigue, weakness, weight loss, salt craving, low blood pressure and darker pigmentation of the skin are symptoms of the condition

Pheochromocytoma **Benign tumor of the adrenal medulla**

The tumor cells produce excess secretion of epinephrine and norepinephrine

Hyperinsulinism **Excess secretion of insulin causing hypoglycemia.**

Hypoglycemia occurs as insulin draws sugar out of the bloodstream.

Diabetes mellitus **Lack of insulin secretion or resistance of insulin in promoting sugar, starch and fat metabolism in cells**

Type 1 diabetes, With onset of usually in childhood. Patients require insulin injections daily.

Type 2 diabetes Patients are usually older, and obesity is very common Treatment is with diet.

Pituitary Gland

Acromegaly **Enlargement of the extremities caused by hypersecretion of the anterior pituitary after puberty.** An excess of growth hormone is produced that occurs during adulthood

Gigantism **Hyperfunctioning of the pituitary gland before puberty, leading to abnormal overgrowth of the body.**

Dwarfism **Congenital hyposecretion of growth hormone; hypopituitary dwarfism**
The children affected are mentally normal, but their bones remain small

Panypopituitarism **All pituitary hormones are deficient**
Tumors of the sella turcica as well as arterial aneurysms may be etiological factors

Syndrome of inappropriate ADH **Excessive secretion of antidiuretic hormone produces excessive water retention in the body**

Diabetes insipidus **Insufficient secretion of ADH causes the kidney tubules to fail to hold back (reabsorb) needed water and salts.**

THE NERVOUS SYSTEM

The nervous system is one of the most complicated systems in both structure and function. Along with

the endocrine system it controls many bodily activities that maintain a stable and suitable environment for all of the body cells – a situation known as **homeostasis**.

The nervous system senses changes in both the internal and external environment, interpretes these changes, and then coordinates responses that maintain homeostasis. **The central nervous system CNS** is composed of the brain and spinal cord. These structures receive, coordinate and transmit nervous impulses

The peripheral nervous system PNS is composed of all other nervous tissue found outside of the CNS. It includes 12 pairs of cranial nerves, which emerge from the base of the skull, and 31 pairs of spinal nerves which emerge from the spinal cord. These nerves can be sensory or motor, or a mixture of both sensory and motor fibers.

Sensory nerves receive impulses from the sense organs, such as the eyes, ears, nose, tongue, and skin and transmit them to the CNS. These sensory nerves are also known as **afferent nerves**, because they conduct impulses toward a specific site, the central nervous system.

Motor nerves conduct impulses away from the CNS, thus they are known as **efferent nerves**. These impulses travel to muscles and other body organs causing them to respond to some manner. If these response is under the control of the individual, such as walking or talking, the impuls is relayed by voluntary or somatic nerves. If the respons is involuntary or nonthinking, such as digesting food or secreting hormones, the impulse is relayed by autonomic nerves.

Nerves composed of both sensory and motor fibers are called **mixed nerves**. For example, when the facial nerve supplies the facial muscle with motor impulses, such as for smiling or frowning, it is functioning as a motor nerve. But when the tongue transmits a taste impuls to the brain, the facial nerve is functioning as a sensory nerve.

The **autonomic nervous system** is responsible for the control of the internal environment; heart rate, peristaltic movement of the stomach and intestines, constriction of the iris, and other involuntary activities This system is composed of a **sympathetic** and **parasympathetic** division. The two divisions are largely antagonistic to each other, although in certain instances they exhibit independent activity. Generally, sympathetic nerves initiate or accelerate an autonomic function, and parasympathetic nerves decelerate or stop the initiated activity. For example, in situations of fear and fright, sympathetic nerve fibers produce vasoconstriction and an increased heart rate and depress gastrointestinal activity. When the danger is passed, the parasympathetic system conveys impulses to bring about vasodilation, a slower heart rate, and a return to normal gastrointestinal activity.

NERVOUS TISSUE

In spite of its complexity, the nervous system is composed of only two principal types of nerve cells, **neurons** and **neuroglia**. Neurons, the functional cells of the nervous system, are responsible for impulse conduction. All neural circuits are composed of neuron chains. In contrast to neurons, neuroglia does not transmit impulses. It is specialized nervous tissue that functions as connective tissue that supports and binds neurons. During infection, neuroglia is capable of performing certain phagocytic activity.

Neurons

Neurons consist of three major sections: the dendrites, which receive impulses and transmit them to the cell body; the cell body, which contains the cell nucleus; and the axon, a long single projection, which transmits the impulse from the cell body. Many axons in both the PNS and CNS are covered with a white, lipid sheath called myelin. This wrapping accelerates the impulse that travel down the axon. The presence of myelin on axons in the brain and spinal cord gives a white appearance to these structures and makes up what is called **the white matter** of the CNS. Unmyelinated fibers, dendrites, and nerve cell bodies make up **the grey matter**. On peripheral nerves, a thin cellular membrane called **neurolemma**, or **neurolemmal sheath (Schwann's)** wraps around the myelin sheath. The neurolemmal sheath may allow a damaged axon to regenerate. Since no neurolemma can be found in the

CNS, injured nerves in the system cannot regenerate. Their nerve function is permanently lost.

Neurons are not continuous with one another. Instead, a small space known as a synapse is found between the axon of one neuron and the dendrite or cell body of another. In order for the impulse to travel along a nerve path, the impulse must be transmitted at the synapse. This transmission is facilitated by certain chemical substances called **neurotransmitters**.

Neuroglia

The term neuroglia literally means nerve glue. It was once believed that neuroglia served only a supporting role for neurons. But it is now known that different shaped neuroglia cells perform many other functions. **Astrocytes**, as their name suggests, are star-shaped neuroglia and are believed to be involved in the transfer of substances from the blood to the brain. **Oligodendroglia** are cells with only a few processes. They are believed to help in the development of myelin on neurons of the CNS. **Microglia**, the smallest of the neuroglia, possess phagocytic properties and may become very active during times of infection.

The Brain

In addition to being one of the largest organs of the body, the brain is also the most complex in structure and function. It integrates almost every physical and mental activity of the body. This organ is also the center for memory, emotion, thought, judgement, reasoning and consciousness.

The brain is composed of four major sections: **The cerebrum, cerebellum, diencephalon(interbrain), and brain stem**.

The cerebrum is the largest and uppermost portion of the brain. It consists of two hemispheres divided by a deep longitudinal **fissure** or **groove**. The fissure does not completely separate the hemispheres. A structure called the corpus callosum joins them medially on their inferior surfaces. Each hemisphere is further divided into five lobes. Four of these lobes are named after the bones that lie directly above them.

A fifth lobe of the cerebrum is hidden from view and can only be seen upon dissection.

Numerous **fol**ds or **convolutions**, called **gyri**(sing. gyrus) are found in the cerebrum surface. These are separated by **furrows** called **fissures** or **sulci** (sing. sulcus). A thin layer of grey matter called the cerebral cortex, composed of millions of cell bodies, covers the entire cerebrum and is responsible for its grey colour.

The remainder of the cerebrum is composed primarily of white matter (myelinated axons). Major functions of the cerebrum include sensory receptions and interpretation, muscular movement, and the emotional aspects of behaviour and memory.

The second largest part of the brain, the **cerebellum**, occupies the back portion of the brain. It is attached to the brain stem. When the cerebrum initiates muscular movement, the cerebellum coordinates and refines the movement. The cerebellum also maintains the equilibrium or balance of the body.

The **diencephalon**, or interbrain, is composed of many smaller structures, two of which are the **thalamus** and the **hypothalamus**. All sensory stimuli, except olfactory, are received by the thalamus. Here they are processed and transmitted to the proper area of the cerebral cortex. In addition, impulses from the cerebrum are received by the thalamus and relayed to efferent nerves. Beneath the thalamus is a small structure, the **hypothalamus**. Its chief function is the integration of autonomic nerve impulses and the regulation of the certain endocrine functions. The **brain stem** completes the last major section of the brain. It is composed of three structures: the medulla oblongata, the pons, and the midbrain(mesencephalon). In general, the brain stem serves as a pathway for impulse conduction between the brain and the spinal cord. The brain stem also serves as the origin for 10 of the 12 cranial nerves.

Spinal cord

The spinal cord conveys to the brain sensory impulses from different parts of the body and also transmits impulses from the brain to all muscles and organs. The sensory nerve tracts are also called *ascending tracts*, since the direction of the impulse is upward. Conversely, motor nerve tracts that relay

motor impulses to muscles and organs are called *descending tracts*, since they carry impulses in a downward direction. A cross-section of the spinal cord reveals an inner gray area composed of cell bodies and dendrites, with an outer area composed of the myelinated tissue of the ascending and descending tracts.

The entire spinal cord is located within the spinal cavity of the vertebral column. Thirty-one pairs of spinal nerves exit from between the intervertebral spaces almost throughout the entire length of the spinal column. Unlike the cranial nerves, which have specific names, the spinal nerves are known by the region of the vertebral column from which they exit.

Meninges

Both the brain and the spinal cord are protected against injury by bones. The brain is enclosed within the skull and the spinal cord is enclosed within the vertebral column. In addition, both the brain and the spinal cord receive limited protection from a set of three coverings called *meninges*. The outermost coat, *the dura mater*, is tough and fibrous. Immediately beneath the *dura mater* is a cavity called *the subdural space*. It is filled with serous fluid. The next layer of the meninges is the *arachnoid*. As its name suggests, the arachnoid has a spider-web appearance. A *subarachnoid* space filled with *cerebrospinal fluid*, provides additional protection for the brain and spinal cord by acting as a shock absorber. Finally, the innermost layer, the *pia mater*, contains numerous blood vessels and lymphatics, which provide nourishment for the underlying tissue.

Cerebrospinal fluid circulates around the spinal cord and the brain and through spaces called *ventricles*. These ventricles are located within the inner portion of the brain.

Disorders and Pathological conditions of the Nervous System

Congenital Disorders

Hydrocephalus - Abnormal accumulation of fluid (CSF) in the brain

Spina bifida - Congenital defect in the lumbar spinal column caused by imperfect union of vertebral parts (neural tube defect).

Alzheimer's disease- Brain disorder marked by deterioration of mental capacity beginning at middle age. This disorder develops gradually, and early signs are loss of memory for recent events followed by impairment of judgement, comprehension, and intellect. There is as yet no effective treatment.

Amyotrophic lateral sclerosis(ALS) - Degenerative disease of motor neurons in the spinal cord and brainstem.

It presents in adulthood and affects men more often than women. Symptoms are weakness and atrophy of muscles in the hands, forearms, and legs, followed by difficulty in swallowing, talking, and dyspnea as the respiratory muscles become affected.

Epilepsy - Chronic brain disorder characterized by recurrent seizure activity

A seizure is an abnormal, sudden excessive discharge of electrical activity within the brain. **Tonic-clonic seizure (ictal events)** are characterized by a sudden loss of consciousness, falling down, and then tonic contractions (stiffening of muscles) followed by clonic contractions (twitching and jerking movements of the limbs). These convulsions are often preceded by an **aura**, which is a peculiar sensation appearing before more definite symptoms. Dizziness, numbness, or visual disturbances are examples of an aura. **Absence seizure** are a minor form of seizure consisting of momentary clouding of consciousness and loss of contact with the environment.

Huntington disease Hereditary nervous disorder caused by degenerative changes in the cerebrum and involving bizarre, abrupt, involuntary, dance like movements.

Multiple sclerosis (MS) Destruction of the myelin sheath on neurons in the CNS and its replacement by plaques of sclerotic (hard) tissue. Demyelination prevents the conduction of nerve impulses through the axon and causes paresthesias, muscle weakness, unsteady gait (manner of walking) and paralysis.

Myasthenia gravis Neuromuscular disorder characterized by weakness (-asthenia) of voluntary muscles (attached to bones). It is a chronic autoimmune disorder. Antibodies block the ability of acetylcholine (neurotransmitter) to transmit the nervous impulse from nerve to muscle cell. Normal muscle contractions fail to occur. Onset of symptoms is usually gradual with ptosis of the upper eyelid, double vision (diplopia) and facial weakness.

Palsy – Paralysis

Cerebral palsy – is partial paralysis and lack of muscular coordination caused by loss of oxygen or blood flow to the cerebrum during gestation or perinatal period. **Bell palsy** is paralysis on one side of the face. Etiology is likely infection with a virus.

Parkinson disease - Degeneration of nerves in the basal ganglia, occurring in later life and leading to tremors, weakness of muscles, and slowness of movements.

INFECTIOUS DISORDERS

Herpes zoster – Viral infection affecting peripheral nerves.

Meningitis - Inflammation of meninges; leptomeningitis.

Human immunodeficiency virus (HIV) encephalopathy – Brain disease and dementia occurring with AIDS.

NEOPLASTIC DISORDERS

Brain tumors – Abnormal growths of brain tissues and meninges

TRAUMATIC DISORDERS

Cerebral concussion – Temporary brain dysfunction after injury, usually clearing within 24 hours. There is no evidence of structural damage to the brain.

Cerebral contusion - Bruising of brain tissues as a result of direct trauma to the head; neurological deficits persist more than 24 hours. It is usually associated with a fracture of the skull.

VASCULAR DISORDERS

Cerebrovascular accident (CVA) - disruption in the normal blood supply to the brain; stroke. This condition is also known as cerebral infarction. There are three types of strokes

1. **Thrombotic** – blood clot in the arteries leading to the brain resulting in **occlusion** (blocking) of the vessel.
2. **Embolic** – an embolus (a dislodged thrombus) travels to cerebral arteries and occludes a

small vessel. This type of stroke occurs very suddenly.
3. **Hemorrhagic** – a blood vessel, such as the cerebral artery, breaks and bleeding occurs.

The major risk factors for stroke are hypertension, diabetes, smoking and heart disease. Other risk factors include obesity, substance abuse (cocaine), and elevated cholesterol levels.

COMBINING FORMS AND TERMINOLOGY

lept/o - thin, slender - leptomeningitis - the pia and arachnoid membranes are known as the leptomeninges.

my/o - muscle - myoneural - _____

myel/o - spinal cord - myelogram - _____

pont/o - pons - cerebellopontine - _____

radicul/o - nerve root(of spinal nerves) – radiculopathy _____

thec/o - sheath(refers to the meninges) – intrathecal injections _____

algos/o - excessive sensitivity to pain – analgesia- _____
- algesia - - hypalgesia- _____

caus/o – burning - causalgia- _____

comat/o – deep sleep - comatose
Coma

esthesi/o – feeling, nervous sensation - anesthesia - _____
-esthesia nervous sensation – ž

kines/o - movement - bradykinesia - _____
-kinesia
-lepsy - seizure - epilepsy - _____

lex/o - word, phrase - dyslexia _____

-paresis – slight paralysis(weakness)- hemiparesis _____

-phasia - speech - aphasia _____

-plegia - paralysis - hemiplegia _____
paraplegia _____
quadriplegia _____

-praxia – action - apraxa _____

-sthenia – strength - neurasthenia _____

syncop/o – to cut off - syncopal _____

tax/o - order, coordination – ataxia _____

Sense Organs : The Eye and the Ear

Introduction

The eye and the ear are sense organs, like the skin, taste buds, and olfactory (centers of smell in the nose)regions. They provide information regarding the external environment The eye is the receptor for light stimulation and is responsible for vision. The ear is the receptor of sound stimulation and is responsible for hearing.

The eye

Light rays enter the dark center of the eye, the **pupil** . The **conjunctiva** is a membrane lining the inner surfaces of the eyelids and anterior portion of the eyeball over the white of the eye. The conjunctiva is clear and colorless except when blood vessels are dilated. Dust and smoke may cause the blood vessels to dilate and give the conjunctiva a reddish appearance, commonly known as bloodshot eyes. Before entering the eye through the pupil, light passes through the **cornea** . The cornea is a fibrous, transparent tissue that extends over the pupil and colored portion of the eye. The function of the cornea is to bend, or refract, the rays of light , so they are focused properly on the sensitive receptor in the posterior region of the eye. The normal, healthy cornea is avascular (has no blood vessels) but receives nourishment from blood vessels near its junction with the opaque white of the eye, the **sclera** . Corneal transplants for people with scarred or opaque corneas are successful because antibodies responsible for rejection of foreign tissue do not reach the avascular, transplanted corneal tissue. The sclera is a tough, fibrous, supportive, connective

tissue that extends from the cornea on the anterior surface of the eyeball to the optic nerve in the back of the eye.

The **choroid** is a dark brown membrane outside the sclera. It contains many blood vessels that supply nutrients to the eye. The choroid is continuous with the pigment-containing **iris** and the **ciliary body** on the anterior surface of the eye.

The iris is the colored (it can appear blue, green, hazel, gray, or brown) portion of the eye that surrounds the pupil. Muscles of the iris constrict the pupil in bright light and dilate the pupil in dim light, thereby regulating the amount of light entering the eye. The ciliary body on each side of the **lens**, contains muscles that adjust the shape and thickness of the lens. These changes in the shape of the lens cause **refraction** of light rays.

Refraction is the bending of rays as they pass through the cornea, lens, and other tissue. Muscles of the ciliary body produce flattening of the lens (for distant vision) and thickening and rounding (for close vision) .This refractory adjustment is **accommodation** .

Besides regulating the shape of the lens, the ciliary body also secretes a fluid called **aqueous humor**, which is found in the **anterior chamber** of the eye. Aqueous humor maintains the shape of the anterior portion of the eye and nourishes the structures in that region. The fluid is constantly produced and leaves the eye through a canal that carries it into the bloodstream. Another cavity of the eye is the **vitreous chamber**, which is a large region behind the lens filled with a soft, jelly-like material, the **vitreous humor**. Vitreous humor maintains the shape of the eyeball and is not constantly reformed. Its escape may result in significant damage to the eye, leading to blindness. Both the aqueous and the vitreous humors further refract light rays.

The **retina**, is the thin, delicate, and sensitive nerve layer of the eye. As light energy, in the form of waves, travels through the eye, it is refracted (by the cornea, lens and fluids) so that it focuses on sensitive receptor cells of the retina called the **rods** and **cones**. There are approximately 6.5 million cones and 120 million rods in the retina. The cones function in bright levels of light and are responsible for color and central vision.

There are three types of cones, each stimulated by one of the primary colors in light (red ,green ,or blue). Most cases of colour blindness affect either the green or the red receptors, so that the two colors cannot be distinguished from each other. Rods function at reduced levels of light and are responsible for peripheral vision.

Light energy, when focused on the retina, causes a chemical change in the rods and cones, initiating nerve impulses that then travel from the eye to the brain via the **optic nerve**. The region in the eye where the optic nerve meets the retina is called the **optic disc**. Because there are no light receptor cells in the optic disc, it is known as the blind spot of the eye.

The **macula** is a small ,oval, yellowish area to the side of the optic disc. It contains a central depression called the **fovea centralis** , which is composed largely of cones and is the location of the sharpest vision in the eye.

If a portion of the fovea or macula is damaged, vision is reduced and central vision blindness occurs. The **fundus** of the eye is the inner part that is visualized through the ophthalmoscope.

Six muscles control the movement of the eye – the superior, inferior, lateral and medial rectus muscles, and the superior and inferior oblique muscles. These muscles are coordinated to move both eyes in a synchronized manner. The front of the eye is protected by two movable folds of skin, **the eyelids** . The edges are lined with two or three rows of eyelashes, which protect the surface of the eye.

A thin mucous membrane called conjunctiva lines the inner surface of the eyelids and passes over the cornea. Lying superior and to the outer edges of each eye are the lacrimal glands. They produce tears to bathe and lubricate the eyes. The tears collect at the inner edges of the eyes, the **canthi (sing. canthus)**, and pass through pinpoint openings, the **lacrimal canaliculi**, of the nose.

Combining forms

blephar/o	eyelid (also palpebr/o)	blepharitis _____ blepharoptosis _____
cor/o	pupil(also pupill/o)	anisocoria _____
cycl/o	ciliary body or muscle of the eye	cycloplegic _____
dacry/o	tears, tear duct also lacri/o	dacryodenitis _____
ir/o irid/o	iris	iritis _____ iridic _____

		iridectomy_____
kerat/o	cornea	keratitis_____
ocul/o	eye	intraocular_____
ophthalm/o	eye	ophthalmologist_____
opt/o	eye, vision	optic_____
optic/o	“	optician_____
papill/o	optic disc	papilledema_____
phac/o	lens of the eye	phacomulsification_____
phak/o		aphakia_____

Conditions

ambly/o	dull, dim	amblyopia_____
diplo/o	double	diplopia_____
glauco/o	gray	glaucoma_____
mi/o	smaller, less	miosis_____
mydr/o	widen, enlarge	mydriasis_____
nyct/o	night	nyctalopia_____ -
phot/o	light	photophobia_____
presby/o	old age	presbyopia_____
scot/o	darkness	scotoma_____
xer/o	dry	xerophthalmia_____

Suffixes

-opia	vision	hyperopia_____ -
-opsia	vision	hemianopsia_____
-tropia	to turn	esotropia_____

Errors of Refraction

Astigmatism **Defective curvature of the cornea or lens of the eye**

Hyperopia (hypermetropia) **Farsightedness**

Myopia **Nearsightedness**

Presbyopia **Impairment of vision as a result of old age**

Pathological conditions

Cataract **Clouding of the lens, causing decreased vision**

Chalazion **Small, hard, cystic mass (granuloma) on the eyelid; formed as a result of chronic inflammation of a sebaceous gland**

Diabetic retinopathy **Retinal effect of diabetes mellitus include microaneurysms, hemorrhages, dilation of retinal veins, and neovascularization**

Glaucoma **Increased intraocular pressure results in damage to the retina and optic nerve.**

Hordeolum (sty) **Localized , purulent, inflammatory staphylococcal infection of a sebaceous gland in the eyelid**

Macular degeneration **Progressive damage to the macula of the retina.**

Retinal detachment **Two layers of the retina separate from each other.**

Strabismus **Abnormal deviation of the eye.**

Clinical Procedures and Abbreviations

Ophthalmoscopy **Visual examination of the interior of the eye.**

Visual acuity test **Clarity of vision is assessed.**

Visual field test **Measures the area within which objects are seen when the eyes are fixed.**

Treatment

Enucleation **Removal of the entire eyeball**

Keratoplasty **Surgical repair of the cornea.**

LASIK **Use of an excimer laser to correct errors of refraction (myopia, hyperopia, and astigmatism)**

Test za fizioterapeute

Microscopic fiber that carries the nervous impulse - _____

Lower portion of the brain that connects the cerebrum with the spinal cord - _____

Outer region of the brain - _____

Largest part of the brain - _____

Part of the nerve cell that contains the nucleus - _____

Microscopic branching fiber of a nerve cell - _____

Motor nerves carry _____ away from the brain and the spinal cord.

Myelin sheath is _____ tissue that surrounds, protects and insulates the axon.

A nerve cell is called - _____.

Essential, distinguishing tissue cells of an organ - _____.

Change in the internal or external environment that evokes a response- _____.

Main relay center of the brain - _____.

Middle vascular layer of the eye - _____.

Tough, white, outer coat of the eyeball - _____.

Light-sensitive nerve cell layer of the eye containing rods and cones - _____

Refraction is _____ of light rays.

Iris is the _____ portion of the eye.

Delicate membrane lining the eyelids and the anterior eyeball - _____

Fluid produced by the ciliary body - _____.

Myopia is also called _____.

The opposite of myopia is _____.

Astigmatism is a defective _____ of the cornea.

Strabismus – abnormal _____ of the eye.

Auricle is also known as the _____.

The inner ear is also known as the _____.

The ear is an important organ of _____ as well as for balance.

The auditory canal is _____ from the middle ear to the pharynx.

Malleus, incus, and stapes are three small _____.

Cerumen is a _____ substance secreted by the external ear.

Tympanic membrane is also called the _____.

The cochlea is _____-shaped structure.

Loss of the ability to hear is _____.

Otitis media is _____.

Tinnitus is a sensation of _____ in the ears.

Visual examination of the ear - _____.

Adrenaline is also called _____.

Hormones are produced by _____ glands.

Progesterone is produced in _____.

GH is short for _____.

Hypophysis is better known as the _____ gland.

Androgen is male hormone and _____ is female hormone.

Write down the meaning of the combining forms

lact/o - _____ ; dips/o - _____ ;

glyc/o - _____ ; myx/o - _____ ;

phac/o - _____ ; vitre/o - _____

palpebr/o - _____ ; ophthalm/o - _____ ; kerat/o -

_____ ; lacrim/o - _____ kines/o

_____ ; myel/o - _____

ONCOLOGY

Oncology is the study of tumors. It includes both **malignant** and nonmalignant growths.

Tumors (also called **neoplasms**) are masses, or growths, that arise from normal tissue. They may be either malignant or **benign**.

Benign neoplasms

Benign neoplasms are growths that occur in body tissues. They are composed of the same (**differentiated**) cells as the tissue in which they are growing. Benign neoplasms are contained within a capsule and do not invade the surrounding tissue. They harm the individual only insofar as they place pressure on surrounding structures. If the benign neoplasm remains small and places no pressure on adjacent structures, it is not often removed. If it becomes enlarged or places pressure on other organs or structures, it must be removed. Benign brain tumors are always very serious, since the cranial cavity is enclosed and pressure on other parts of the brain inevitably results. As a general rule, however, benign tumors are not life-threatening. Once they are removed they do not regrow.

Malignant neoplasms

The cells that compose a malignant neoplasm often do not resemble the tissue in which they are growing and they are characteristically invasive and infiltrative. In such cases the tumor is said to be **undifferentiated**. Malignant tumors are composed of cancerous cells that resemble primitive, or embryonic, cells that lack the capacity to perform mature cellular functions. This characteristic is called **anaplasia** (ana- means backward and -plasia means growth). Anaplastic cells lack an orderly arrangement. Thus tumor cells vary in size and shape and are piled one on top of the other. More significantly the cells of the malignant neoplasm are not incapsuled and are able to spread to normal tissues. This invasive growth occurs by direct extensions, or **metastasis**. They can detach themselves from the primary tumor site, penetrate a blood vessel or lymphatic vessel, travel through the bloodstream or lymphatic system, and establish a new tumor site at a distant tissue, such as the lung, liver, or bone marrow.

What Causes Cancer?

The process of transformation from a normal cell to a cancerous one (**carcinogenesis**) is only partially understood at the present time. What is clear is that malignant transformation results from damage to the genetic material, or DNA of the cell. When a cell divides, the DNA material in each chromosome copies itself so that exactly the same DNA is passed on to the two new daughter cells that are formed. This process of cell division is called **mitosis**. Second, between cycles of mitosis, DNA controls the production of new proteins in the cell. When a cell becomes malignant, the process of mitosis and protein synthesis are disturbed. Cancer cells reproduce almost continuously, and abnormal proteins are made. Malignant cells are anaplastic, that is, their DNA stops making codes that allow the cells to carry on the function of mature cells. Instead, altered DNA and altered cellular programs make new signals that lead to cell proliferation, movement of cells, invasion of adjacent tissue, and metastasis.

Environmental Agents

Agents from the environment, such as chemicals, drugs, tobacco smoke, radiation, and viruses can cause damage to DNA and thus produce cancer. These environmental agents are called **carcinogens**.

Heredity

Cancer can be also caused by inherited factors. Susceptibility to some forms of cancer is transmitted from parents to offspring through defects in the DNA of the egg or sperm cells. Examples are **retinoblastoma** (tumor of the retina of the eye), **polyposis coli syndrome** (polyps that grow in the colon or rectum). Because inherited changes can be detected in all tissues of the body, not simply cancerous cells, blood cells from family members can be tested to determine whether a person has inherited the cancer-causing gene.

Classification of Cancerous Tumors

Almost half of all cancer deaths are caused by malignancies that originate in lung, breast, or colon; however, in all there are more than 100 distinct types of cancer, each having a unique set of symptoms and requiring a specific type of therapy. It is possible to divide these types of cancer into three broad groups: **carcinomas**, **sarcomas**, and **mixed-tissue tumors**.

Carcinomas, the largest group, are solid tumors that are derived from epithelial tissue that lines external and internal body surfaces, including skin, glands, and digestive, urinary, and reproductive organs. About 90% of all malignancies are carcinomas.

Sarcomas are less common than carcinomas, comprising less than 5 percent of all malignant tumors. They derive from connective tissues of the body, such as bone, fat, muscle, cartilage, and bone marrow, and from cells of the lymphatic system.

Mixed-tissue tumors are derived from tissue that is capable of differentiating into both epithelial and connective tissue. Examples of mixed-tissue tumors can be found in the kidney, ovaries, and testies.

Grading and Staging Systems

Tumors are classified on the basis of their location, microscopic appearance, extent of spread. Of particular importance are the tumor's **grade** (its degree of maturity or differentiation under the microscope) and its **stage** (its extent of spread within the body). These two properties influence the prognosis and determine the specific treatment to be used.

When grading a tumor, three or four grades are used. **Grade I** tumors are very well differentiated, so that they closely resemble cells from the normal parent tissue of their origine. **Grade IV** tumors are so undifferentiated or anaplastic that even recognition of the tumor's tissue of origine may be difficult. **Grades II and III** are intermediate in appearance. Grading is often of value in determining the prognosis. Patients with grade I tumors have a high survival rate, and patients with grades II, III, and IV have an increasingly poorer survival rate.

Staging is an attempt to define the extent of cancer by classifying it into three categories: T, N, and M. T represents the primary tumor site or place of origin; N represents local or regional node involvement; and M tells whether or not there is metastasis. When the primary site contains classification of T1, T2, T3, or T4, the higher number would indicate progressive increase in tumor size and involvement. Similarly, N0, N1, N2, or N3 represents progressively advancing nodular involvement. Finally, M0 or M+ defines absence or presence of metastasis, respectively.

CANCER TREATMENT

Four major approaches to cancer treatment are **surgery, radiation therapy, chemotherapy, and biological therapy**. Each method may be used alone, but often they are used together in combined-modality programs to improve the overall treatment result.

Surgery

In many patients with cancer, the tumor is discovered before it has spread, and it may be cured by surgical excision. Some common cancers in which surgery may be curative are those of the stomach, breast, colon, lung, and uterus. Often, surgical removal of the primary tumor prevents local spread or complications, even in the presence of distant disease. A **debulking procedure** may be used if the tumor is attached to a vital organ and cannot be completely removed. As much tissue as possible is removed and the patient receives **adjuvant** (assisting) radiation or chemotherapy.

The following is the list of terms that describes surgical procedures used in treating cancer.

cryosurgery Malignant tissue is frozen and thus destroyed.

electrocauterization Malignant tissue is destroyed by burning .

en bloc resection Tumor is removed along with a large area of surrounding tissue containing lymph nodes.

excisional biopsy Removal of tumor and a margin of normal tissue.

exenteration Wide resection involving removal of the tumor, its organ of origin, and all surrounding tissue in the body space.

fulguration Destruction of tissue by electric sparks generated by a high-frequency current.

incisional biopsy Piece of tumor is removed for examination to establish a diagnosis.

RADIATION THERAPY

The goal of radiation therapy is to deliver a maximal dose of ionizing radiation (irradiation) to the tumor tissue and a minimal dose to the surrounding normal tissue. In reality, this goal is difficult to achieve, and usually one accepts a degree of residual normal cell damage (**morbidity**) as a side effect of the destruction of the tumor. High-dose radiation produces damage to DNA. Newer techniques of radiation utilize high-energy beams of **protons** to improve the focus of the beam and limit damage to normal tissues.

CHEMOTHERAPY

Cancer chemotherapy is the treatment of cancer using chemicals (drugs). It is the standard treatment for many types of cancer, and it produces cures in most patients who have choriocarcinoma, testicular cancer, acute lymphocytic leukemia, and Hodgkin

disease. Chemotherapy can be used alone or in combination with surgery and radiation to improve cure rates. Combination chemotherapy is the use of two or more antitumor drugs together to kill a specific type of malignant growth. Drugs cause tumor cells to die by damaging their DNA. Tumor cells with damaged DNA undergo **apoptosis**, or self-destruction.

BIOLOGICAL THERAPY

Another approach to cancer treatment is to use body's own defenses to fight tumor cells. Investigators are exploring how the elements of the immune system can be restored, enhanced, mimicked, and manipulated to destroy cancer cells. Substances produced by normal cells that directly block tumor growth or that stimulate the immune system and other body defenses are called **biological response modifiers**. Examples of these substances are **interferons** (made by lymphocytes), **monoclonal antibodies** (made by mouse cells and capable of binding to human tumors), **colony-stimulating factors (CSFs)** that stimulate blood-forming cells to combat the myelosuppressive side effects of chemotherapy, and **interleukins** that stimulate the immune system to destroy tumors.

Differentiating Agents

Some new drugs cause tumor cells to differentiate, stop growing, and die. These include **ATRA** (all-trans retinoic acid), a vitamin A derivative, which is highly active against acute promyelocytic leukemia (APL), and arsenic trioxide (Trisenox), which has similar effects on APL.

Combining Forms, Suffixes, Prefixes, and Terminology

Alveoli/o	small sac	alveolar _____
Cac/o	bad	cachexia _____

Carcin/o	cancer, cancerous	carcinoma in situ
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Cauter/o	burn, heat	electrocauterization
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Cry/o	cold	cryosurgery _____
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Pharmac/o	chemical, drug	pharmacokinetics _____
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Plas/o	formation	dysplastic _____
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Ple/o	many, more	pleomorphic _____
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Scirr/o	hard	scirrhous _____
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Xer/o	dry	xerostomia _____
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-blastoma	immature tumor	retinoblastoma _____
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-genesis	formation	angiogenesis _____
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-plasia	formation, growth	hyperplasia _____
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-plasm	formation, growth	neoplasm _____
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-suppression	to stop	myelosuppression _____
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-therapy	treatment	biological therapy _____
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ana-	backward	anaplasia _____
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apo-	off, away	apoptosis _____
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brachy-	near	brachytherapy _____
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epi-	upon	epidermoid _____
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meta-	beyond, change	metastasis _____
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tele-	far	teletherapy _____
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RADIOLOGY AND NUCLEAR MEDICINE

I. Introduction

Radiology (also called roentgenology after its discoverer, Wilhelm Conrad Roentgen) is the medical specialty concerned with the study of x-rays. **X-rays** are invisible waves of energy that are produced by an energy source(x-ray machine) and are useful in diagnosis and treatment of disease.

Nuclear medicine is the medical specialty that studies the characteristics and uses of radioactive substances in the diagnosis of disease. Radioactive substances are materials that emit high-speed particles and energy-containing rays from the interior of their matter. The emitted particles and rays are called **radioactivity** and can be of three types : **alpha particles**, **beta particles**, and **gamma rays**. **Gamma rays** are similar to x-rays in that they have no mass and are used effectively as a diagnostic label to trace the path and uptake of chemical substances in the body.

A **radiologist** is a physician who specialises in the practice of diagnostic radiology. A **nuclear physician** is a physician who specializes in the practice of administering diagnostic nuclear medicine procedures .

Allied health care professionals **radiologic technologists**. Types of radiologic technologists are : **radiographers**, **nuclear medicine technologists**, and **sonographers**.

II. Radiology

Several characteristics of x-rays are useful to physicians in the diagnosis and treatment of disease.

1. **Ability to cause exposure of a photographic plate.** If a photographic plate is placed in front of a beam of x-rays, traveling unimpeded through the air, will expose the silver coating of the plate and cause it to blacken
2. **Ability to penetrate different substances to varying degrees.** If the x-rays are absorbed (stopped) by the denser body substance (e.g. calcium in the bones), they do not reach the photographic plate held behind the patient, and white areas are left in the x-ray film.

A substance is said to be **radiolucent** if it permits passage of most of the x-rays. **Radiopaque** substances (bones) are those that absorb most of the x-rays they are exposed to.

3. **Invisibility.** X-rays cannot be detected by sight, sound, or touch. Workers exposed to x-rays must wear a **film badge** to detect and record the amount of radiation to which they have been exposed.
4. **Travel in straight lines.** This property allows the formation of precise shadow images on the x-ray plate and also permits x-ray beams to be directed accurately at a tissue site during radiotherapy.
5. **Scattering of radiation.** Scattering occurs when x-rays come in contact with any material. Greater scatter occurs with dense objects. Scatter can blur images so a grid is placed in front of the film to absorb scattered radiation before it strikes the x-ray film.
6. **Ionization.** X-rays have the ability to ionize substances through which they pass. Ionization is a chemical process in which the energy of an x-ray beam causes rearrangement and disruption within a substance. In x-ray therapy, the ionizing effect of x-rays can help kill cancerous cells and stop tumor growth. Ionizing x-rays can also affect normal body cells, leading to tissue damage and malignant changes. Thus, persons exposed to high doses of x-rays are at risks of developing leukemia, thyroid tumors, breast cancer, or other malignancies.

Diagnostic Techniques

X-rays

X-rays are used in a variety of ways to detect pathological conditions. The most common use of the diagnostic x-ray is dental, to locate cavities in teeth. Other areas examined include the digestive, nervous, reproductive, and endocrine systems and the chest and bones. Some special diagnostic x-ray techniques are the following:

Computed Tomography or Computerized Axial Tomography (CT, CAT). Machines called CT scanners beam x-rays at multiple angles through a section of a patient's body. A computer creates a cross-sectional picture of the body section examined. The CT scanners are highly sensitive in detecting diseases in bony structures and can provide images of internal organs that are impossible to visualize with ordinary x-ray technique.

Contrast Studies. In x-ray film, the natural differences in the density of body tissues produce contrasting shadow images on the x-ray film; however, when x-rays pass through two adjacent body parts composed of substances of the same density, their images cannot be distinguished on the film or on the screen. It is necessary, then, to inject a **contrast medium** into the structure or fluid so that a specific part, organ, tube, or liquid can be visualized.

The following are artificial materials used in diagnostic radiological studies.

Barium Sulfate. Barium sulfate is a metallic powder that is mixed in water and used for examination of the upper and lower gastrointestinal tract. An **upper GI series** involves oral ingestion of barium sulfate so that the esophagus, stomach, and duodenum can be visualized. A **small bowel follow-through** traces the passage of barium in a sequential manner as it passes through the small intestine. A **barium enema (lower GI series)** opacifies the lumen of the large intestine. A **double-contrast study** uses both a radiopaque and a radiolucent contrast medium. For example, the walls of the stomach or intestine are coated with barium and the lumen is filled with air.

Iodine Compounds. Radiopaque fluids containing up to 50 percent iodine are used in the following tests:

Angiography An x-ray image of blood vessels and heart chambers.

Arthrography Contrast or air, or both, is injected into a joint, and x-rays are taken of the joint.

Pyelography X-ray images are made of the renal pelvis.

Fluoroscopy. This x-ray procedure uses a fluorescent screen instead of a photographic plate to derive a visual image from the x-rays that pass through the patient. The fact that ionizing radiation can produce **fluorescence** is the basis for fluoroscopy. A major advantage of fluoroscopy over normal radiography is that internal organs, such as the heart and digestive tract organs, can be observed in motion.

Interventional Radiology. Interventional radiologists perform invasive procedures (therapeutic or diagnostic) under fluoroscopic, CT, and more recently MR (magnetic resonance) guidance. Procedures include placement of drainage catheters, drainage of abscesses, occlusion of bleeding vessels, and installation of antibiotics or chemotherapy through catheters.

Ultrasound

This technique employs high-frequency, inaudible sound waves that bounce off the body tissues and are then recorded to give information about the anatomy of an internal organ. An instrument called a **transducer or probe** is placed near or on the skin, which is covered with a thin coating of gel to assure good transmission of sound waves.

Ultrasound is used as a diagnostic tool not only by radiologists but also by neurosurgeons and

ophthalmologists to detect intracranial and ophthalmic lesions, by cardiologists to detect heart valve and blood vessel disorders as well as gastroenterologists, obstetricians and gynecologists. It is important to know that sound waves are nonionizing and noninjurious to tissues.

Two ultrasound techniques, **Doppler ultrasound and color-flow imaging**, make it possible to record blood velocity, and to image major blood vessels in patients at risk for stroke.

Magnetic Imaging or Magnetic Resonance Imaging

This is a type of diagnostic radiography that uses electromagnetic energy rather than x-rays. The technique produces sagittal, coronal (frontal), and axial (cross-sectional) images.

MR examinations are performed with and without contrast. The contrast agent most commonly used for MRI is gadolinium (Gd). MRI is used for providing soft-tissue images, detecting edema in the brain, projecting a direct image of the spinal cord, detecting tumors in the chest and the abdomen, and visualizing the cardiovascular system.

X-Ray Positioning

In order to take the best view of the part of the body being radiographed, the patient, film, and x-ray tube must be positioned in the most favourable alignment possible. There are special terms used by radiologists to refer to the direction of travel of x-ray through the patient.

1. **Posteroanterior (PA) view.** In this most commonly requested chest x-ray view, x-rays travel from a posteriorly placed source to an anteriorly placed detector.
2. **Anteroposterior (AP) view.** X-rays travel from an anteriorly placed source to a posteriorly placed detector
3. **Lateral view.** In a left lateral view, x-rays travel from a source located to the right of the patient to a detector placed to the left of the patient
4. **Oblique view.** X-rays travel in a slanting direction at an angle from the perpendicular plane. Oblique views show regions ordinarily hidden and superimposed in routine PA and AP views.

NUCLEAR MEDICINE

Radioactivity and radionuclides

The emission of energy in the form of particles or rays coming from the interior of a substance is called **radioactivity**. A radionuclide or radioisotope is a substance that gives off high-energy particles or rays as it disintegrates. **Half-life** is the time required for a radio-substance to lose half of its radioactivity by disintegration. The half-life must be long enough to allow for diagnostic imaging but as short as possible to minimize patients exposure to radiation. Radionuclides emit three types of radioactivity: alpha particles, beta particles, and gamma rays. Gamma rays, which have greater penetrating ability than alpha and beta particles, and more ionizing power, are especially useful in both the diagnosis and the treatment of disease. Technetium-99m is a pure gamma emitter with a half-life of 6 hours. Its properties make it the most frequently used radionuclide in diagnostic imaging.

Nuclear medicine physicians use two types of tests in the diagnosis of disease: **in vitro** (in the test tube) and **in vivo** (in the body). In vitro procedures involve analysis of blood and urine specimens using radioactive chemicals. RIA (radioimmunoassay) is an in vitro procedure to detect hormones and drugs in a patient's blood. In vivo tests trace the amounts of radioactive substance within the body.

Examples of diagnostic procedures that utilize radionuclides.

1. **Bone scan.** ^{99m}Tc (technetium) is used to label phosphate substances and is injected intravenously. The scan is useful in demonstrating malignant metastasis to the skeleton.
2. **Gallium scan.** The radioisotope gallium-67 is injected intravenously and has an affinity for tumors and non-neoplastic lesions such as abscesses.
3. **Liver and spleen scan.** To visualize the liver and spleen, a radiopharmaceutical (^{99m}Tc and sulfur colloid) is injected intravenously, and images are taken with a scintiscanner (gamma camera).
4. **Positron emission tomography (PET scan).** Radioactive substances are given intravenously and then emit positrons which create a cross-sectional image of the metabolism of the body. PET scanning has determined that schizophrenics do not metabolize glucose equally in all parts of the brain and that drug treatment can bring improvement to these organs.

5. **Single-photon emission computed tomography(SPECT).** Clinical application includes detecting liver tumors, detecting cardiac ischemia, and evaluating bone diseases of the spine.
6. **99mTechnetium sestamibi scan.** It is injected intravenously to study the motion of the heart wall muscle and the ventricle's ability to eject blood(ejection fraction)
7. **Thallium scan(TL).** It is injected intravenously to allow for myocardial perfusion. Infarcted or scarred myocardium does not extract any Tl, showing up as cold spots.
8. **Thyroid scan.** Hyperfunctioning thyroid nodules(adenomas) accumulate higher amounts of ¹³¹I radioactivity and are termed "hot". Thyroid carcinoma does not concentrate radioiodine well and is seen as a "cold" spot on the scan.

Abbreviations

Angio -	angiography	AP -	anteroposterior
Ba -	barium	CAT-	computerized axial tomography
CT -	computerized tomography	CXR –	chest x-ray
Decub -	lying down, decubitus	DI -	diagnostic imaging
FDG -	fluorodeoxyglucose (radiopharmaceutical)		
⁶⁷ Ga -	radioactive gallium	¹³¹ I	radioactive iodine
IVP -	intravenous pyelogram	KUB –	kidneys, uriters, bladder
LAT -	lateral	MR or MRI –	magnetic resonance
MRA -	magnetic resonance angiography	PA -	posteroanterior
PET –	positron emission tomography	SPECT –	single photon emission computed

Tomography.

201Tl - radioisotope (thallium)
US, U/S – ultrasound

UGI - upper gastrointestinal (series)
VQ scan – ventilation perfusion scan of the lungs

PHARMACOLOGY

Introduction

Drugs (medicines) are substances used to prevent or treat a condition or disease. Drugs are obtained from parts of plants, such as the roots, leaves, and fruit. An example of a plant-derived drug is a cardiac medicine, digitalis(from the foxglove plant). Other drugs (antibiotics such as penicillin) are obtained from yeast, molds, and fungi. Drugs are also obtained from animals; for example, hormones are secretions from the glands of animals. Some drugs are synthesized in a laboratory. Anticancer drugs, such as methotrexate and prednisone, are laboratory synthesized drugs. Vitamins are drugs that are isolated from plant or animal sources and are contained in foods.

A pharmacist prepares and dispenses drugs through a pharmacy(drugstore) on written orders from a physician. Currently, most schools/colleges of pharmacy offer a Pharm. D. (Doctor of Pharmacy) degree after six or seven years of study. As a health care professional, a pharmacist cooperates with, and sometimes advises licensed practitioners concerning drugs. In addition, the pharmacist answers patient's questions concerning their prescription needs.

Pharmacology is the study of the preparation, properties, uses, and action of drugs. A pharmacologist is either an M.D.(Medical Doctor) or a Ph.D.(Doctor of philosophy) who specializes in pharmacology. Pharmacology contains many subdivisions of study: medicinal chemistry, pharmacodynamics, pharmacokinetics, molecular pharmacology, chemotherapy, and toxicology.

Medicinal chemistry is the study of new drug synthesis and the relationship between chemical structure and biological effect. **Pharmacodynamics** involves the study of drug effects in the body. The mathematical description of drug disposition (appearance and disappearance) in the body over time is **pharmacokinetics**. **Molecular pharmacology** involves the interaction of drugs and

subcellular entities, such as DNA, RNA, and enzymes.

Chemotherapy is the study of drugs that destroy microorganisms, parasites, or malignant cells within the body.

Toxicology is the study of the harmful effects of drugs and chemicals on the body. A toxicologist is also interested in finding proper **antidotes** to any harmful effects of drugs.

A drug can have three different names. The **chemical name** is the chemical formula for the drug. The **generic name** (shorter and less complicated) identifies the drug legally and scientifically. The **brand name** or trademark is the private property of the individual drug manufacturer.

Chemical Name	Generic Name	Brand Name
Derivative of 6-aminopenicillanic acid	ampicillin	Omnipen Polycillin Principen Totacillin

Administration of Drugs

How a drug is introduced into the body.

Oral administration. Drugs given by mouth are slowly absorbed into the bloodstream through the stomach or intestinal wall. This method although convenient for the patient, has several disadvantages: it can be destroyed in the digestive tract or cannot pass through the intestinal mucosa. It is also not good in case when time is an important factor in therapy.

Sublingual administration. Drugs placed under the tongue dissolve in the saliva. Nitroglycerin is administered in this way.

Rectal administration. Suppositories and aqueous solutions are inserted into the rectum. Drugs are given by rectum when oral administration presents difficulties, as when the patient is nauseated and vomiting.

Parenteral administration. Injection of drug from a **syringe** through a hollow needle placed under the skin, into a muscle, vein, or body cavity. There are several types of parenteral injections:

1. **Intracavitary injection.** This injection is made into a body cavity, such as the peritoneal or pleural cavity.
2. **Intradermal injections.** This shallow injection is made into the upper layers of the skin and is used chiefly in skin testing for allergic reactions.
3. **Intramuscular injection.** (IM) The buttock or upper arm is usually the site for this injection.
4. **Intrathecal injection.** This injection is made into the space under the membranes (meninges) surrounding the spinal cord and brain. Methotrexate is injected intrathecally for treatment of leukemia.
5. **Intravenous injection.** This injection is made directly into a vein. It is used when an immediate effect from the drug is desired.
6. **Subcutaneous injection.** Introduction of a hypodermic needle under the skin, usually on the upper arm, thigh, or abdomen.

Inhalation. Vapors, or gases, taken into the nose or mouth are absorbed into the bloodstream through the thin walls of air sacs in the lungs.

Topical Application. Drugs are locally applied on the skin or mucous membranes of the body. **Antiseptics** (against infection) and **antipruritics** (against itching) are commonly used as ointments, creams, and lotions.

Terminology of Drug Action

When a drug enters the body, the target substance with which the drug interacts to produce its effects is called a **receptor**. The following terms describe the action and interaction of drugs in the body after they have been absorbed into the bloodstream:

Additive Action. If the combination of two similar drugs is equal to the sum of the effects of each, then the drugs are called **additive**. If two drugs give less than an additive effect, they are called **antagonistic**. If they produce greater than additive effect, they are called **synergistic**.

Synergism. A combination of two drugs can sometimes cause an effect that is greater than the sum of the individual effects of each drug given alone. For example penicillin and streptomycin produce a synergistic effect.

Tolerance. Tolerance is a feature of addiction to drugs such as morphine. **Addiction** is the physical and psychological dependence on and craving for a drug.

Drug Toxicity

Drug toxicity is the poisonous and potentially dangerous effect of some drugs. **Idiosyncrasy** is an example of an unpredictable type of drug toxicity. This is an unexpected effect that appears in the patient following administration of a drug. In some patients penicillin causes an idiosyncratic reaction, such as **anaphylaxis** (acute hypersensitivity with asthma and shock).

Iatrogenic (produced by treatment) disorders can occur, however, as a result of mistakes in drug use or in individual sensitivity to a given agent.

Side effects are toxic effects that routinely result from the use of a drug. For example, nausea, vomiting, and alopecia are common side effects of chemotherapeutic drugs used to treat cancer. **Contraindications** are factors in a patient's condition that make the use of a drug dangerous and ill advised.

PSYCHIATRY

Psychiatry (**psych/o** means mind, **iatr/o** means treatment) is the branch of medicine that deals with the diagnosis, treatment, and prevention of mental illnesses.

Psychiatrists complete the same medical training as other physicians and receive an M.D. degree. Then they spend a varying number of years training in the methods and practice of **psychotherapy** and drug therapy. Psychiatrists can also take additional years of training to specialize in various aspects of psychiatry. **Child psychiatrists** specialize in the treatment of children; **forensic psychiatrists** specialize in the legal aspects of psychiatry, such as the determination of mental competence in criminal cases. **Psychoanalysts** complete 3 to 5 years of training in a special psychotherapeutic technique called **psychoanalysis** in which the patient freely relates her or his thoughts to the analyst, who does not interfere in the flow of thoughts.

A **psychologist** is a non medical person who is trained in methods of psychotherapy, analysis, and research. A **clinical psychologist**, like a psychiatrist, can use various methods of psychotherapy to treat patients, but, unlike the psychiatrists, cannot prescribe drugs or electroconvulsive therapy. Other nonphysicians trained in the treatment of mental illness are licensed clinical social workers and psychiatric nurses. Clinical psychologists are trained in the use of tests to evaluate various aspects of a patient's mental health and intelligence.

Psychiatric Clinical Symptoms

These terms describe abnormalities in behaviour that are evident to an examining mental health professional.

amnesia	Loss of memory.
anxiety	Varying degrees of uneasiness, apprehension, or dread often accompanied by palpitations, tightness in the chest, breathlessness, and choking sensations.
apathy	Absence of emotions ; lack of interest or emotional involvement.
autism	Severe lack of responsiveness to others, preoccupation with inner thoughts; withdrawal and retarded language development.
compulsion	Uncontrollable urge to perform an act repeatedly.
conversion	Anxiety becomes a bodily symptom, such as blindness, deaf-

ness, or paralysis, that does not have an organic basis.

delusion	A fixed, false belief that cannot be changed by logical reasoning or evidence.
dissociation	Uncomfortable feelings are separated from their real object. In order to avoid mental distress, the feelings are redirected toward a second object or behaviour pattern.
dysphoria	Sadness, hopelessness; depressive mood.
euphoria	Exaggerated feeling of well-being(high).
hallucination	False or unreal sensory perception as, for example, hearing voices none are present.
labile	Unstable; undergoing rapid emotional change.
mania	State of excessive excitability; hyperactivity and agitation.
mutism	Nonreactive state; stupor.
obsession	An involuntary, persistent idea or emotion.
paranoia	Delusions persecution or grandeur or combination of the two.

Psychiatric Disorders

Anxiety Disorders

These disorders are characterized by anxiety-the experience of unpleasant tension, distress, troubled feelings, and avoidance behaviour. A **panick attack**, marked by intense fear or discomfort and symptoms such as palpitations, sweating, trembling, and dizziness, can occur on its own with no symbolic meaning for the patient(i.e., it occurs “out of the blue”), or it can occur in the context of the following anxiety disorders: **phobic disorders, obsessive-compulsive disorder, and post-traumatic stress disorders.**

Phobic disorders are characterized by irrational or debilitating fears associated with a specific object or situation.The patient with a phobic disorder goes to extreme lengths to avoid the object of her or his fear.Panic attacks can occur in anticipation of the phobic situation.

Agoraphobia is the fear of being alone or in open , crowded, public places from which escape would be difficult or in which help might not be available.They may feel comfortable only by remaining at home or in the company of a friend or relative.

A social phobia (social anxiety disorder) is the fear of situations in which the individual is open to public scrutiny, which could result in possible embarrassment and humiliation. Fear of speaking in public, using public lavatories, or eating in public are examples of social phobias.

Other specific phobias are **claustrophobia** (fear of closed-in places); **acrophobia** (fear of heights); **zoophobia** (fear of animals).

Obsessive compulsive disorder (OCD) involves recurrent thoughts(**obsessions**) and repetitive acts (**compulsions**) that dominate the patients behaviour. The patient experiences anxiety if he or she is prevented from performing special rituals, which are used to shield against overwhelming anxiety or fear. Often the OCD consumes time and significantly

interferes with the individual's social or occupational functioning.

Post-traumatic stress disorder is the development of symptoms (intense fear, helplessness, insomnia, nightmares etc.) following exposure to a traumatic event. Many survivors of the September 11 attack experienced post-traumatic stress disorder.

Delirium and Dementia

Delirium and dementia are both disorders of abnormal **cognition** (mental processes of thinking, perception, reasoning, judgement).

Delirium is acute, temporary disturbance of consciousness and mental confusion. It is characterized by rambling, irrelevant, or incoherent speech, sensory misperceptions, and disorientation as to time, place, or person and by memory impairment. Delirium is caused by a variety of conditions, including drug intoxication or withdrawal, seizures or head trauma, and metabolic disturbances such as hypoxia, hypoglycemia, electrolyte imbalances, or hepatic or renal failure. **Delirium tremens** is brought on by withdrawal after prolonged periods of heavy alcohol ingestion.

Dementia is a general more gradual loss of intellectual abilities that involves impairment of judgement, memory, and abstract thinking as well as changes in personality. Dementia may be caused by conditions, some reversible and some progressive, involving damage to the brain. The most common cause is Alzheimer disease, but others are cerebrovascular disease (stroke), central nervous system infection, brain trauma, tumors, and Parkinson and Huntington disease.

Dissociative Disorders

Dissociative disorders are chronic or sudden disturbances of memory, identity, consciousness, or perception of the environment that are not caused by the direct effects of brain damage or drug abuse. Symptoms hide the pain and anxiety of unconscious conflicts. Examples of dissociative disorders are **dissociative identity disorder**, which is the existence within the individual of two or more distinct personalities that take hold of the individual's behaviour (illustrated in literature by Dr. Jekyll and Mr. Hyde); **dissociative amnesia** (inability to remember important personal information that is too extensive to be explained by ordinary forgetfulness); and **dissociative fugue** (sudden, unexpected travel away from home or customary work locale). The fugue (flight) disorder includes the assumption of a new identity and inability to recall one's previous identity.

Eating Disorders

Eating disorders are severe disturbances in eating behaviour. Examples are **anorexia nervosa** and **bulimia nervosa**. Anorexia nervosa is a refusal to maintain a minimally normal body weight. An individual is intensely afraid of gaining weight and has a disturbance in the perception of the shape or size of her or his body. The condition predominantly affects adolescent females, and its principal symptom is a conscious, relentless attempt to diet along with excessive, compulsive overactivity, such as exercise, running, or gymnastics. Most postmenarchal females with this disorder are amenorrheic.

Bulimia nervosa (bulimia means abnormal increase in hunger) is characterized by binge eating (uncontrolled indulgence in food) followed by purging (eliminating food from the body). Bulimic individuals maintain normal or nearly normal weight because after bingeing they engage in inappropriate purging. Examples are self-induced vomiting and the misuse of laxatives or enemas.

Mood Disorders

A mood disorder is prolonged emotion such as depression or mania (elation) that dominates a patient's entire mental life. Examples of mood disorders are **bipolar disorders** and **depressive disorders**. **Bipolar disorders** (bi- two; pol/o -m, extreme) are characterized by one or more **manic** episodes alternating with depressive episodes. A manic episode is a period during which the predominant mood is excessively elevated (euphoria), expansive, or irritable. Associated symptoms include inflated self-esteem, or grandiosity, decreased need for sleep, nearly continuous flow of rapid speech with quick changes of topic, distractibility, an increase in goal-directed activity, and excessive involvement in pleasurable activities that have a high potential for painful consequences.

Often there is increased sociability and participation in multiple activities marked by intrusive, domineering, and demanding behaviour. **Hypomania** describes a mood resembling mania, but of lesser intensity. **Bipolar I** is one or more manic episodes, often alternating with major depressive episodes. **Bipolar II** is recurrent major depressive episodes alternating with hypomanic episodes

Cyclothymic disorders (cycl/o –cycle; thym/o – mind) is a mild form of bipolar disorder characterized by at least two years of hypomania and numerous depressive episodes that do not meet the criteria that define a major depressive episode.

Depressive disorders are marked by one or more major depressive episodes without a history of mania or hypomania. **Major depression** involves episodes of severe **dysphoria** (sadness, helplessness, worry, discouragement). Other symptoms are appetite disturbances and changes in weight, sleep disorders such as insomnia or hypersomnia, fatigue or low energy, feelings of worthlessness, hopelessness, or excessive or inappropriate guilt, difficulty thinking or concentrating, and recurrent thought of death or suicide. **Dysthymia** is a depressive disorder involving depressed mood that persists over a 2-year period but is not as severe as major depression. Also there are no psychotic features(delusion, hallucinations, incoherent thinking) as are sometimes found in major depression. Dysthymic disorder can be very impairing but commonly responds well to medications.

Physicians have noted a relationship between the onset of an episode of depressive disorder and a particular 60-day period of the year. A regular appearance of depression may occur between the beginning of October and the end of November every year. This is referred to as a **seasonal affective (mood) disorder (SAD)**. A change from depression to mania or hypomania also may occur within a 60-day period from mid-February to mid-April.

Personality Disorders

Personality traits are established patterns of thinking and ways of relating to and perceiving the environment and one's self; however, when these traits become inflexible and rigid, causing impairment of functioning, distress, and conflict with others, they constitute personality disorders. Examples of personality disorders are as follows:

- antisocial** No loyalty to or concern for others, and without moral standards; acts only in response to desires and impulses; cannot tolerate frustration and blames others when he or she is at fault.
- borderline** Instability in interpersonal relationships and sense of self; characterized by alternating involvement with and rejection of people. Frantic efforts are made to avoid real or imagined abandonment.
- histrionic** Emotional, attention-seeking, immature, and dependent; irrational outbursts and tantrums; flamboyant and theatrical; having general dissatisfaction with one's self and angry feelings about the world
- narcissistic** Grandiose sense of self-importance or uniqueness and preoccupation with fantasies of success and power. **Narcissism** is a pervasive interest in one's self with a lack of empathy for others.
- paranoid** Continually suspicious and mistrustful of other people but not to a psychotic or delusional degree; jealous and overly concerned with hidden motives of others; quick to take offense.
- schizoid** Emotionally cold and aloof; indifferent to praise or criticism or to the feelings of others; few friendships and rarely appears to experience strong emotions, such as anger or joy.

III. Therapeutic Terminology

Psychotherapy

This is the treatment of emotional problems by using psychological techniques. The following are psychological techniques used by psychiatrists, psychologists, and other mental health professionals.

Cognitive Behaviour Therapy (CBT). Codnitioning (changing behaviour patterns and responses by training and repetition) is used to relieve anxiety and treat phobias and other disorders.

Family Therapy . Treatment of an entire family to resolve and understand their conflicts and problems.

Group Therapy. A group of patients with similar problems gains insight into their own personalities through discussions and interaction with each other. IN **psychodrama**, patients express their feelings by acting out roles along with other patients-actors on a stage. After a scene has been presented, the audience (composed of other patients) is asked to make comments and offer interpretations about what they have observed.

Hypnosis. A **trance** (state of altered consciousness) is created to increase the speed of psychotherapy or to help recovery of deeply repressed memories.

Insight-Oriented Psychotherapy. Face-to-face discussion of life problems and associated feelings.

Play Therapy. Therapy in which a child, through play, uses toys to express conflicts and feelings that he or she is unable to communicate in a direct manner.

Psychoanalysis. Developed by Sigmund Freud, this long-term and intense form of psychotherapy seeks to influence behaviour and resolve internal conflicts by allowing patients to bring their unconscious emotions to the surface.

Sex Therapy. This form of therapy helps individuals overcome sexual dysfunctions such as **frigidity, impotence and premature ejaculation.**

Supportive Psychotherapy. Offering encouragement, support, and hope to patients facing difficult life transitions and events..

Electroconvulsive Therapy

A treatment in which an electric current is applied to the brain while the patient is anesthetized, paralyzed, and being ventilated. This produces convulsions (involuntary muscular contractions) which, with modern techniques, are usually observable only in the form of a twitching of the toe. It is chiefly used for serious depression and depressive phase of bipolar (manic-depressive) disorder.

Drug Therapy

The following are categories of drugs used to treat psychiatric disorders.

Antianxiety and antipanic agents. These drugs lessen anxiety, tension, and agitation, especially when they are associated with panic attacks. Example – **benzodiazepines (BZDs).**

Antidepressants. These drugs gradually reverse depressive symptoms and produce feelings of well-being. The basis of depression is thought to be an imbalance in the levels of neurotransmitters in the brain.

Anti-obsessive-compulsive disorder agents (OCD). These drugs are prescribed to relieve the symptoms of obsessive-compulsive disorder.

Antipsychotics (neuroleptics). These drugs modify psychotic symptoms and behaviour. Examples are **phenothiazines**, which are tranquilizers that reduce the anxiety, tension, agitation, and aggressiveness associated with psychoses and modify psychotic symptoms such as delusions and hallucinations.

Hypnotics. These drugs are used to produce sleep and relieve insomnia. Examples are sedatives and benzodiazepines.

Mood stabilizers. These drugs treat the manic episodes of bipolar illness. **Lithium** is commonly used to reduce the levels of manic symptoms, such as rapid speech, hyperactive movements,

grandiose ideas, poor judgement, aggressiveness, and hostility. Lithium is a simple salt that is thought to stabilize nerve membranes.

Stimulants. These drugs (**amphetamines**) are prescribed for **attention-deficit hyperactivity disorder** in children. Common symptoms of ADHD are having a short attention span and being easily distracted, emotionally unstable, impulsive, and moderately to severely hyperactive.

V Combining Forms, Suffixes, Prefixes, and Terminology

anxi/o	uneasy, anxious, distressed	anxiolytic _____
hallucin/o	hallucination,	hallucinogen _____
hypn/o	sleep	hypnosis _____
iatr/o	treatment	psychiatrist _____
ment/o	mind	mental _____
phil/o	attraction to, love	paraphilia _____
phren/o	mind	schizophrenia _____
psych/o	mind	psychosis _____
schiz/o	split	schizoid _____
somat/o	body	psychosomatic _____
		somatophorm disorder _____

Suffixes

-genic	produced by	psychogenic _____
-leptic	to seize hold of	neuroleptic drugs _____
-mania	obsessive preoccupation	kleptomania _____
-phobia	fear(irrational and disabling)	agoraphobia _____
-phoria	feeling, bearing	euphoria _____
-thymia	mind	cyclothymia _____
		dysthymia _____

Prefixes

a-, an- no,not apathy_____

cata- down catatonic stupor_____ -

hypo- deficient, less than , below
hypomania_____

hypochondriasis_____

para- abnormal paranoia_____