



3470 HEALTHCARE

BASIC MEDICAL CODING

TRAINING MANUAL

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INTRODUCTION TO MEDICAL CODING

WHAT IS MEDICAL CODING?

Transformation of Healthcare Diagnosis, Procedures, Medical Services and Equipment into Universal Medical Alphanumeric Codes.

PURPOSE OF MEDICAL CODING:

- Medical Coding And Medical Billing Are The Backbone Of Healthcare Revenue Cycle
- Used By Health Insurance Companies To Pay Health Insurance Claims
- Helps In Billing Process At Hospitals
- Ensuring Payers And Patients Reimburse Providers For Services Delivered

TASK OF A MEDICAL CODER:

- ❖ To Review Clinical Statements And Assign Standard Codes Using CPT, ICD – 10 CM, Hcpcs Level II Classification Systems.
- ❖ Medical Coders Translate The Provider's Documentation Into Standardized Codes That Tell Payers The Following:
 - Pt's Diagnosis
 - Medical Necessity For Treatments, Services Or Supplies The Pt Received
 - Treatments, Services And Supplies Provided To The Pt
 - Any Unusual Circumstances Or Medical Condition That Affected Those Treatments And Services

PATIENT

- Patient – One Who Seeks Medical Service / Treatment



PROVIDER

One Who Renders (Provides) Services To The Patient

- Physician (Doctors)



- Other Qualified Health Professionals (Registered Nurse, Physician Assistants, Nurse Practitioners, Certified Registered Nurse Anesthetists, And Physical, Speech, Occupational, And Massage Therapists.

PAYERS

- Payer – One Who Pays For Medical Treatments
- Health Insurance
- Self Insured Employer
- Pays By Self If Uninsured

TO BE PRECISED

- Pt Visits Physician
- Physician Documents Diagnosis And Procedures
- Medical Coder Reviews And Translate Into Medical Codes
- Medical Biller Checks And Submit Claims To Payers
- Provider Receives Payment

TYPE OF CODES USED

- ICD – 10 CM
- ICD – 10 PCS
- CPT
- HCPCS LEVEL II
- CDT (CODE ON DENTAL PROCEDURES AND NOMENCLATURE)
- NDC (NATIONAL DRUG CODES)
- MODIFIERS
- MS-DRG (MEDICAL SEVERITY DIAGNOSIS RELATED GROUPS)
- APC (AMBULATORY PAYMENT CATEGORIES)

ICD 10 CM – INTERNATIONAL CLASSIFICATION OF DISEASES 10TH EDITION , CLINICAL MODIFICATION.

- Conditions And Disease, Poisons, Neoplasms, Injuries
- 3- 7 Alphanumeric Characters

CPT – CURRENT PROCEDURAL TERMINOLOGY

- American Medical Association
- Five-Character Alphanumeric Codes
- Describing Services Provided To Patients By Physicians And QHP

ICD – 10 PCS - INTERNATIONAL CLASSIFICATION OF DISEASES 10TH EDITION , PROCEDURE CODING SYSTEM

- Alphanumeric Code Set
- Used By Hospitals – In Patient Procedures

HCPCS LEVEL II

- - Alphanumeric Codes
- – For Supplies / Devices

MODIFIERS

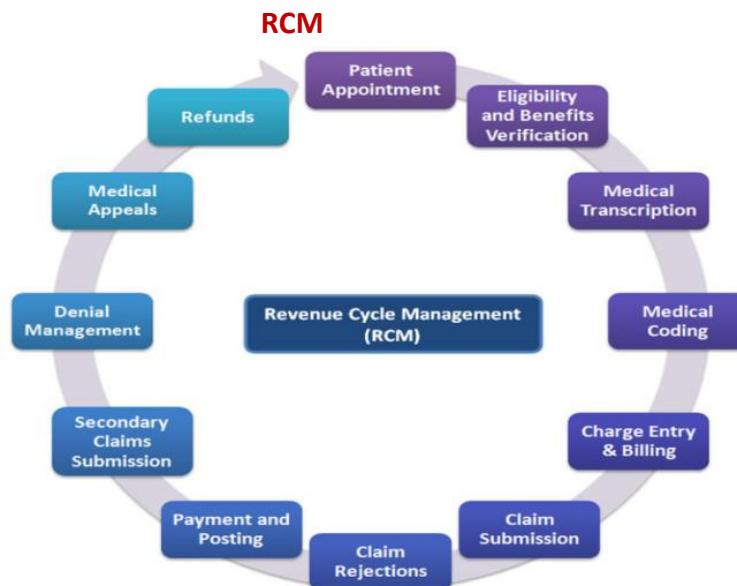
- USED BY CPT[®] AND HCPCS LEVEL II CODES
- Alphanumeric Two-Character Codes To Add Clarity
- Status Of The Patient, The Part Of The Body On Which A Service Is Being Performed, A Payment Instruction, An Occurrence That Changed The Service The Code Describes, Or A Quality Element.

REQUIREMENTS OF A MEDICAL CODER

- Knowledge Of Anatomy , Physiology And Medical Terminology.
- Knowledge Of Diseases, Injuries And Clinical Procedures.
- Read And Understand Medical And Surgical Reports And Patient Charts.
- Knowledge Of Classification And Coding Conventions.

RCM – REVENUE CYCLE MANAGEMENT

- Revenue Cycle Management Is The Process Used By Healthcare Systems In The United States And All Over The World To Track The Revenue From Patients, From Their Initial Appointment Or Encounter With The Healthcare System To Their Final Payment Of Balance.





COMMON ABBREVIATIONS

- CMS - CENTERS FOR MEDICARE AND MEDICAID SERVICES
- AMA - AMERICAN MEDICAL ASSOCIATION
- AHIMA - AMERICAN HEALTH INFORMATION MANAGEMENT ASSOCIATION
- NCHS – NATIONAL CENTER FOR HEALTH STATISTICS
- ICD 10 CM – INTERNATIONAL CLASSIFICATION OF DISEASES, 10TH EDITION , CLINICAL MODIFICATION.
- ICD 10 PCS – INTERNATIONAL CLASSIFICATION OF DISEASES, 10TH EDITION , PROCEDURE CODING SYSTEM.
- HCPCS – HEALTHCARE COMMON PROCEDURE CODING SYSTEM
- CPT – CURRENT PROCEDURAL TERMINOLOGY.
- CMS - CENTERS FOR MEDICARE AND MEDICAID SERVICES

AN INTRODUCTION TO MEDICAL TERMINOLOGIES

WHAT IS ANATOMY?

Anatomy is the study of the structure and form of organisms. Scientists who specialize in anatomy are called anatomists.

WHAT IS PHYSIOLOGY?

Physiology is the study of functions and mechanisms of a living being.

WHAT IS MEDICAL TERMINOLOGY?

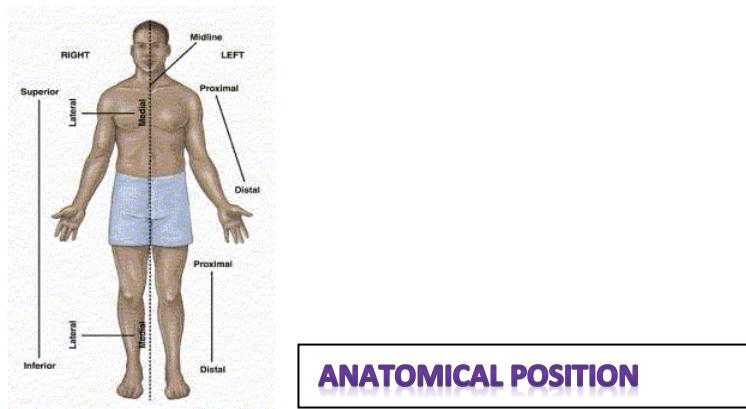
The words, or terms, which make up the language of medicine are referred to as the terminology of the medical field, or medical terminology.

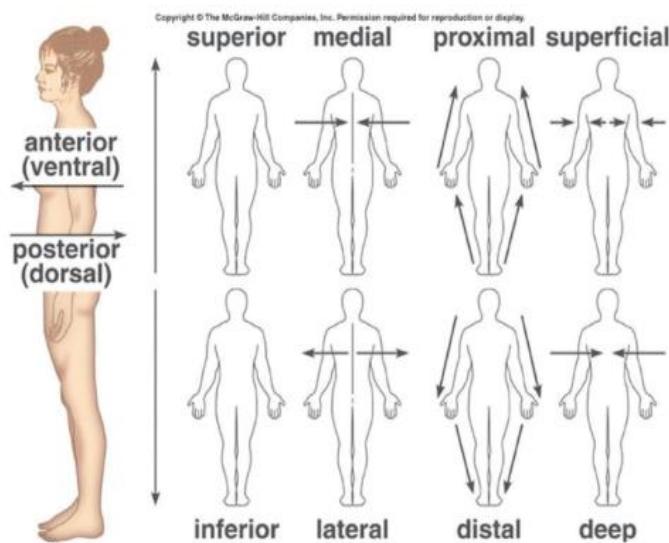
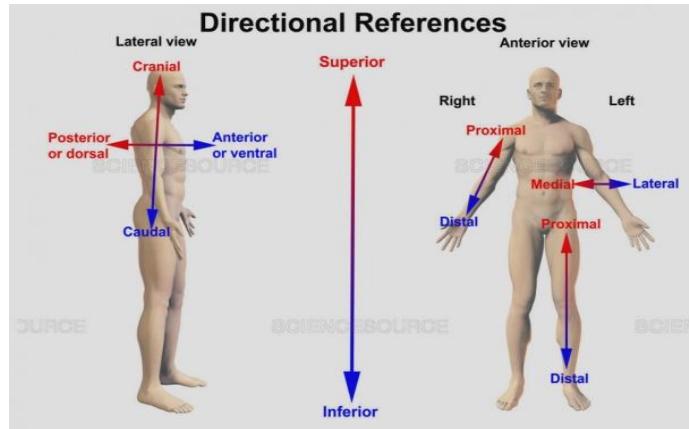
WHAT IS ANATOMICAL POSITION?

Anatomical position refers to the pose in which a person is standing upright with their face forward, their arms at their sides, and their palms and feet facing forward. The term is used in medicine and related fields when referring to the position of body parts in relation to each other.

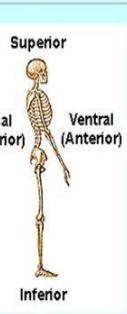
IMPORTANCE OF ANATOMICAL POSITION:

The anatomical position is of importance in anatomy because it is the position of reference for anatomical nomenclature. Anatomic terms such as anterior and posterior, medial and lateral, abduction and adduction, and so on apply to the body when it is in the anatomical position.





Directional Terms of the Body	
Direction	Description
Ventral	Toward the belly (front)
Dorsal	Toward the back
Rostral	Toward the nose
Caudal	Toward the tail
Superior	Toward the top of the head/body
Lateral	Away from the middle
Medial	Toward the middle
Bilateral	On both sides
Ipsilateral	On the same side
Contralateral	On the opposite side



Superior
Dorsal (Posterior)
Ventral (Anterior)
Inferior
Side View



Superior
Lateral
Medial
Inferior
Front View

DIRECTIONAL TERMS

- **Superficial** – On the surface / toward the surface
- **Deep** – internal / away from the surface
- **Right** – Towards the right side
- **Left** – Towards the left side
- **Anterior / ventral** – Front
- **Posterior / dorsal** – back
- **Medial** – toward the centre / midline of the body
- **Lateral** – Away from the centre/ midline of the body
- **Superior** – upper portion
- **Inferior** – lower portion
- **Proximal** – an extremity – toward / closer to the attachment
- **Distal** – an extremity – away / farther from the attachment
- **Prone** – face downward, palms facing posteriorly (dorsal up , ventral down)
- **Supine** – face upward , palms facing anteriorly down , (dorsal ventral up)
- **Ulnar** – related to medial side structures in the upper limb
- **Radial** - related to lateral side structures in the upper limb

PRONE POSITION



SUPINE POSITION



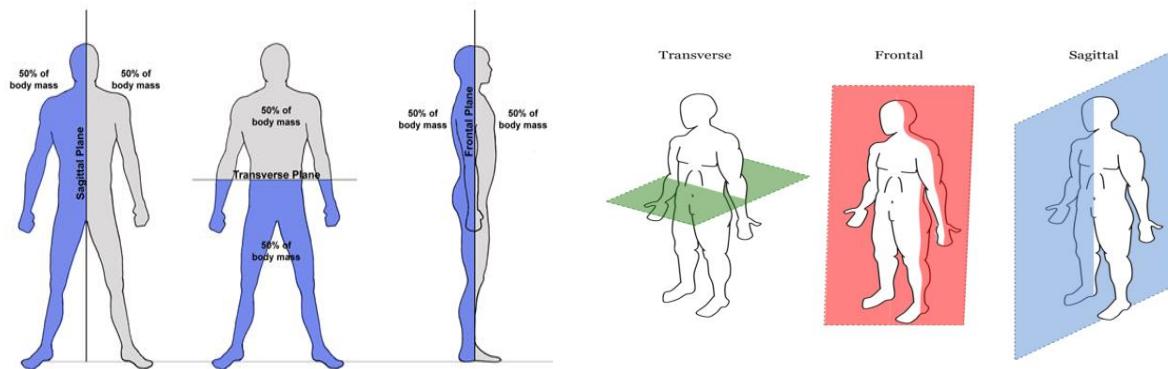
RADIAL AND ULNAR SIDE



PLANES OF THE BODY

An anatomical plane of the body is an imaginary flat surface that passes through the body at different places in order to divide it for anatomical purposes.

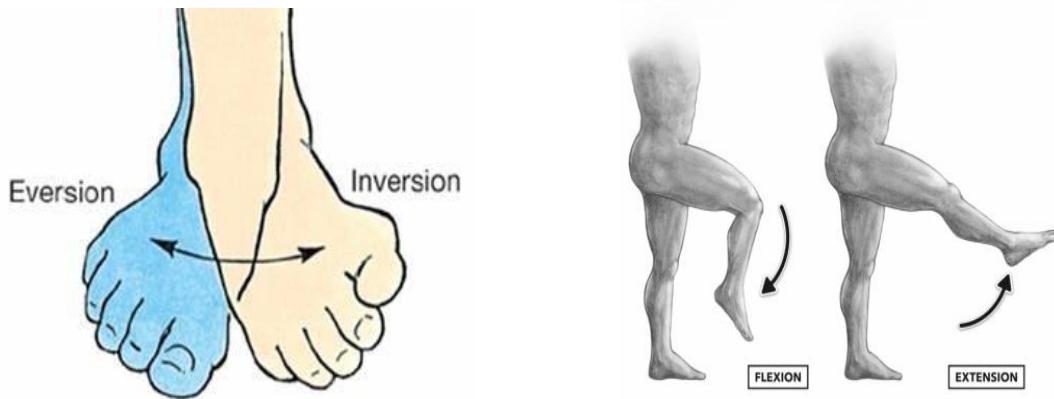
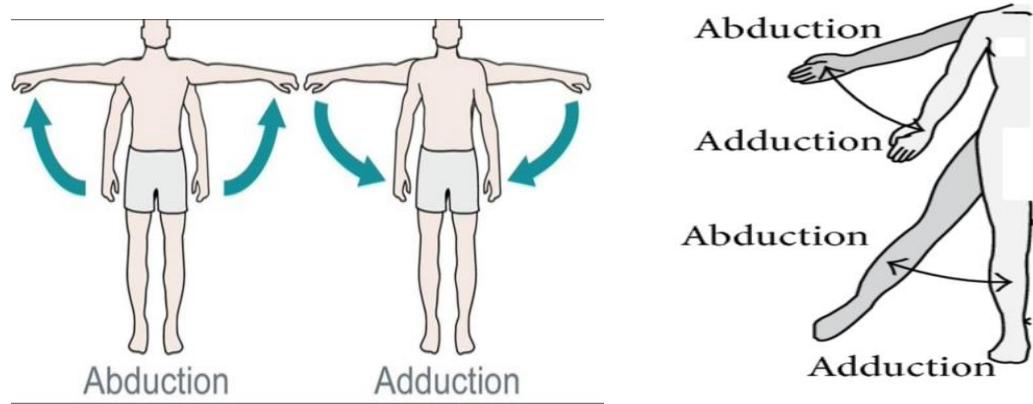
- **Mid sagittal / median plane** – equal right and left halves
 - **Sagittal/ lateral plane** – right and left halves
- **Transverse / horizontal plane** – upper and lower halves
- **Frontal plane / coronal plane**– front and back halves

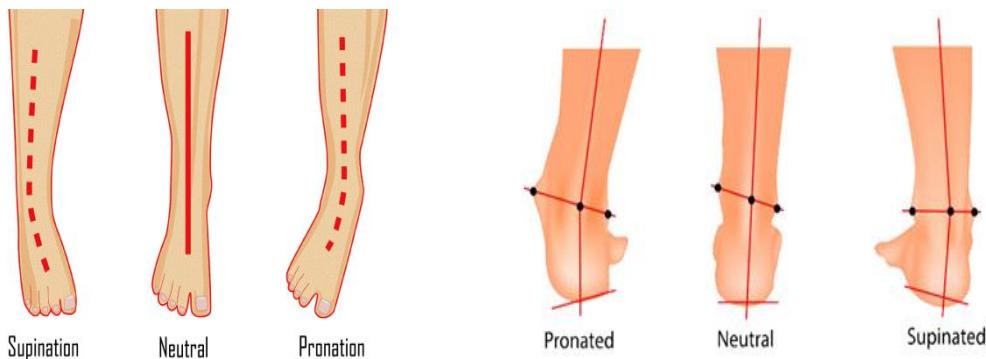
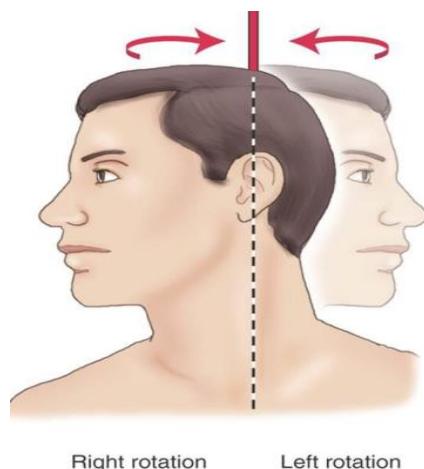
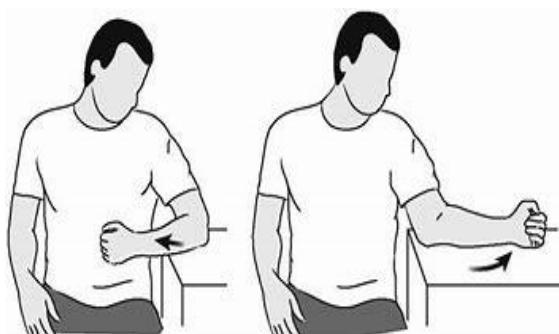


MOVEMENT TERMS

- **ADDUCTION** – Toward the medial line
- **ABDUCTION** – Away from the medial line
- **INVERSION** – Turning toward the midline
- **EVERSION** – Turning away from the midline
- **FLEXION** – Decreases the angle b/w two adjoining bones
- **EXTENSION** - Increases the angle b/w two adjoining bones
- **DORSIFLEXION** – Toes and foot upward
- **PLANTAR FLEXION** – Toes and foot downward
- **RADIAL DEVIATION** – Joint of a wrist / hand away from midline

- **ULNAR DEVIATION** – Joint of a wrist / hand toward the midline
- **INTERNAL ROTATION** – Joint rotation inward
- **EXTERNAL ROTATION** – joint rotation outward
- **RIGHT / LEFT ROTATION** – Joint rotation to the RIGHT / LEFT
- **SUPINATION OF FOREARM**– Rotation of a forearm – palm facing upward
- **SUPINATION OF A FOOT** – medial edge raised upward (foot adducted and inverted)
- **PRONATION OF FOREARM** – Rotation of a forearm – palm facing downward
- **PRONATION OF A FOOT**– lateral edge raised upward (foot abducted and everted)





BODY CAVITIES

The body has many cavities, such as the nasal cavity, the cranial cavity, and the thoracic (chest) cavity. Some of these cavities open to the outside of the body and others do not.

Four major body cavities :

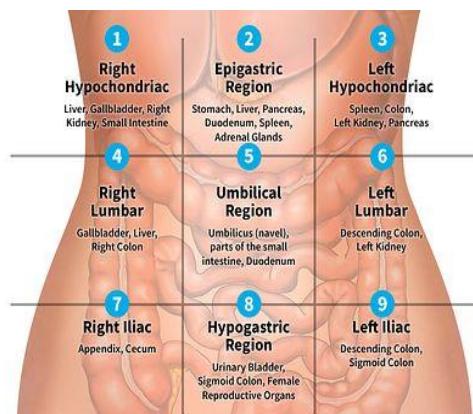
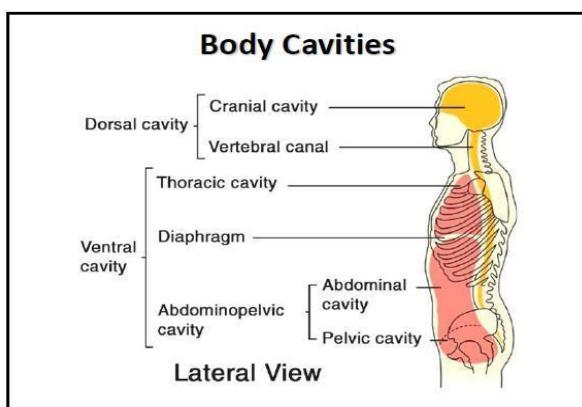
The dorsal cavities are the cranial cavity and the spinal cavity. The ventral cavities are the thoracic cavity and the abdominopelvic cavity.

■ DORSAL CAVITIES

- **CRANIAL CAVITY** – Brain
- **SPINAL CAVITY** – Spinal cord

■ VENTRAL CAVITIES

- **THORACIC CAVITY**
 - Lungs , trachea, esophagus , heart
- **ABDOMINO PELVIC CAVITY**
 - Stomach, Intestines
 - Liver , Spleen , pancreas, Kidneys, Reproductive organs



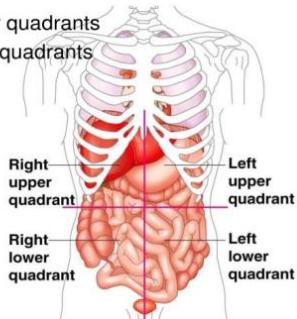
REGIONS OF ABDOMINO PELVIC CAVITY

- RT hypochondriac
- Epigastric
- LT hypochondriac
- RT Lumbar
- Umbilical
- LT lumbar
- RT inguinal
- Hypogastric / suprapubic
- LT inguinal

Abdominal Quadrants

- **Abdominal quadrants** divide the abdomen into four quadrants

- Right upper and left upper quadrants
- Right lower and left lower quadrants



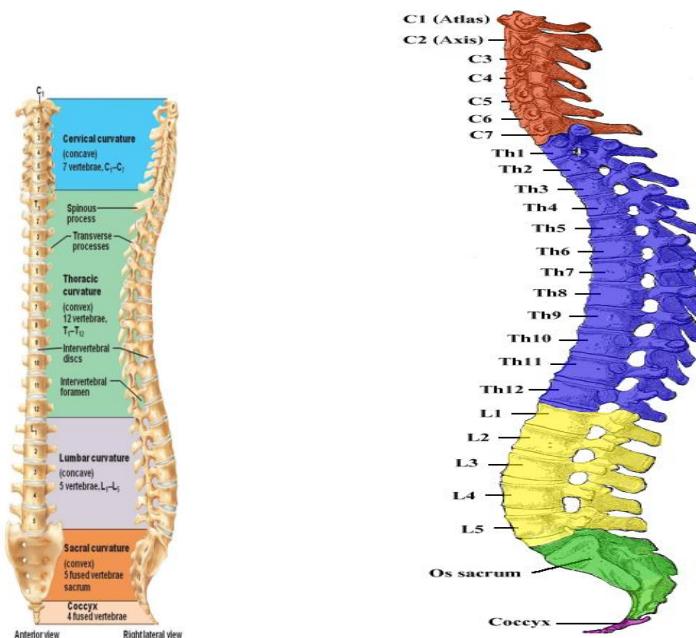
- **RUQ – RIGHT UPPER QUADRANT**
- **RLQ – RIGHT LOWER QUADRANT**
- **LUQ – LEFT UPPER QUADRANT**
- **LLQ – LEFT LOWER QUADRANT**

SPINE - VERTEBRAL COLUMN / BACKBONE

- Provides support to our body
- Supports Spinal cord (carries nerve impulses between brain and rest of the body)
- Bones called Vertebrae – 5 regional divisions
- Except coccyx , individual vertebrae are numbered
- The thoracic region is also referred to as the *dorsal region*
- There are five sacral vertebrae, which fuse to form the sacrum.
- Four small segments of bone form the coccyx.

DIVISIONS OF VERTEBRAE

- **CERVICAL – C1 – C7**
- **THORACIC – T1 – T12**
- **LUMBAR -- L1 – L5**
- **SACRAL -- S1 - S5 (FUSED TO FORM SACRUM)**
- **COCCYX / TAIL BONE -- 4 coccygeal segments fuse to form one bone**



BASIC STRUCTURE OF A MEDICAL TERMINOLOGY:

Medical terms generally have 3 parts:

1. Roots
2. Prefixes
3. Suffixes

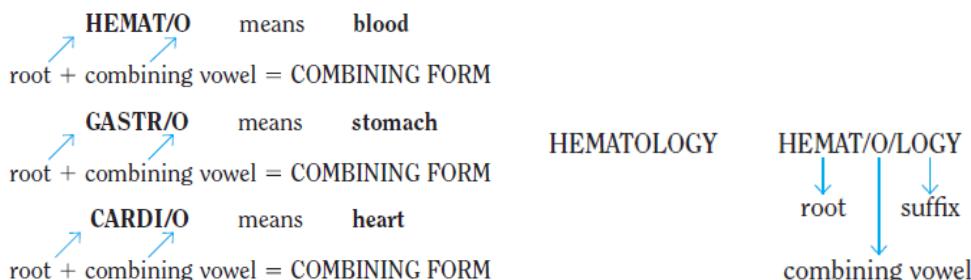
When you put them all together, the three parts of the word create a more specific medical term. Some medical terms may have all three parts, whereas others might have only one or two.

Root Words are the part of the word that can stand alone as the main part of the medical term. It holds the fundamental meaning of the phrase. Sometimes, medical terms can have more than one root.

These word roots were derived from the Greek / Latin word

COMBINING FORMS

- Combining form of a word consists of a word root and a vowel
- Eg : Brachi/o
- Brachi – word root , o - vowel
- Word roots derived from Greek or Latin
- If suffix starts with vowel , combining vowel is dropped.
- Eg : bronchi/itis



The root is the **foundation of the word**. All medical terms have one or more roots. For example, the root hemat means blood.

The suffix is the **word ending**. All medical terms have a suffix. The suffix -logy means process of study.

The combining vowel—usually o, as in this term—**links the root to the suffix or the root to another root**. A combining vowel has no meaning of its own; it joins one word part to another.

It is useful to read the meaning of medical terms **starting from the suffix and then going back to the beginning of the term**.

Thus, the term **hematology** means process of study of blood.

GASTRITIS GASTR/ITIS
 ↓ ↓
 root suffix

The root **gastr** means stomach.

The suffix **-itis** means inflammation.

The entire word, reading from the end of the term (suffix) to the beginning, means inflammation of the stomach.

Notice that the combining vowel, o, is missing in this term. This is because the suffix, -itis, begins with a vowel. The combining vowel is dropped before a suffix that begins with a vowel. It is retained, however, between two roots, even if the second root begins with a vowel.

Some of the combining forms and its meaning:

COMBINING FORMS	MEANING
arthr/ð	joint
audi/o; audit/o	hearing
bronch/o	bronchus
carcin/ð	cancer
cardi/o	heart
derm/o; dermat/o	skin
enter/o	intestines
gastr/o	stomach
hem/o; hemat/o	blood
hepat/o	liver
lip/o	fat, lipid
lith/o	stone, calculus
mast/o	breast
muscul/o	muscle
my/o, myos/o	muscle
nephhr/ð	kidney
neur/o	nerve
oste/o	bone
pulm/o; pulmon/o	lung
ren/o	kidney
rhin/o	nose
scler/o	hardness
ten/o	tendon
thorac/ð	chest
vascul/ð	blood vessel

COLOR RELATED COMBINING FORMS

COMBINING FORM	COLOR
<ul style="list-style-type: none"> • alb/o • albin/o • leuc/o • leuk/o 	WHITE
<ul style="list-style-type: none"> • anthrac/o • melan/o 	BLACK
• chlor/o	GREEN
• cyan/o	BLUE
• eosin/o	RED / ROSY
<ul style="list-style-type: none"> • erythem/o • erythemat/o • erythr/o 	RED / REDNESS
<ul style="list-style-type: none"> • glauc/o • poli/o 	GRAY
• cirrh/o	TAWNY YELLOW
<ul style="list-style-type: none"> • jaund/o • lute/o • xanth/o 	YELLOW
<ul style="list-style-type: none"> • chrom/o • chromat/o 	COLOR
• phe/o	DARK / DUSKY



PREFIXES

- A word element attached at the beginning of a word

SUFFIXES

- A word element attached at the last of a word

In summary, the **important elements of medical terms** are the following:

1. **Root:** foundation of the term
2. **Suffix:** word ending
3. **Prefix:** word beginning
4. **Combining vowel:** vowel (usually o) that links the root to the suffix or the root to another root
5. **Combining form:** combination of the root and the combining vowel

PREFIXES

PREFIXES	MEANING	EXAMPLE
ant-	against	antacid
anti-	against	anticoagulant
auto-	self	autoimmune
brachy-	short	brachycephalic
brady-	slow	bradycardia
co-	together, with	codependent
con-	together, with	congenital
contra-	against; opposite	contraceptive
counter-	opposing	counterbalance
dys-	bad; painful; difficult	dyspepsia
echo-	sound	echocardiogram
eu-	good; normal	euthyroid
ex-	former	ex-husband
hetero-	different	heterozygote
homo-	same	homozygote
mal-	bad	malpractice
meta-	between; beyond; change	metastasis
neo-	new	neoplasm
mid-	middle	midwife
pachy-	thick	pachyderm
pseudo-	false	pseudoplatelet
quasi-	to some degree	quasidominant
re-	again; back	regenerate
self-	oneself	selfexamination
sym-	together; with	sympathetic
syn-	together; with	synchondrosis
tachy-	rapid	tachycardia
tele-	distant	telemotosis

PREFIXES OF NEGATION

PREFIXES	MEANING	EXAMPLE
a-	no; not; without	amorphous
an-	no; not; without	analgesic
de-	lack of; loss; removal of	dehydration
im-	not	impotent
in-	not	infertile
nulli-	none	nulligravida
un-	not	unplug

PREFIXES OF POSITION / DIRECTION

PREFIXES	MEANING	EXAMPLE
ab-	away from	absorb
ad-	toward	Adsorption
af-		afferent
ana-	backward; up; again	anaphase
ante-	before; forward; in front	antipyretic
cata-	down (opposite of <i>ana-</i>)	catatonic
circum-	circular movement; surrounding	circumcision
de-	down	descending
dia-	through; across; complete	diathermy
ec-	out; outside	Ecchondroma
ecto-		ectoblast
ef-	out, away from	efferent
em-	in	embolism
en-	in; within	Encystment
end-		Endarterectomy
endo-		endoscope
epi-	above; upon; on	epidural
ex-	out; away from	Exenteration
exo-	out; outside; away from	Exocytosis
extra-	outside	extraocular
in-	in; into	inborn
infra-	under; below; inferior to; beneath	infrared
inter-	between	intercourse

intra-	within	intraocular
medi-	middle	Medisect
meso-		mesoderm
over-	above or beyond in position; above in rank	overcorrection
para-	near; beside; beyond; abnormal	parathyroid
per-	through	perfuse
peri-	around; surrounding	peridural
post-	after; behind	postnasal
pre-	before; in front	precardiac

PREFIXES OF QUANTITY

PREFIXES	MEANING	EXAMPLE
bi-	Two	Bipolar
bis-	two or twice	bisalbuminemia
di-	Two	Diphenyl
diplo-	double; twofold	diplobacillus
hemi-	half	hemisphere
hyper-	excessive; above normal; above	hyperactive
hypo-	deficient; less than; below; under	hypoallergenic
mono-	one	mononucleosis
multi-	many	multipara
pan-	all	panarteritis
poly-	many; much	polyarthritis
quadri-, quadruplo-	four	quadruplet
semi-	half	semiconscious
tetra-	four	tetracoccus
uni-	one	unicellular

GENERAL SUFFIXES

SUFFIX	MEANING	EXAMPLE
-able	capable of; able to	Viable
-ible		audible
-ac	one affected with	hypochondriac
-al	pertaining to; action or process	renal
-ar	relating to or resembling	bipolar
-ary	of or relating to	dietary
-ate	characterized by	chordate
-ate	to act on in a specific way	indoctrinate
-er	one who	leader
-ia	condition	dementia
-ic	of or pertaining to	Optic
-ical		optica
-icle	small; minute	particle
-ics	organized knowledge or practice	pediatrics
-ion	process	digestion
-ism	medical condition or disease; doctrine or belief	alcoholism
-ist	someone who specializes in a particular subject	psychiatrist
-ive	tending toward a specific action	supportive
-ize	to make or become; to treat; used to make a verb from a noun	catheterize
-logist	one who studies a particular subject	psychologist
-logy	study of a particular subject	hematology
-or	one who	actor
-ose	having the characteristics of	Verbose
-ous		studious
-y	having the qualities of; full of state or condition; activity; body or group of	Hairy jealousy

MEDICAL AND SCIENTIFIC SUFFIXES

SUFFIX	MEANING	EXAMPLE
-algia	pain	neuralgia
-blast	immature cell	erythroblast
-cele	swelling; hernia	cystocele
-clasia	break; fracture	Dioclasis
-clasis		Anaclasis
-clast		osteoclast
-cyte	cell	lymphocyte
-desis	binding; tying together	arthrodesis
-dynia	pain	mastodynia
-ectomy	removal of an anatomical part	appendectomy
-emia	blood condition	leukemia
-form	in the shape of; equivalent to	vermiform
-gen	producing; one that produces	Carcinogen
-genesis	coming into being	Pathogenesis
-genic	produced or formed by or in	pathogenic
-gram	Recording	Sonogram
-graph	instrument for recording	Cardiograph
-graphy	process of recording	cardiography
-iasis	condition or state, usually unhealthy	lithiasis
-iatry	treatment; medical specialty	psychiatry
-itis	inflammation	colitis
-megaly	enlargement	cardiomegaly
-meter	Measure	Thermometer
-metry	process of measuring	audiometry
-oid	resembling	fibroid
-ole	small; minute	systole
oma (pl. -omata)	mass; tumor	lymphoma
-osis (pl. -oses)	denotes a condition (usually abnormal)	cirrhosis
-pathy	disease; emotion	osteopathy
-penia	deficiency	osteopenia
-pexy	fixation; put in place surgically	mastopexy
-phage	eating; swallowing	Lipophage
-phagia		Lipophagia
-phagic		Cytophagic
-phagy		cytophagy

-phasia	speech	aphasia
-philia	affinity for	Haemophilia
-philic		hemophilic
-plasia	formation or growth	Hyperplasia
-plastic	pertaining to formation	rhinoplastic
-plasty	surgical repair	rhinoplasty
-plegia	paralysis; palsy	paraplegia
-pnea	breathing	apnea
-poiesis	producing	hemopoiesis
-rrhage	excessive discharge	Haemorrhage
-rrhagia		menorrhagia
-rrhaphy	suture	gastorrhaphy
-rrhea	flow; discharge	diarrhea
-rrhexis	rupture	arteriorrhesis
-scope	instrument for examination	Stethoscope
-scopy	action of using an instrument for viewing	endoscopy
-stomy	artificial opening	colostomy
-tome	instrument to cut; segment	Tenotome
-tomy	incision; process of cutting into	tenotomy
-tripsy	crushing	lithotripsy
-trophic	pertaining to nutrition	Hypertrophic
-trophy	nourishment; development	hypertrophy
-ula	small; minute	Fistula
-ule		granule
-um	thing	pericardium

MEDICAL TERMS USED AS SUFFIXES

TERM AS SUFFIXES	MEANING	EXAMPLE
centesis	surgical puncture to remove fluid	amniocentesis
coccus (pl. cocci)	berry-shaped bacterium	pneumococcus
constriction	narrowing	vasoconstriction
cytosis	abnormal increase in number of cells	phagocytosis
dilation	widening	vasodilation
ectasia, ectasis	dilation	ureterectasia, ureterectasis
edema	swelling (with fluid)	lymphedema
emesis	vomiting	cholemesis
fusion	pouring	transfusion

globin	protein	Haemoglobin
globulin		immunoglobulin
gravid	pregnant woman	nulligravida
lysis	Destruction , breaking down	catalysis
lytic	pertaining to lysis	catalytic
malacia	softening	scleromalacia
para	a woman who has given birth, used to indicate the number of times a woman has given birth	multipara
Paresis	slight paralysis	hemiparesis
Phobia	fear	hydrophobia
Plasm	formation	protoplasm
Porosis	lessening in density	osteoporosis
Ptosis	drooping; sagging; prolapse	nephroptosis
Sclerosis	hardening	arteriosclerosis
Spasm	sudden contraction of muscles; twitching	angospasm
stasis	stopping; controlling	homeostasis
stenosis	tightening; stricture	bronchostenosis
therapy	treatment	chemotherapy
thorax	pleural cavity; chest	pneumothorax

IRREGULAR PLURAL FORMS

When the word ends in ...	The plural ending is ...	Singular	Plural
-a	-ae	bursa	bursae
-ax	-aces	thorax	thoraces
-en	-ina	lumen	lumina
-ex	-ices	cortex	cortices
-is	-es	diagnosis	diagnoses
-ix	-ices	varix	varices
-ma	-mata	carcinoma	carcinomata
-nx	-nges	pharynx	pharynges
-on	-a	spermatozoon	spermatozoa
-um	-a	ilium	ilia
-us	-i	streptococcus	streptococci
-y	-ies	surgery	surgeries

ABBREVIATION

ABBREVIATIONS	MEANING
cc	courtesy copy
CC	Chief Complaint
FH	Family History
HPI	History of Present Illness
IS	information system
MR#	medical record number
OP	operation, operative procedure, outpatient
OR	operating room, operative report
PE	Physical Examination
PMH	Past Medical History
PSH	Past Surgical History
RO	rule out
ROS	Review of Systems
SH	Social History
PFSH	Past, family and social history

EYE/ VISUAL SYSTEM

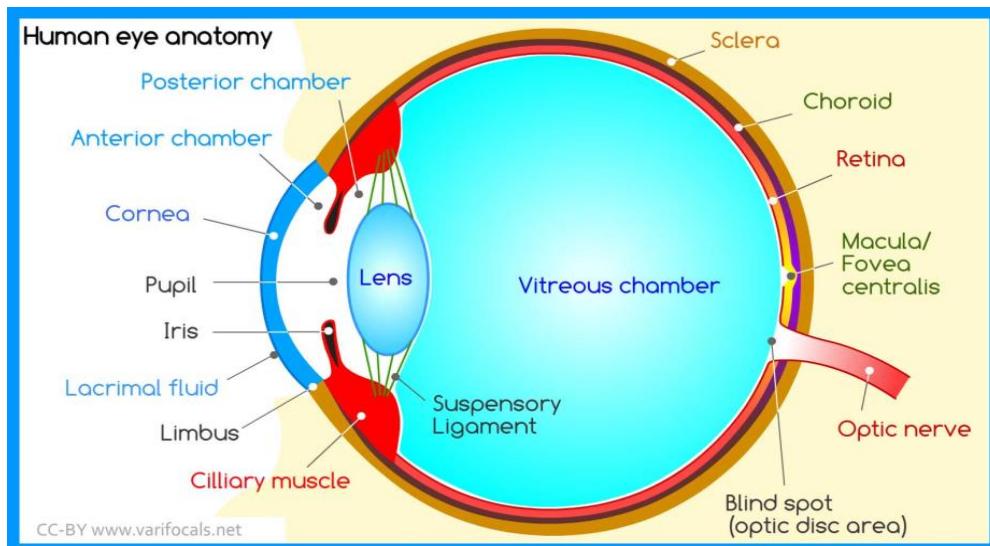
GENERAL TERMS:

- OPTHALMOLOGY
- OPTHALMOLOGIST
- OPTOMETRIST
- ANATOMY AND PHYSIOLOGY OF THE EYE
- VISUAL DISORDERS
- LENS CORRECTION
- PATHOLOGY – DISEASE CONDITIONS
- PROCEDURES – DIAGNOSTIC AND THERAPEUTIC
- MEDICAL TERMINOLOGIES
- ABBREVIATIONS

EYE

- EYES ARE THE ONE OF THE MOST IMPORTANT SENSE ORGANS WHICH ENABLES US TO SEE THE WORLD
- EYES ARE A MEDIUM TO INTERACT WITH OUR ENVIRONMENT
- THE STUDY OF THE STRUCTURE, DISEASES, AND REFRACTIVE ERRORS ASSOCIATED WITH THE EYES IS KNOWN AS OPHTHALMOLOGY
- A PHYSICIAN WHO SPECIALIZES IN THIS AREA OF STUDY IS KNOWN AS AN OPHTHALMOLOGIST
- AN OPTOMETRIST IS A LICENSED MEDICAL PROFESSIONAL WHO SPECIALIZES IN THE EXAMINATION OF THE EYES AND THE DIAGNOSIS AND CORRECTION OF REFRACTIVE ERRORS THROUGH THE USE OF CORRECTIVE LENSES

ANATOMY OF EYE



- EYE Is Located In A Bony Cavity – Orbit / Eye Socket
- Eye – Spherical , Has 3 Layers
- **Sclera (Outermost Layer)**
- **Choroid (Middle Layer)**
- **Retina (Innermost Layer)**

SCLERA

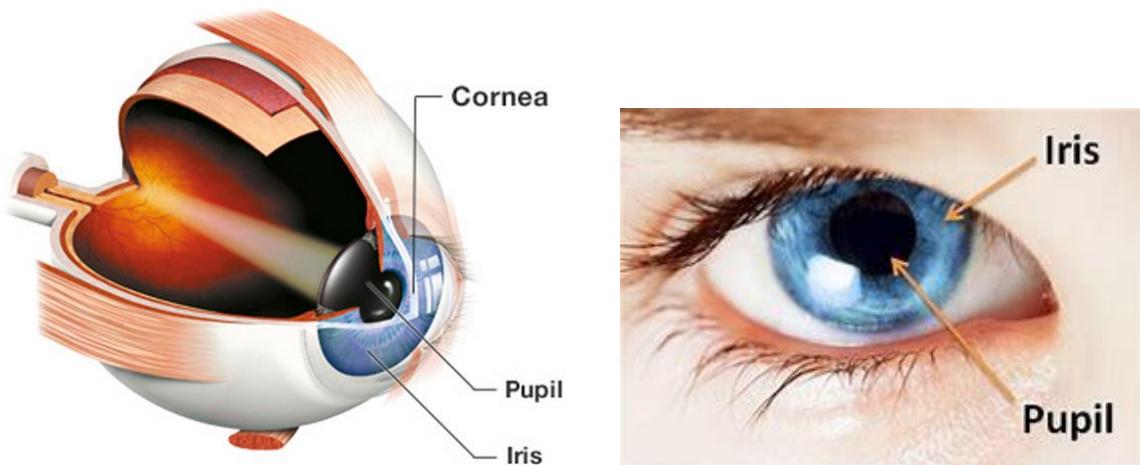
- Tough Protective Layer Of The Eye, “White Part”

CHOROID

- The Middle Layer And Provides Blood Supply

RETINA

- Innermost Layer Which Contains Nerve Endings That Receive Light And In Response Transmit This Information To The Brain
- Contains Light-Receptive Cells (Rods And Cones)
- Converts Light To Electrical Signals



PUPIL

- Pupil, Also Known As The “Black Hole” – Dark Centre Of The Eye
- ✓ The Hole / Opening Where Light Enters The Eye
- ✓ Pupil Size Is Controlled By Iris Muscles
- MECHANISM:
- The Pupil Dilates In Dark Or Dim Light To Regulate The Amount Of Light And Enhances The Vision
- Similarly, It Constricts During Bright Light As Enough Amount Of Light Is Present

IRIS

- IRIS – Belongs To The Middle Layer
- The Coloured Part Of The Eye
- Brown, Blue, Grey, Hazel, Black, Sea Green / Various Other Combinations

- Iris Controls The Amount Of Light Entering Through Pupil By Dilating The Pupil In Dim Light And Constricting It In Bright Light.

CORNEA

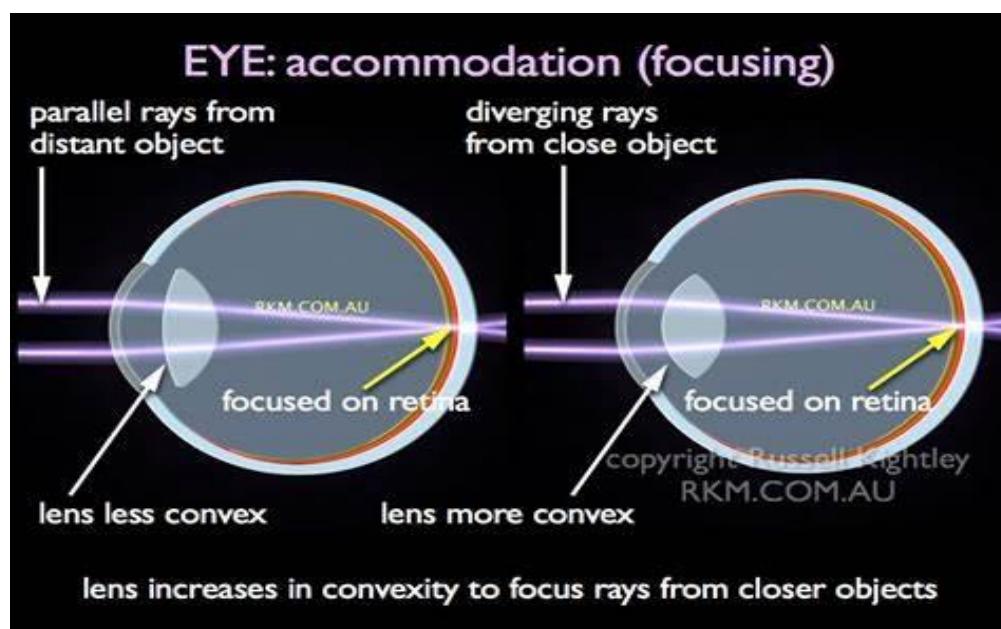
- Transparent Portion Of Sclera - Extends Over The Pupil
- Directly In Front Of The Lens And Focuses Light Through The Lens Onto The Retina At The Back Of The Eye

LENS

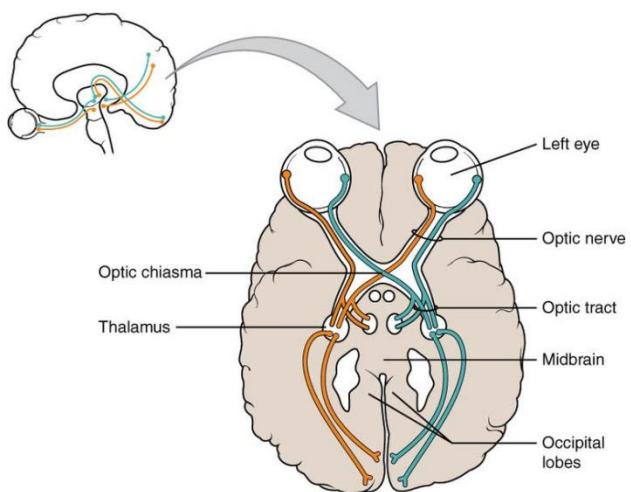
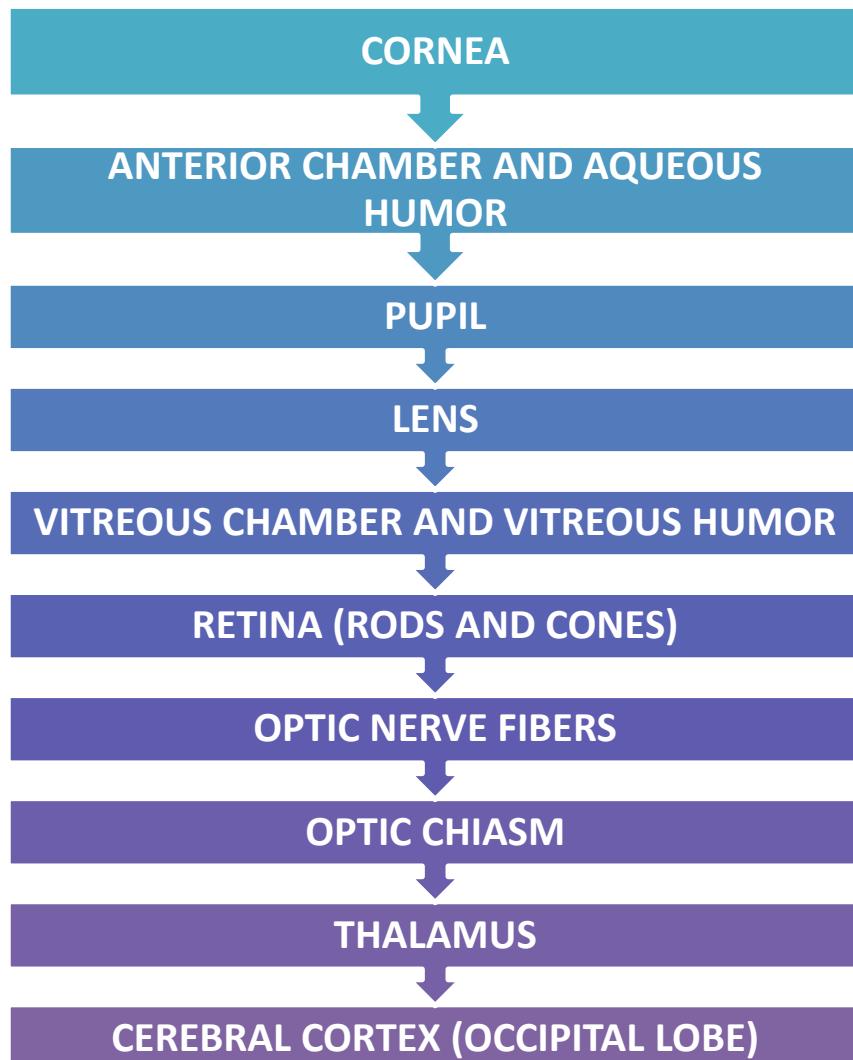
- Held In Place By Special Muscles Called The Ciliary Body
- Ciliary Body – These Muscles Relax And Contract, They Make The Lens Thicker Or Thinner. This Process Is Referred To As Accommodation.
- Causes Light Rays To Be Properly Focused On The Retina.
- Converging Lens
 - Allows Us To See Objects Near And Far
 - Lens Is Situated Behind The Pupil

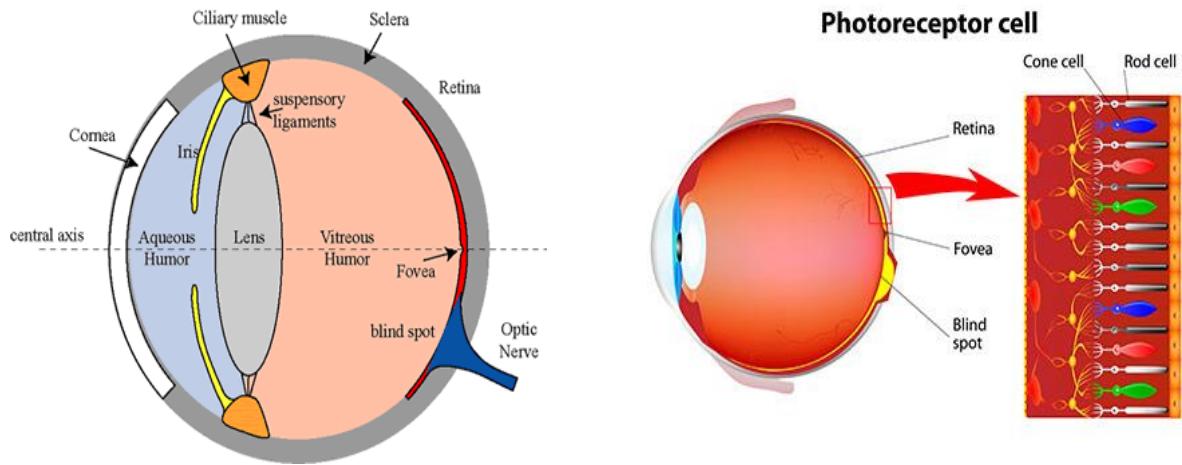
ACCOMODATION OF EYE

- Contraction And Relaxation Of The Ciliary Muscles Help The Lens To Adjust And Make It Thicker Or Thinner, This Makes The Light Rays To Focus Properly On Retina



PATHWAY OF LIGHT – CORNEA TO CEREBRAL CORTEX OF BRAIN





HUMOURS OF EYE

- Aqueous Humour
- Vitreous Humour
- Aqueous Humour Is Contained In The Aqueous Body Which Is The Part Of The Eye Infront Of The Lens.
- Secreted By Ciliary Body.
- The Iris Divides The Aqueous Body Into An Anterior Chamber And Posterior Chamber
- The Posterior Chamber Continuously Produces Aqueous Humour And Is Drained Into The Vascular System From The Eye By A Duct Named Canal Of Schlemm (Located Near The Anterior Chamber)
- Vitreous Humour Is Contained In The Vitreous Body(Part Of The Eye Behind The Lens) – Soft, Jelly Like Material
- Both The Humours Are Capable Of Refracting Light

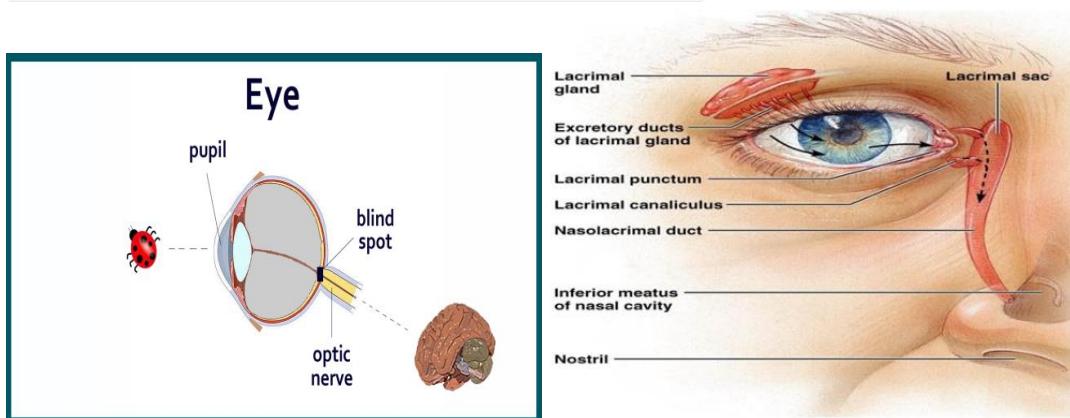
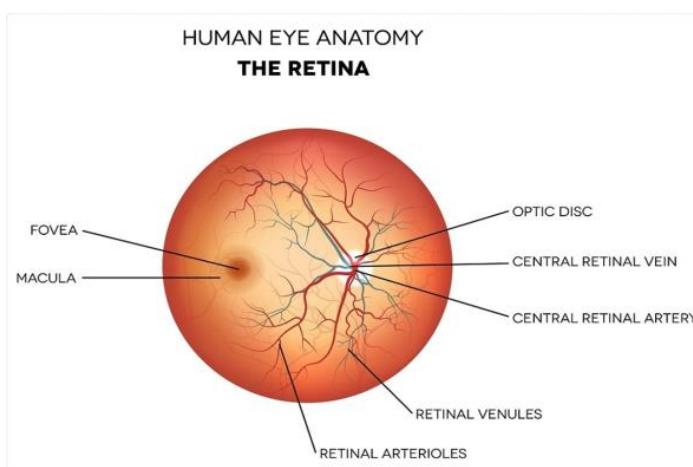
PHOTO RECEPTORS

- 2 Types
- Rods (Dim Light- Black And White Including Various Shades Of Grey)
- Cones (Bright Light- Colour Vision)
- They Contain Photo Pigments –Undergo A Change When Light Strikes Them Stimulating The Rods And Cones And Causing Nerve Impulses To Be Transmitted Through Optic Nerve To The Brain

PARTS IN RETINA

- Optic Nerves Enter The Eye At Optic Disks.
- Center Of The Optic Disk , Region Without Any Photoreceptors – Blind Spot

- **Macula** : Posterior Pole Of The Eye. Intersection Point Of The Retina With Optical Axis Of The Eye.
- **Fovea Centralis**: Area Of Slight Depression In The Macula , Making Retina Very Thin. It Is The Area Of The Eye Where Vision Is Most Perfect



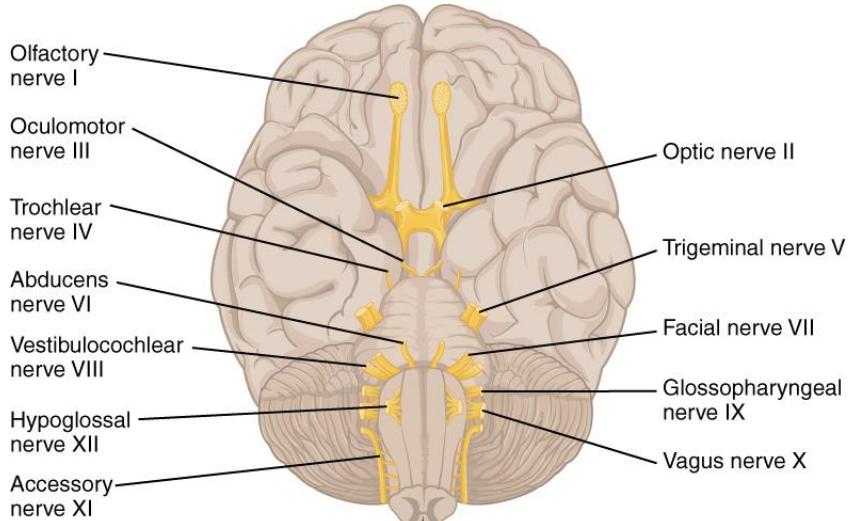
- Both Eyes Are Protected And Moisturized Via Movable Folds Of Skin Above And Below The Eyeballs. They Are Called **Eyelids**.
- **Conjunctiva** Covers The Exposed Part Of Sclera(Except Cornea) Along With Inner-Surface Of Eyelids.
- **Eyelashes** Protect Eyes From Dust And Small Airborne Particles.

LACRIMAL GLANDS:

- Lacrimal Glands Situated Superolateral To The Center Of The Eye Is Responsible For Tear Production And Eye Lubrication As A Whole
- Lacrimal Ducts Transport Tears To Superolateral Part Of The Conjunctiva, Collecting At Medial Canthus(Medial Angle Of The Eye) Then Through The Opening Of Lacrimalpuncta(Pinpoint/Microscopic Openings) To The Lacrimal Canals And Finally Collecting In The Lacrimal Sac.

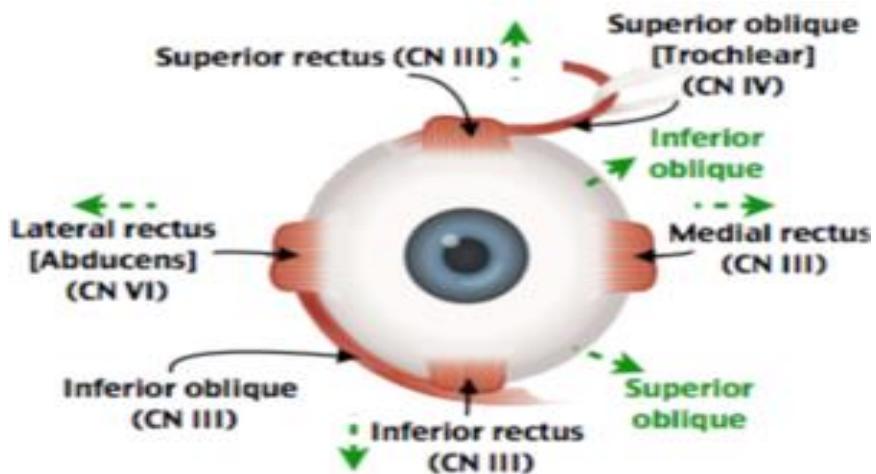
- Lacrimal Sac Is Superior Portion Of Nasolacrimal Duct Which Empties Into Nasal Cavity ,Hence Leading To Congestion While Crying.

Movement Of Eye Ball Controlled By NERVES AND MUSCLES:

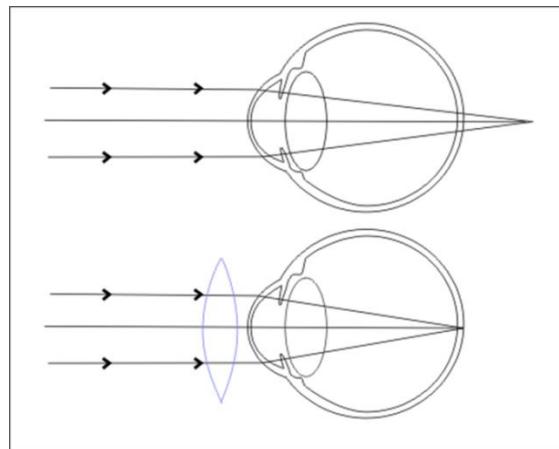
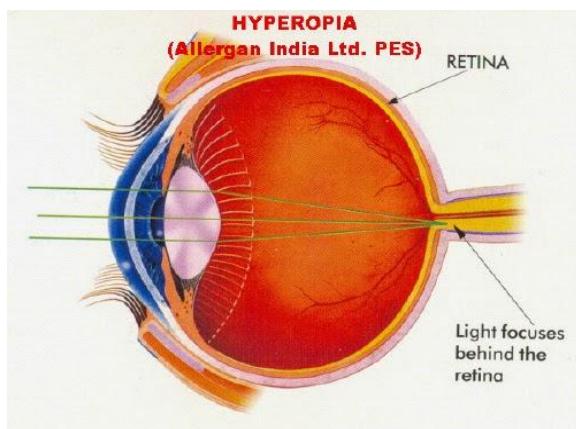


**OCULOMOTOR NERVE III
TROCHLEAR NERVE IV
ABDUCENS NERVE VI**

MUSCLE	FUNCTION	CRANIAL INNERVATION
EXTRINSIC MUSCLES OF THE EYE		
Inferior rectus	Rotates eyeball downward and medially; adducts	Oculomotor nerve (III)
Lateral rectus	Rotates eye laterally; abducts eyeball	Abducens nerve (VI)
Medial rectus	Rotates eye medially; adducts eyeball	Oculomotor nerve (III)
Superior rectus	Causes eye to look up	Oculomotor nerve (III)
Inferior oblique	Rotates eyeball upward and outward; abducts	Oculomotor nerve (III)
Superior oblique	Rotates eyeball downward and outward; abducts	Trochlear nerve (IV)
INTRINSIC SMOOTH MUSCLES OF THE EYE		
Ciliary muscle	Regulation of lens shape for close vision	Oculomotor (III)
Iris (radial muscles)	Sympathetic stimulation; dilation of pupil	Oculomotor (III)
Iris (circular muscles)	Parasympathetic stimulation; contraction of pupil	Oculomotor (III)



VISUAL DISORDERS / REFRACTIVE ERRORS

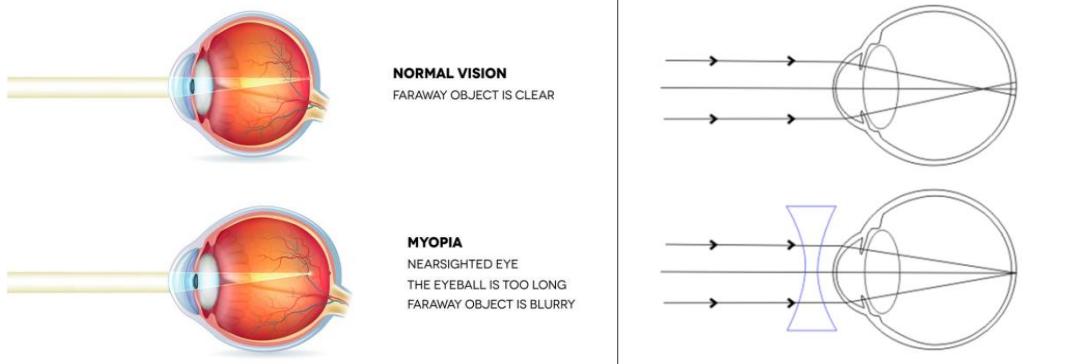


HYPERMETROPIA/HYPEROPIA

- Far-Sightedness
- Problem Seeing Close Objects
- Distance Between Lens And Retina Too Small
- Light Focused Behind Retina
- HYPERMETROPIA - CORRECTION USING CONVERGING LENS

MYOPIA

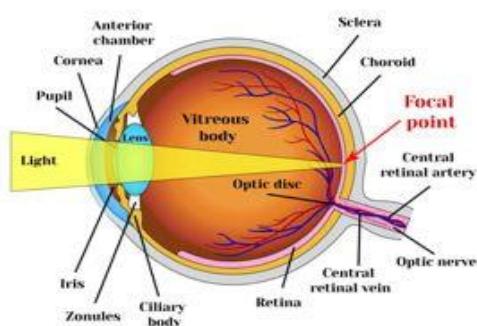
- Near-Sightedness/Short -Sightedness
- Problem Seeing Objects Far Away
- Distance Between Lens And Retina Too Large
- Light Focused In Front Of Retina
- MYOPIA - CORRECTION USING DIVERGING LENS



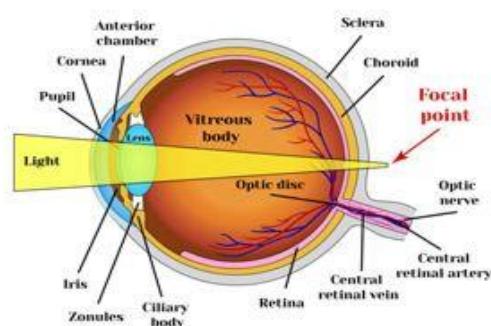
PRESBYOPIA

- Loss Of Accommodation Of The Eyes
- Form Of Far-Sightedness
- Harder For People To Read As They Age
- Lens Loses Elasticity
- Corrected By Glasses With Converging Lenses

Normal vision



Presbyopia

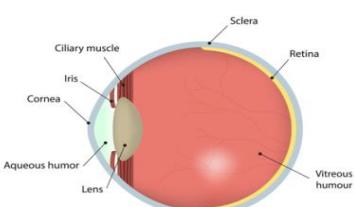


ASTIGMATISM

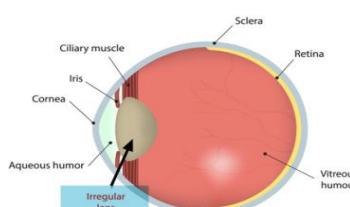
- Eye Cannot Focus An Object's Image On A Single Point On Retina
- Cornea Is Oval Instead Of Spherical / Lens Imperfection
- Causes Blurred Vision
- Some Types Can Be Corrected With Lenses

Astigmatism

Healthy Eye



Eye with Astigmatism

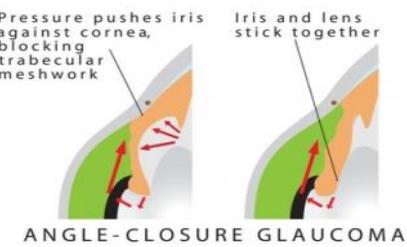
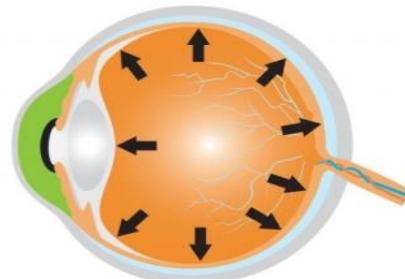
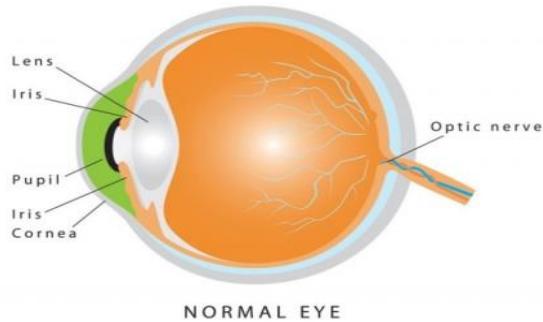
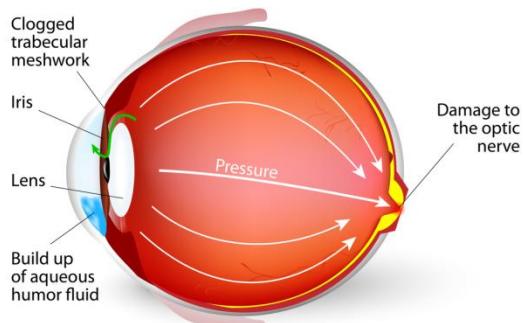


PATHOLOGY / DISEASES

GLAUCOMA

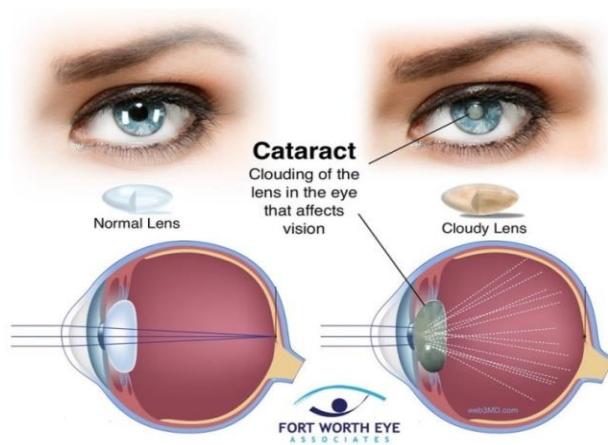
- Affects Optic Nerve – Increases The Intra-Ocular Pressure
- Loss Of Ganglion Cells
- Gradual Loss Of Sight And Eventual Blindness
- Check Eyes Regularly
- Can Be Treated

GLAUCOMA



CATARACT

- Clouding (Opacification) In Lens Due To Denaturing Of Lens Protein
- Obstructs Passage Of Light
- Caused By Age, Chronic Exposure To UV, Or Due To Trauma
- Removed By Surgery



- **Achromatopsia** – Colour Blindness
- **Amblyopia** – Poor Vision In One Eye Leading To Diminished Vision In The Other Eye
- **Blepharitis** – Inflammation Of The Margins Of The Eyelid
- **Bullous Keratopathy** – Caused Due To Edema Of The Cornea
- **Cataract** – Clouding Of The Lens Of The Eye Causing Painless And Progressive Loss Of Vision
- **Chalazion** – A Small Hard Mass On The Eyelid Due To Chronic Inflammation Of The Sebaceous Gland
- **Chemosis** – Edema That Causes Swelling Around The Cornea
- **Conjunctivitis** – Inflammation Of One Or The Both Conjunctivae
- **Corneal Ulcer** – Necrosis Of The Corneal Tissue
- **Corneitis** – Inflammation Of The Cornea
- **Cytomegalovirus Infection** – Infection By Cytomegalovirus Which May Manifest As Retinitis, Fever, Pneumonia And Hepatitis. Usually Seen In AIDS Patients
- **Dacryostenosis** – Narrowing Of The Lacrimal Canal/Nasolacrimal Duct
- **Diplopia** – Double Vision
- **Ectropion** – Eversion Of The Border Of The Eyelid
- **Entropion** – Inversion Of The Border Of The Lower Eyelid
- **Epiphora** – An Overflowing Of The Tears Onto The Cheek Caused By Inadequate Drainage
- **Episcleritis** – Inflammation Of The Episclera
- *Episclera Is The Connective Tissue B/W The Conjunctiva And The Sclera



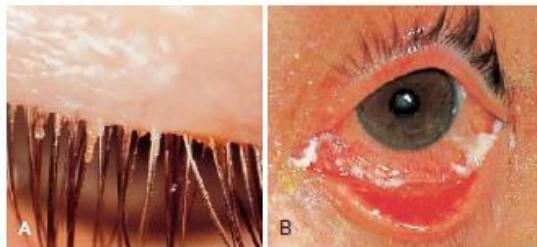
Ectropion



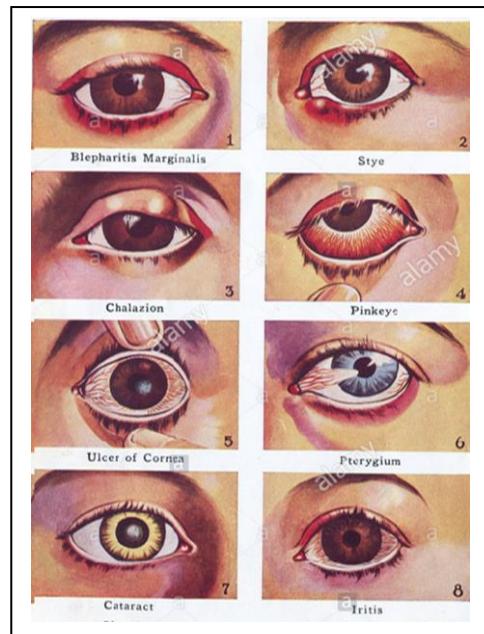
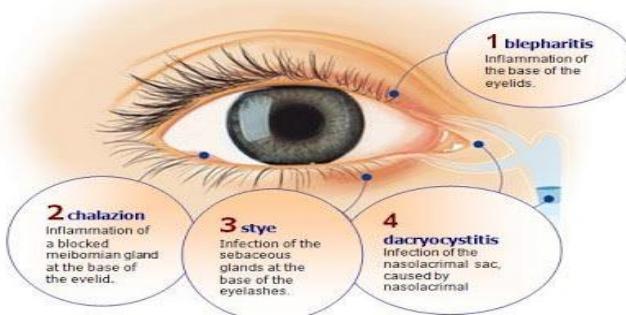
Entropion



DIPLOPIA

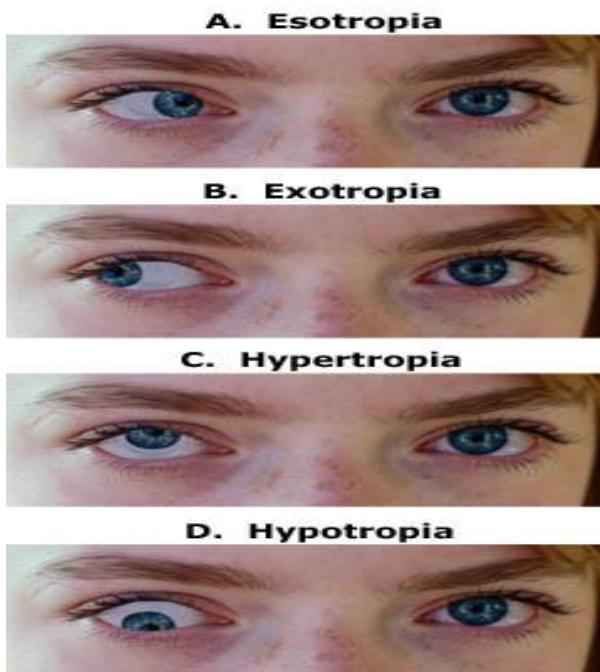


BLEPHARITIS



- **Exophthalmos** – Protusion Of The Eye Ball
- **Floater** – Vitreous Debris/Macroscopic Mass Of The Vitreous Fibers
- **Glaucoma** – Damage To The Optic Nerve Due To Increased Intra Ocular Pressure
- **Hemianopsia** – Half Vision Lost
- **Hyphema** – Blood In The Anterior Chamber Of The Eye
- **Keratitis** – Inflammation Of The Cornea
- **Keratoconus** – Thinning Of The Cornea Usually B/W Ages 10-20
- **Nyctalopia** – Night Blindness
- **Macular Degeneration** – Damage To The Macula Resulting In Loss Of Vision
- **Nystagmus** – Involuntary Movements Of The Eye Balls
- **Ocular Hypertension** – Excessively High Intra Ocular Pressure
- **Optic Neuritis** – Inflammation Of The Optic Nerve
- **Orbital Cellulitis** – Inflammation Of The Tissues Of The Orbit
- **Papilledema** – Swelling Of The Optic Disk Caused Due To Abnormally High Intracranial Pressure
- **Papillitis** – Inflammation Of The Blood Supply To The Optic Disk
- **Photophobia** – An Unusual Inability To Tolerate Light
- **Pink Eye** – Contagious Conjunctivitis
- **Pterygium** – A Triangular Fleshy Growth Of The Conjunctiva Onto The Cornea/ Web Eye
- **Ptosis** – Drooping Of Upper Eyelid
- **Retinal Detachment** – Separation Of The Neurosensory Part Of The Retina From The Epithelial Layer

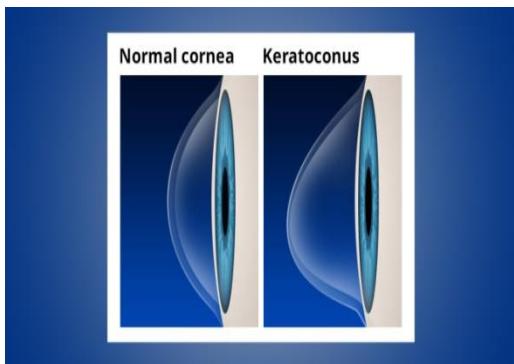
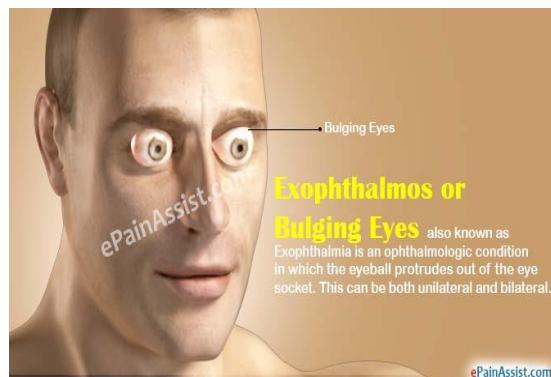
- **Retinitis** – Inflammation Of The Retina
- **Retinitis Pigmentosa** – Chronic Progressive Disease Which Causes Night Blindness Followed By Loss Of Peripheral Vision And Complete Blindness
- **Retinoblastoma** – Inherited Malignant Neoplasm Of The Retina ,Usually In Children Around 3 Years Of Age
- **Rhegmatogenous Retinal Detachment** – Retinal Detachment Caused By Small Rips And Tears Of The Retina
- **Scleritis** – Severe Inflammation Of The Sclera
- **Scotoma** – A Small Area Of Irregular Size And Shape In The Eye's Visual Field Where The Vision Is Absent Or Abnormal
- ***A Negative Scotoma** Causes A Blind Spot. Caused Due To Retinal Haemorrhage,Swelling,Detachment Or By Improper Functioning Of The Optic Nerve
- ***A Positive Scotoma** Is A Light Spot Or Flashes Of Light Or May Be Due To Migraines
- **Strabismus** – Unable To Focus On A Particular Point



Squint Eye (Strabismus) – 4 TYPES – MENTIONED BELOW

- **Esotropia** – Medial Rotation Of Eyeball.
- **Exotropia** – Lateral Rotation(Outward Turning) Of The Eye Ball
- **Hypertropia** – Superior Rotation Of One Eye Ball
- **Hypotropia** – Inferior Rotation Of One Eye Ball

- **Stye /Sty** – Pus Formation Or Inflammation
- **Trachoma** – Infectious Disease Caused By The Organism Chlamydia Trachomatis
- **Uveal Melanoma** – Carcinoma Of The Uvea
- **Uveitis** – Inflammation Of The Iris,Ciliary Body Or Choroid
- **Xanthopsia** – Everything Apers To Be Yellow
- **Anisocoria** - Condition Characterized By An Unequal Size Of The Eyes' Pupils.



DIAGNOSTIC TESTS

- **Fluorescein Angiography** - Intravenous Injection Of Fluorescein (A Dye) Followed By Serial Photographs Of The Retina Through Dilated Pupils.
- **Ophthalmoscopy** - Visual Examination Of The Interior Of The Eye
- **Slit Lamp Microscopy** - Examination Of Anterior Ocular Structures Under Microscopic Magnification
- **Tonometry (Ton/O = Tension)** - Measures Intraocular Pressure To Detect Glaucoma
- **Visual Acuity Test** - Clarity Of Vision Is Assessed - Snellen Chart
- **Visual Field Test** - Measurement Of The Area (Peripheral And Central) Within Which Objects Are Seen When The Eyes Are Fixed, Looking Straight Ahead Without Movement Of The Head
- Near Vision Is Usually Tested By Requesting The Patient To Read A Handheld Card Containing Text Or Letters With Increasingly Smaller Print. Two Such Cardsystems Are The **Jaeger Eye Chart** And The **Point System Eye Chart**.
- Macular Degeneration Is Tested With An **Amsler Chart**



OPHTHALMOSCOPY



TONOMETRY



A. SNELLEN CHART



B. VISUAL FIELD TEST

TREATMENT / THERAPEUTIC PROCEDURES

- **Enucleation** - Removal Of The Entire Eyeball
- **Keratoplasty** - Surgical Repair Of The Cornea (Corneal Transplant - Penetrating Keratoplasty).
- **Laser Photocoagulation** - Intense, Precisely Focused Light Beam (Argon Laser) Creates An Inflammatory Reaction That Seals Retinal Tears And Leaky Retinal Blood Vessels
- **LASIK** - Use Of An Excimer Laser To Correct Errors Of Refraction (Myopia, Hyperopia, And Astigmatism).
- **Phacoemulsification** - Ultrasonic Vibrations Break Up The Lens, Which Then Is Aspirated Through The Ultrasonic Probe
- **Scleral Buckle** – Suture Of A Silicone Band To The Sclera Over A Detached Portion Of The Retina
- **Vitrectomy** - Removal Of The Vitreous Humor

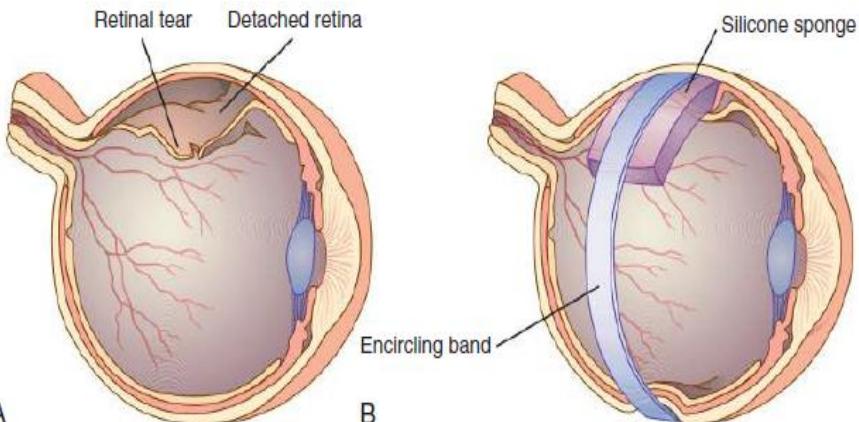


FIGURE 17-21 A, Detached retina. B, Scleral buckling procedure to repair retinal detachment.

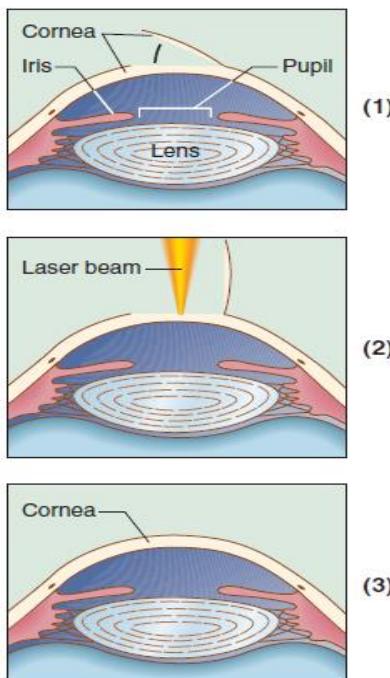
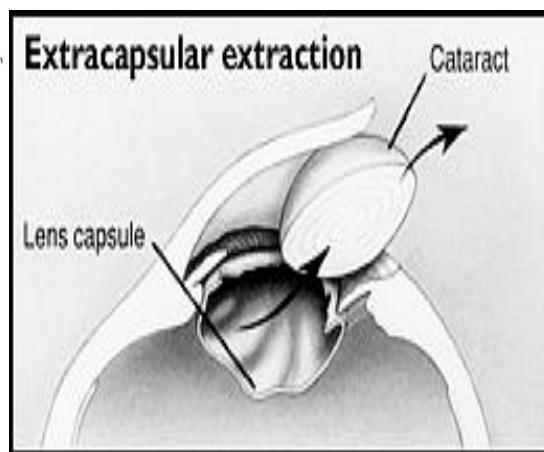
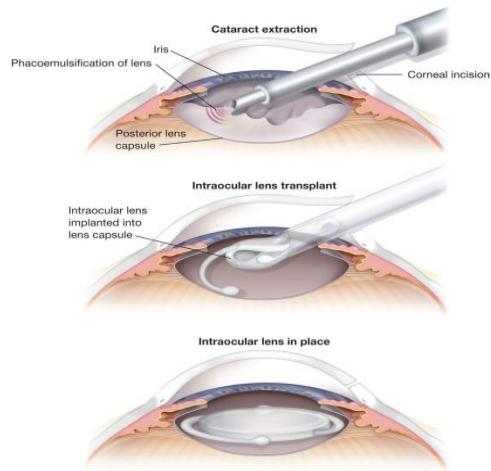


FIGURE 17-19 A, LASIK refractive surgery: (1). An instrument to cut the cornea (microkeratome) creates a hinged cap of tissue, which then is lifted off the corneal surface. (2). An excimer laser vaporizes and reshapes the cornea to correct the refraction. (3). The corneal flap is replaced. B, Ophthalmologists typically perform LASIK surgery as an office procedure. The patient with corrected vision returns home that day and is visually functioning normally or close to it the next day. (B, Courtesy Eric R. Mandel, MD, Mandel Vision, New York.)



FIGURE 17-20 Phacoemulsification of a cataractous lens through a small scleral tunnel incision.

- **Goniopuncture** - Surgically Puncturing The Peripheral Iris To Allow For Drainage Of Aqueous Humor. Used For Congenital Glaucoma.
- **Implantation Of Intraocular Lens** - After The Removal Of A Damaged Lens, Such As With Cataracts, Inserting An Intraocular Lens Made Of Plastic.
- **Iridodialysis** - Separating The Iris From Its Attachment At The Origination Of The Ciliary Muscle Fibers. This Procedure May Be Used To Reduce Intraocular Pressure.
- **Keratocentesis** - Surgically Puncturing The Cornea, Used To Drain Aqueous Humor
- **Cyclodialysis** - Surgically Creating An Opening Between The Anterior Chamber And The Space Above The Choroid To Drain The Aqueous Humor And Reduce Intraocular Pressure. Used In The Treatment Of Glaucoma.
- **Dilation Of The Lacrimal Canal** - Using A Series Of Successively Larger Probes To Enlarge The Lacrimal Canal To Allow Proper Drainage Of Tears
- **Blepharectomy** - Excising A Growth On The Eyelid.
- **Cataract Removal** - There Are Several Methods Of Cataract Removal.
 - **Intracapsular Extraction** - The Entire Lens Is Removed As A Single Unit.
 - **Extracapsular Extraction** - The Hard Central Part Of The Lens Is Removed, And The Soft Outer Part Is Then Removed In Pieces By **Aspiration Or Phacoemulsification**. Phacoemulsification Uses Ultrasound Along With Aspiration And Irrigation To Break Up And Remove The Lens. In Both Extracapsular Extraction And Phacoemulsification, The Posterior Capsule Of The Lens Is Not Removed



MEDICAL TERMINOLOGY – THE EYE

COMBINING FORMS	MEANING
aque/o	water
blephar/o	eyelid (see palpebr/o)
conjunctiv/o	conjunctiva
cor/o	pupil (see pupill/o)
corne/o	cornea (see kerat/o)
cycl/o	ciliary body or muscle of the eye
dacry/o	tears, tear duct (see lacrim/o)
ir/o, irid/o	iris (colored portion of the eye around the pupil)
kerat/o	cornea
lacrim/o	tears
ocul/o	eye
ophthalm/o	eye
opt/o, optic/o	eye, vision
palpebr/o	eyelid
papill/o	optic disc; nipple-like
phac/o, phak/o	lens of the eye
pupill/o	pupil
retin/o	retina
scler/o	sclera (white of the eye); hard
uve/o	uvea; vascular layer of the eye (iris, ciliary body, and choroid)
vitre/o	glassy
ambly/o	dull, dim
dipl/o	double
glauc/o	gray
mi/o	smaller, less
mydr/o	widen, enlarge
nyct/o	night
phot/o	light
presby/o	old age

scot/o	darkness
xer/o	dry

suffix	meaning
-opia	vision
-opsia	vision
-tropia	to turn

ABBREVIATIONS – THE EYE

ABBREVIATION	MEANING
AMD	Age-Related Macular Degeneration
HEENT	Head, Eyes, Ears, Nose, And Throat
IOL	Intraocular Lens
IOP	Intraocular Pressure
LASIK	Laser In Situ Keratomileusis
OD	Right Eye (Latin, <i>Oculus Dexter</i>); Doctor Of Optometry (Optometrist)
OS	Left Eye (Latin, <i>Oculus Sinister</i>)
OU	Both Eyes (Latin, <i>Oculus Uterque</i> , "Each Eye")
PERRLA	Pupils Equal, Round, Reactive To Light And Accommodation
POAG	Primary Open-Angle Glaucoma
PRK	Photorefractive Keratectomy—A Laser Beam Flattens The Cornea To Correct Myopia
VA	Visual Acuity
VF	Visual Field
EOM	Extraocular Movements
REM	Rapid Eye Movement
L&A	Light And Accommodation

ENT/ OTORHINOLARYNGOLOGY

GENERAL TERMS:

1. Otorhinolaryngology/ENT
2. Otorhinolaryngologists /ENT Specialists
3. Anatomy and physiology of Human ear
4. Structure of the Nasal cavity , Pharynx and Larynx
5. Examination of ENT
6. Otologic Diseases and conditions
7. Diseases of the nose and throat
8. Diagnostic and therapeutic Procedures

STRUCTURE OF EAR

The Outer (External) Ear

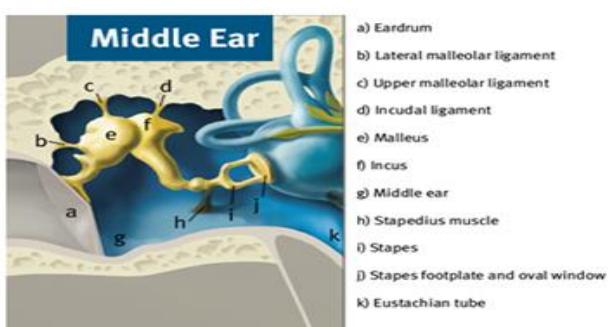


PARTS

- OUTER EAR
- MIDDLE EAR
- INNER EAR

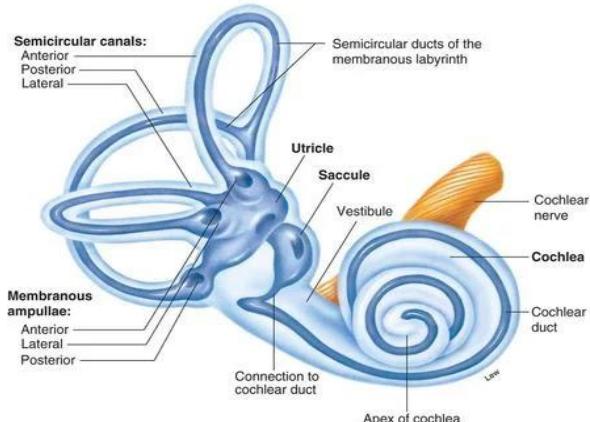
- The outer ear is called the pinna / auricle – flap / projecting part and is made of ridged cartilage covered by skin.
- The external auditory meatus (auditory canal) leads from the pinna and is lined with numerous glands that secrete a yellowish brown, waxy substance called cerumen. Cerumen lubricates and protects the ear.

MIDDLE EAR



- Sound travels through the pinna into the external auditory canal & strike a membrane between the outer and the middle ear - tympanic membrane, or eardrum. As the eardrum vibrates, it moves three small bones, or ossicles, that conduct the sound waves through the middle ear.
- Ossicles are the tiny bones of the ear: malleus(hammer), incus(anvil), stapes(stirrup)(smallest bone)
- As the stapes moves, it touches a membrane called the oval window / fenestra ovalis - separates the middle from the inner ear.
- The stapes are attached to the surface of the cochlea at a spot called the oval window or fenestra ovalis.
- The cochlea is filled with fluid and has tiny nerve endings called the hairs of Corti
- Auditory or eustachian tube is a canal leading from the middle ear to the pharynx.
- Closed but opens on swallowing - can prevent damage to the eardrum and shock to the middle and inner ears (equalizing pressure inside the tympanic cavity with that of the outside)

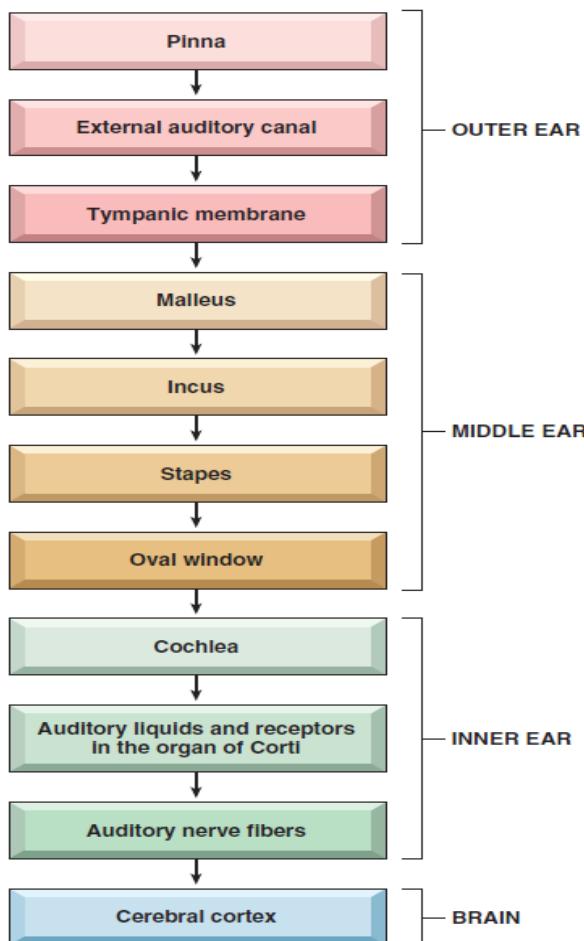
INNER EAR



- Sound vibrations transmitted by the movement of the eardrum to the bones of the middle ear - reach the inner ear via the fluctuations of the oval window (separates the middle and inner ears).
- The inner ear is also called the labyrinth because of its circular, maze-like structure. The part of the labyrinth that leads from the oval window is a bony, snail shell-shaped structure called the cochlea. The cochlea contains special auditory liquids called perilymph and endolymph through which the vibrations travel.
- Also present in the cochlea is a sensitive auditory receptor area called the organ of Corti. In the organ of Corti, tiny hair cells receive vibrations from the auditory liquids - auditory nerve fibers - auditory center of the cerebral cortex - impulses are interpreted and “heard.”

PHYSIOLOGY OF EAR

- Sound causes the eardrum and its tiny attached bones in the middle portion of the ear to vibrate, and the vibrations are conducted to the nearby cochlea.
- Cochlea transforms sound into nerve impulses that travel to the brain.
- The fluid-filled semicircular canals (labyrinth) attach to the cochlea and nerves in the inner ear.



TRANSMISSION OF SOUND

- The sound waves are transmitted within the ear in 2 phases:
 1. **Conductive phase**
 2. **Sensorineural phase**
- The sound waves travel through the external and middle ear by conduction
- The sensorineural phase involves the cochlea and the vestibulo cochlear nerve

TYPES OF BODY EQUILIBRIUM

- There are 2 types of body equilibrium (sense of balance):
 1. **Static** – allows to determine the current position of head in relation to gravity (semi circular canals)
 2. **Dynamic (kinetic)** – allows to evaluate the head movements in relation to gravity (vestibule)

NASAL CAVITY

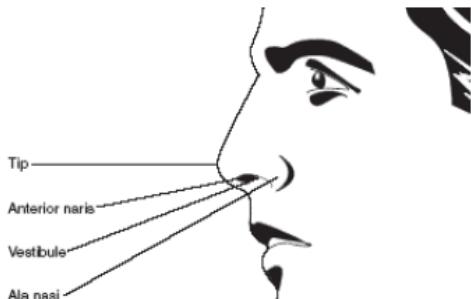


Figure 11-2 External Components of the Nose

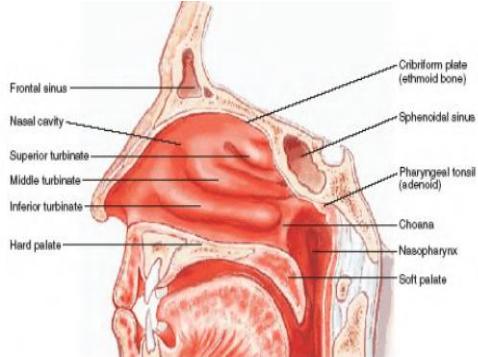
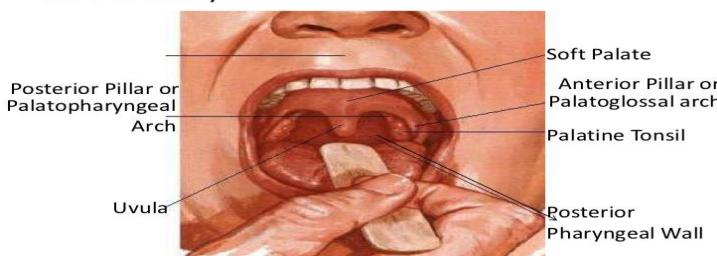


Figure 11-3 Nasal Cavity

1. The flared portion on each side of the nose is called ala nasi
2. The two openings is called anterior nares with tiny hairs present inside called vibrissae (removal of dirt particles)
3. The vestibule lies immediately inside the opening of the nostril where the space widens
4. Septum divides the nasal cavity in to two chambers-nasal fossa
5. The bony roof present on each nasal fossa is called cribriform plate
6. The lateral walls of the fossa are formed by thin, bony plates called turbinates or conchae
7. Olfactory neurons are composed of special receptors to detect odors
8. Nasal meatus is a passageway formed by the turbinates
9. Choana lies at the posterior part of the nasal cavity
10. Hyoid bone is a U-shaped structure located in the anterior neck
11. The nasopharynx forms the superior portion of the pharynx(throat)
12. The nasopharynx (naso-pharynx)- posterior to the nose
13. The oropharynx (oral –pharynx)- posterior to the mouth
14. The laryngopharynx (laryngeal –pharynx)- posterior to the larynx
15. The floor of the nasopharynx is called soft palate
16. A soft grape shaped tissue which extends down from the posterior edge of the soft palate is known as uvula

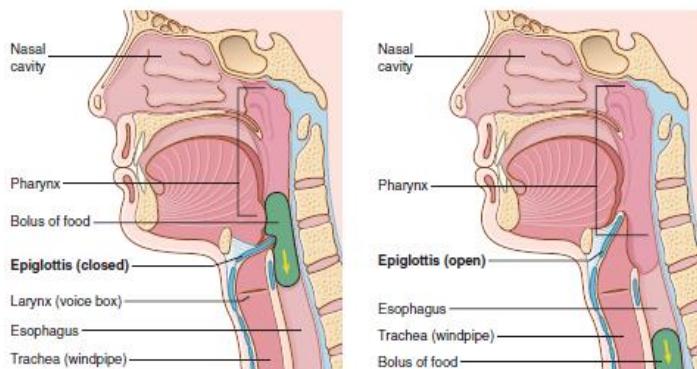
OROPHARYNX

It is the middle part of the pharynx situated behind the oral cavity.



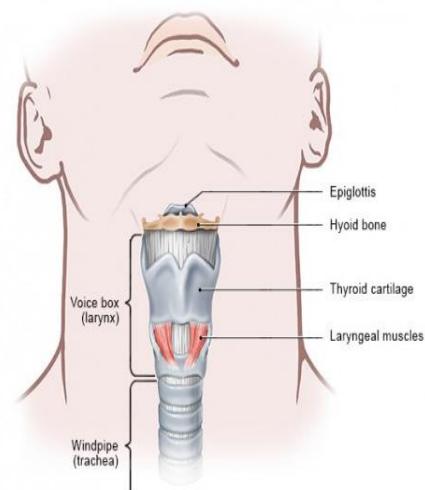
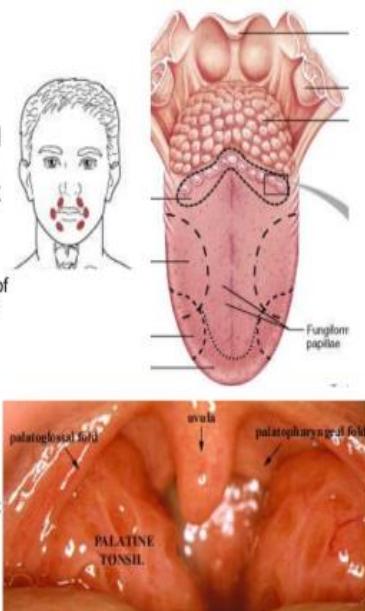
17. The oropharynx opens into the oral cavity (mouth) and extends from the uvula to the epiglottis

18. The epiglottis is an elastic plate of cartilage at the posterior part of the tongue



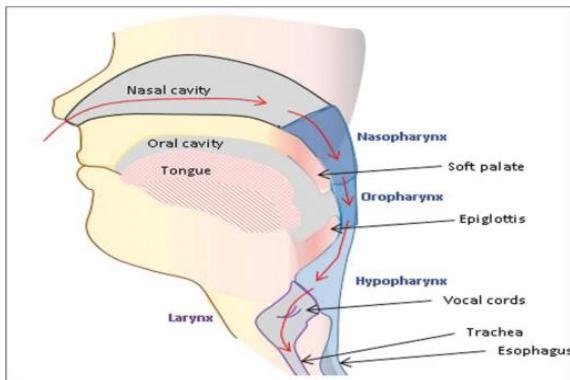
Tonsils

- Form a ring of lymphoid tissue around the entrance to the pharynx
- 3 main sets:
 - Palatine**
 - Located on either side of the posterior oral cavity
 - Largest and infected most often
 - Lingual**
 - Lie at the base of the tongue
 - Pharyngeal**
 - Found in the posterior wall of the nasopharynx
 - Called **adenoids** when infected



LARYNGOPHARYNX

- Larynx** – also called voice box, consists of 9 rings of cartilage attached to one another by muscles and ligaments
- The thyroid cartilage** – also called Adam's apple is the largest ring
- The cricoid cartilage** is at the inferior portion of the larynx and creates a base on which the other cartilages rest
- The vocal cords** are ligaments that pass through the larynx and vibrate when air gushes through them producing sound
- The entire vocal apparatus in the larynx** is called glottis which contains vocal cords as well as surrounding muscles and tissues controlling it



EXAMINATION OF THE EAR

Right and left ear

- Pre auricular region
- Pinna
- Post auricular region
- External auditory canal
- Tympanic membrane
- Fistula test
- Mastoid tenderness
- Facial nerve
- Tuning fork tests –
- Rinne's
- Weber's
- Air bone conduction

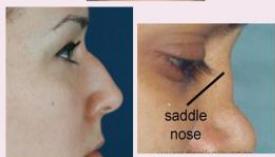
EXAMINATION OF EAR:

- Tuning fork test - Test of ear conduction using a vibration source (tuning fork)
- Otoscopy - Visual examination of the ear canal with an otoscope
- Audiometry - Testing the sense of hearing.
- Ear thermometry - Measurement of the temperature of the tympanic membrane by detection of infrared radiation from the eardrum

EXAMINATION OF NOSE:

Examination of the nose- inspection

- Size in relation to the rest of the face
- Deviation of bridge
- Dorsum:
 - Convexity (hump)
 - Concavity (saddling) of the dorsum of the nose

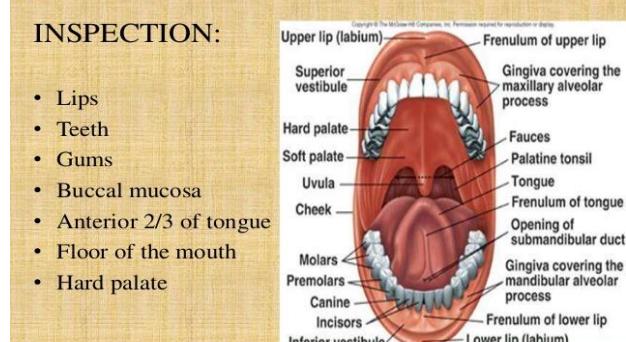


EXAMINATION OF ORAL CAVITY /OROPHARYNX:

ORAL CAVITY & OROPHARYNX

INSPECTION:

- Lips
- Teeth
- Gums
- Buccal mucosa
- Anterior 2/3 of tongue
- Floor of the mouth
- Hard palate



PATHEOLOGY

- Acute otitis media- inflammation in the middle ear
- Acoustic neuroma - Benign tumor arising from the acoustic vestibulocochlear nerve (eighth cranial nerve) in the brain.
- Anacusis – deafness
- Barotitis media- inflammation of the middle ear caused by sudden increase in air pressure
- Cholesteatoma – collection of skin cells and cholesterol in a sac within the middle ear
- Chronic otitis media- severe infection of the ear
- Conduction impairment -blockage of the sound waves

- **Hearing loss- inability to properly hear**
- **Labyrinthitis –inflammation of the inner ear leading to vertigo**
- **Mastoiditis – inflammation of the mastoid process**
- **Meniere disease-disorder of the labyrinth leading to a progressive loss of hearing**
- **Myringitis/tympanitis – inflammation of the tympanic membrane**
- **Otalgia – earache**
- **Otitis externa – inflammation of the external auditory canal**
Otorrhea – discharge from the ear
- **Otosclerosis –hardening of the ear wax**
- **Perforation of the ear drum –one or more holes in the eardrum**
- **Presbyacusia – gradual loss of hearing due to aging**
- **Recruitment – abnormally large increase in perceived loudness of sound caused by a slight increase in its intensity**
- **Secretory otitis media- chronic discharge from the middle ear from unresolved otitis media**
- **Vertigo – hallucinatory sensation of spinning**
- **Vestibular neuronitis - vertigo due to inflammation of the nerve to the semi circular canal**
- **Tinnitus - Sensation of noises (ringing, buzzing, whistling, booming) in the ears.**
- **Acute rhinitis - inflammation of the nasal mucous membrane associated with viral or bacterial**
- **Allergic rhinitis - exposure to allergens like dust mites,animal dander,pollen and grasses**
- **Aphtha – small ulcer in the oral mucous membrane**
- **Cancer of the oral cavity- carcinoma of the mouth including cheeks,gums and tongue**
- **Cancer of the paranasal sinuses - carcinoma of the paranasal sinuses**
- **Cancer of the pharynx - any carcinoma in the connecting the nasal passage with the esophagus**
- **Coryza –involves upper respiratory tract ,also called common cold**
- **Deviated or perforated nasal septum- improperly aligned nasal septum**
- **Epiglottitis –inflammation of the epiglottis**
- **Epitaxis – nosebleed**
- **Gingivitis – inflammation of the gingivae(gums)**
- **Herpes simplex- viral infection**
- **Laryngitis – inflammation of the vocal cords**
- **Oropharyngeal candidiasis-fungal infection of the mouth due to candida**
- **Pharyngitis – inflammation of the pharynx**
- **Rhinitis – inflammation of the nasal mucous membrane**

- Rhinophyma – hypertrophy of the nose with overgrowth of the thickened sebaceous glands
- Rhinorrhea – discharge from the nasal mucous membrane
- Salivary gland cancer- carcinoma of the salivary glands
- Seasonal allergic rhinitis(SAR)- allergies caused by seasonal change
- Sinusitis – inflammation of the paranasal sinuses
- Sleep apnea – absence of respiration during sleep
- Squamous cell carcinoma of the palatine tonsils-cancer of the squamous epithelial cells in the tonsils
- Tonsilitis –acute inflammation of the palatine tonsils
- Upper respiratory infection-acute viral infection of the upper respiratory tract
- Uvulitis –inflammation of the uvula
- Vincent angina- painful bacterial infection of the soft tissues of the pharynx (ALSO CALLED TRENCH MOUTH)
- Vocal cord nodules-connective tissue nodules that form on the vocal cords due to chronic voice abuse
- Vocal cord polyp- bulging vocal cord tissue caused by chronic laryngeal allergies,toxic reactions or by voice abuse

THERAPEUTIC PROCEDURES

- Cochlear implant procedure - Surgical insertion of a device that allows sensorineural hearing impaired persons to understand speech

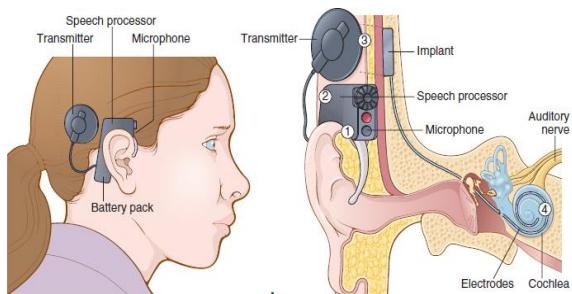
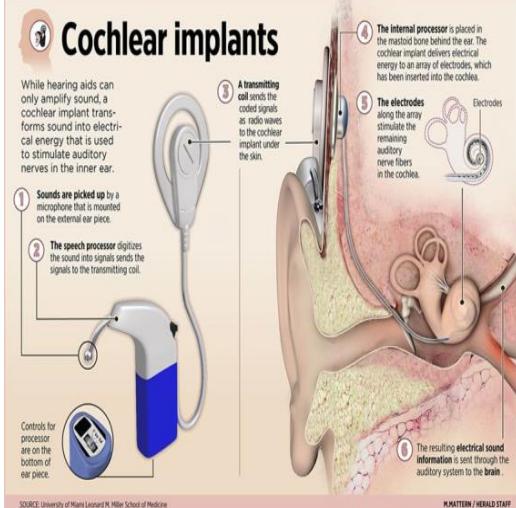


FIGURE 17-28 A. Cochlear implant.
 (1) Microphone receives sound. (2) Speech processor converts sounds into digital signals. (3) Signals are sent to a transmitter that relays them to an implant, where they are converted to electrical impulses.
 (4) Impulses are sent to electrodes that stimulate nerve cells in the cochlea, which sends them to the auditory nerve and brain.
 B. Otoscopic examination. The auricle is pulled up and back. The hand holding the otoscope is braced against the patient's face for stabilization.



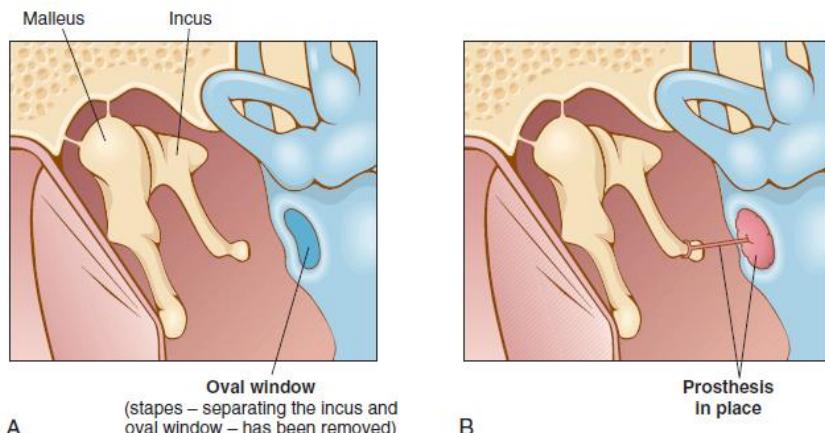


FIGURE 17-24 A, Stapedectomy. Using microsurgical technique and a laser, the stapes bone is removed from the middle ear. B, A prosthetic device (wire, Teflon, or metal) is placed into the incus and attached to a hole in the oval window.

- **Adenoidectomy** - Surgically removing the pharyngeal tonsils (adenoids).
- **Cochlear implant** - Surgically implanting a microprocessor under the skin capable of converting sound into electric current. This current is transmitted to implanted electrodes in the middle or inner ear, which then stimulate the auditory division of the vestibulocochlear nerve. Cochlear implants are used to provide limited hearing for those with sensory deafness.
- **Laryngectomy** - Surgically removing the larynx.
- **Laryngostomy** - Surgically creating a permanent opening into the larynx
- **Myringoplasty** - Surgically repairing the tympanic membrane. Also known as *tympanoplasty*
- **Myringotomy** - Surgically puncturing the tympanic membrane and inserting a tube to allow for drainage or aspiration of fluid from the middle ear. This procedure is most commonly performed on young children. Also known as *tympanotomy*.
- **Otoplasty** - Surgically altering the shape of a deformed or excessively large or small auricle. This procedure is most commonly performed for cosmetic reasons.
- **Palatopharyngoplasty** - Surgically resecting unneeded tissue in the oropharyngeal region to treat certain types of snoring and/or sleep apnea. Also known as *uvulopalatopharyngoplasty*.
- **Rhinoplasty** - Surgically repairing a defect of the nose or altering its shape. This procedure can be performed for medical or cosmetic reasons.
- **Septoplasty** - Surgical repair of a deviated or perforated nasal septum.
- **Stapedectomy** - Removing the stapes. It may be replaced with a prosthesis. This procedure is typically done to surgically correct otosclerosis and also involves reconstruction of the oval window.
- **Tonsillectomy** - Surgically removing the palatine tonsils.

MEDICAL TERMINOLOGIES:

COMBINING FORMS	MEANING
acous/o	hearing
audi/o	hearing; the sense of hearing
audit/o	hearing

aur/o, auricul/o	ear (see ot/o)
cochle/o	cochlea
epiglott/o	epiglottis
gingiv/o	gums
laryng/o	larynx (voice box)
lingu/o	tongue
mastoid/o	mastoid process
myring/o	eardrum, tympanic membrane (see tympan/o)
nas/o	nose
ossicul/o	ossicle
ot/o	ear
palat/o	palate
pharyng/o	throat; pharynx
rhin/o	nose
sept/o	septum
staped/o	stapes (third bone of the middle ear)
tonsill/o	tonsil
tympan/o	eardrum, tympanic membrane
vestibul/o	vestibule

SUFFIXES

SUFFIX	MEANING
-acusis or -cysis	hearing
-meter	instrument to measure
-otia	ear condition

ABBREVIATIONS:

Abbreviation	Meaning
AD	Right ear (Latin, <i>auris dextra</i>)
AS	Left ear (Latin, <i>auris sinistra</i>)
AOM	Acute otitis media
ENT	Ears, nose, and throat
EENT	Eyes, ears, nose, and throat
ENG	Electronystagmography
HEENT	Head, eyes, ears, nose, and throat
ETD	Eustachian tube dysfunction
PE tube	Pressure-equalizing tube

SOM	Serous otitis media
SAR	Seasonal allergic rhinitis
T&A	Tonsillectomy and adenoidectomy
TM	Tympanic membrane
TMJ	Temporomandibular joint
UPPP	Uvulopalatopharyngoplasty
URI	Upper respiratory infection

RESPIRATORY SYSTEM

GENERAL TERMS:

- RESPIRATION
- PULMONOLOGY
- PULMONOLOGIST
- STRUCTURE AND FUNCTIONS OF THE RESPIRATORY SYSTEM
- DISEASE CONDITIONS
- DIAGNOSTIC TESTS
- THERAPEUTIC PROCEDURES
- MEDICAL TERMS
- ABBREVIATIONS

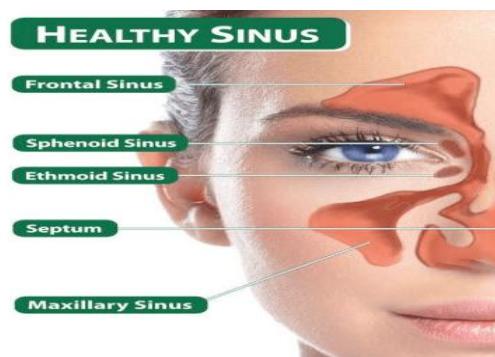
GENERAL TERMS:

- Pulmonology is the medical study of the structure and diseases of the respiratory system, which includes all of the air passages from the nose to the tiny air sacs in the lungs
- A pulmonologist is a physician who specializes in the diagnosis and treatment of diseases and conditions related to the respiratory system.
- Respiration - the mechanical process of breathing
- Exchange of air at the lungs is called external respiration.
- Internal (cellular) respiration, which involves an exchange of gases at the level of the cells within all organs of the body.

STRUCTURE AND FUNCTIONS OF RESPIRATORY SYSTEM:

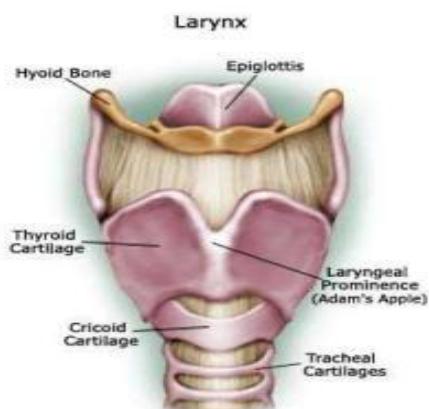
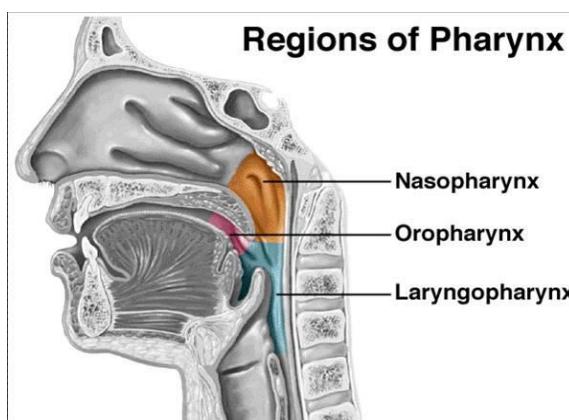
- Air enters the body via the nose through two openings called nostrils or nares.
- Air then passes through the nasal cavity , lined with a mucous membrane and fine hairs(cilia) to help filter out foreign bodies, as well as to warm and moisten the air.
- Paranasal sinuses are hollow, air-containing spaces within the skull that communicate with the nasal cavity - produces mucus- a lubricating fluid
- The sinuses lighten the bones of the skull and help produce sound.

PARANASAL SINUSES



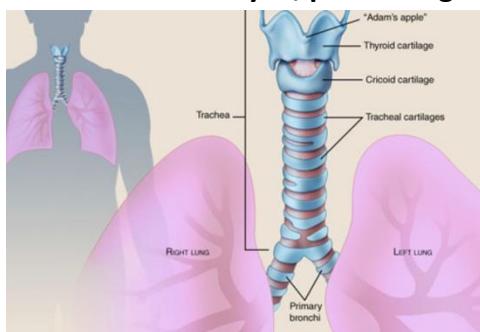
- The air next reaches the pharynx (throat).

1. Nasopharynx : 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.
2. 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 in the oropharynx.
3. The third division of the pharynx, the laryngopharynx , serves as a common passageway for food from the mouth and air from the nose. It divides into the larynx (voice box) and the esophagus.



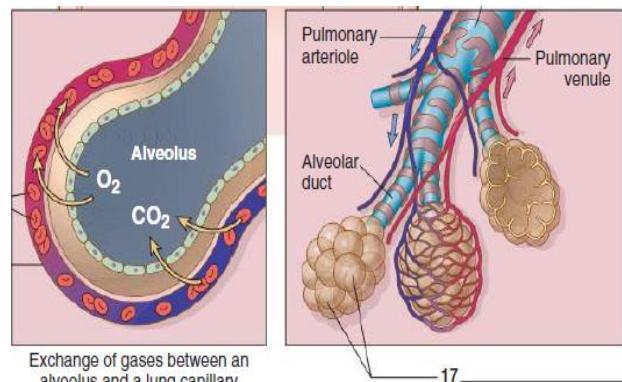
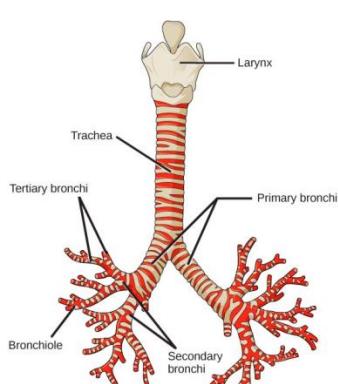
LARYNX

- The larynx contains the vocal cords and is surrounded by pieces of cartilage for support.
- The thyroid cartilage is the largest and in men is commonly referred to as the Adam's apple.
- As expelled air passes the vocal cords, they vibrate to produce sounds. The tension of the vocal cords determines the high or low pitch of the voice.
- The epiglottis, a flap of cartilage attached to the root of the tongue, prevents choking or aspiration of food. It acts as a lid over the opening of the larynx.
- During swallowing, when food and liquid move through the throat, the epiglottis closes over the larynx, preventing material from entering the lungs.

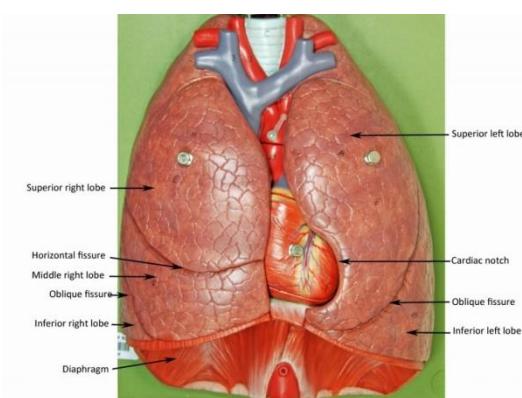
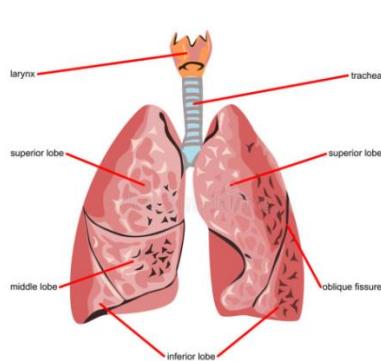


TRACHEA

- Air passes through the larynx to the trachea (windpipe)
 - Vertical tube
 - 4½ inches long and 1 inch in diameter
 - 16 to 20 C-shaped rings of cartilage separated by fibrous connective tissue
- In the region of the mediastinum - the trachea divides into two branches, the right and left bronchial tubes, or bronchi
- The bronchi are tubes composed of delicate epithelium surrounded by cartilage rings and a muscular wall.
- Each bronchus leads to a separate lung where it divides and subdivides into smaller and finer tubes, somewhat like the branches of a tree - called bronchioles.
- Each terminal bronchiole narrows into alveolar ducts, which end in collections of air sacs called alveoli.
- About 300 million alveoli are estimated to be present in both lungs.
- This very thin wall permits an exchange of gases between the alveolus and the capillary surrounding it. Blood flowing through the capillary accepts oxygen from the alveolus while depositing carbon dioxide into the alveolus.
- Erythrocytes in the blood carry oxygen away from the lungs to all parts of the body and carbon dioxide back to the lungs for exhalation



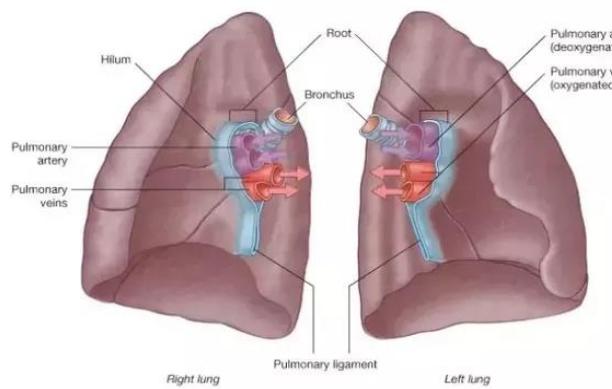
LUNGS



- The medial space between the two lungs is called the mediastinum and contains the heart and thoracic viscera, except for the lungs.
- Because the heart is inclined to the left in the mediastinum, the right lung is slightly larger than the left. Each lung is divided into sections called lobes.
- The left lung has two lobes while the right lung has three lobes.
- Each lung has an oblique (major) fissure.
- In addition, the right lung has a horizontal (minor) fissure

APEX, BASE, HILUM OF LUNG

Hilum of lung



- The uppermost part of the lung is the apex
- The lower area is the base.
- The hilum of the lung is the midline region in which blood vessels, nerves, lymphatic tissue, and bronchial tubes enter and exit.

- The lungs extend from the collarbone to the diaphragm in the thoracic cavity.
- The diaphragm is a muscular partition separating the thoracic from the abdominal cavity and aiding in the process of breathing.
- It contracts and descends with each inhalation (inspiration) and relaxes and ascends with each exhalation (expiration).
- The downward movement of the diaphragm enlarges the area in the thoracic cavity, decreasing 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, thus increasing air pressure in the chest. Air then is expelled out of the lungs to equalize the pressure; this is exhalation (expiration).
- Normally, breathing occurs about 14 to 20 times a minute.

INSPIRATION / EXPIRATION

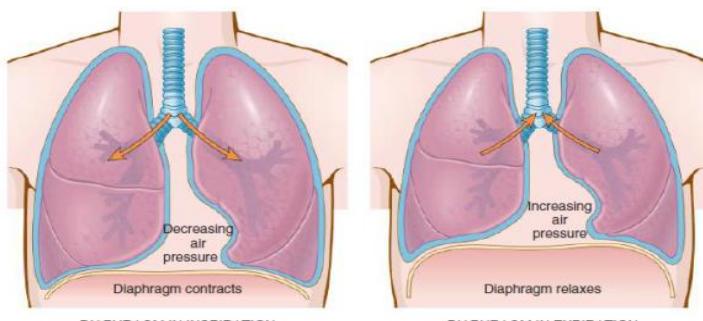
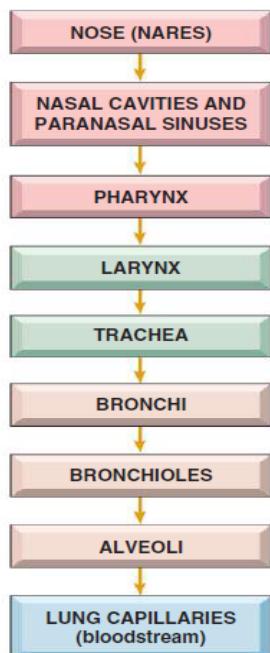
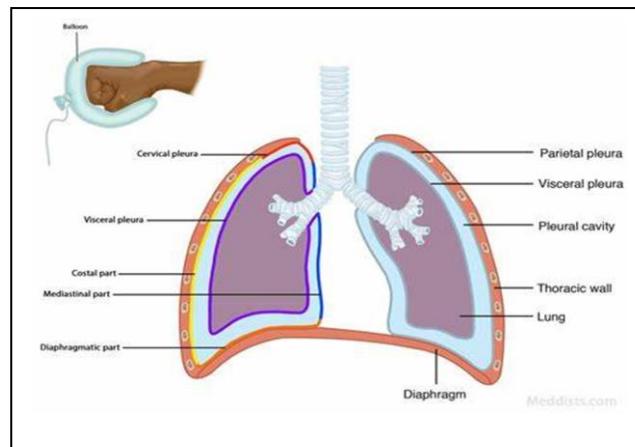


FIGURE 12-3 Position of the diaphragm during inspiration (inhalation) and expiration (exhalation).



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



PLEURA

- Each lung is covered by a double membrane, called the pleurae (pleura)
- The visceral pleura adheres to the surface of the lung
- The parietal pleura attaches to the thoracic cavity
- The space between parietal and visceral layer is called pleural space / pleural cavity
- The pleural cavity is filled with pleural fluid.

PATHOLOGY

DIAGNOSTIC TERMS

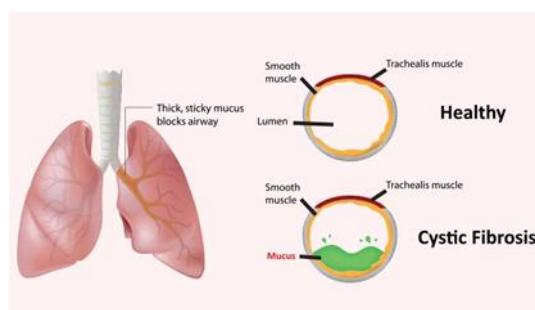
- Auscultation - Listening to sounds within the body.
- Percussion - Tapping on a surface to determine the difference in the density of the underlying structure.
- Pleural rub - Scratchy sound produced by pleural surfaces rubbing against each other.
- Rales (crackles) - Fine crackling sounds heard on auscultation (during inhalation) when there is fluid in the alveoli.
- Rhonchi (*singular: rhonchus*) - Loud rumbling sounds heard on auscultation of bronchi obstructed by sputum.
- Sputum - Material expelled from the bronchi, lungs, or upper respiratory tract by spitting.
- Stridor - Strained, high-pitched sound heard on inspiration caused by obstruction in the pharynx or larynx.
- Wheezes - Continuous high-pitched whistling sounds produced during breathing

UPPER RESPIRATORY DISORDERS

- Croup - Acute viral infection of infants and children with obstruction of the larynx, accompanied by barking cough and stridor.
- Diphtheria - Acute infection of the throat and upper respiratory tract caused by the diphtheria bacterium (*Corynebacterium*).
- Epistaxis - Nosebleed.
- Pertussis - Whooping cough; highly contagious bacterial infection of the pharynx, larynx, and trachea caused by *Bordetella pertussis*.



DIPHTHERIA



BRONCHIAL DISORDERS

- Asthma - Chronic bronchial inflammatory disorder with airway obstruction due to bronchial edema and constriction and increased mucus production.
- Bronchiectasis - Chronic dilation of a bronchus secondary to infection.
- Chronic bronchitis - Inflammation of bronchi persisting over a long time; type of chronic obstructive pulmonary disease (COPD).
- Cystic fibrosis (CF) - Inherited disorder of exocrine glands resulting in thick mucinous secretions in the respiratory tract that do not drain normally.

LUNG DISORDERS

- Atelectasis - Collapsed lung; incomplete expansion of alveoli,
- Emphysema - Hyperinflation of air sacs with destruction of alveolar walls
- Emphysema and chronic bronchitis are both forms of COPD
- Lung cancer - Malignant tumor arising from the lungs and bronchi
- Pneumoconiosis - Abnormal condition caused by dust in the lungs, with chronic inflammation, infection, and bronchitis
- Pulmonary embolism (PE) - Clot or other material lodges in vessels of the lung
- Pulmonary fibrosis - Formation of scar tissue in the connective tissue of the lungs.
- Sarcoidosis - Chronic inflammatory disease in which small nodules (granulomas) develop in lungs, lymph nodes, and other organs.

- **Tuberculosis (TB)**- Infectious disease caused by *Mycobacterium tuberculosis*; lungs usually are involved, but any organ in the body may be affected.
- **Pneumonia** - Acute inflammation and infection of alveoli, which fill with pus or products of the inflammatory reaction.
- **Pulmonary abscess** - Large collection of pus (bacterial infection) in the lungs.
- **Pulmonary edema** - Fluid in the air sacs and bronchioles.

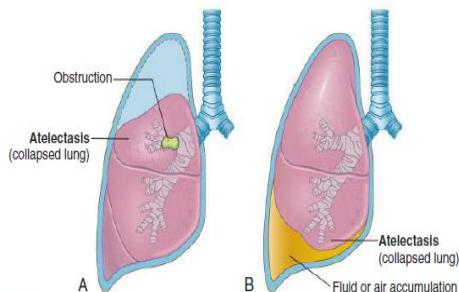
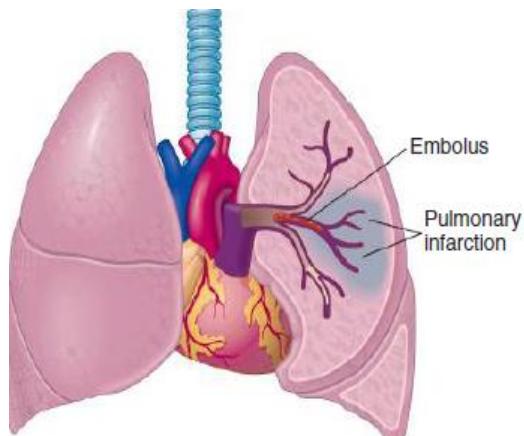


FIGURE 12-7 Two forms of atelectasis. A, An obstruction prevents air from reaching distal airways and alveoli collapse. The most frequent cause is blockage of a bronchus by a mucous or mucopurulent (pus-containing) plug, as might occur postoperatively. B, Accumulation of fluid, blood, or air within the pleural cavity collapses the lung. This can occur with congestive heart failure (poor circulation leads to fluid buildup in the pleural cavity), pneumonia, trauma, or a pneumothorax.



PULMONARY EMBOLISM

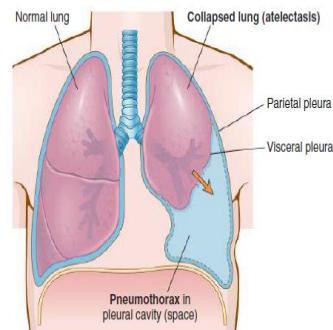
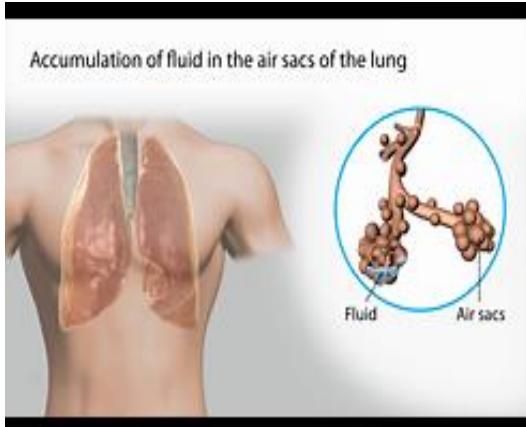


FIGURE 12-6 Pneumothorax. Air gathers in the pleural cavity, causing the lung to collapse. When this happens, the lung cannot fill up with air, breathing becomes more difficult, and the body gets less oxygen. Onset of pneumothorax is marked by sudden, sharp chest pain with difficulty breathing.

PLEURAL DISORDERS

- **Mesothelioma**- Rare malignant tumor arising in the pleura.
- **Pleural effusion** - Abnormal accumulation of fluid in the pleural space (cavity).
- **Pleurisy (pleuritis)** - Inflammation of the pleura.
- **Pneumothorax** - Collection of air in the pleural space.

SUMMARY:

CONDITION / DISEASE	DESCRIPTION
Adult respiratory Distress syndrome (ARDS)	Acute respiratory failure that appears following pulmonary injury, Such as direct chest trauma, sepsis, or inhalation of toxic gas. Hypoxemia, respiratory distress, and pulmonary edema are some of The signs.

Anoxia	Complete or nearly complete absence of oxygen from the blood And/or tissue.
Anthracosis	A type of lung disease caused by the long-term inhalation of coal dust During coal mining. A type of pneumoconiosis. Also called <i>coal Workers pneumoconiosis or black lung disease</i>
Asbestosis	A type of lung disease caused by the long-term inhalation of asbestos Dust. A type of pneumoconiosis
Asphyxia	An inadequate exchange of oxygen and carbon dioxide.
Asthma	Inflammation and constriction of the airway over a relatively short Period of time that can be caused by a reaction to a stimulus such as An allergen or exercise. Asthma is usually reversible
Atelectasis	An absence of air from all or part of the lungs which can lead to a Collapsed lung. It can be acute (for example, when there is bronchial Obstruction due to a foreign object) or chronic (such as obstruction by A tumor).
Bradypnea	Breathing that is slower than normal
Bronchiectasis	Chronic dilation of bronchi or bronchioles as a result of an obstruction Or an inflammatory disease. Symptoms include coughing and spitting Up mucus.
Bronchitis	Inflammation of the bronchi.
Bronchogenic Carcinoma	Cancer that originates in a bronchus. The most common type of lung Cancer. Its primary cause is tobacco smoking
Cheyne-Stokes respiration	Abnormal breathing characterized by periods of deep breathing (hyperpnea) followed by periods of no breathing (apnea).
Chronic bronchitis	Bronchitis that lasts at least 3 months. It can be a symptom of lung Cancer, tuberculosis, or chronic heart failure.
Chronic obstructive Pulmonary Disease(COPD)	A general term used for diseases that cause the bronchi to be either Permanently or temporarily narrowed.
Clubbing of the fingers	A physical finding in which the ends of the fingers are enlarged, Round, and bulbous. And lung cancer
Cough	A sudden, explosive forcing of air out of the airways. Its primary purpose is to clear sputum and other materials from the airways.

Crackles	Abnormal breath sounds heard on auscultation of the chest that are Brief, sharp, and nonmusical
Croup	Any acute respiratory condition in children and infants that is Characterized by rough breathing and a hoarse cough.
Cyanosis	A bluish or purplish discoloration of the skin and mucous membranes Due to inadequate oxygenation of the blood cells.
Cystic fibrosis	A disease in which the secretions of the exocrine glands are thick, causing obstruction of various passageways in the respiratory and digestive systems It is an inherited disease in which symptoms Typically first appear during childhood
Dyspnea	An unpleasant sensation of shortness of breath along with a subjective feeling of not being able to breathe normally (difficulty in breathing)
Edema	An accumulation of excessive amounts of fluid in cells, tissues, or in a body cavity
Emphysema	Abnormal and permanent enlargement of the alveoli with destruction of the alveolar walls.
Empyema	Pus in a body cavity. This term is most commonly used to refer to pus In a pleural cavity (pyothorax).
Hemoptysis	The act of spitting blood.



CLUBBING OF FINGERS



CYANOSIS

Hyaline membrane Disease (HMD)	A condition in premature newborns caused by deficient pulmonary surfactant, the substance required for the lungs to expand, leading to Respiratory distress. Also called <i>respiratory distress syndrome</i> .
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Hypercapnia	An abnormally excessive amount of carbon dioxide in the arterial Blood.
Hyperpnea	Rapid deep breathing that can be brought on by exertion, anxiety, or Certain abnormal medical conditions
Hypoxemia	Below-normal oxygenation of the arterial blood. Hypoxemia is not as Severe as anoxia.
Hypoxia	A below-normal level of oxygen in arterial blood, tissues, or inspired Gases. Hypoxia is not as severe as anoxia.
Legionnaire disease	A serious form of bacterial pneumonia caused by <i>Legionella Pneumophila</i>
Malignant Mesothelioma	A cancerous growth of the pleural lining.
Orthopnea	The situation in which breathing is easier in an upright position and Becomes more difficult when lying flat.
Paroxysmal nocturnal Dyspnea	An abnormal shortness of breath that occurs during the night, causing the patient to wake up gasping for air. It may be indicative of cardiovascular disease
Pleural effusion	Increased amount of fluid in the pleural cavity.
Pleural rub	A rubbing sound caused by friction of the pleura when inflamed. Also Called <i>pleural friction</i> .
Pleurisy	An inflammation of the pleura that usually causes stabbing chest pain And pleural effusion. Also called <i>pleuritis</i>
Pleurodynia	Pain in the tendinous attachments of thoracic muscles. Also referred To as <i>pleuralgia</i> .
Pneumoconiosis	An occupational lung disease causing inflammation of the lungs due To the inhalation of dust particles.
Pneumomelanosis	Blackening of lung tissue due to the inhalation of coal dust.
Pneumonia	An acute inflammation of the lung tissue, including the air spaces Within the alveoli. The alveoli typically fill with pus or other materials As a result of inflammation. Pneumonia can be caused by inhalation of Chemicals; trauma; or bacterial, viral, or fungal infections.

Pneumonocèle	The protrusion of a portion of the lung through an opening in the Chest wall. Also referred to as <i>pleurocele</i> or <i>pneumocele</i> .
Pneumothorax	The presence of air or gas in the pleural cavity.
Pulmonary abscess	A collection of pus in the lungs as an end product of the destruction of Lung tissue
Pulmonary edema	Excess fluid and swelling in the alveoli and bronchioles.
Pulmonary embolism (PE)	A sudden dislodging of a blood clot in the pulmonary artery (the Artery that supplies blood to the lungs), causing obstruction of blood To the lung tissue.
Pyothorax	Pus in a pleural cavity
Rale	An added sound heard on auscultation of breath sounds.
Rhonchus (pl. Rhonchi)	Musically pitched sounds in addition to the normal sounds heard During inspiration or expiration.
Silicosis	An occupational lung disease caused by the inhalation of small silica Particles, such as those found in coal, copper, silver, and gold mining. A type of pneumoconiosis
Stridor	An abnormal, high-pitched breath sound, predominantly heard on Inspiration. It can be heard without a stethoscope. Stridor sounds like The wind blowing
Tachypnea	Breathing that is more rapid and more shallow than normal.
Tuberculosis (TB)	An infectious disease typically characterized by coughing, weight Loss, chest pain, and spitting up blood. It is caused by Mycobacterium Tuberculosis.
Wheeze	Abnormal breath sounds that are longer than crackles and may have a Whistling, puffing, or hissing quality.

CLINICAL PROCEDURES

- X-RAY TESTS
- Chest x-ray (CXR)
- Computed tomography (CT) scan of the chest
- CT pulmonary angiography (CTPA)

- **MAGNETIC IMAGING** - magnetic resonance imaging(MRI) of the chest
- **NUCLEAR MEDICINE TESTS** - positron emission tomography (PET) scan of the lung
- **Ventilation-perfusion (V/Q) scan** –radioactive test of lung ventilation and blood perfusion throughout the lung capillaries (lung scan)
- **Arterial blood gas (ABG) analysis** - A measurement of the partial pressures of O₂ and CO₂ levels in arterial blood.
- **Bronchoalveolar lavage (BAL)** - A bronchoscope is inserted through the mouth or nose. A fluoroscope may be used to guide the bronchoscope to the part of the lung to be examined. A saline solution is used to irrigate the pulmonary passages and the washings are then suctioned out and sent to the laboratory for analysis. This test is used to diagnose certain types of pneumonia and lung cancer
- **Pulse oximetry** - An electronic device is placed on the patient's finger to measure oxygen saturation in the blood.
- **Spirometry** - The quantity of air entering the lungs and the rate of its movement over a period of time are measured. The instrument used is a spirometer.

THERAPEUTIC PROCEDURES

- **Bronchoscopy** - Fiberoptic endoscope examination of the bronchial tubes.
- **Thoracentesis** - Surgical puncture to remove fluid from the pleural space.
- **Endotracheal intubation** - Placement of a tube through the mouth into the pharynx, larynx, and trachea to establish an airway
- **Laryngoscopy** - Visual examination of the voice box.
- **Laryngectomy** -Partial or total surgical removal of the larynx, most commonly performed as a cancer treatment.
- **Lung biopsy** - Removal of lung tissue followed by microscopic examination
- **Mediastinoscopy** - Endoscopic visual examination of the mediastinum.
- **Pulmonary function tests (PFT)** - Tests that measure the ventilation mechanics of the lungs: Airway function, lung volume, and the capacity of the lungs to exchange oxygen and carbon dioxide efficiently.
- **Thoracotomy** - Large surgical incision of the chest

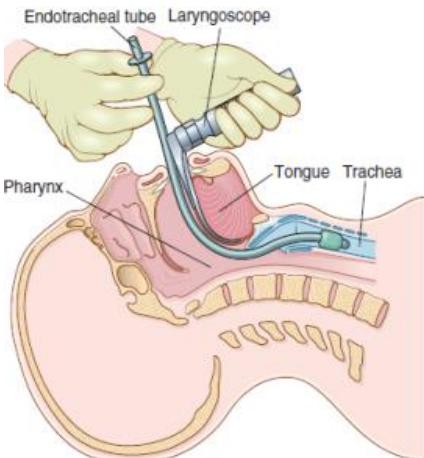


FIGURE 12-15 Endotracheal intubation. The patient is in a supine position; the head is hyperextended, the lower portion of the neck is flexed, and the mouth is opened. A laryngoscope is used to hold the airway open, to expose the vocal cords, and as a guide for placing the tube into the trachea.

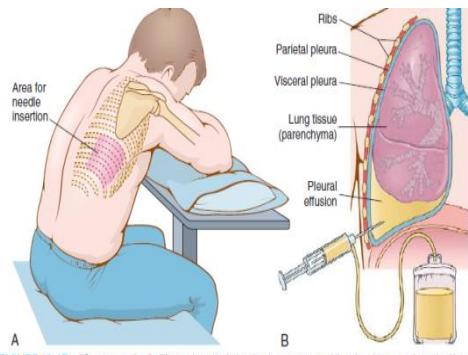


FIGURE 12-17 Thoracentesis. A. The patient is sitting in the correct position for the procedure; it allows the chest wall to be pulled outward in an expanded position. B. The needle is inserted close to the base of the effusion so that gravity can help with drainage, but it is kept as far away from the diaphragm as possible.

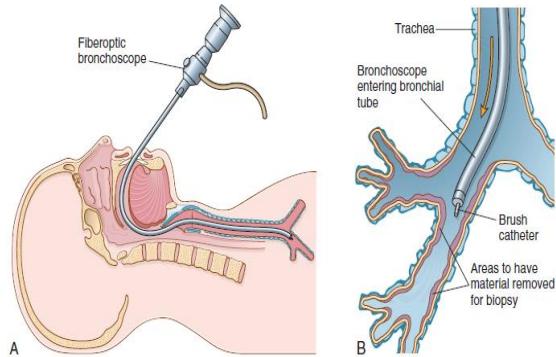


FIGURE 12-14 A. Fiberoptic bronchoscopy. A bronchoscope is passed through the nose, throat, larynx, and trachea into a bronchus. B. A bronchoscope, with brush catheter, in place in a bronchial tube.

- **Thoracoscopy (thorascopy) - Visual examination of the chest via small incisions and use of an endoscope. (VATS)**
- **Tracheostomy - Surgical creation of an opening into the trachea through the neck.**
- **Tuberculin test - Determines past or present tuberculous infection based on a positive skin reaction.**
- **Tube thoracostomy - A flexible, plastic chest tube is passed into the pleural space through an opening in the chest.**
- **Cricothyrotomy- Establishment of a temporary airway by surgically creating an opening into the larynx. This opening is usually intended to be temporary. A large needle or needle catheter is inserted into the airway so that air can be supplied to the lungs. This procedure is safer to perform in an emergency situation than a tracheostomy.**

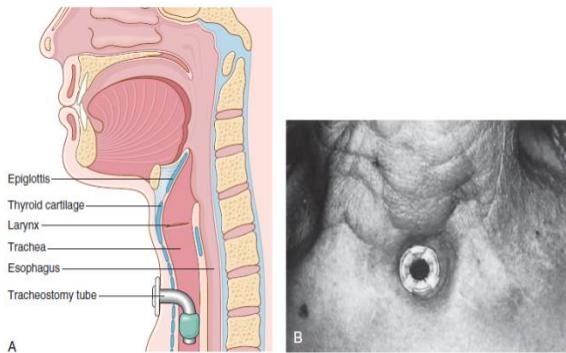


FIGURE 12-18 A. Tracheostomy tube in place. B. Healed tracheostomy after laryngectomy.

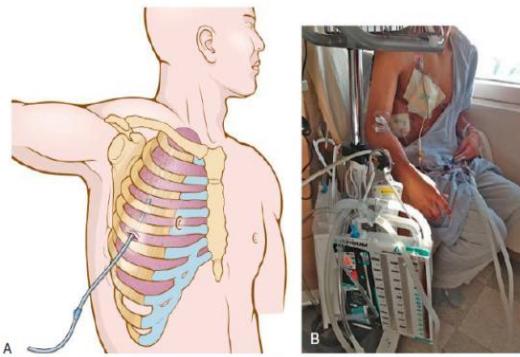


FIGURE 12-19 A. Tube thoracostomy. B. A patient with two thoracostomy tubes draining a pleural effusion in two different areas of the chest.

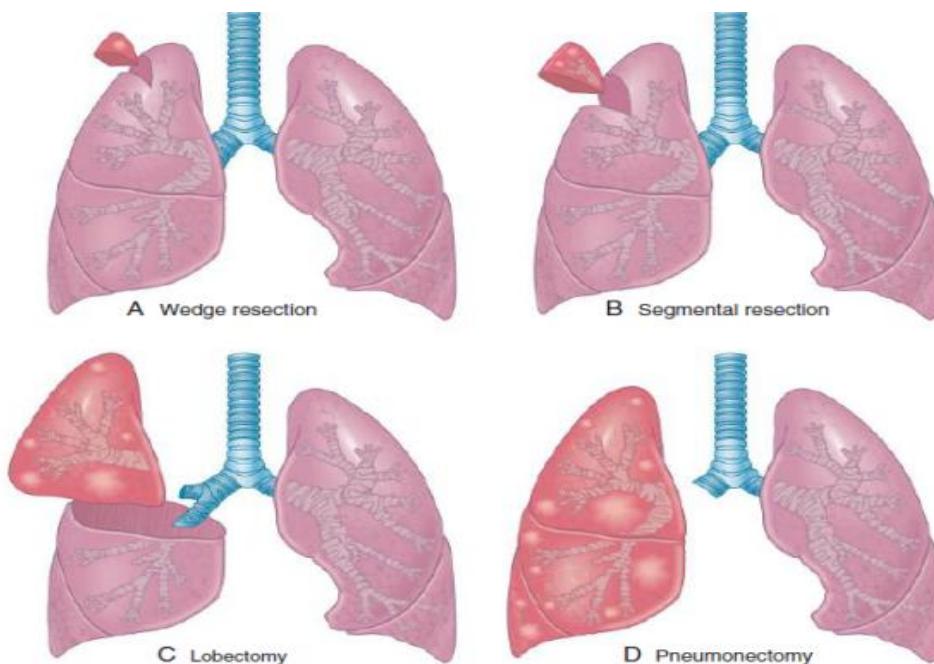


FIGURE I2-5 Pulmonary resections. **A, Wedge resection** is the removal of a small, localized area of diseased tissue near the surface of the lung. Pulmonary function and structure are relatively unchanged after healing. **B, Segmental resection** is the removal of a bronchiole and its alveoli (one or more lung segments). The remaining lung tissue expands to fill the previously occupied space. **C, Lobectomy** is the removal of an entire lobe of the lung. After lobectomy, the remaining lung increases in size to fill the space in the thoracic cavity. **D, Pneumonectomy** is the removal of an entire lung. Techniques such as removal of ribs and elevation of the diaphragm are used to reduce the size of the empty thoracic space.

- **Lobectomy**- Excision of a lobe of any organ. When the term is used alone, it usually refers to the excision of a lobe of a lung.
- **Pneumonectomy** - Excision of a lung. Also called *pulmonectomy*
- **Lung transplant** - Surgical replacement of one or both lungs with the healthy lungs of a donor. The lungs typically come from a brain-dead donor who is on life support. In some instances, a portion of a lung may be transplanted from a living donor. Lung transplants are performed only on individuals with severe, life threatening lung disease.

MEDICAL TERMINOLOGIES

COMBINING FORMS	MEANING
adenoid/o	adenoids
alveol/o	alveolus, air sac
bronch/o bronchi/o	bronchial tube, bronchus
bronchiol/o	bronchiole, small bronchus

capn/o	carbon dioxide
coni/o	dust
cyan/o	blue
epiglott/o	epiglottis
laryng/o	larynx, voice box
lob/o	lobe of the lung
mediastin/o	mediastinum
nas/o	nose
orth/o	straight, upright
ox/o	oxygen
pector/o	chest
pharyng/o	pharynx, throat
phon/o	voice
phren/o	diaphragm
pleur/o	pleura
pneum/o, pneumon/o	air, lung
pulmon/o	lung
rhin/o	nose
sinus/o	sinus, cavity
spir/o	breathing
tel/o	complete
thorac/o	chest
tonsill/o	tonsils
trache/o	trachea, windpipe

SUFFIXES:

suffix	meaning
-ema	condition
-osmia	smell
-pnea	breathing
-ptysis	spitting
-sphyxia	pulse
-thorax	pleural cavity, chest

ABBREVIATIONS:

ABBREVIATION	MEANING
ABGS	Arterial blood gases
AFB	Acid-fast bacillus—the type of organism That causes tuberculosis
ARDS	Acute respiratory distress syndrome

BAL	Bronchoalveolar lavage
CF	Cystic fibrosis
CO ₂	Carbon dioxide
COLD	Chronic obstructive lung disease
COPD	Chronic obstructive pulmonary disease
CPAP	Continuous positive airway pressure
CPR	Cardiopulmonary resuscitation
CXR	Chest x-ray (chest radiograph)
C&S	Culture and sensitivity testing
CTPA	Computed tomography pulmonary Angiography
DOE	Dyspnea on exertion
DPT	Diphtheria, pertussis, tetanus
HMD	Hyaline membrane disease
IPPB	Intermittent positive-pressure breathing
IRDS	Infant respiratory distress syndrome
PCP	Pneumocystis carinii pneumonia
PE	Pulmonary embolism
ICU	Intensive care unit
LLL	Left lower lobe (of lung)
LUL	Left upper lobe (of lung)
O ₂	Oxygen
OSA	Obstructive sleep apnea
PND	Paroxysmal nocturnal dyspnea
RDS	Respiratory distress syndrome
RLL	Right lower lobe (of lung)
RSV	Respiratory syncytial virus
RUL	Right upper lobe (of lung)
RV	Residual volume
SOB	Shortness of breath
TB	Tuberculosis
TLC	Total lung capacity
URI	Upper respiratory infection
VT	Tidal volume
VATS	Video-assisted thoracic surgery (thoracoscopy)
VC	Vital capacity
V/Q SCAN	Ventilation-perfusion scan

CARDIO VASCULAR SYSTEM

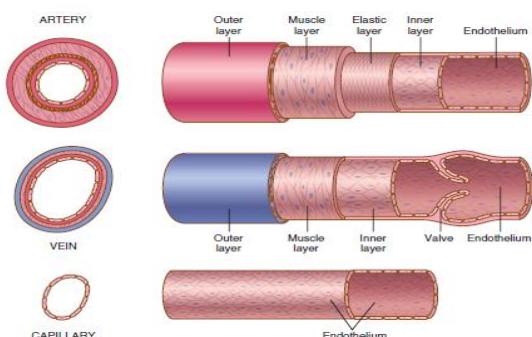
GENERAL TERMS:

- CARDIOLOGY
- CARDIOLOGIST
- STRUCTURE OF HEART
- STUDY OF BLOOD VESSELS RELATED TO HEART
- CARDIOLOGY DISEASES AND CONDITIONS
- DIAGNOSTIC TESTS AND PROCEDURES
- MEDICAL TERMS AND ABBREVIATIONS

CARDIOVASCULAR SYSTEM :

- ALSO CALLED CIRCULATORY SYSTEM
- CONSISTS OF THE HEART, ARTERIES, VEINS, CAPILLARIES

BLOOD VESSELS



- **Artery – carries oxygenated blood away from the heart**
 - “distributors”
 - Arteriole: small artery
 - Precapillary sphincters: regulate the blood flow into capillaries
- **Vein – carries deoxygenated blood towards the heart**
 - Veins have valves that prevent the backflow of blood
 - And keep the blood moving in one direction. Muscular Action also helps the movement of blood in veins
 - Great ability to stretch (*capacitance*)
 - Function as reservoirs: blood pools in the valves then is pushed forward from the pumping pressure
 - Venules: small vein
- **Capillaries – arterial system switches to venous system**
- Capillaries have walls that are only one endothelial cell in thickness
 - “primary exchange vessels”
 - Transport materials to and from the cells
 - Microcirculation: blood flow between arterioles, capillaries and venules

CIRCULATION OF BLOOD

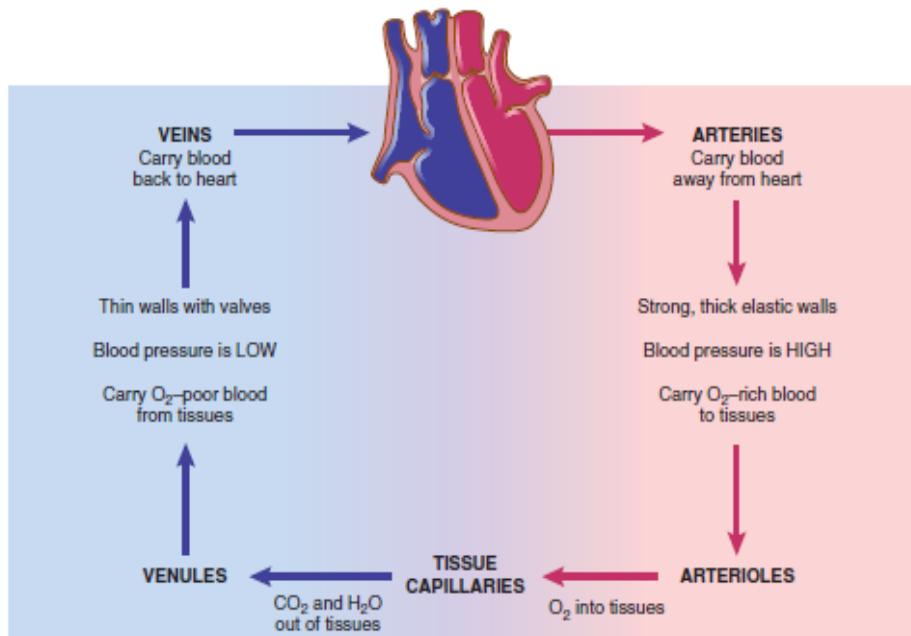
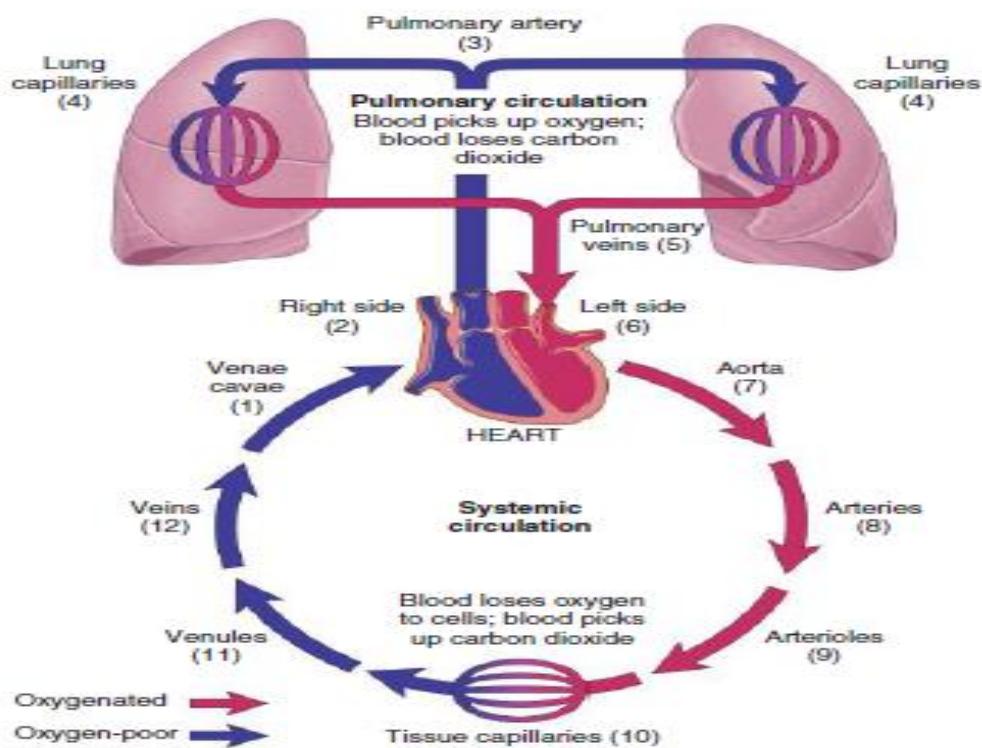


FIGURE 11-2 Relationship and characteristics of blood vessels.



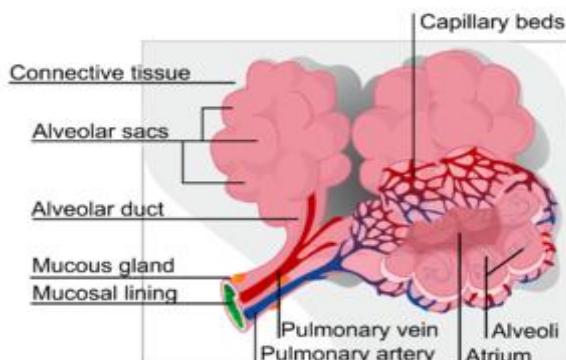
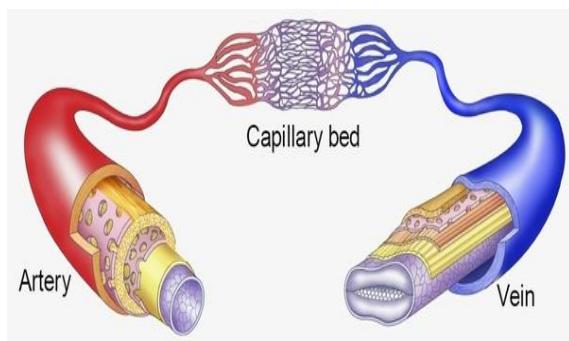
1. The superior and inferior vena cavae carry deoxygenated blood to the heart's right Atrium.
- 2 .Blood passes through the tricuspid valve into the right ventricle.
- 3 .Blood is pumped from the right ventricle into the pulmonary artery.
- 4 .The pulmonary artery carries blood to lungs.
5. Blood is oxygenated in the lungs.

- 6 .The pulmonary veins carry oxygenated blood to the left atrium.
- 7 .Blood passes through the mitral valve into the left ventricle.
- 8 .Blood is pumped from the left ventricle into the aorta.
- 9 .The arterial system pumps blood throughout the body where it eventually reaches Capillary beds.
10. In the capillary beds, oxygen is transferred from the blood to the surrounding tissue, and carbon dioxide is transferred from the tissue to the blood.
- 11 .The venous system transports deoxygenated blood to the superior and inferior vena Cavae.

CAPILLARY BED:

A closely interwoven collection of capillaries that lie next to body tissues is called a capillary bed.

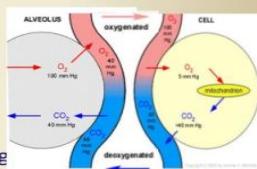
These capillary beds are where the transfer of oxygen and carbon dioxide takes place



Gas Exchange

- Sites of Gas exchange:
 - At tissues (between blood & tissues).
 - At the lungs (between blood & air).
- Mechanism of Gas exchange
 - Simple diffusion.

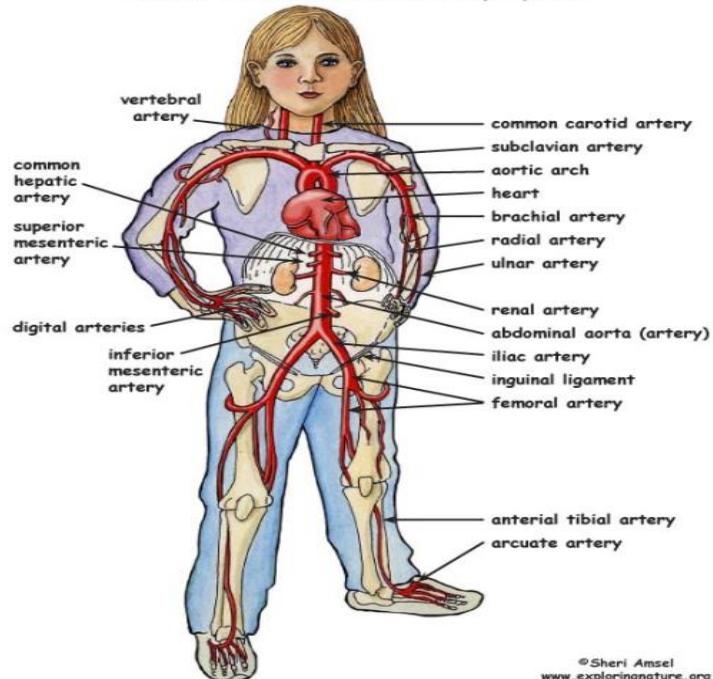
i.e. down partial pressure gradient. from high to low partial pressure.



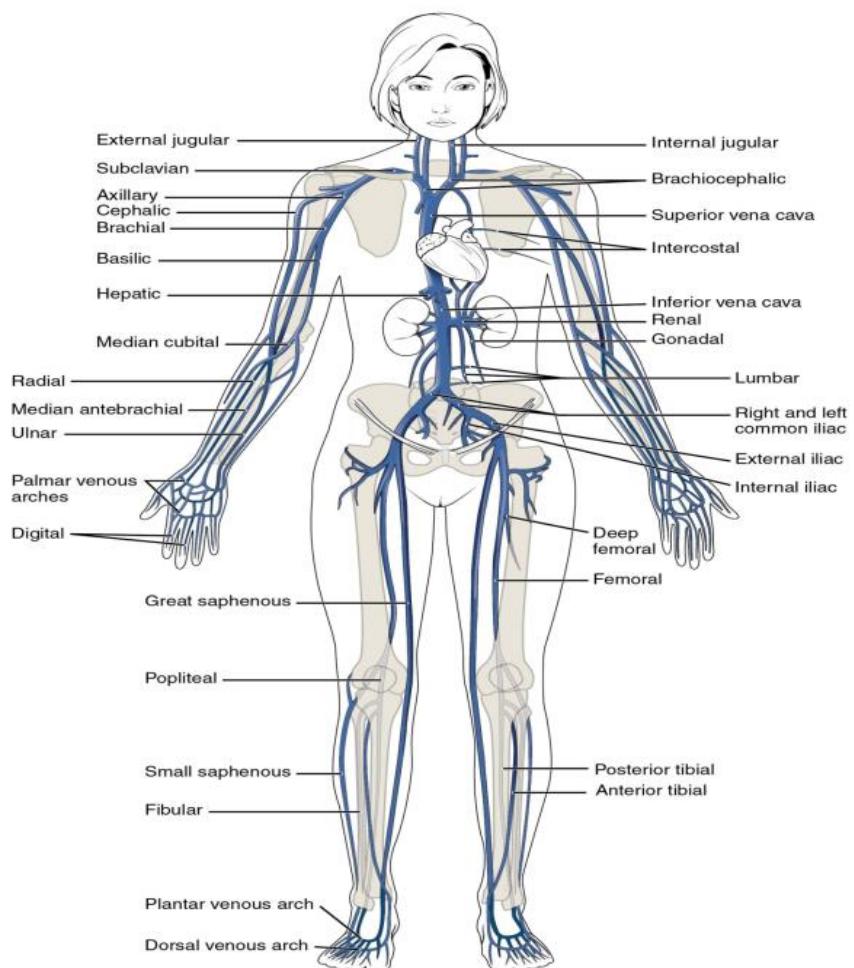
The diagram illustrates the mechanism of gas exchange. On the left, a circular structure labeled 'ALVEOLUS' contains a red circle labeled 'O₂' with an arrow pointing towards it, and a blue circle labeled 'CO₂' with an arrow pointing away from it. The text '100 mm Hg' is written above the O₂ circle. On the right, a circular structure labeled 'CELL' contains a yellow circle labeled 'O₂' with an arrow pointing towards it, and a blue circle labeled 'CO₂' with an arrow pointing away from it. The text '5 mm Hg' is written above the O₂ circle. Below the cell, the text 'desaturated' is written above the 'CIRCULATORY SYSTEM', which is shown as a blue line with arrows indicating blood flow. The overall title 'Gas Exchange' is centered at the top of the diagram area.

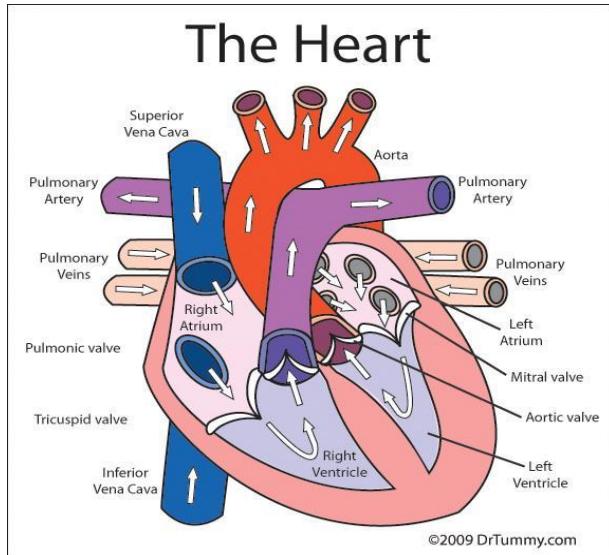
- The circulation of blood through the vessels from the heart to the lungs and then back to the heart again is the pulmonary circulation.
- The pathway of blood from the heart to the tissue capillaries and back to the heart is the systemic circulation

Blood Vessels of the Circulatory System



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HEART

- Four chamber muscular pumping organ
- Comparable to the size of a closed fist
- Located in the mediastinum
 - Behind sternum
 - Between 2nd and 6th ribs
 - Between T5-T8
- Apex – base of heart
 - Located at the 5th intercostal space

CHAMBERS OF HEART - 4

- Atria – two superior chambers
 - “Receiving chambers”
 - Blood from veins enters atria
- Ventricles – two inferior chambers
 - “pumping chambers”
 - Thick muscular walls to increase force of pumping action
 - Separated by inter ventricular septum

VALVES OF HEART

- Permit blood flow in one direction during circulation
- **Atrioventricular valves (AV valves)**
 - Also called cuspid valves
 - Between atria and ventricles
- **Tricuspid valve**
 - B/w RT atrium and ventricle
 - Connected to ventricular papillary muscle via chordae tendinae

- **Bicuspid valve**
 - B/w LT atrium and ventricle
 - Also called mitral valve
- **Semilunar (SL valves)**
 - Between RT ventricle and pulmonary arteries , LT ventricle and aorta consisting of three cusps or flaps which prevent the flow of blood back into the heart.
- **Pulmonary valve**
 - B/w RT ventricle and pulmonary trunk
- **Aortic valve**
 - B/w LT ventricle and aorta

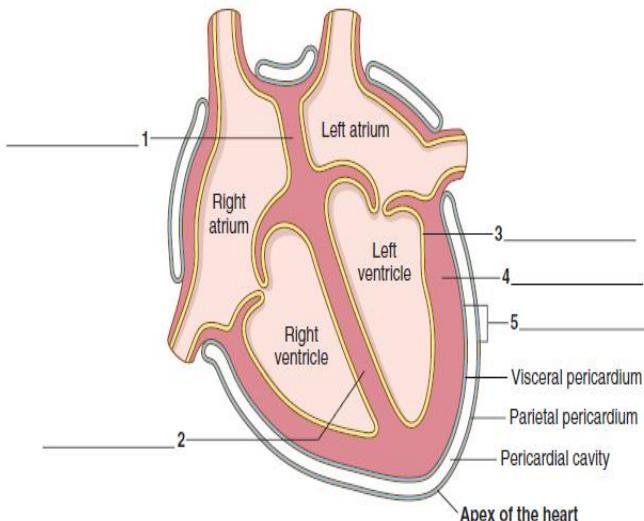
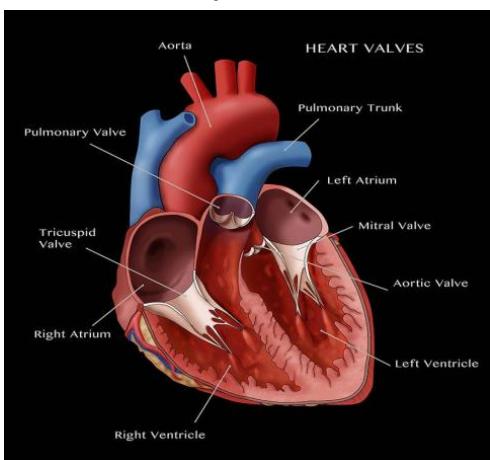


FIGURE 11-6 The walls of the heart and pericardium. Note that the apex of the heart is the conical (shaped like a cone) lower tip of the heart.

SEPTUM

- The four chambers of the heart are separated by partitions called septa (*singular: septum*).
- Inter atrial septum separates the two upper chambers (atria)
- Inter ventricular septum, a muscular wall, lies between the two lower chambers (ventricles).

MEMBRANE COVERING THE HEART:

- **Pericardium – fitting sac (MEMBRANE) surrounding the heart**
 - Fibrous pericardium – tough, loose-fitting, inelastic

- Serous pericardium
 - Parietal layer: lines the inside of the fibrous pericardium
 - Visceral layer: adheres to outside of the heart
- Pericardial space: between parietal and visceral layer
 - Filled with 10-15ml of pericardial fluid
 - Decreases friction

3 LAYERS OF CARDIAC WALL

- Epicardium – outer layer
 - Epicardium = serous pericardium
- Myocardium – thick, contractile layer composed of cardiac muscle cells
 - Intercalated disks contain many gap junctions
 - Allow cardiac muscle cells to function as a single unit → *syncytium*
- Endocardium – interior of cardiac wall
 - Endothelial tissue
 - Covers projections of myocardial tissue called *trabeculae*

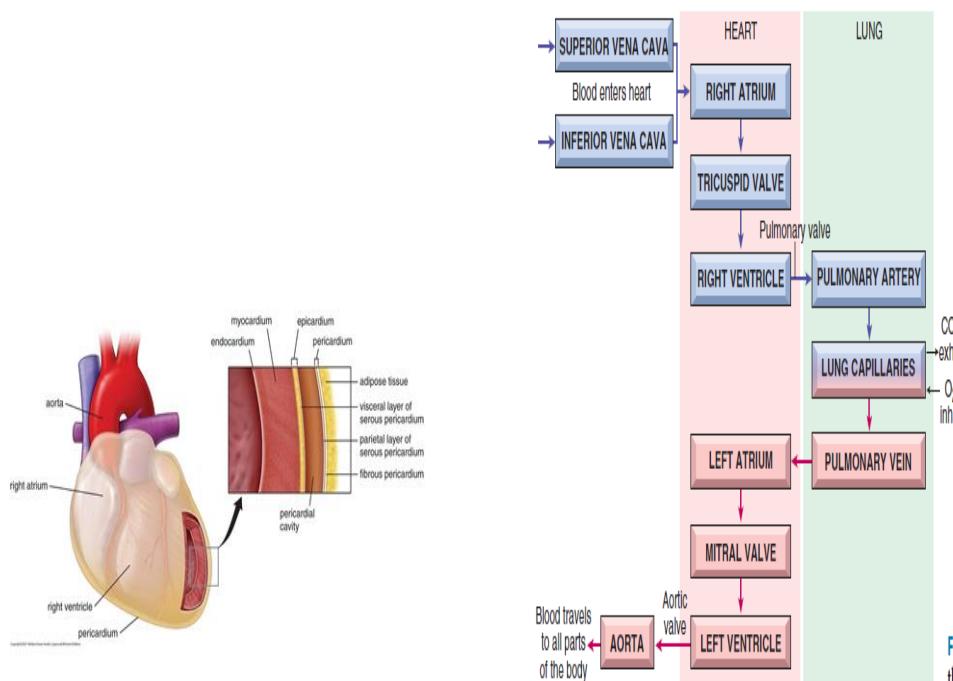


FIGURE 11-7 Pathway of blood through the heart.

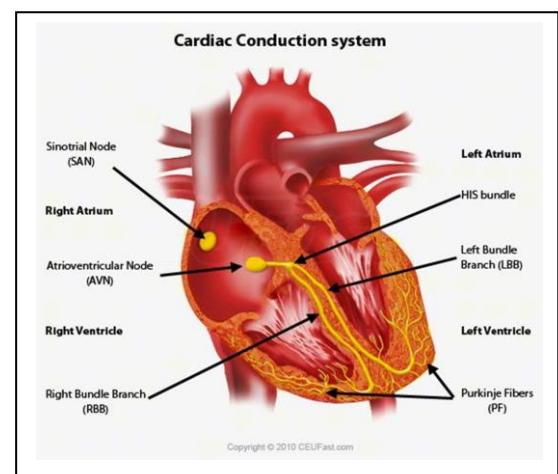
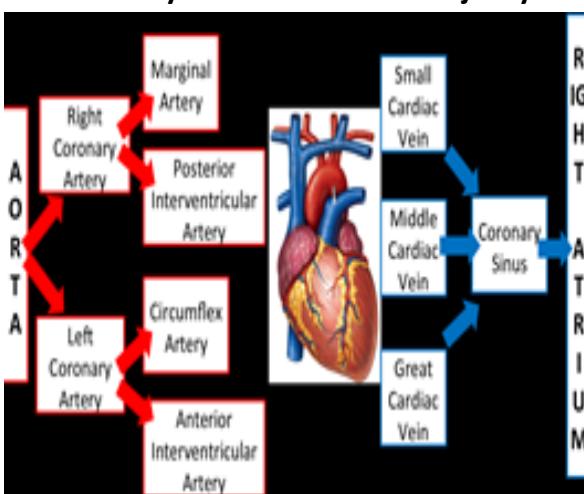
CARDIAC LAYERS

PATHWAY OF BLOOD THROUGH HEART

BLOOD SUPPLY TO THE HEART

- Right and left coronary arteries
 - First branches off aorta
 - Right coronary artery → right marginal artery & posterior interventricular artery

- Left coronary artery → circumflex artery & anterior interventricular artery
- Most of the blood goes to the LT ventricle
- Anastomosis: Connections between blood vessels that allow for collateral circulation
- In presence of an obstruction in a large artery ischemia will result to a large area of tissue
 - Myocardial infarction (MI) (aka heart attack)
- Anastomoses do exists between smaller branches of the R and L coronary arteries
- After traveling through the capillaries of the heart, blood empties into the R atrium via the *coronary sinus*
- The coronary sinus collects the majority of the cardiac venous blood



PHYSIOLOGY OF HEART

HEARTBEAT AND HEART SOUNDS

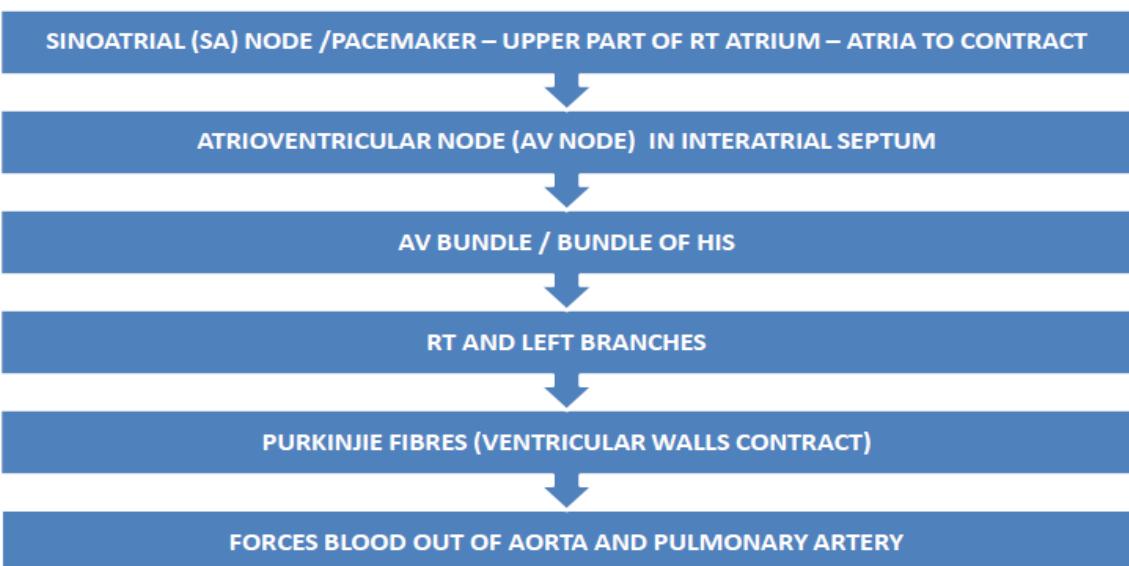
- Two phases of the heartbeat: diastole (relaxation) and systole (contraction).
- Diastole occurs when the ventricle walls relax and blood flows into the heart from the venacavae and the pulmonary veins - tricuspid and mitral valves open in diastole
- Systole - the walls of the right and left ventricles contract to pump blood into the pulmonary artery and the aorta- the tricuspid and the mitral valves are closed
- Heart beats 70 and 80 times per minute
- The heart pumps about 3 ounces of blood with each contraction.
- Closure of the heart valves is associated with audible sounds, such as “lubb-dubb,”
- The “lubb” is associated with closure of the tricuspid and mitral valves at the beginning of systole, and the “dubb” with the closure of the aortic and pulmonary valves at the end of systole.
- What is Murmur?
- What is ECG?
- What is blood pressure?

- Sphygmomanometer – device used to check the BP
- Apical impulse / point of maximum impulse?

CONDUCTION SYSTEM OF HEART

- Heart – contains a **conductive tissue**
- Modified cardiac muscle tissue
- **Generates rhythmic electrical impulses** without any electrical stimulation
- **Four masses** of conductive tissue

CONDUCTION SYSTEM OF HEART



PATHOLOGY: THE HEART AND BLOOD VESSELS

- Arrhythmias - Abnormal heart rhythms (dysrhythmias).
- Bradycardia - Heart rate slower than 60 beats per minute.
- Heartblock (atrioventricular block)- Failure of proper conduction of impulses from the SA node through the AV node to the atrioventricular bundle (bundle of His).
- Flutter - Rapid but regular contractions, usually of the atria.
- Fibrillation - Very rapid, random, inefficient, and irregular contractions of the heart (350 beats or more per minute).
- Bundle branch block (BBB) - A partial or complete interruption in the conduction of one of the two main branches of the bundle of His.

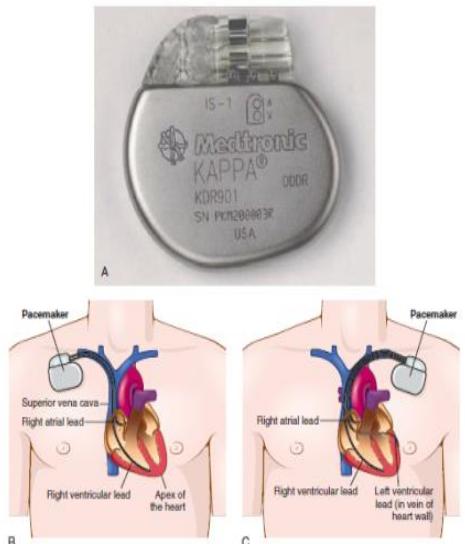
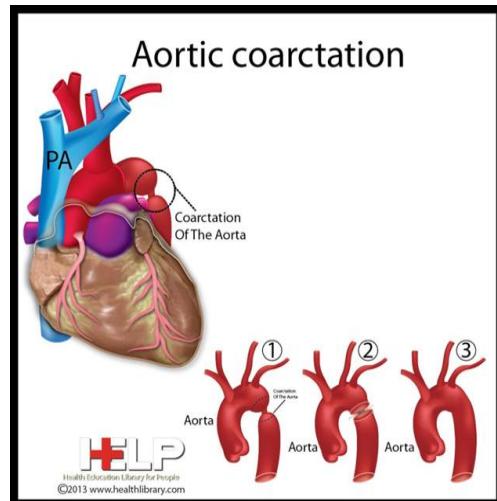
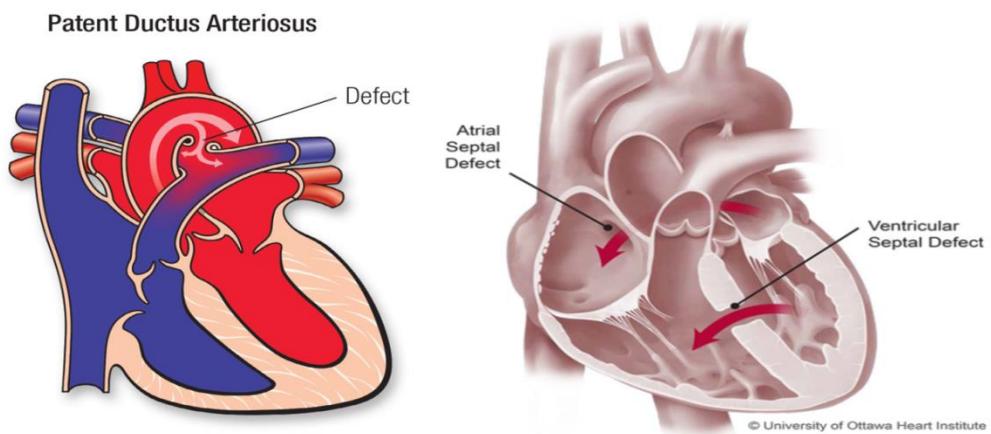


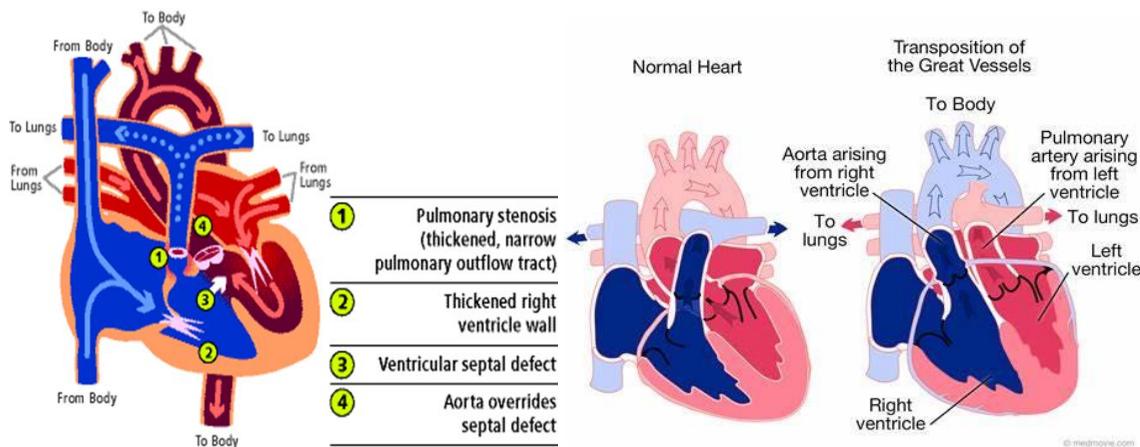
FIGURE 11-13 A. A dual-chamber, rate-responsive pacemaker (actual size shown) is designed to detect body movement and automatically increase or decrease paced heart rates based on levels of physical activity. B, Cardiac pacemaker with leads in the right atrium and right ventricle enable it to sense and pace in both heart chambers. C, Biventricular pacemaker with leads in the right atrium and the right and left ventricles to synchronize ventricular contractions.



CONGENITAL HEART DISEASE

- Congenital heart disease - Abnormalities in the heart at birth.
- Coarctation of the aorta -(coa) - Narrowing (coarctation) of the aorta.
- Patent ductus arteriosus (PDA) - Passageway (ductus arteriosus) between the aorta and the pulmonary artery remains open (patent) after birth
- Septal defects - Small holes in the wall between the atria (atrial septal defects) or the ventricles (ventricular septal defects).



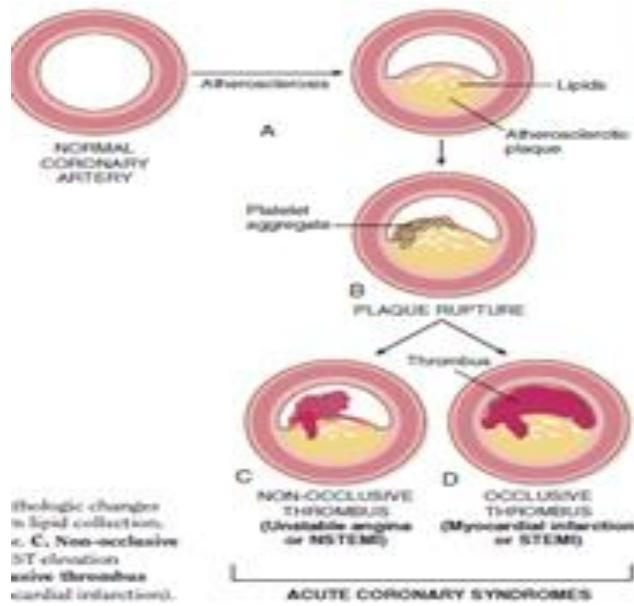


- **Tetralogy of Fallot - Congenital malformation involving four (tetra-) distinct heart defects.**
 - Pulmonary artery stenosis - Pulmonary artery is narrow or obstructed.
 - Ventricular septal defect - Large hole between two ventricles lets venous blood pass from the right to the left ventricle and out to the aorta without oxygenation.
 - Shift of the aorta to the right - Aorta overrides the interventricular septum. Oxygen-poor blood passes from the right ventricle to the aorta.
 - Hypertrophy of the right ventricle
- **Transposition of the great arteries (TGA) - pulmonary artery arises from the left ventricle and the aorta from the right ventricle cause cyanosis and hypoxia.**

PATHOLOGY OF HEART:

- **CONGESTIVE HEART FAILURE(CHF)** - Heart is unable to pump its required amount of blood.
- **Coronary artery disease (CAD)** - Disease of the arteries surrounding the heart – **MAINLY OF ATHEROSCLEROSIS**
- **Endocarditis** - Inflammation of the inner lining of the heart.
- **Hypertensive heart disease** - High blood pressure affecting the heart.
- **Cardiac sarcoma** - A malignant tumor of the heart muscle.
- **Cardiomyopathy** - Any disease of the heart muscle.
- **Cardiac arrest (CA)** - Failure of the systemic circulatory system due to absent or inadequate contraction of the ventricles
- **Cor pulmonale** - Right ventricular enlargement that is caused by a lung disorder. It leads to hypertension in the pulmonary artery.
- **Mitral Valve Prolapse (MVP)**
 - Flaps of mitral valve extend back into L atrium causes leaking
 - Mostly genetic basis

- **1 in 20 people**
- **Most asymptomatic; chest pain, fatigue**
- **Treatment: valvuloplasty**
- **Murmur - Extra heart sound, heard between normal beats**
- **Pericarditis - Inflammation of the membrane (pericardium) surrounding the heart**
- **Rheumatic heart disease - Heart disease caused by rheumatic fever.**
- **Aortic Regurgitation**
 - Blood leaks back into LT ventricle during ejection into the aorta
 - Volume overload in LT ventricle, hypertrophy, dilation of Ltventricle
 - Complications: myocardial ischemia
 - Treatment: valvuloplasty



Atherosclerosis
Type of arteriosclerosis
- Lipids build up on the inside of vessel walls → calcify → vessels hard & brittle
- Risk factors: cigarette smoking, high fat/cholesterol diet, hypertension

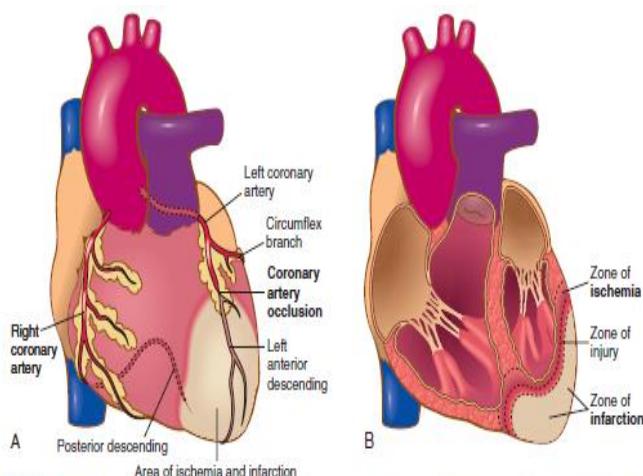


FIGURE 11-16 A, Ischemia and infarction produced by coronary artery occlusion. B, Internal view of the heart showing an area damaged by myocardial infarction.

Myocardial Infarction
“Heart Attack”
- Coronary thrombosis: clot
- Coronary embolism: mobilized clot
Occlude coronary artery → heart tissue deprived of oxygen → cell death
Angina pectoris – severe chest pain resulting from inadequate oxygen to myocardium
Treatment: Coronary Bypass Surgery
Veins are harvested from other areas of the body and used to bypass

- **Arteriosclerosis**
 - Arteries become occluded, weak and hardened

- Complications: ischemia, necrosis, gangrene
- Risk factors: age, diabetes, high fat/cholesterol diet, hypertension, smoking
- Treatment: vasodilators, angioplasty, stent placement, bypass surgery
- Complications: aneurysm
- Varicose Veins
 - Enlarged veins caused by pooling
 - Results in varicositis or varices (“spider veins”)
 - Risk factors: standing for long periods
 - Semilunar valves widen → more pooling
 - Treatment: compression stockings, surgical removal

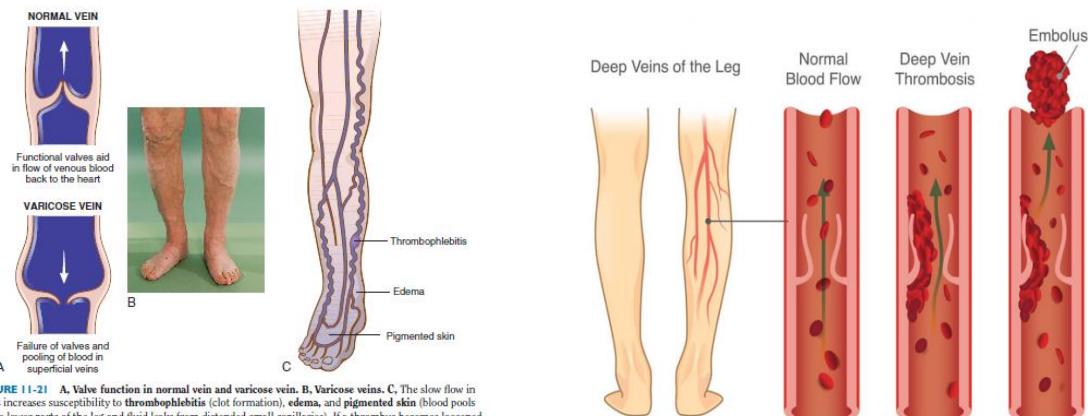


FIGURE 11-21 A. Valve function in normal vein and varicose vein. B. Varicose veins. C. The slow flow in veins increases susceptibility to thrombophlebitis (clot formation), edema, and pigmented skin (blood pools in the lower parts of the leg and fluid leaks from distended small capillaries). If a thrombus becomes loosened from its place in the vein, it can travel to the lungs (pulmonary embolism) and block a blood vessel there.

- Phlebitis – vein inflammation
 - Causes: irritation by IV catheter
- VENOUS STASIS ULCERS
 - Result of chronic vein insufficiency
 - Lack of oxygen to peripheral tissues
 - Elevate leg & apply pressure
 - Irregular edges
- Aneurysm - Local widening (dilation) of an arterial wall - the brain (berry aneurysms)
- Deep vein thrombosis (DVT) - Blood clot (thrombus) forms in a large vein, usually in a lower limb. This condition may result in a pulmonary embolism (clot travels to the lung) if not treated effectively.

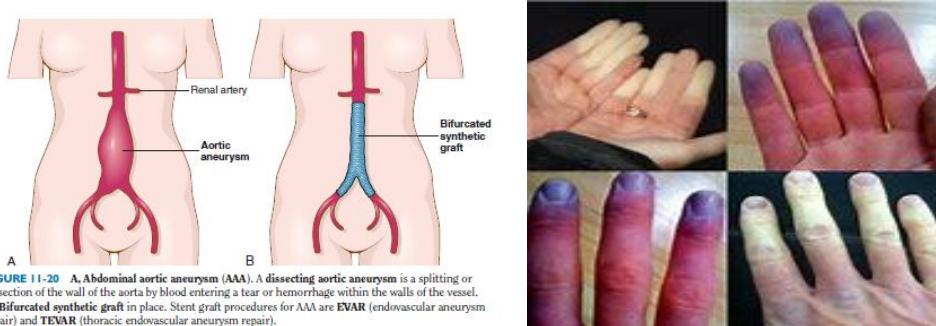


FIGURE 11-20 A. Abdominal aortic aneurysm (AAA). A dissecting aortic aneurysm is a splitting or dissection of the wall of the aorta by blood entering a tear or hemorrhage within the walls of the vessel. B. Bifurcated synthetic graft in place. Stent graft procedures for AAA are EVAR (endovascular aneurysm repair) and TEVAR (thoracic endovascular aneurysm repair).

- Hypertension (HTN) - High blood pressure.
- Essential hypertension – NO CAUSE
- Secondary hypertension - caused by another medical condition
- PERIPHERAL ARTERY DISEASE (PAD) - Blockage of arteries carrying blood to the legs, arms, kidneys and other Organs
- Raynaud (rā-NŌ) disease - Recurrent episodes of pallor and cyanosis primarily in fingers and toes.
- Hypercholesterolemia - Abnormally high levels of serum cholesterol.
- Hyperlipidemia - Several types of disorders characterized by increased plasma lipoprotein levels. Also called *hyperlipoproteinemia*.
- Hypertriglyceridemia - Abnormally high levels of serum triglycerides.
- Intermittent claudication - Intense pain, cramping, weakness, and/or numbness in the lower extremities. It is usually intermittent and indicates impaired circulation to the extremities
- Lipedema - Swelling due to fluid and subcutaneous fat deposition in tissues. Also called *painful fat syndrome*.
- Lymphedema - Swelling and localized accumulation of lymph in tissues that occur when lymphatic channels are obstructed
- Shock - A state in which blood flow to peripheral tissues is inadequate.
- Syncope - A sudden, temporary loss of consciousness. Also called *fainting*.
- Tamponade - Compression of the heart due to abnormally excessive fluids filling the pericardium.
- Thromboangiitis obliterans - Inflammation of the walls of small- and medium-sized blood vessels that is associated with thrombotic occlusion. Also called *Buerger disease*

LABORATORY TESTS AND CLINICAL PROCEDURES

LABORATORY TESTS

- BNP test - Measurement of BNP (brain natriuretic peptide) in blood.
- Cardiac biomarkers - Chemicals are measured in the blood as evidence of a heart attack
- Lipid tests (lipid profile) - Measurement of cholesterol and triglycerides (fats) in a blood sample
- Lipoprotein electrophoresis - Lipoproteins (combinations of fat and protein) are physically separated AND measured in a blood sample. – LDL , HDL
- Angiography - X-ray imaging of blood vessels after injection of contrast material.
- Arteriography - x-ray imaging of arteries after injection of contrast via a catheter into the aorta or an artery.
- Computed tomography angiography (CTA)
- Digital subtraction angiography (DSA)

- Electron beam computed tomography (EBCT or EBT)
- Doppler ultrasound studies - Sound waves measure blood flow within blood vessels. An instrument focuses sound waves on blood vessels, and echoes bounce
- Echocardiography (ECHO)
- Positron emission tomography (PET) scan
- Technetium Tc 99m sestamibi scan
- Thallium 201 scan - cardiac MRI Images of the heart are produced using radiowave energy in a magnetic field
- Cardiac catheterization - Thin, flexible tube is guided into the heart via a vein or an artery.
- Electrocardiography (ECG) - Recording of electricity flowing through the heart.
- Holter monitoring - An ECG device is worn during a 24-hour period to detect cardiac arrhythmias.
- Stress test Exercise tolerance test (ETT) - determines the heart's response to physical exertion (stress).

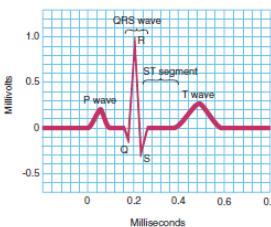


FIGURE 11-10 Electrocardiogram. P wave = spread of excitation wave over the atria just before contraction; QRS wave = spread of excitation wave over the ventricles as the ventricles contract; T wave = electrical recovery and relaxation of ventricles. A heart attack or myocardial infarction (MI) can be recognized by an elevation in the ST segment of the electrocardiographic tracing. Thus, one type of MI is an ST elevation MI (STEMI).

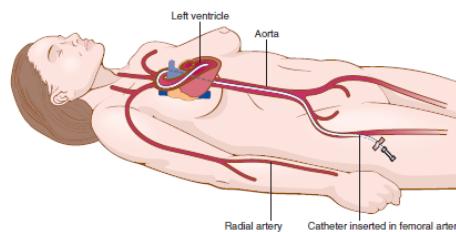


FIGURE 11-24 Left-sided cardiac catheterization. The catheter is passed retrograde (backward) from the femoral artery into the aorta and then into the left ventricle. Catheterization also is performed using the radial artery by an increasing number of interventional cardiologists. For right-sided cardiac catheterization, the cardiologist inserts a catheter through the femoral vein and advances it to the right atrium and right ventricle and into the pulmonary artery.

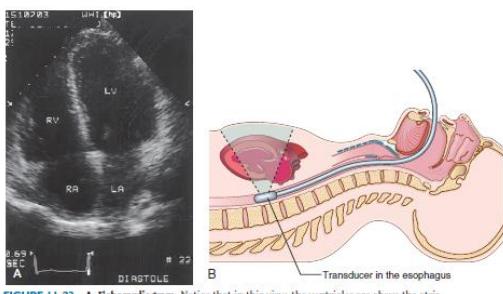


FIGURE 11-23 A, Echocardiogram. Notice that in this view, the ventricles are above the atria. B, Transesophageal echocardiography.

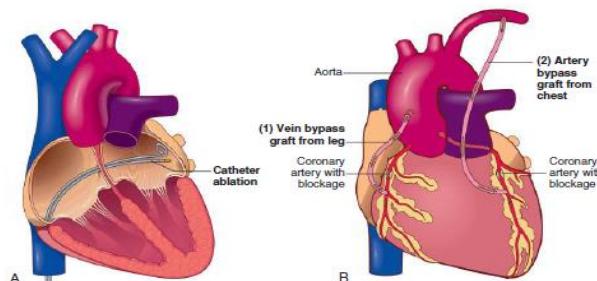


FIGURE 11-26 A, Catheter ablation. SVT, atrial flutter, AF, and VT may be treated with ablation when clinically indicated. B, Coronary artery bypass grafting (CABG) surgery with anastomosis of vein and arterial grafts. (1) A section of a vein is removed from the leg and anastomosed (upside down because of its directional valves) to a coronary artery, to bypass an area of arteriosclerotic blockage. (2) An internal mammary artery is grafted to a coronary artery to bypass a blockage.

TREATMENT

- Catheter ablation - Brief delivery of radiofrequency energy to destroy areas of heart tissue that may be causing arrhythmias
- Coronary artery bypass grafting (CABG) - Arteries and veins are anastomosed to coronary arteries to detour around blockages.
- Defibrillation - Brief discharges of electricity are applied across the chest to stop dysrhythmias (ventricular fibrillation).

- For patients at high risk for sudden cardiac death from ventricular dysrhythmias, an implantable cardioverter-defibrillator (ICD) or automatic implantable cardioverter-defibrillator (AICD) is placed in the upper chest.
- Cardioversion is another technique using lower energy to treat atrial fibrillation, atrial flutter, and supraventricular tachycardia.
- Endarterectomy -Surgical removal of plaque from the inner layer of an artery
- Extracorporeal circulation - Extracorporeal circulation is a medical procedure where blood is pumped out of the body, cleaned or treated and then pumped back in again. EG : HEART – LUNG MACHINE
- Heart-lung machine diverts blood from the heart and lungs while the heart is repaired.
- Heart transplantation - A donor heart is transferred to a recipient.
- Percutaneous coronary intervention (PCI) - Balloon-tipped catheter is inserted into a coronary artery to open the artery; stents are put in place.
- Thrombolytic therapy - Drugs to dissolve clots are injected into the bloodstream of patients with coronary thrombosis.
- Transcatheter aortic valve replacement (TAVR) - Placement of a balloon-expandable aortic heart valve into the body via a catheter

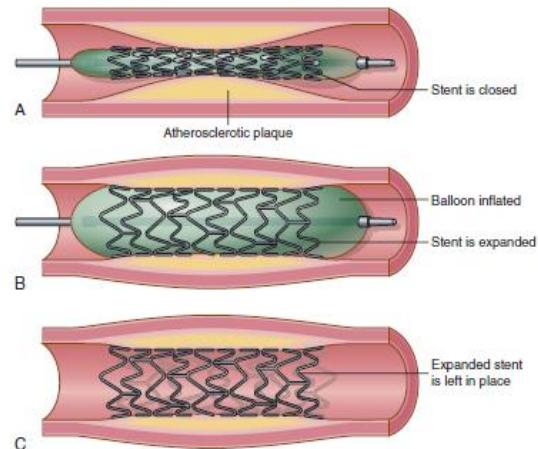


FIGURE 11-27 Placement of an intracoronary artery drug-eluting stent. **A**, The stent is positioned at the site of the lesion. **B**, The balloon is inflated, expanding the stent and compressing the plaque. **C**, When the balloon is withdrawn, the stent supports the artery and releases a drug to reduce the risk of restenosis. Stents are stainless-steel scaffolding devices that help hold open arteries, such as the coronary, renal, and carotid arteries.

SUMMARY OF PATHOLOGY AND PROCEDURES:

CONDITON / DISEASE	DESCRIPTION
Aneurysm	An abnormal dilation or bulging out of an artery wall due to a Congenital or acquired weakness in the wall.

Angina pectoris	An attack of severe and often constricting chest pain. It is usually Caused by blockage of the coronary arteries due to atherosclerosis. Other causes include coronary embolism.
Aortic dissection	A tear in the innermost layer of the aorta which allows blood to surge into the aortic wall, creating a false lumen within the aorta.
Arrhythmia	An irregular heartbeat
Arteriosclerosis	A generic term for several conditions characterized by thickening of The walls of arteries. The arteries lose their elasticity, making them less Efficient in pumping blood. Commonly called <i>hardened arteries</i> .
Arteriovenous fistula	Abnormal passage of blood between an artery and a vein, bypassing Capillary beds.
Arteritis	Inflammation of one or several arteries
Atherosclerosis	A type of arteriosclerosis characterized by patchy lipid (fat) deposits Inside large- and medium-sized arteries
Atrial septal defect (ASD)	A congenital defect in which there is an abnormal opening in the Septum between the left and right atria.
Bruit	An abnormal heart sound heard on auscultation that often has a harsh Or musical quality.
Bundle branch block (BBB)	A partial or complete interruption in the conduction of one of the two Main branches of the bundle of His.
Cardiac arrest (CA)	Failure of the systemic circulatory system due to absent or inadequate Contraction of the ventricles.
Cardiac sarcoma	A malignant tumor of the heart muscle.
Cardiomyopathy	Any disease of the heart muscle.
Coarctation	A constriction of a blood vessel, usually the aorta.
Congestive heart failure (CHF)	The inability of the heart to pump adequate amounts of blood. It Results in congestion and edema of tissues and is frequently a result of Myocardial infarction.
Cor pulmonale	Right ventricular enlargement that is caused by a lung disorder. It Leads to hypertension in the pulmonary artery.
Coronary artery disease (CAD)	A broad term used to cover any condition that affects the coronary Arteries.
Embolism	Any blockage or occlusion of a vessel by a mass such as a thrombus (blood clot) or a foreign body
Endocarditis	Inflammation of the endocardium.
Fibrillation	Rapid, irregular contractions of the atrial or ventricular muscles. Ventricular fibrillation leads to virtually no cardiac output and is Extremely serious.
Flutter	Regular, rapid contractions of the atrial or ventricular muscles
Hypercholesterolemia	Abnormally high levels of serum cholesterol.
Hyperlipidemia	Several types of disorders characterized by increased plasma Lipoprotein levels. Also called <i>hyperlipoproteinemia</i> .
Hypertension	Abnormally high blood pressure.

Hypertriglyceridemia	Abnormally high levels of serum triglycerides.
Intermittent claudication	Intense pain, cramping, weakness, and/or numbness in the lower extremities. It is usually intermittent and indicates impaired circulation to the extremities.
Ischemia	A temporary deficiency in blood supply within a localized area. It is due to an obstruction in a blood vessel, most commonly the narrowing of an artery.
Lipedema	Swelling due to fluid and subcutaneous fat deposition in tissues. Also called <i>painful fat syndrome</i> .
Lymphedema	Swelling and localized accumulation of lymph in tissues that occur when lymphatic channels are obstructed.
Mitral valve prolapse (MVP)	A bulging into the left atrium during left ventricular systole of one or More of the flaps (called <i>leaflets</i>) that make up the mitral valve.
Myocardial infarction (MI)	A sudden insufficiency of the blood supply to an area of the heart Muscle. It is most commonly caused by an occlusion of a coronary Artery.
Nonatheromatous Arteriosclerosis	A type of arteriosclerosis primarily caused by the aging process in Which fibrous tissue develops in arterial walls with loss of elasticity And some thickening. Arterial muscle atrophies resulting in a widening Of the lumen, possibly leading to aneurysms or dissections (splitting Apart of arterial walls).
Occlusion of the Abdominal aorta	Blockage of the abdominal aorta or a major branch. It can be caused By an embolism, a narrowed artery, or aortic dissection.
Palpitation	Unusually forceful, rapid, and/or irregular heartbeats of which the Patient is aware
Pericarditis	Inflammation of the pericardium
Peripheral arterial Occlusion	Blockage of the blood supply to an extremity caused by an embolism Or plaque caused by atherosclerosis.
Phlebitis	Inflammation of a vein.
Raynaud disease	Spasms of arterioles, along with cyanosis or pallor. There is bilateral Involvement, and no underlying cause can be determined.
Raynaud phenomenon	Spasms of the arterioles, along with cyanosis or pallor. Unlike Raynaud disease, an underlying cause can be determined.
Shock	A state in which blood flow to peripheral tissues is inadequate.
Syncope	A sudden, temporary loss of consciousness. Also called <i>fainting</i> .
Tamponade	Inflammation of the walls of small- and medium-sized blood vessels That is associated with thrombotic occlusion. Also called <i>Buerger Disease</i>
Thromboembolism	An obstruction of a blood vessel caused by a thrombus. Tissues Supplied by the vessel or its branches become necrotic from lack of Blood supply.
Thrombophlebitis	Inflammation of a vein caused by thrombus formation
Thrombus	A clot formed from blood components and found in the cardiovascular System.

Valvular heart disease	Any condition in which a heart valve improperly functions
Valvular regurgitation	Backward flow of blood through an incompetent heart valve. Also Called <i>valvular insufficiency</i> or <i>valvular incompetence</i>
Valvular stenosis	Narrowing of a cardiac valve.
Varicose veins	Veins with damaged valves that allow blood to backflow in the veins. Varicose veins may occur anywhere but are most commonly found in The legs, esophagus (<i>varices</i>), and anus (<i>hemorrhoids</i>).
Venous thrombosis	A thrombus in a vein.
Ventricular septal Defect (VSD)	A congenital defect in which there is an abnormal opening in the Septum between the left and right ventricles.

PROCEDURES	DESCRIPTION
Aneurysmectomy	Excision of an aneurysm.
Angioplasty	Restoration of the integrity of a blood vessel using a stent, Mechanical stripping of the vessel wall, balloon dilation within the Compromised area of the vessel, and/or injection of fibrinolytic drugs Such as tissue plasminogen activators (tpa) or thrombolytic Enzymes.
Atherectomy	Removal of an atheroma (lipid deposit) from an artery. Can be Accomplished by surgery or by catheterization.
Atriotomy	Formation of an opening into an atrium
Cardiopulmonary Resuscitation (CPR)	The use of artificial respiration and techniques such as closed chest compressions in an attempt to restore normal breathing and heartfunctioning.
Cardioversion	Restoration of normal heart rhythm by using very brief electrical shocks. Also referred to as <i>defibrillation</i>
Commissurotomy	Division of a commissure or fibrous band using surgery or a balloon Catheter technique. One notable cardiac commissurotomy is a <i>mitral Commissurotomy</i> , undertaken for relief of mitral valve stenosis.
Coronary arterial bypass Surgery	Grafting the internal mammary artery or segments of an autologous Saphenous vein to coronary arteries, in order to detour a coronary Artery obstruction. Also called <i>coronary artery bypass graft (CABG) Surgery</i> .
Cutdown	Incision or dissection of a vein to insert a cannula, needle, or Catheter. Used when percutaneous catheter insertion cannot be Accomplished. Also called <i>venous cutdown</i> or <i>venostomy</i> .
Embolectomy	Excision of an embolus (a detached thrombus obstructing a blood Vessel).
Endarterectomy	Excision of atherosomas in which the innermost layer of the artery is Removed. Sometimes a tubular graft or patch is inserted to restore the Integrity of the artery
Femoropopliteal bypass Surgery	Grafting a shunt that detours around an obstruction in the femoral Artery. The shunt may be made from autologous or heterologous Tissue or from synthetic material.

Greater saphenous vein Ligation and stripping	Excision of the greater saphenous vein and its tributaries, currently Performed on patients with severe varicose veins secondary to Venous valvular incompetence
Heart transplantation	Replacement of the heart with the healthy heart of a donor. The heart Typically comes from a brain-dead donor who is on life support
Median sternotomy	Incision of the anterior chest through the midline of the sternum
Pacemaker implantation	Implantation of an electronic device that electrically stimulates the Heart to keep it beating properly.
Percutaneous Transluminal coronary Angioplasty (PTCA)	Reconstruction of a coronary artery by inserting a balloon-tipped Catheter into the artery at the site of the obstruction and inflating it, Rupturing the obstruction and thereby dilating the artery. Also called <i>Coronary angioplasty, coronary artery angioplasty, and balloon Angioplasty.</i>
Portosystemic shunt	Diversion of portal venous blood into the inferior vena cava to Relieve portal hypertension
Stent implantation	Implantation of a stent (a metallic meshlike tube) into a blood vessel At the site of an obstruction. The stent is intended to remain Permanently to keep the vessel open
Surgical resection of an Artery	Surgical resection of an Artery
Thrombectomy	Excision of a thrombus (an attached blood clot in a vessel or heart Wall).
Valve replacement Surgery	Excision and replacement of a defective heart valve either with an Artificial valve or a valve from an animal donor, typically a porcine (pig) valve
Valvotomy	Incision of a stenotic cardiac valve. Also called <i>valvulotomy</i> .

MEDICAL TERMINOLOGIES:

COMBINING FORM	MEANING
angi/o	vessel
aort/o	aorta
arter/o , arteri/o	artery
atri/o	atrium
ather/o	yellowish plaque
brachi/o	arm
cardi/o	heart
coron/o	heart
isch/o	hold back
phleb/o	vein
sphygm/o	pulse
thromb/o	clot
valv/o	valve
vas/o	vessel; duct; vas deferens
vascul/o	blood vessel

ven/o	vein
ventricul/o	ventricle (of brain or heart)
venul/o	venule; small vein

ABBREVIATIONS:

ABBREVIATION	MEANING
AAA	Abdominal aortic aneurysm
ACG	Angiocardiography
AS	Aortic stenosis
ASD	Atrial septal defect
ASHD	Arteriosclerotic heart disease, atherosclerotic heart disease
AV node	Atrioventricular node
BBB	Bundle branch block
BP	Blood pressure
CA	Cardiac arrest
CABG	Coronary artery bypass graft
CAD	Coronary artery disease
CC	Cardiac catheterization
CCU	Coronary care unit, cardiac care unit
CHF	Congestive heart failure
CK-MB	Creatine kinase-myoglobin
CPR	Cardiopulmonary resuscitation
CV	Cardiovascular
CVP	Central venous pressure
DVT	Deep vein thrombosis
ECG (EKG)	Electrocardiogram
EDP	End-diastolic pressure
EDV	End-diastolic volume
EPS	Electrophysiologic study
HTN	Hypertension
ICA	Internal carotid artery
IMA	Internal mammary artery
ICD	Implantable cardioverter - defibrillator
JVP	Jugular venous pressure
LAD	Left anterior descending coronary artery
LCA	Left coronary artery
LCCA	Left circumflex coronary artery
LIMA	Left internal mammary artery
LMCA	Left main coronary artery
LPA	Left pulmonary artery
MI	Myocardial infarction
MPA	Main pulmonary artery
MRA	Magnetic resonance angiography

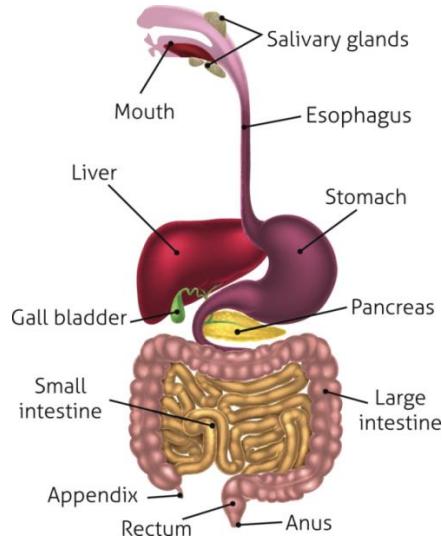
MS	Mitral stenosis
MVP	Mitral valve prolapse
OM	Obtuse marginal (artery)
PA	Pulmonary artery
PAT	Paroxysmal atrial tachycardia
PAWP	Pulmonary artery wedge pressure
PDA	Posterior descending artery; patent ductus arteriosus
PMI	Point of maximal impulse
PTCA	Percutaneous transluminal coronary angioplasty
PVC	Premature ventricular contraction
RCA	Right coronary artery
RPA	Right pulmonary artery
SA node, S-A node	Sinoatrial node
SFA	Superficial femoral artery
TIMI	Thrombolysis in myocardial infarction
TAVR	Transcatheter aortic valve replacement
tPA	Tissue plasminogen activator

DIGESTIVE SYSTEM

GENERAL TERMS:

- ▶ **Gastroenterology**
- ▶ **Gastroenterologist**
- ▶ **Digestion**
- ▶ **Structure Of Digestive System**
- ▶ **Oral Cavity**
- ▶ **Structure Of Teeth**
- ▶ **Esophagus**
- ▶ **Stomach**
- ▶ **Small Intestine**
- ▶ **Large Intestine**
- ▶ **Accessory Organs- Liver, Pancreas, Gallbladder**
- ▶ **Diseases And Conditions**

DIGESTIVE SYSTEM



- **The Digestive Or Gastrointestinal Tract Begins With The Mouth, Where Food Enters, And Ends With The Anus, Where Solid Waste Material Leaves The Body.**
- **Four Functions Of The Digestive System**
 - Ingestion,
 - Digestion,
 - Absorption,
 - Elimination.

PHASES OF DIGESTION

- **Phases Include**
- 1. **Ingestion**

- **Types**
 - 1. **Mechanical (Physical)**
 - Chew
 - Tear
 - Grind
 - Mash
 - Mix
 - 2. **Chemical**
 - Enzymatic Reactions To Improve Digestion Of
 - Carbohydrates
 - Proteins
 - Lipids
 - **Teeth Mechanically Break Down Food Into Small Pieces.**
 - **Tongue Mixes Food With Saliva (Contains Salivary Amylase, Which Helps Break Down Starch).**

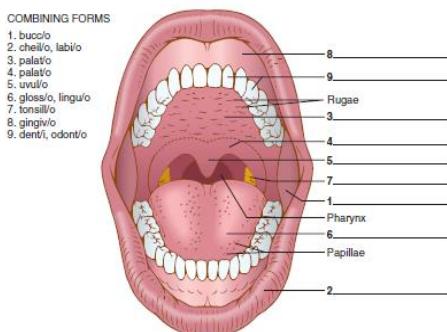
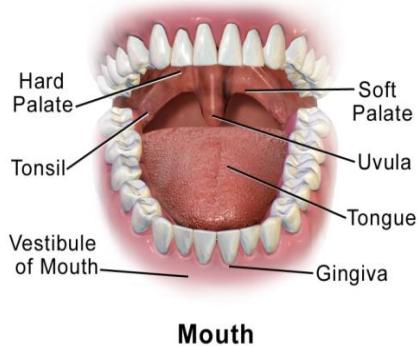
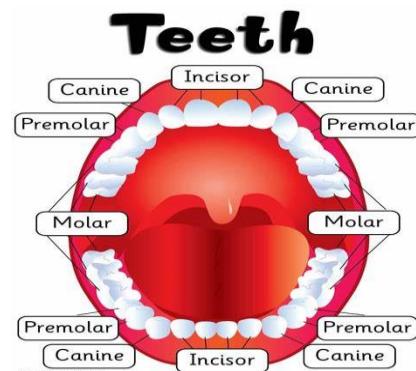
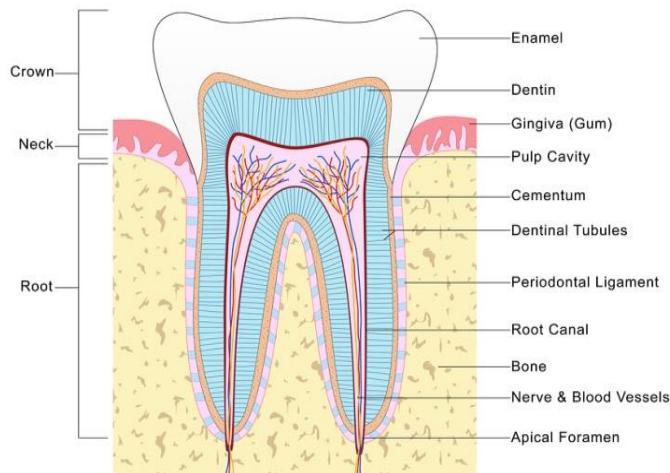


FIGURE 5-1 Oral cavity.

ORAL CAVITY

- The Gastrointestinal Tract Begins With The Oral Cavity.
 - Oral Means Pertaining To The Mouth (Or/O).
 - The Cheeks Form The Walls Of The Oral Cavity
 - Lips Surround The Opening To The Cavity.
 - The Hard Palate Forms The Anterior Portion Of The Roof Of The Mouth
 - The Muscular Soft Palate Lies Posterior To It.
 - Rugae Are Irregular Ridges In The Mucous Membrane Covering The Anterior Portion Of The Hard Palate.
 - The Uvula - A Small Soft Tissue Projection, Hangs From The Soft Palate. It Aids Production Of Sounds And Speech.

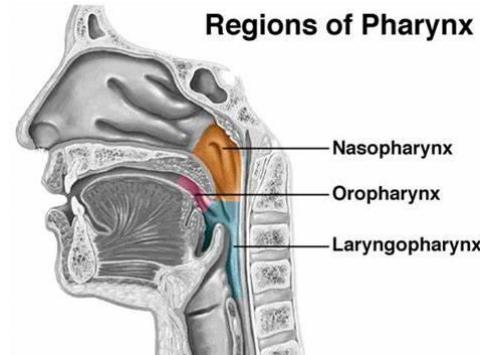
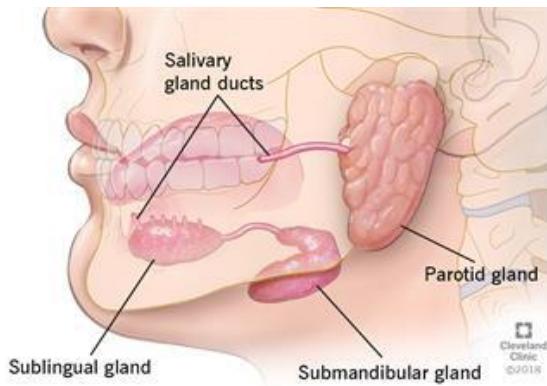
- The Tongue Extends Across The Floor Of The Oral Cavity, And Muscles Attach It To The Lower Jawbone. It Moves Food Around During Mastication (Chewing) And Deglutition (Swallowing).
- Papillae, Small Raised Areas On The Tongue, Contain Taste Buds That Are Sensitive To The Chemical Nature Of Foods And Allow Discrimination Of Different Tastes As Food Moves Across The Tongue.
- Tonsils
- Gum



STRUCTURE OF TEETH

- A Tooth Consists Of A Crown (Above The Gum Line)
- A Root - Lies Within The Bony Tooth Socket.
- The Outermost Protective Layer Of The Crown -The Enamel Protects The Tooth. Enamel Is A Dense, Hard, White Substance—The Hardest Substance In The Body.
- Dentin - The Main Substance Of The Tooth, Lies Beneath The Enamel And Extends Throughout The Crown - Yellow And Composed Of Bony Tissue.
- The Cementum Covers, Protects, And Supports The Dentin In The Root.
- A Periodontal Membrane Surrounds The Cementum And Holds The Tooth In Place In The Tooth Socket.
- The Pulp Lies Underneath The Dentin - Center Of The Tooth.
- Blood Vessels, Nerve Endings, Connective Tissue, And Lymphatic Vessels Are Within The Pulp Canal (Also Called The Root Canal).
- Root Canal Therapy Often Is Necessary When Disease Or Abscess (Pus Collection) Occurs In The Pulp Canal..

SALIVARY GLANDS



- Three Pairs Of Salivary Glands Surround And Empty Into The Oral Cavity.
- These Exocrine Glands Produce Saliva - Lubricates The Mouth.
- Saliva Contains Important Digestive Enzymes As Well As Healing Growth Factors Such As Cytokines.
- Saliva Is Released From A Parotid Gland, Submandibular Gland And Sublingual Gland On Both Sides Of The Mouth.
- Narrow Ducts Carry Saliva Into The Oral Cavity. The Glands Produce About 1.5 Liters Of Saliva Daily.

PHARYNX:

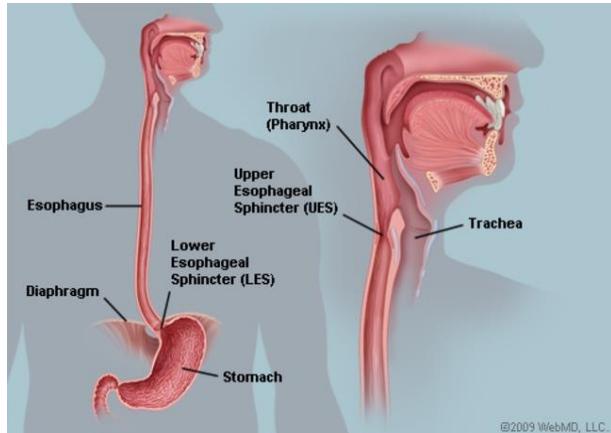
- The Pharynx Or Throat - Muscular Tube, About 5 Inches Long
- Lined With A Mucous Membrane.
- A Passageway Both For Air Traveling From The Nose (Nasal Cavity) To The Windpipe (Trachea) And For Food Traveling From The Oral Cavity To The Esophagus.

When Swallowing (Deglutition) Occurs, A Cartilaginous Flap Of Tissue, The Epiglottis, Covers The Trachea So That Food Cannot Enter And Become Lodged There

ESOPHAGUS

- ▶ Approximately 20 Cm Long (9- To 10-Inch)
- ▶ Functions Include:
 1. Secrete Mucus
 2. Moves Food From The Throat To The Stomach Using Muscle Movement Called Peristalsis (Involuntary, Progressive, Rhythmic Contraction Of Muscles In The Wall Of The Esophagus)

If Acid From The Stomach Gets In Here That's Heartburn.



UES – UPPER ESOPHAGEAL SPHINCTER

- The Uppermost Part Is The Upper Esophageal Sphincter, A Specialized Ring Of Muscle That Forms The Upper End Of The Tubular Esophagus And Separates The Esophagus From The Throat.
- The Upper Sphincter Remains Closed Most Of The Time To Prevent Food In The Main Part Of The Esophagus From Backing Up Into The Throat.

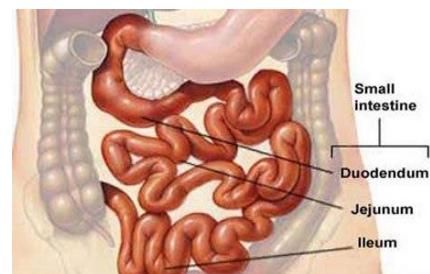
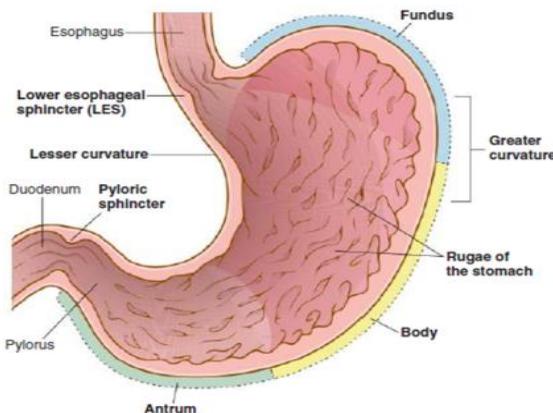
LES – LOWER ESOPHGEAL SPHINCTER

- The Lower Esophageal Sphincter, Or LES, Is The Muscle That Connects The Esophagus To The Stomach(Also Called Cardiac Sphincter)
- It Remains Closed The Majority Of The Time, Only Opening To Let Food Through To The Stomach Or To Regurgitate Stomach Gas.
- If A Person's LES Is Weak Or Damaged, The Muscle Can Lose Its Ability To Close (As With GERD), Or It's Ability To Open (As With Achalasia). When The LES Fails To Close, It Allows Stomach Acid To Splash Up From The Stomach Into The Esophagus, Causing Severe Acid Reflux And Heartburn.

STOMACH

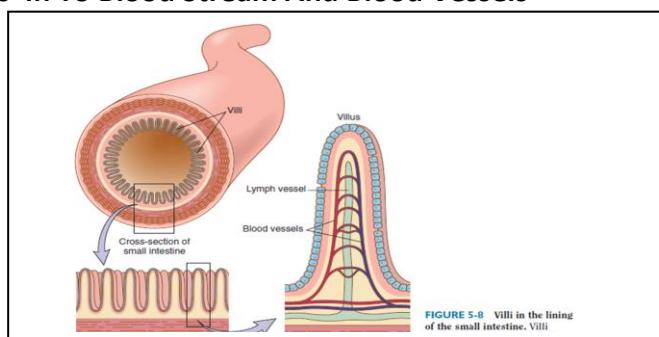
- Food Passes From The Esophagus Into The Stomach
- J Shaped Muscular Bag
- The Stomach Has Three Main Parts:
 - Fundus (Upper Portion)
 - Body (Middle Section)
 - Antrum (Lower Portion).
- Rings Of Muscle Called Sphincters Control The Openings Into And Leading Out Of The Stomach.
- They Prevent Food From Regurgitating (Flowing Backward From The Normal Direction).
- The Lower Esophageal 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 (Mucosa) Lining The Stomach Are Called Rugae.
- The Rugae Increase Surface Area For Digestion And Contain Digestive Glands That Produce The Enzyme Pepsin (To Begin Digestion Of Proteins) And Hydrochloric Acid.
- Mixes Food With Digestive Juices That Contain Enzymes To Break Down Proteins And Lipids.
- Acid (HCl) In The Stomach Kills Bacteria.
- Food Found In The Stomach Is Called Chyme.



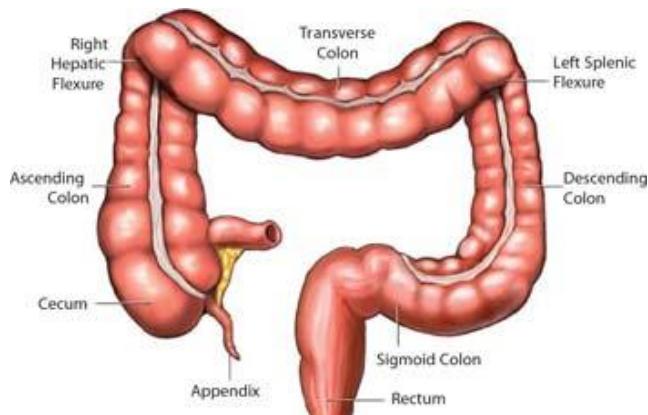
SMALL INTESTINE

- The Small Intestine (Small Bowel) Extends For 20 Feet From The Pyloric Sphincter To The First Part Of The Large Intestine. It Has Three Parts.
- The First Section, The Duodenum - Only 1 Foot Long.
 - Receives Food From The Stomach ,Bile From The Liver And Gallbladder , Pancreatic Juice From The Pancreas.
 - Enzymes And Bile Help Digest Food
- 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
- Lining Of Intestine Walls Has Finger-Like Projections Called Villi, To Increase Surface Area.
- The Villi Are Covered In Microvilli Which Further Increases Surface Area For Absorption Of Nutrients In To Blood Stream And Blood Vessels
- Absorbs:
 - 80% Ingested Water
 - Vitamins
 - Minerals
 - Carbohydrates
 - Proteins
 - Lipids



- Secretes Digestive Enzymes

LARGE INTESTINE



Anatomy of Large Intestine

- The Large Intestine Extends From The End Of The Ileum To The Anus.
- It Has Three Main Components: The Cecum, The Colon, And The Rectum.
- The Cecum- A Pouch On The Right Side
 - Connects To The Ileum At The Ileocecal Valve (Sphincter).
- The Appendix Hangs From The Cecum.
- The Appendix Has No Clear Function And Can Become Inflamed And Infected When Clogged Or Blocked.
- The Colon - 5 Feet Long - Has Four Segments: Ascending, Descending, Transverse, And Sigmoid.
- The Ascending Colon Extends From The Cecum To The Undersurface Of The Liver, Where It Turns To The Left (Hepatic Flexure) To Become The Transverse Colon .
- The Transverse Colon Passes Horizontally To The Left Toward The Spleen And Then Turns Downward (Splenic Flexure) Into The Descending Colon.
- The Sigmoid Colon - Shaped Like An S (Sigmoid Means Resembling The Greek Letter Sigma, Which Curves Like The Letter S), Begins At The Distal End Of The Descending Colon And Leads Into The Rectum.
- The Rectum Terminates In The Lower Opening Of The Gastrointestinal Tract, The Anus.
- Rectum (Short Term Storage Which Holds Feces Before It Is Expelled).
- Defecation Is The Expulsion Or Passage Of Feces From The Body Through Anus.
- Functions Of LI
 - Bacterial Digestion
 - Ferment Carbohydrates
 - Absorbs More Water
 - Concentrate Wastes

LIVER, GB , PANCREAS

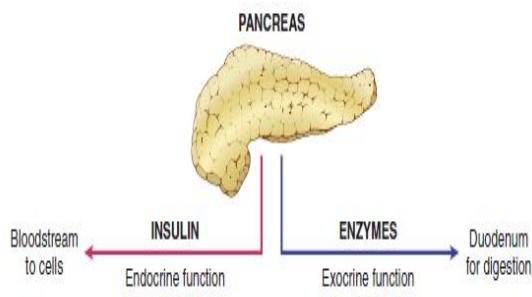
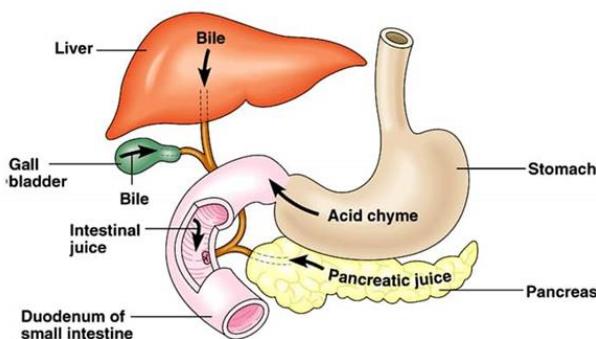


FIGURE 5-11 The pancreas and its functions.

- Not Part Of The Path Of Food, Play Crucial Roles In The Proper Digestion And Absorption Of Nutrients.
- Includes: Liver, Gall Bladder, And Pancreas

Liver - (RUQ) Of The Abdomen

- Directly Affects Digestion By Producing Bile
- Bile Contains Cholesterol (A Fatty Substance), Bile Acids, And Several Bile Pigments
- Bilirubin – One Of The Pigment (Hb Breakdown)

Gallbladder , A Pear-Shaped Sac Under The Liver,

- Which Stores And Concentrates The Bile For Later Use

FUNCTIONS OF LIVER:

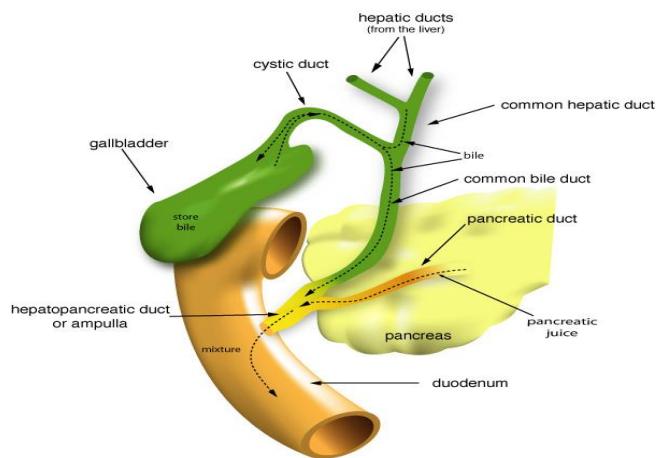
- The Liver Has Several Other Vital And Important Functions:
- Maintaining Normal Blood Glucose (Sugar) Levels – Stores Glycogen (Glycogenolysis/Gluconeogenesis)
- Manufacturing Blood Proteins, Particularly Those Necessary For Blood Clotting
- Releasing Bilirubin, A Pigment In Bile
- Removing Poisons (Toxins) From The Blood

PANCREAS

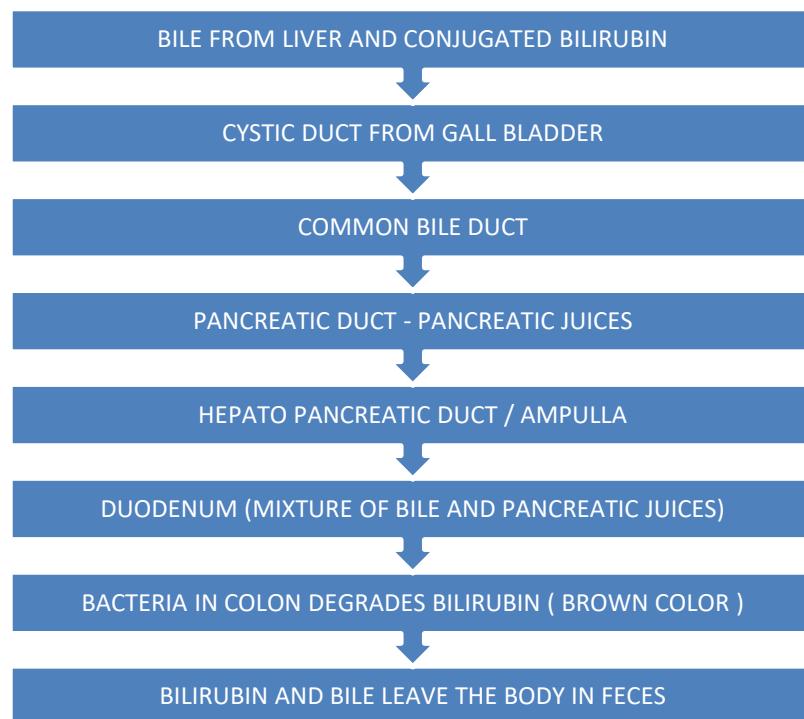
As An Exocrine Gland, It Produces Enzymes To Digest Starch, Such As Amylase (Amyl/O = Starch, -Ase = Enzyme), To Digest Fat, Such As Lipase (Lip/O = Fat), And To Digest Proteins, Such As Protease (Prote/O = Protein).

As An Endocrine Gland (Secreting Into The Bloodstream), The Pancreas Secretes Insulin. This Hormone, Needed To Help Release Sugar From The Blood, Acts As A Carrier To Bring Glucose Into Cells Of The Body To Be Used For Energy.

BILIRUBIN PATHWAY



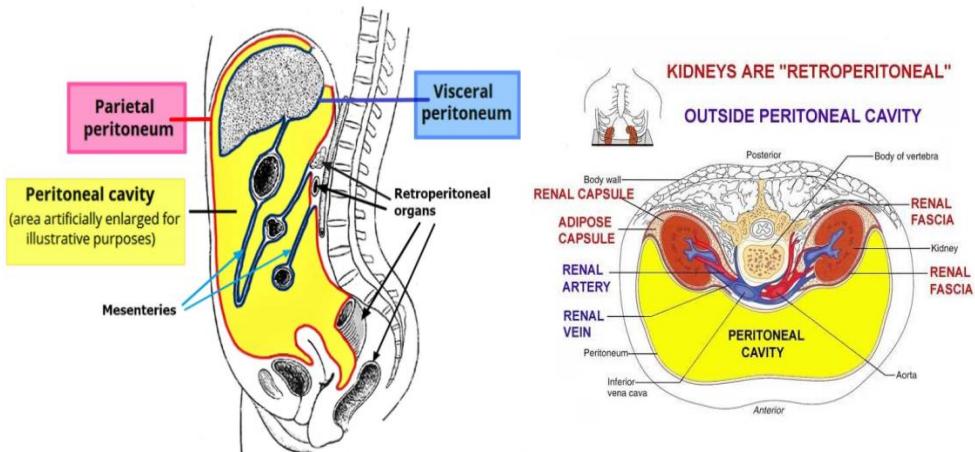
BILIRUBIN PATHWAY



ABDOMINAL CAVITY

- Largest Body Cavity
- Located Between Diaphragm And Pelvis
- A Part Of Abdominopelvic Cavity
- The Abdominal Cavity Is Lined With A Protective Membrane Termed The Peritoneum.
- The Inside Wall Is Covered By The Parietal Peritoneum.
- Viscera Covered By Visceral Peritoneum

- Between Visceral And Parietal Peritoneum – Peritoneal Cavity – Serous Fluid (Allows Motion)
- Organs Inside Peritoneum – Peritoneal Organs
- Organs Lie Against The Abdominal Wall And Outside The Peritoneum – Retro Peritoneal Organs



PATHOLOGY

- **Anorexia** - Lack Of Appetite
- **Anorexia Nervosa** - A Mental Disorder Characterized By An Intense Fear Of Eating And Obesity. Even When The Patient Becomes Underweight, The Fear Remains And The Refusal To Eat Can Become Life-Threatening
- **Ascites** - Accumulation Of Fluid In The Abdomen
- **Boerhaave Syndrome** - Spontaneous Rupture Of The Esophagus. It Is Life-Threatening
- **Borborygmus (Plural:Borborygmi)** - Rumbling Or Gurgling Noise Produced By The Movement Of Gas, Fluid, Or Both In The Gastrointestinal Tract.
- **Bulimia** - A Mental Disorder Characterized By Secretive Binge Eating Followed By Self-Induced Vomiting (Purging), The Use Of Laxatives And Diuretics, Strict Fasting, And Strenuous Exercise To Avoid Weight Gain. The Individual Typically Has Feelings Of Guilt And Self-Loathing And Is Obsessively Concerned About Weight Gain.
- **Constipation** - Difficulty In Passing Stools (Feces).
- **Diarrhea** - Frequent Passage Of Loose, Watery Stools.
- **Dysphagia** - Difficulty In Swallowing
- **Eruption** - Gas Expelled From The Stomach Through The Mouth (Belching)
- **Flatus** - Gas Expelled Through The Anus.
- **Hematochezia** - Passage Of Fresh, Bright Red Blood From The Rectum.
- **Melena** - Black, Tarry Stools; Feces Containing Digested Blood.
- **Nausea** - Unpleasant Sensation In The Stomach Associated With A Tendency To Vomit

- **Steatorrhea** - Fat In The Feces; Frothy, Foul-Smelling Fecal Matter.

ORAL CAVITY AND TEETH

- **Aphthous Stomatitis** - Inflammation Of The Mouth With Small, Painful Ulcers (Canker /Sores)
- **Dental Caries** - Tooth Decay - Dental Plaque Results From The Accumulation Of Foods, Proteins From Saliva, And Necrotic Debris On The Tooth Enamel
- **Herpetic Stomatitis** - Inflammation Of The Mouth Caused By Infection With The Herpes Virus.
- **Oral Leukoplakia**- White Plaques Or Patches On The Mucosa Of The Mouth.
- **Periodontal Disease** - Inflammation And Degeneration Of Gums, Teeth, And Surrounding Bone.

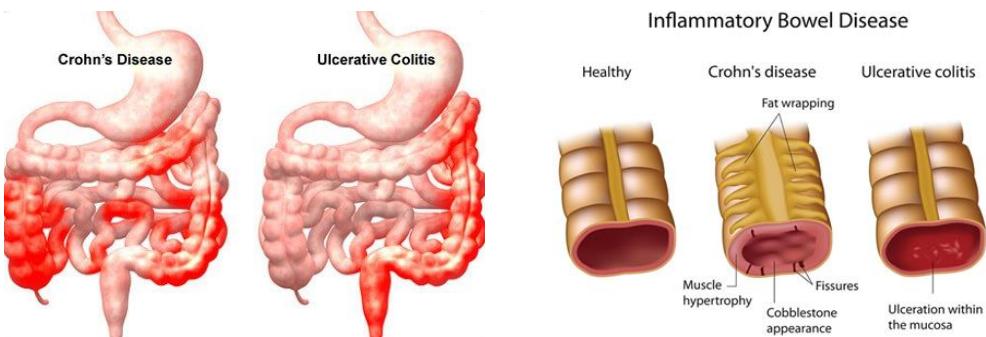
UPPER GASTROINTESTINAL TRACT

- **Achalasia** - Failure Of The Lower Esophagus Sphincter (LES) Muscle To Relax.
- **Esophageal Cancer** - Malignant Tumor Of The Esophagus.
- **Esophageal Varices** - Swollen, Varicose Veins At The Lower End Of The Esophagus
- **Boerhaave Syndrome** - Spontaneous Rupture Of The Esophagus. It Is Life-Threateninggastric Cancer - Malignant Tumor Of The Stomach.
- **Gastroesophageal Reflux Disease (GERD)** - Solids And Fluids Return To The Mouth From The Stomach (Heart Burn)
- **Hernia** - Protrusion Of An Organ Or Part Through The Tissues And Muscles Normally Containing It
- **Hiatal Hernia** - Occurs When The Upper Part Of Your Stomach Bulges Through The Large Muscle Separating Your Abdomen And Chest (Diaphragm).
- **Peptic Ulcer** - Open Sore In The Lining Of The Stomach Or Duodenum.
- **Mallory-Weiss Syndrome** - A Tear In The Lower Part Of The Esophagus Leading To Bleeding. It Is Usually Caused By Severe Vomiting, Retching, Or Hiccuping. (GASTRO ESOPHAGEAL LACERATION SYNDROME)

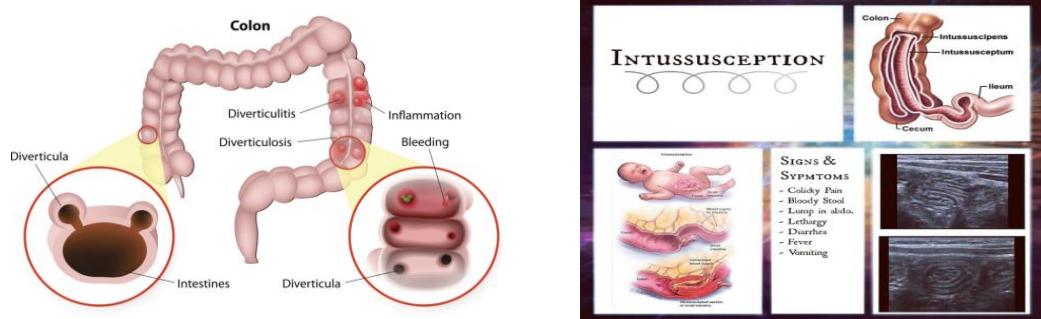
LOWER GASTROINTESTINAL TRACT (SMALL AND LARGE INTESTINES)

- **Anal Fistula** - Abnormal Tube-Like Passageway Near The Anus – Fissure - Abscess.
- **Colonic Polyps** - Polyps (Benign Growths) Protrude From The Mucous Membrane Of The Colon – Pedunculated / Sessile
- **Colorectal Cancer** - Adenocarcinoma Of The Colon Or Rectum, Or Both.
- **Inflammatory Bowel Disease (IBD)** - Inflammation Of The Colon And Small Intestine.
- **Crohn Disease (“Crohn’s”)** - Chronic Inflammation Of The Intestinal Tract
- **Ulcerative Colitis** - Chronic Inflammation Of The Colon With Presence Of Ulcers.

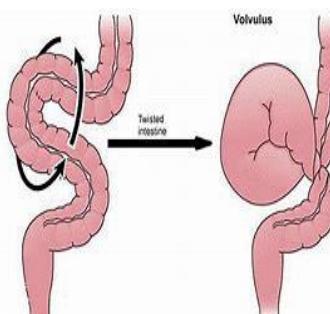
- Both Crohn Disease And Ulcerative Colitis Are Forms Of Inflammatory Bowel Disease (IBD).
- **Dysentery** - Painful, Inflamed Intestines Commonly Caused By Bacterial Infection



DIVERTICULOSIS and DIVERTICULITIS



- **Hemorrhoids** - Swollen, Twisted, Varicose Veins In The Rectal Region.
- **Ileus** - Loss Of Peristalsis With Resulting Obstruction Of The Intestines.
- **Paralytic Ileus** - (Acute, Transient Loss Of Peristalsis).
- **Intussusception** - Telescoping Of The Intestines.
- **Diverticulosis** - Abnormal Outpouchings (Diverticula) In The Intestinal Wall Of The Colon.
- **Irritable Bowel Syndrome (IBS)** - Group Of GI Symptoms (Abdominal Pain, Bloating, Diarrhea, Constipation), But Without Abnormalities In The Intestines.
- **Volvulus** - Twisting Of The Intestine On Itself.



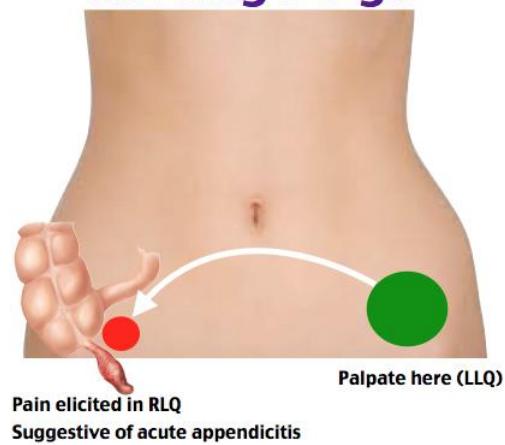
LIVER, GALLBLADDER, AND PANCREAS

- **Cholelithiasis** - Gallstones In The Gallbladder. (Calculi (Stones) Prevent Bile From Leaving The Gallbladder And Bile Ducts)
- Symptoms Related To Gallbladder Stones Are Either Biliary Colic (Pain From Blocked Ducts) Or Cholecystitis (Inflammation And Infection Of The Gallbladder), Both Of Which Require Treatment
- **Cirrhosis** - Chronic Degenerative Disease Of The Liver.
- **Pancreatic Cancer** - Malignant Tumor Of The Pancreas.
- **Pancreatitis** - Inflammation Of The Pancreas.
- **Viral Hepatitis** - Inflammation Of The Liver Caused By A Virus.

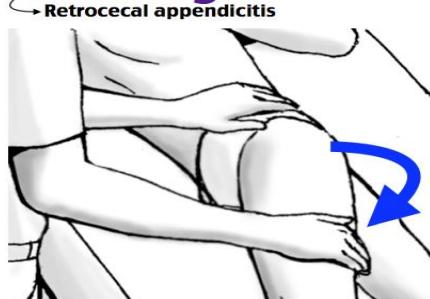
Examination

- History Of - Vomiting , Diarrhoea , Constipation , Weight Loss – Unexplained , Abdominal Pain , Change In Stools.
- Lesions , Growths And Mal Aligned Teeth
- Examination Of Quadrants (Regions)
- Auscultation – Borborygmus
- Clinical Sign In Detecting Appendicitis – Rovsing Sign , Psoas Sign, Obturator Sign
- Murphy's Sign – Acute Cholecystitis

Rovsing's Sign



Psoas Sign



1. Patient lies on left side
2. Examiner extends patient's right thigh while applying counter resistance to the right hip
3. Elicitation of pain is concerning for retrocecal appendicitis

Obturator Sign

Raise the patient's right leg with the knee flexed
Rotate the leg internally at the hip
Increased abdominal pain indicates a positive obturator sign



Murphy's sign

- **Elicitation:** Palpate the right subcostal area while the patient inspires deeply
- **Positive response:** The patient feels pain upon this manoeuvre and may have an associated inspiratory cessation



LABORATORY TESTS AND CLINICAL PROCEDURES

- Amylase And Lipase Tests
- Liver Function Tests (Lfts) - Tests For The Presence Of Enzymes And Bilirubin In Blood.
- Stool Culture Test - For Microorganisms Present In Feces
- Stool Guaiac Test Or Hemoccult Test - Test To Detect Occult (Hidden) Blood In Feces.
- Lower Gastrointestinal Series (Barium Enema) - X-Ray Images Of The Colon And Rectum Obtained After Injection Of Barium Into The Rectum.
- Upper Gastrointestinal Series - X-Ray Images Of The Esophagus, Stomach, And Small Intestine - Obtained After Administering Barium By Mouth.
- Cholangiography - X-Ray Examination Of The Biliary System Performed After Injection Of Contrast Into The Bile Ducts.
- ERCP (Endoscopic Retrograde Cholangiopancreatography) - Uses An Endoscope To Visualize Hepatic And Pancreatic Ducts, The Common Bile Duct, Gallbladder, And Duodenal Papilla. The Endoscope Is Inserted Through The Mouth. A Catheter Is Used To Inject A Contrast Agent Into The Hepatic And Pancreatic Duct Systems, Which Can Then Be Examined By Fluoroscopy

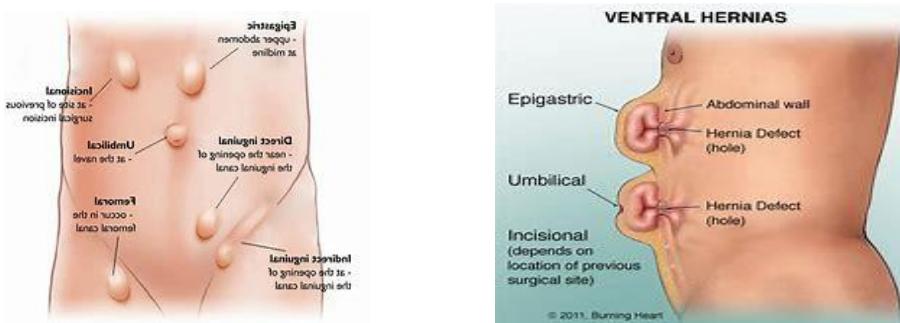
ULTRASOUND EXAMINATIONS

- Abdominal Ultrasonography - Sound Waves Beamed Into The Abdomen Produce An Image Of Abdominal Viscera.
- Endoscopic Ultrasonography (EUS) - Use Of An Endoscope Combined With Ultrasound To Examine The Organs Of The Gastrointestinal Tract.
- Magnetic Resonance Imaging (MRI) - Magnetic Waves Produce Images Of Organs And Tissues In All Three Planes Of The Body.
- NUCLEAR MEDICINE TEST - HIDA Scan Radioactive Imaging Procedure That Tracks The Production And Flow Of Bile From The Liver And Gallbladder To The Intestine.

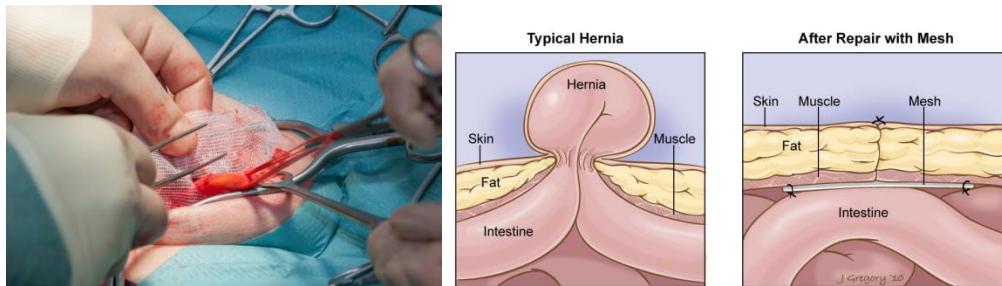
PROCEDURES

- **Gastric Bypass Or Bariatric Surgery** - Reducing The Size Of The Stomach And Diverting Food To The Jejunum (Gastrojejunostomy).
- **Gastrointestinal Endoscopy** - Visual Examination Of The Gastrointestinal Tract Using An Endoscope
- **Esophagogastroduodenoscopy (EGD)** - A Test To Examine The Lining Of The Esophagus, Stomach, And First Part Of The Small Intestine (The Duodenum).
- **Colonoscopy** - A Telescopic And Visual Examination Of The Colon And Rectum
- **Sigmoidoscopy** – Visual Examination Of Sigmoid Colon And Rectum.
- **Proctoscopy** - Examining The Anus And Lower Part Of The Rectum
- **Anoscopy**.

- **Virtual Colonoscopy (CT Colonography)** - Laparoscopy Visual (Endoscopic) Examination Of The Abdomen With A Laparoscope Inserted Through Small Incisions In The Abdomen.
- **Liver Biopsy** - Removal Of Liver Tissue For Microscopic Examination.
- **Nasogastric Intubation** - Insertion Of A Tube Through The Nose Into The Stomach
- **Paracentesis (Abdominocentesis)** - Surgical Puncture To Remove Fluid From The Abdomen.
- **Pancreatoduodenectomy** - Excision Of All Or Part Of The Pancreas And Duodenum. Also Called *Whipple Procedure* Or *Whipple Operation*



HERNIOPLASTY



COMBINING FORMS FOR TERMS

COMBINING FORMS	MEANING
an/o	Anus
append/o, appendic/o	Appendix
bucc/o	Cheek
cec/o	Cecum
celi/o	Belly, Abdomen
cheil/o	Lip
cholecyst/o	Gallbladder
choledoch/o	Common Bile Duct
col/o, colon/o	Colon
dent/i	Tooth

duoden/o	Duodenum
enter/o	Intestines, Usually Small Intestine
esophag/o	Esophagus
faci/o	Face
gastr/o	Stomach
gingiv/o	Gums
gloss/o	Tongue
hepat/o	Liver
ile/o	Ileum
jejun/o	Jejunum
labi/o	Lip
lapar/o	Abdomen
lingu/o	Tongue
mandibul/o	Lower Jaw, Mandible
odont/o	Tooth
or/o	Mouth
palat/o	Palate
pancreat/o	Pancreas
peritone/o	Peritoneum
pharyng/o	Throat
proct/o	Anus And Rectum
pylor/o	Pyloric Sphincter
rect/o	Rectum
sialaden/o	Salivary Gland
sigmoid/o	Sigmoid Colon
stomat/o	Mouth
uvul/o	Uvula
amyl/o	Starch
bil/i	Gall, Bile
bilirubin/o	Bilirubin (Bile Pigment)
chol/e	Gall, Bile
chlorhydr/o	Hydrochloric Acid
gluc/o	Sugar
glyc/o	Sugar
glycogen/o	Glycogen, Animal Starch
lip/o	Fat, Lipid
lith/o	Stone
prote/o	Protein

py/o	Pus
sial/o	Saliva, Salivary
steat/o	Fat

Suffixes

Suffix	Meaning
-ase	Enzyme
-chezia	Defecation, Elimination Of Wastes
-iasis	Abnormal Condition
-prandial	Meal

ABBREVIATIONS:

ABBREVIATION	MEANING
ALT	Alanine Transaminase
AST	Aspartate Transaminase
BE Or BaE	Barium Enema
BM	Bowel Movement
ERCP	Endoscopic Cholangiopancreatography Retrograde,
GB	Gallbladder
GERD	Gastroesophageal Reflux Disease
GI	Gastrointestinal
HCl	Hydrochloric Acid
HPE	History And Physical Examination
IBD	Inflammatory Bowel Disease, Ischemic Bowel Disease
IVC	Intravenous Cholangiography
NG Tube	Nasogastric Tube
PTC Or PTHC	Percutaneous Transhepatic Cholangiography
PUD	Peptic Ulcer Disease
UGI	Upper Gastrointestinal

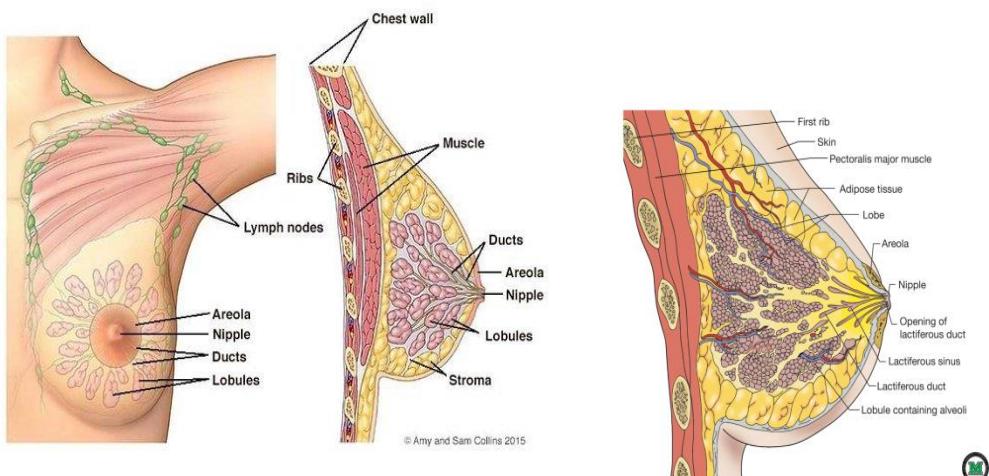
Female reproductive system

General terms:

- **Gynecology** - the medical study of the structure of the female reproductive system, its associated conditions and diseases, and their treatment
- **Obstetrics** - concerned with the care of women during pregnancy, childbirth, and the 6-week period following delivery. Jointly, these areas are often referred to as ob/gyn
- **Gynecologist** – a physician specialises in gynecology.
- **Obstetrician** – a physician specialises in obstetrics.
- **Genetics** - science that studies the transmission of traits that are biologically inherited.

Structure of the female reproductive system

- Breasts, ovaries, fallopian tubes, uterus, and vagina
- The breasts (accessory organ of reproduction)
 - female breasts, or mammae
 - Contain the mammary glands (modified sweat glands capable of secreting milk)
 - Areola - circular, pigmented - at the front center
 - Nipple - protrudes from the areola – called mamillary papilla
 - has 15 to 20 separate glandular lobes- have a lactiferous duct - opens at the nipple
 - When lactating (producing milk), the ends of the ducts expand to form sacs called *alveoli*. The lobes are covered by adipose (fat) tissue, which gives the breast its form.



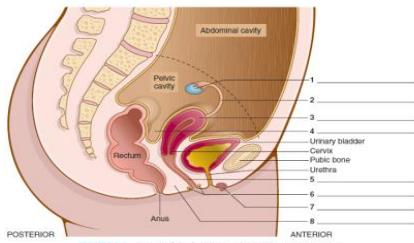
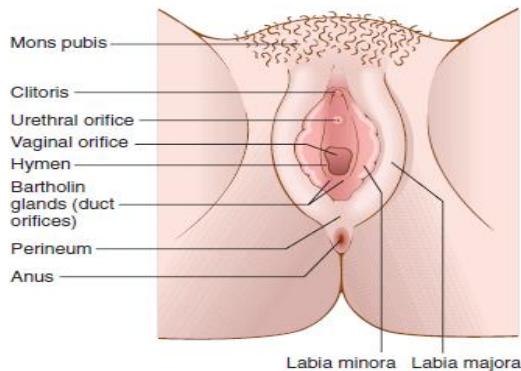


FIGURE 8-1 Organs of the female reproductive system, lateral view.



- The female reproductive system has both external and internal organs.
- External structure is known as the vulva (or pudendum)
 - Mons pubis,
 - labia majora
 - labia minora
 - clitoris
 - prepuce
 - bartholin glands.
- The mons pubis is a fat pad covered with hair that lies over the pubic symphysis (the joint between the two pubic bones)
- The vagina is a tube that extends from the uterus to the vulva. Its external opening is called the introitus.
- The labia majora, two folds of fat tissue, form the lateral boundaries of the vulva.
- Within the labia majora, smaller lateral folds of reddish-pink tissue create the labia minora.
- Anteriorly, the labia form the prepuce that covers the clitoris like a hood.
- The clitoris contains sensitive erectile tissue and is similar to the penis in the male but smaller.
- Bartholin glands are on either side of the introitus and produce mucus to lubricate the vagina.
- the area between the vaginal opening and the anus is the perineum.
- The hymen, a thin membrane partially covering the entrance to the vagina, is broken apart during the first episode of intercourse.

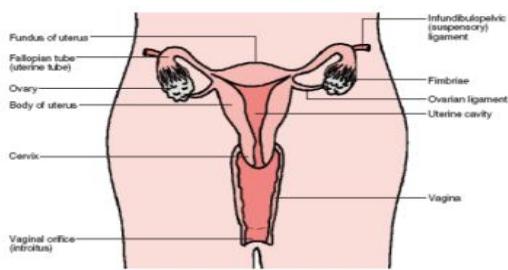
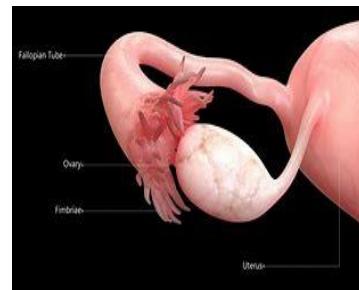
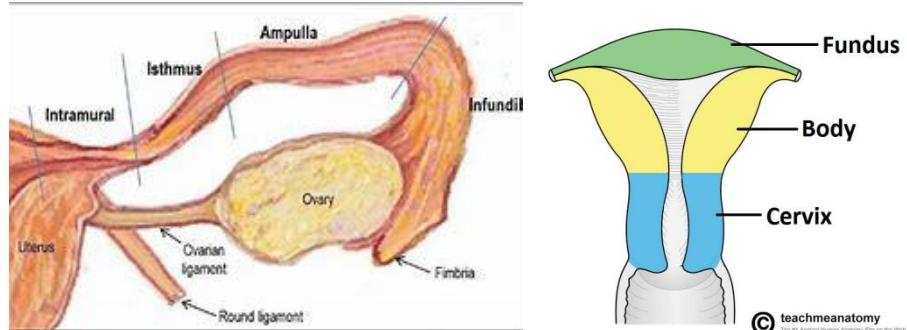


Figure 15-3 Female Reproductive System (Anterior View)



Internal organs

- The internal organs include the vagina, uterus, ovaries, and fallopian tubes.
- The term adnexa is commonly used to refer to structures that are accessory to a main organ or structure.
- In gynecology, the term adnexa refers to those organs that are accessory to the uterus: the ovaries, fallopian tubes, and supporting structures.
- The ovaries are two almond shaped organs held in place by the broad ligaments that extend from each ovary to the posterosuperior wall of the uterus and by the suspensory (infundibulopelvic) ligaments that extend from each ovary to the lateral pelvic wall.
- The ovarian ligament attaches each ovary to the lateral wall of the uterus.
- During a woman's reproductive years, the ovaries release ova (eggs), the female sex cells. They also secrete hormones, including estrogen, progesterone, and testosterone.
- Two fallopian tubes (also called uterine tubes or oviducts) extend from the area of the ovaries to the uterus.
- They transport the eggs from the ovaries to the uterus. The end of the fallopian tube near the ovary opens into the peritoneal cavity and is surrounded by fringe-like processes called fimbriae.
- The fimbriae contain cilia that sweep a released ovum into the fallopian tube and carry the ovum to the uterus (or womb)



Uterus

- The uterus is where a fetus grows until it is ready for birth.
- The uterus is comprised of three parts:
- The fundus, which is superior to the location where the fallopian tubes enter;
- The body, which makes up the main part; and
- The cervix, the narrower, cone-shaped part that leads to the vagina. The upper part of the vagina is attached around the outside of the cervix.
- The wall of the uterus has three layers:
- An external serous layer called the perimetrium that is made up of peritoneum,
- A middle muscular layer called the myometrium, and
- The inner layer called the endometrium.

- The endometrium is composed of epithelial cells; the superficial portion of the endometrium is shed during menstruation

The structure of the uterus

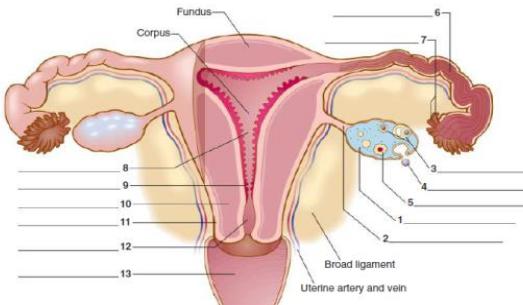
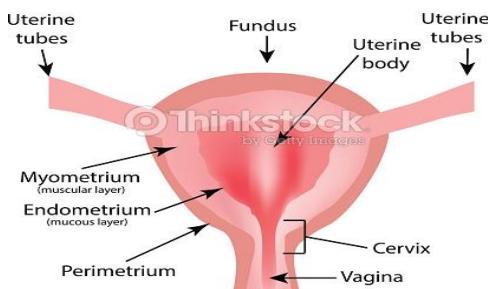


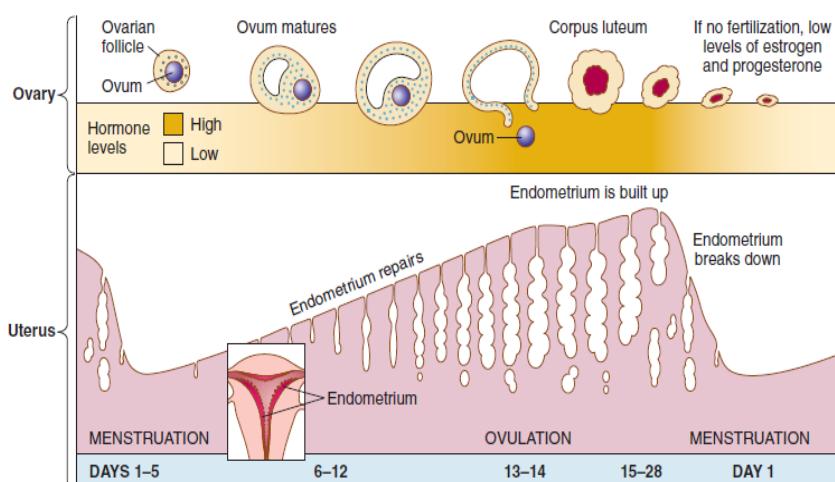
FIGURE 8-3 Organs of the female reproductive system, anterior view.

- Puberty** primary sex characteristics are those characteristics with which a child is born; in the case of a normal girl, they include a vagina, uterus, ovaries, etc.
- During puberty, secondary sex characteristics begin to develop
- The first sign of puberty in a girl is the gradual enlargement of the breasts, called thelarche, around ages 8 to 13 years. Pubic hair begins to develop around 8 to 14 years of age.
- Young women begin menstruating around 9 to 16 years.
- The first menstrual period is known as menarche.
- Tanner staging (also called tanner sex maturity rating) is used to assess the sexual maturity of children.

The menstrual cycle

- The purpose of the menstrual cycle is to bring an ovum to maturity and release it from its follicle so that, if it is fertilized, pregnancy is a possibility.
- The levels of a number of hormones fluctuate during this cycle, including estrogen, progesterone, follicle-stimulating hormone (FSH), and luteinizing hormone (LH).

Menstrual cycle



- Lasts approximately 28 days

- Three phases:
 - The follicular phase
 - The ovulatory phase
 - The luteal phase
- Days 1 to 5 (menstrual period) -discharge of bloody fluid containing disintegrated endometrial cells, glandular secretions, and blood cells.
- Days 6 to 12 - after bleeding ceases, the endometrium begins to repair itself. The maturing follicle in the ovary releases estrogen, which aids in the repair. The ovum grows in the follicle during this period.
- Days 13 and 14 (ovulatory period) -(LH) on about the 14th day of the cycle, the follicle ruptures and the egg leaves the ovary (ovulation), passing through the fallopian tube.
- Days 15 to 28 - the empty follicle fills with a yellow material and becomes the corpus luteum (yellow body).
- The corpus luteum functions as an endocrine organ and secretes the hormone progesterone into the bloodstream. This hormone stimulates the building up of the lining of the uterus in anticipation of fertilization of the egg and pregnancy.
- If fertilization does *not* occur, the corpus luteum in the ovary stops producing progesterone and regresses.
- At this time, lowered levels of progesterone and estrogen probably are responsible for some women's symptoms of depression, breast tenderness, and irritability before menstruation. The combination of these symptoms is known as premenstrual syndrome (PMS).
- After 2 days of decrease in hormones, the uterine endometrium breaks down, and the menstrual period begins
- Cycles vary in length, ranging from 21 to 42 days or longer

Pregnancy

- Sexual reproduction occurs when the ovum unites with the spermatozoon (sperm or male sex cell).
- When the nuclei of these two cells unite, the resulting cell contains the complete number of chromosomes--half coming from the mother and half from the father.
- When the male ejaculates during sexual intercourse (also called coitus), sperm are released into the vagina. If a sperm reaches an ovum and fertilizes it, conception takes place and pregnancy begins.
- Pregnancy (gestation) is the condition of a woman from the time she conceives until she gives birth

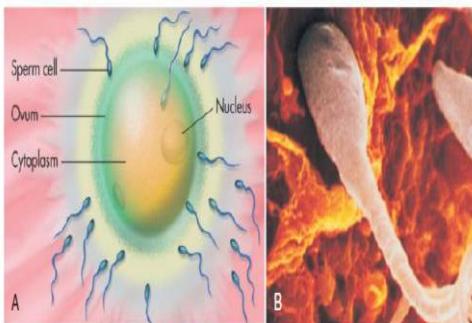


FIGURE 8-4 Fertilization.

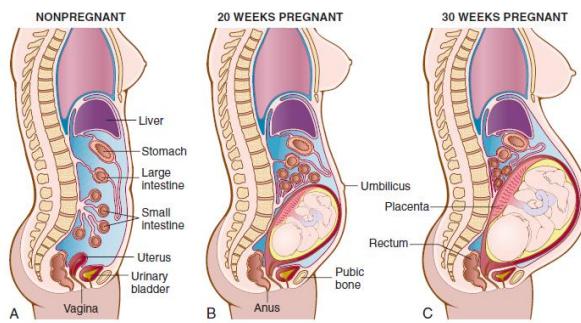


FIGURE 8-8 The growing uterus changes the pelvic anatomy during pregnancy, as shown here in sagittal section: A, nonpregnant woman, B, 20 weeks pregnant, C, 30 weeks pregnant.

- **Pregnancy lasts 38 to 42 weeks**
- **This time period is divided into three trimesters, each approximately 13 weeks in length.**
- **Healthcare workers typically use the date of the last menstrual period (lmp) to calculate the approximate date of parturition (childbirth).**
- **This date is called the estimated date of confinement (edc) / edd**
- **When pregnancy occurs, the uterus quickly increases in muscle mass and the peritoneal covering becomes enlarged.**
- **Secretions increase and the mucosa becomes thicker.**
- **The placenta also develops and becomes attached to the uterine wall.**
- **the placenta's job is to prevent the embryonic and maternal blood supplies from mixing, yet allow nutrients and waste products to be passed between the two circulatory systems via the umbilical cord.**
- **The embryo is encased in the amniotic sac, filled with amniotic fluid.**
- **The sac and fluid provide a cushion to protect it from being physically jarred.**
- **From the time of conception to approximately the end of the second month, the developing organism is called an embryo.**
- **After the beginning of the third month until birth, it is referred to as a fetus.**
- **Gestational ages are specified using the ballard scale**
- **After the first trimester, the woman may experience braxton hicks contractions, rhythmic contractions of the uterus that usually are not painful**
- **When it is time for the fetus to be expelled from the uterus, labor begins.**
- **There are three stages.**
- **The first stage occurs when uterine contractions begin and continues through the dilation of the cervix.**
- **The second stage begins with the complete dilation of the cervix and continues through the birth of the infant.**
- **During the last stage, the placenta and associated membranes are expelled**

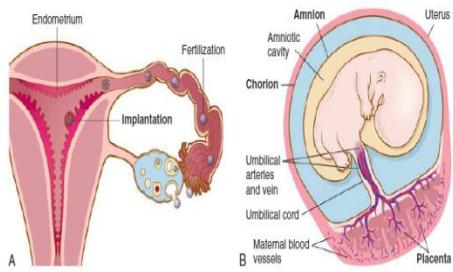


FIGURE 8-7 A. Implantation of the embryo in the endometrium. B. The placenta, chorion, and amnion membranes.

- After the first trimester, the woman may experience Braxton Hicks contractions, rhythmic contractions of the uterus that usually are not painful
- When it is time for the fetus to be expelled from the uterus, labor begins.
- There are three stages :
- The first stage occurs when uterine contractions begin and continues through the dilation of the cervix.
- The second stage begins with the complete dilation of the cervix and continues through the birth of the infant.
- During the last stage, the placenta and associated membranes are expelled
- The Bishop scoring system of labor is sometimes used to document the progression of labor
- The indicators used in this scoring system are the amount of dilation of the cervix, effacement, current station of the fetus, consistency of the cervix, and cervical position.
- Station is the current location of the presenting part of the fetus in the maternal pelvis.
- Cesarean section (c-section)
- in this procedure an incision is made through the abdominal wall, and a second incision is made into the uterus through which the infant is removed.
- CPD (cephalopelvic disproportion) ?
- Episiotomy, which is a clean, straight cut in perineum -may be easier to repair than a tear (to prevent tear during normal delivery)
- Puerperium period, the 6 weeks immediately following childbirth.

Abortion:

- An abortion occurs when an embryo or fetus is expelled from the uterus before it is viable.
- There are two types of abortions.
- Induced – with medical intervention
- a spontaneous abortion (or miscarriage) occurs without medical intervention.
- The following Latin terms are sometimes used (note that the term gravid means pregnant):

- Nulligravida - no pregnancies
- Primigravida - 1 pregnancy
- Secundigravida - 2 pregnancies
- Nullipara - no deliveries of viable offspring

Pathology

Condition or Disease	Description
Adenomyosis	A benign invasion of the endometrium into the myometrium (the muscular layer of the uterus). Rarely causes symptoms, but can be accompanied by menorrhagia and intermenstrual bleeding.
Amenorrhea	Absence of menstruation.
Bacterial vaginosis	Bacterial infection of the vagina, typically causing excessive and Malodorous discharge, itching, and irritation.
Breast cancer	A malignancy of the breast. The malignancy can be in the ducts and/or lobes and can spread to surrounding tissue.
Breech Presentation	During childbirth, the situation in which the infant's feet or buttocks Present first. The head normally presents first.
Candidal vaginitis	A vaginal inflammation due to a yeast infection caused by candida Albicans. Also called <i>candidiasis</i> or <i>candidosis</i> .
Cephalopelvic Disproportion (CPD)	The situation during pregnancy in which the maternal pelvis is Disproportionately small compared to the size of the fetal head.
Cervical cancer	A malignancy of the cervix.
Cervicitis	Inflammation of the cervix in which it appears red and bleeds easily (friable). A type of pelvic inflammatory disease.
Chancroid	A sexually transmitted disease caused by the bacterium <i>haemophilus Ducreyi</i> . Characterized by painful lesions (ulcers) at the site of infection. Also called <i>venereal ulcer</i> .
Chlamydia	A sexually transmitted disease caused primarily by the bacterium <i>Chlamydia trachomatis</i> . Can cause inflammation of the genitals, eyes, pharynx, lungs, and other organs. Can also infect the newborn.
Cystocele	A bulging of the urinary bladder, usually against the anterior vaginal wall.
Dysgerminoma	A rare type of ovarian malignancy typically occurring in young females.

Dysmenorrhea	Pain during menstruation, typically cramps or a constant ache in the lower abdomen and/or lower back. The cause may be unknown (primary dysmenorrhea), or it may be caused by conditions such as endometriosis (secondary dysmenorrhea).
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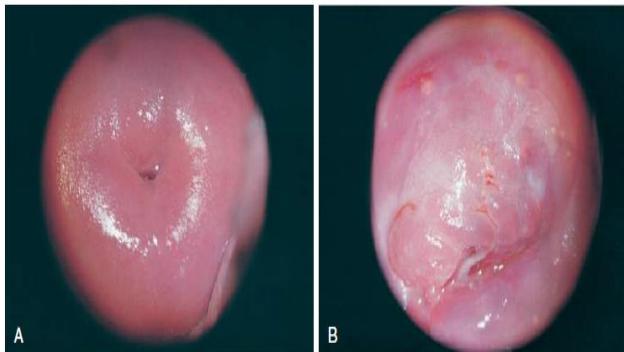
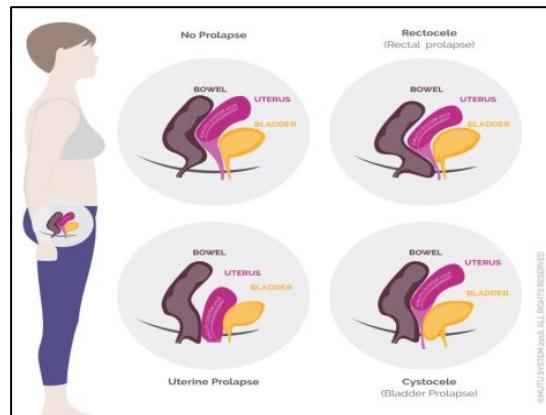
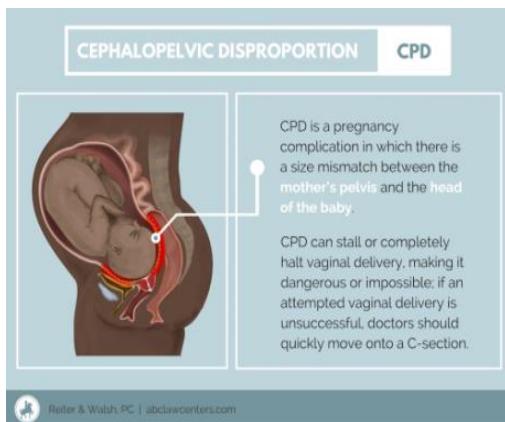


FIGURE 8-15 Normal cervix (A) and cervix with cervical cancer (B) as seen via colposcopy.

CIN



Dyspareunia	Pain during sexual intercourse or attempted sexual intercourse.
Eclampsia	The occurrence of convulsions or coma in a patient with preeclampsia during pregnancy. May also occur following delivery (<i>puerperal eclampsia</i>).
Ectopic pregnancy	The situation in which a fertilized ovum becomes implanted in some area other than the uterine cavity. The most common site is a fallopian tube. Can cause severe pelvic pain. The ectopic site commonly ruptures after the first missed menstrual period following conception. Can be lifethreatening to the mother.
Endometrial cancer	A malignancy of the endometrium.
Endometriosis	A nonmalignant condition in which aberrant endometrial tissue grows outside the uterus, especially occurs on the ovaries. Commonly forms cysts containing altered blood.

Endometritis	Inflammation of the endometrium.
Female orgasmic Disorder	The absence or persistent delay of orgasm after normal excitement during sexual activity.
Fibroadenoma	A benign tumor in the epithelium of a gland. Commonly occurs in breast tissue.
Fibroid (uterine)	A benign tumor that originates in the smooth muscle of the uterus. Also called <i>fibromyoma</i> and <i>leiomyoma</i> .
Gestational Diabetes	The onset of diabetes during pregnancy.
Gonorrhea	An infection of the epithelium of the cervix, rectum, urethra (urinary opening), pharynx, or eyes by the bacterium <i>neisseria gonorrhoeae</i> . Primarily a sexually transmitted disease.
Herpes simplex Genital ulcers	A sexually transmitted disease caused by the herpes simplex virus (hsv)type 2, which may produce genital lesions.
Human Papillomavirus genital warts	A sexually transmitted disease caused by the human papillomavirus (hpv). Also called <i>genital warts</i> .
Hyperemesis Gravidarum	Extreme nausea and vomiting during pregnancy that can lead to Dehydration.
Infertility	The inability to conceive.
Mastalgia	Pain in one or both breasts. Also called <i>mastodynias</i> .
Menopause	Cessation of menses and end of a woman's reproductive capabilities. Attributed to decreased ovarian function and decline in estrogen production.
Menorrhagia	Excessively long periods of menstruation and/or excessive amounts of menses.
Metrorrhagia	Bleeding from the uterus that is nonmenstrual or between menstrual periods.
Miscarriage	The spontaneous expulsion of the embryo or fetus from the uterus before it is viable. Also called <i>spontaneous abortion</i> .
Mittelschmerz	Severe pain in the middle of the menstrual cycle due to ovulation.
Oophoritis	Inflammation of the ovaries.

Ovarian cancer	A malignancy in an ovary.
Pediculosis pubis	Infestation of pubic (crab) lice in pubic hair.
Pelvic Inflammatory disease (pid)	Any infection of the upper reproductive tract of a female, including the ovaries, fallopian tubes, uterus, and cervix. Includes oophoritis, salpingitis, endometritis, and cervicitis.
Placentae abruptio	The premature separation of the placenta from the uterine wall.

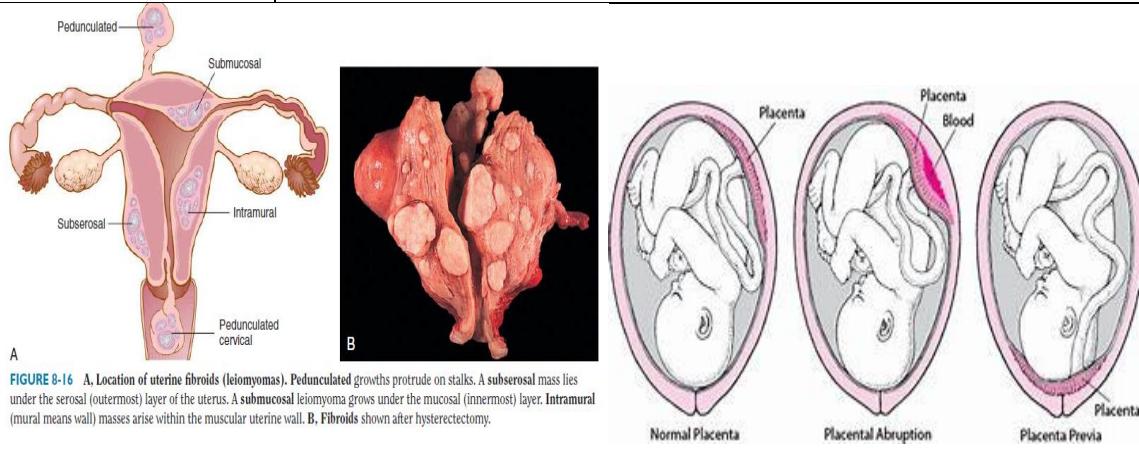
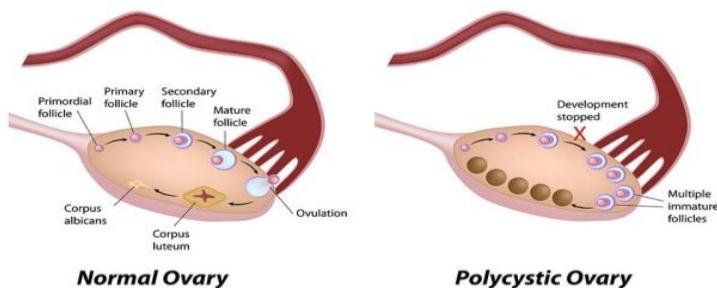


FIGURE 8-16 A, Location of uterine fibroids (leiomyomas). Pedunculated growths protrude on stalks. A subserosal mass lies under the serosal (outermost) layer of the uterus. A submucosal leiomyoma grows under the mucosal (innermost) layer. Intramural (mural means wall) masses arise within the muscular uterine wall. B, Fibroids shown after hysterectomy.

Polycystic ovary Syndrome	A benign condition usually characterized by enlarged ovaries, benign ovarian cysts, irregular menses, hirsutism, and mild obesity. May cause amenorrhea. Also called <i>hyperandrogenic chronic anovulation</i> .
Preeclampsia	The development of hypertension, edema, and proteinuria during Pregnancy. Also called <i>toxemia</i> and <i>pregnancy-induced hypertension</i> .
Premature ovarian Failure	A variety of disorders in which women under 40 years of age have Abnormal hormone levels, including a deficiency of estrogen. Also called <i>premature menopause</i> .
Prolapse of the Uterus	Descent of the uterus and cervix into the vagina due to weakened muscles in the pelvic floor.
Pyosalpinx	Distension of the fallopian tubes caused by accumulation of pus. May indicate an ovarian or a tubal abscess.
Rectocele	Bulging of the rectum against the posterior vaginal wall. Also called a <i>proctocele</i> .
Salpingitis	Inflammation of one or both fallopian tubes. A type of pelvic inflammatory disease.

Sexually Transmitted disease (std)	Any contagious disease that is spread during sexual contact, primarily sexual intercourse. Examples include syphilis, gonorrhea, and chlamydia. Also called <i>venereal disease</i> .
Syphilis	An infectious systemic disease caused by <i>treponema pallidum</i> and most commonly transmitted by sexual intercourse. Can affect multiple organs and is characterized by distinct clinical stages.
Toxic shock Syndrome (tss)	A condition caused by staphylococcal infection, most commonly in the vagina of a menstruating woman. Characterized by high fever, rash, vomiting, and diarrhea. Can lead to death.
Trichomonas Vaginitis	A sexually transmitted disease caused by the protozoan <i>trichomonas vaginalis</i> . Also called <i>trichomoniasis</i> .
Vaginal cancer	A malignancy in vaginal tissue.
Vaginismus	An involuntary spasm or contraction of vaginal muscles preventing Intercourse.
Vaginitis	Any inflammation of the vagina. Commonly produces discharge.
Vulvar cancer	A malignancy of the vulva, the external female genitals.



Diagnostic tests and procedures:

Test	Description
Amniocentesis	Amniotic fluid is aspirated from the amniotic sac. This fluid contains fetal cells. A hollow needle is inserted through the abdominal wall and into the uterus. A variety of tests may be performed on the fluid, including karyotyping to diagnose possible genetic defects.

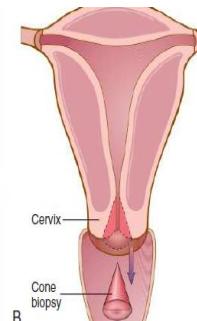
Bacterial culture	Samples of purulent tissue are sent to the laboratory and cultured in substances to promote growth. It may then be determined if bacteria are present, and if so, the type(s). This information is used to determine the course of treatment. In the case of bacterial vaginosis, distinct "clue cells" are present. Bacteria adhere to these "clue cells", obscuring their margins.
Biopsy	A specimen of tissue is collected and examined microscopically to Establish a diagnosis. Commonly used to diagnose malignant growths.
Colposcopy	The vagina and cervix are examined endoscopically to locate any abnormalities, growths, bleeding, etc. Insertion is through the vagina. Tissue may be taken for biopsy and growths removed. Colposcopy is frequently performed when the results of a pap smear are abnormal.
Cone biopsy	A cone-shaped piece of tissue is excised from the cervix and examined microscopically to establish a diagnosis. Commonly used to diagnose malignant growths. Cone biopsy provides a larger tissue sample than punch biopsy. Also called <i>conization biopsy</i> .



FIGURE 8-25 Colposcopy is used to evaluate a patient with an abnormal Pap test. For this examination, the woman lies in the dorsal lithotomy position. This is the same position used to remove a urinary tract stone (lithotomy means incision to remove a stone).



FIGURE 8-26 A, Cervical loop electrocautery excision procedure (LEEP) for cone biopsy. B, Surgical removal of cone biopsy specimen. (A, Courtesy Dr. A. K. Goodman, Massachusetts General Hospital, Boston.)



Fetal monitoring	Fetal vital signs, including heart rate, are electronically recorded during labor.
Follicle-stimulating Hormone (fsh) test	The level of fsh in blood serum is measured. Useful in diagnosing Ovarian abnormalities and menopause.
Hysteroscopy	The uterus is examined endoscopically to locate any abnormalities. Insertion is through the vagina. Tissue may be taken for biopsy and growths removed. In cases of abnormal uterine bleeding, a laser may be used to stop or reduce the bleeding. Also called <i>uteroscopy</i> .
Karyotyping	A graphic display of a cell's chromosomes is created showing their Number, size, and arrangement.

Laparoscopy	The peritoneal cavity is examined with a laparoscope to locate any Abnormalities, growths, bleeding, etc. Insertion is through a small incision in the abdomen. Tissue can be taken for biopsy, and certain operative procedures can be performed. Also called <i>peritoneoscopy</i> .
Mammography	Low-energy x-rays are used to detect tumors in the breasts. Highly Accurate in differentiating between benign and malignant growths.
Pap (papanicolaou) Test	A smear of cervical cells is obtained and checked for precancerous, Cancerous, or other abnormal cells. Results are reported on a 3-point scale. Also called a <i>pap smear</i> .



FIGURE 8-24 A. Mammography. The machine compresses the breast and x-ray pictures (top to bottom and lateral) are taken. B. Mammograms from a 63-year-old woman. The right breast is normal, and the left breast contains a carcinoma.

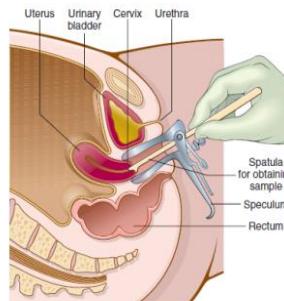


FIGURE 8-23 Method of obtaining a sample for a Pap test. The test is 95% accurate in diagnosing early carcinoma of the cervix. It was invented by and named for a Greek physician, Georgios Papanikolaou.

Pelvic CT (computed tomography)	A computer-generated reconstruction of the pelvic area is created from a series of x-ray images taken as cross-sections of the pelvis. These images (ct scans) are particularly useful in detecting soft tissue abnormalities such as tumors and lesions in the reproductive organs.
Pelvic radiography	X-rays of the pelvic region are taken for diagnostic purposes.
Pelvic Ultrasonography	Ultrasound is used to examine the pelvic area. Used during pregnancy to check for fetal maturity, fetal and placental placement, and cpd. It can also help detect tumors and abscesses.
Pregnancy testing	Blood or urine is tested for a high level of human chorionic gonadotropin (hcg), indicating pregnancy.
Scrapings and KOH Solution (fungal)	Scrapings from affected parts of the mucous membranes are placed in potassium hydroxide (koh) and examined under the microscope to determine the presence of fungal infections. Used to diagnose conditions such as vaginal candidiasis.

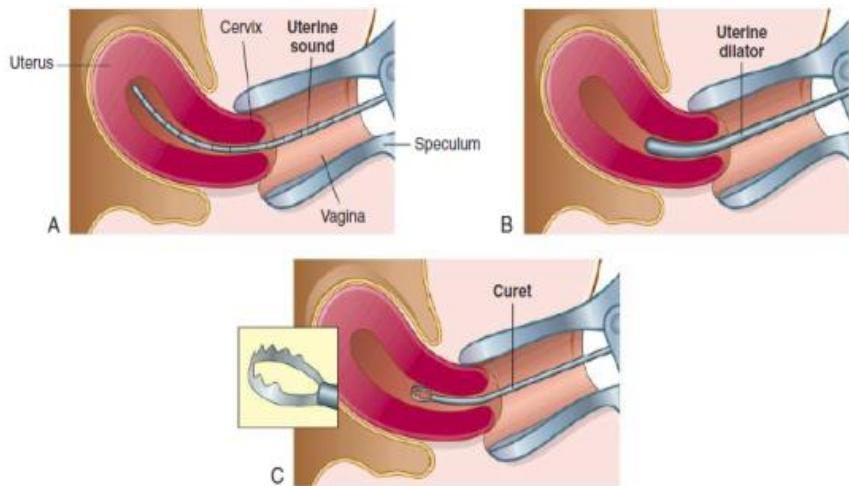
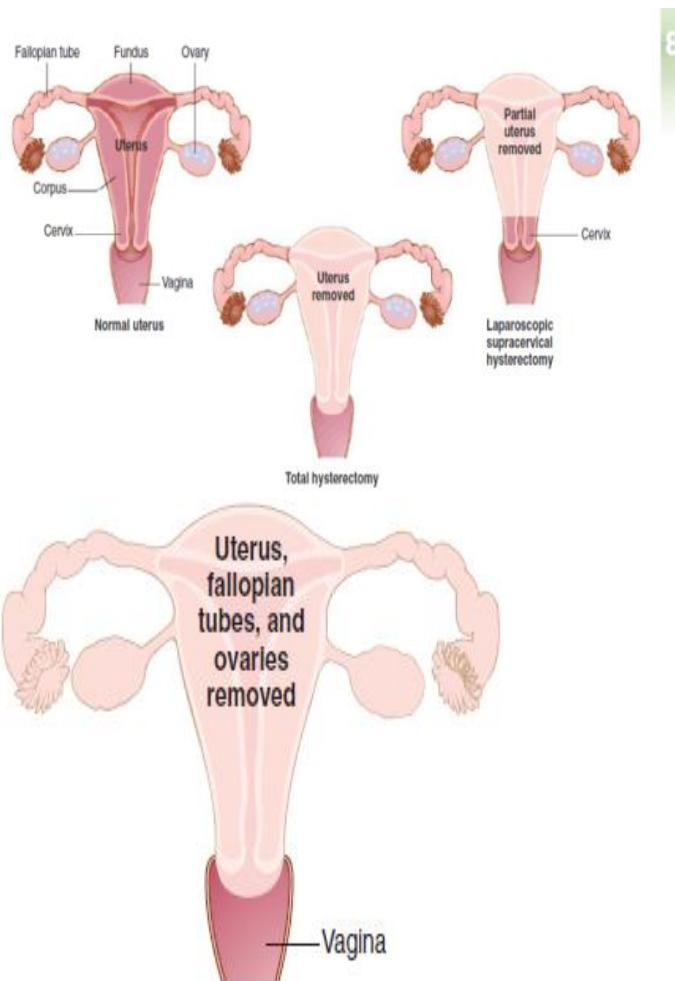


FIGURE 8-27 Dilation and curettage (D&C) of the uterus. **A.** The uterine cavity is explored with a uterine sound (a slender instrument used to measure the depth of the uterus) to prevent perforation during dilation. **B.** Uterine dilators (Hanks or Hagar) in graduated sizes are used to gradually dilate the cervix. **C.** The uterus is gently curetted and specimens are collected.



I2 Total hysterectomy with bilateral salpingo-oophorectomy.

Hysterectomy

NEONATAL

The following terms describe conditions or symptoms that can affect the newborn. The Apgar score (Figure 8-22) is a system of scoring an infant's physical condition 1 and 5 minutes after birth. Heart rate, respiration, color, muscle tone, and response to stimuli each are rated 0, 1, or 2. The maximum total score is 10. Infants with Apgar scores below 7 require special immediate medical attention such as suctioning of the airways or oxygen to help breathing.

Down syndrome	Chromosomal abnormality (trisomy 21) results in mental retardation, retarded growth, a flat face with a short nose, low-set ears, and slanted eyes.		
erythroblastosis fetalis	Hemolytic disease in the newborn (HDN) caused by a blood group (Rh factor) incompatibility between the mother and the fetus. See explanation in Chapter 4, page 119.		
hyaline membrane disease	Acute lung disease commonly seen in the premature newborn. This condition, also called respiratory distress syndrome of the newborn (RDS), is caused by deficiency of surfactant, a protein necessary for proper lung function. Surfactant can be administered to the newborn to cure the condition. Hyaline refers to the shiny (hyaline means glassy) membrane that forms in the lung sacs.		

SIGN	SCORE		
	0	1	2
Heart rate	Absent	Below 100	Over 100
Respiratory effort	Absent	Slow, Irregular	Good, crying
Muscle tone	Limp	Some flexion of extremities	Active motion
Response to catheter in nostril (tested after oropharynx is clear)	No response	Grimace	Cough or sneeze
Color	Blue, pale	Body pink, extremities blue	Completely pink

FIGURE 8-22 Apgar scoring chart. This test is named for anesthesiologist Virginia Apgar (1909-1974), who devised it in 1953. Dr. Joseph Butterfield, in 1963, introduced an “APGAR” acronym as a mnemonic (memory device): Appearance (color), Pulse (heart rate), Grimace (response to catheter in nostril), Activity (muscle tone), and Respiration (respiratory effort).

Medical terminologies:

Combining form	Meaning
amni/o	amnion
cervic/o	cervix; neck (neck of the uterus)
colp/o	vagina
embry/o	embryo
episi/o	vulva
fet/o	fetus

gen/o	producing; produced by
gonad/o	sex glands
gravid/o	pregnancy
gynec/o	woman; female
hyster/o	uterus; womb (see also metri/o, uter/o)
kary/o	nucleus
labi/o	lip
lact/o	milk
mamm/o	breast (see also mast/o)
mast/o	breast (see also mamm/o)
men/o	menses; menstruation
metri/o	uterus; womb (see also hyster/o, uter/o)
nat/i	birth
obstetr/o	midwife
oophor/o	egg (see also ov/o, ovul/o)
ov/o	egg (see also oophor/o, ovul/o)
ovari/o	ovary
ovul/o	egg (see also oophor/o, ov/o)
par/o	bearing offspring
pelv/o	pelvic bone; hip
salping/o	tube
uter/o	uterus; womb (see also metri/o, hyster/o)
vagin/o	vagina
vener/o	sexual intercourse
vulv/o	vulva

prefixes	meaning
dys-	painful
endo-	within

in-	in
intra-	within
multi-	many
nulli-	no, not, none
pre-	before
primi-	first
retro-	backward

suffixes	meaning
-parous	bearing, bringing forth
-rrhea	discharge
-salpinx	fallopian (uterine) tube
-ticia	labor, birth
-version	act of turning

Abbreviations:

Abbreviation	Meaning
AB, AB	Abortion
AI	Artificial insemination
BTL	Bilateral tubal ligation
CPD	Cephalopelvic disproportion
D&C	Dilation and curettage or dilatation and curettage
D&E	Dilation and evacuation
DNA	Deoxyribonucleic acid
DOB	Date of birth
EDC	Estimated date of confinement
EDD	Expected date of delivery
FHR	Fetal heart rate
FSH	Follicle-stimulating hormone
FTND	Full term normal delivery
GC, GC	Gonococcus
GYN	Gynecology
HCG, HCG	Human chorionic gonadotropin
HPV	Human papillomavirus
HRT	Hormone replacement therapy
HSV	Herpes simplex virus
IUD	Intrauterine device
IVF	In vitro fertilization
LH	Luteinizing hormone
LMP	Last menstrual period
NB	Newborn
OB	Obstetrics
OCPS	Oral contraceptive pills
PAP	Papanicolaou
PID	Pelvic inflammatory disease
PMS	Premenstrual syndrome
RNA	Ribonucleic acid
STD	Sexually transmitted disease
TAH/BSO	Total abdominal hysterectomy with bilateral salpingo-
TSS	Toxic shock syndrome
VBAC	Vaginal birth after cesarean section
VD	Venereal disease
VH	Vaginal hysterectomy

Genito urinary system

General terms:

- **Urology** - the branch of medicine and physiology concerned with the function and disorders of the urinary system.
- **Urologists** - specializes in the study or treatment of the function and disorders of the urinary system.
- **Nephrology** - concerned with the structure and diseases and conditions of the kidneys.
- **Nephrologists** - diagnose and treat conditions and diseases associated with the kidneys.
- **Andrology** - the branch of physiology and medicine which deals with diseases and conditions specific to men.
- **Andrologists** - specializes in the study or treatment of the function and disorders of the male reproductive system.

Structure and functions of urinary system:

- The urinary system is responsible for the creation and excretion of urine.
- While the female reproductive system is separate from the female urinary system, in the male, some structures serve purposes in both systems
- Urinary system - removing waste products from the blood and participating in the regulation of various body functions such as the production of red blood cells
- The two kidneys are bean-shaped organs about the size of a clenched fist.
- Positioned on the posterior abdominal wall on either side of the spine and are retroperitoneal (posterior to the peritoneal cavity).
- They excrete urine, which consists of fluid and dissolved waste products.
- This urine is carried from the kidneys to the urinary bladder by small tubes called ureters.
- From the bladder, urine is carried outside the body by a canal called the urethra.

BOX 7-1 FUNCTIONS OF THE KIDNEYS

- Remove nitrogenous wastes: urea, creatinine, uric acid
- Balance water and electrolytes (sodium, potassium)
- Release hormones: renin, erythropoietin, calciferol
- Degrade and eliminate hormones from bloodstream

Kidney :

- Each kidney is surrounded by a renal fat pad that protects the kidney from being jarred.

- Within the fat pad, a layer of connective tissue called the renal capsule surrounds each kidney

The renal artery carries blood containing waste products to each of the kidneys, where these waste products are removed by filtration

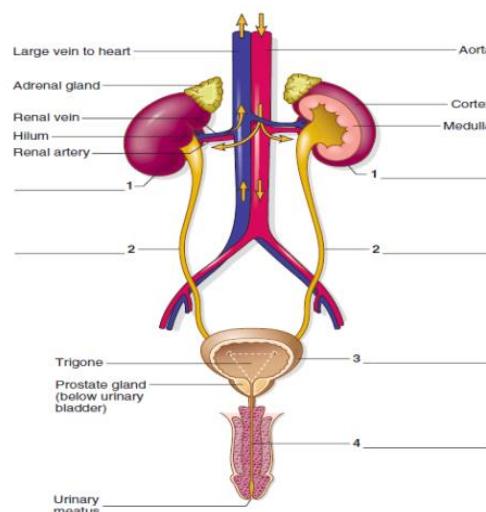
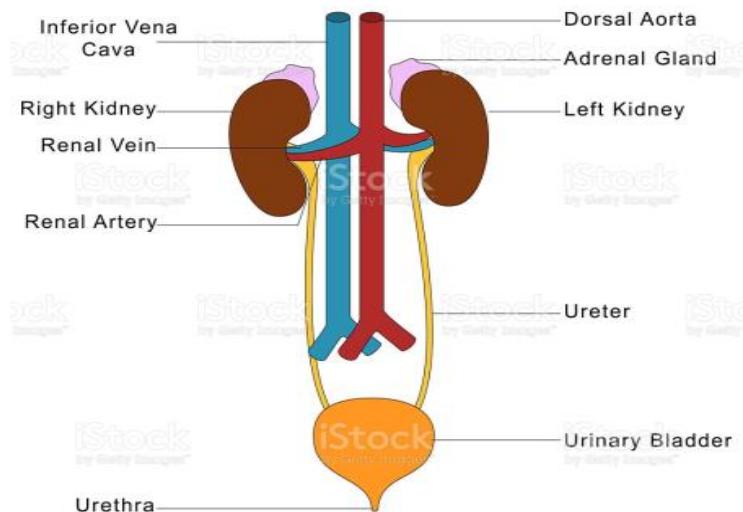


FIGURE 7-1 Male urinary system.

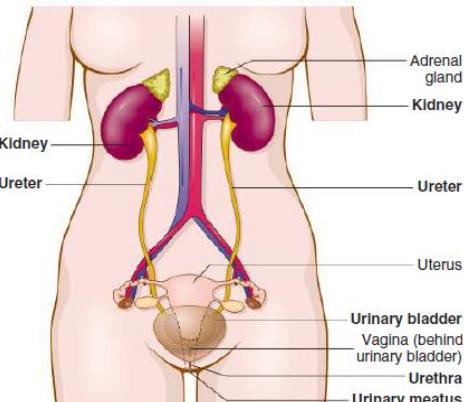
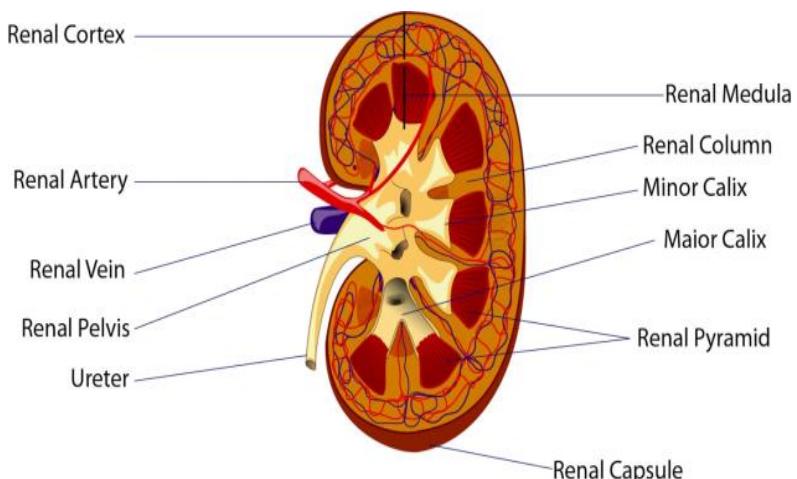


FIGURE 7-2 Female urinary system.

- Cleansed blood leaves each kidney through a renal vein.
- These vessels enter and exit the kidney at the renal hilum.
- The hilum opens into the renal sinus, a cavity containing connective tissue and fat
- Surrounding the renal sinus is the renal medulla
- The renal cortex - outermost portion of the kidney.
- Within the medulla are cone-shaped structures called renal pyramids.
- The tips of these pyramids point toward the renal sinus and a funnel-shaped structure called a calyx surrounds each tip.
- These calyces join together to form a larger funnel called the renal pelvis.

- The renal pelvis then narrows to form the ureter.
- Urine travels from the pyramids through the calyces and renal pelvis and into the ureters where it is carried to the urinary bladder.
- The urinary bladder is an expandable reservoir for urine.
- When the bladder holds approximately 200 to 300 ml of urine, the urge to urinate occurs.



- During micturition (voiding), the walls of the bladder contract and the urethral sphincter relaxes, causing urine to be expelled from the bladder
- Urine travels through the urethra and exits the body at the urethral meatus
- In females the urethra is approximately 4 cm long
- In males, this tube averages about 20 cm in length, as it extends the length of the penis

Physiology: how the kidneys produce urine

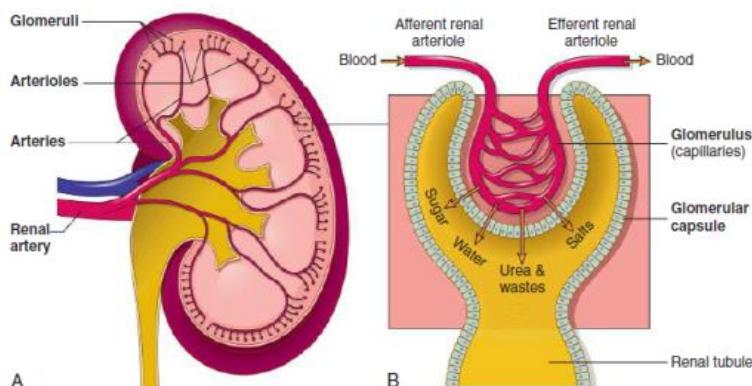


FIGURE 7-3 A, Renal artery branching to form smaller arteries and arterioles, and glomeruli. B, Glomerulus and glomerular capsule. Afferent arteriole carries blood toward (in this term, af- is a form of ad-) the glomerulus. Efferent arteriole carries blood away (ef- is a form of ex-) from the glomerulus.

- 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), it branches into arterioles

- Each arteriole in the cortex of the kidney leads into a mass of very tiny, coiled, and intertwined smaller blood vessels called glomeruli
- Each glomerulus (singular) is a collection of tiny capillaries formed in the shape of a small ball. There are about 1 million glomeruli in the cortex region of each kidney.
- The kidneys produce urine by filtration
- Blood passes through the many glomeruli
- The thin walls of each glomerulus (the filter) permit water, salts, sugar, and urea (with other nitrogenous wastes such as creatinine and uric acid).
- These materials collect in a tiny, cup-like structure, a glomerular (bowman) capsule that surrounds each glomerulus.
- The walls of the glomeruli prevent large substances, such as proteins and blood cells, from filtering into the capsule.
- These substances remain in the blood and normally do not appear in urine.
- After glomerular capsule
- Renal tubule - water, sugar, salts, urea, and other wastes pass through tiny capillaries surrounding each tubule returns to blood stream (reabsorption)
- The final process in the formation of urine is secretion of some substances from the bloodstream into the renal tubule
- Each renal tubule - containing urine (95% water and 5% urea, creatinine, salts, acids, and drugs), ends in a larger collecting tubule.

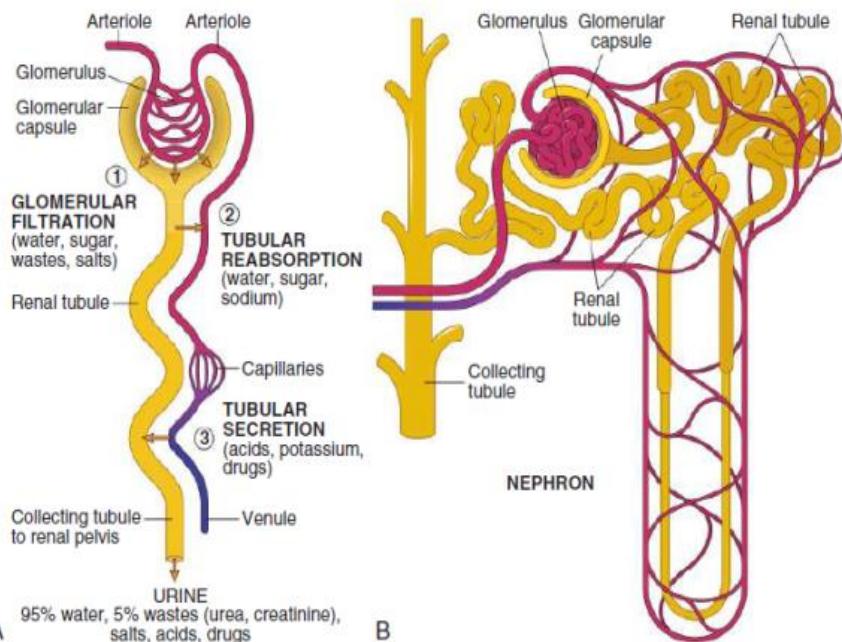


FIGURE 7-4 A, Three steps in the formation of urine: (1) Glomerular filtration of water, sugar, wastes (urea and creatinine), and sodium. (2) Tubular reabsorption of water, sugar, and sodium. (3) Tubular secretion of acids, potassium, and drugs. B, Nephron.

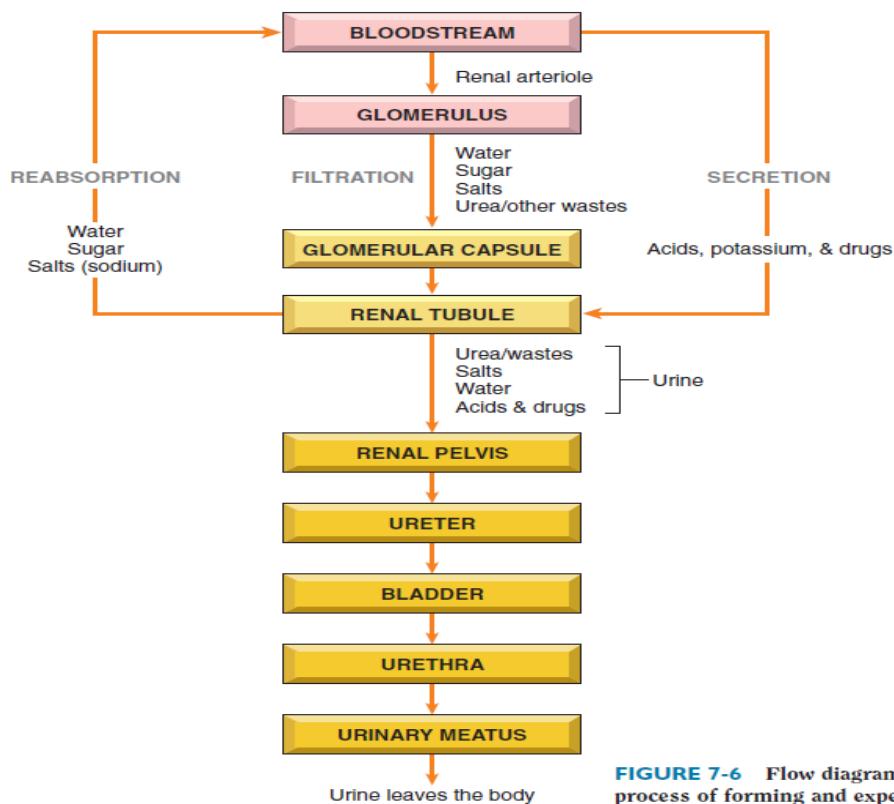
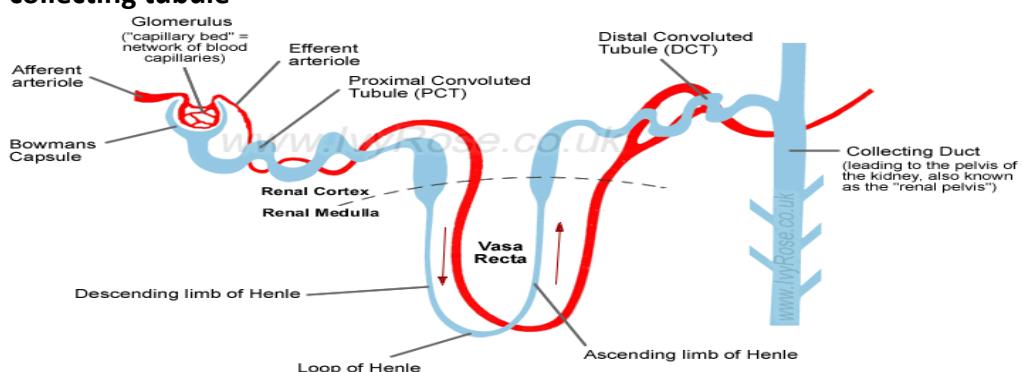


FIGURE 7-6 Flow diagram process of forming and excreting urine

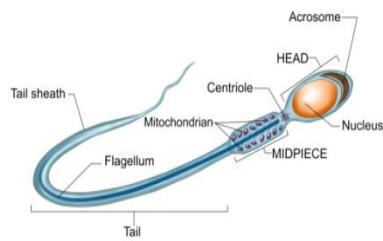
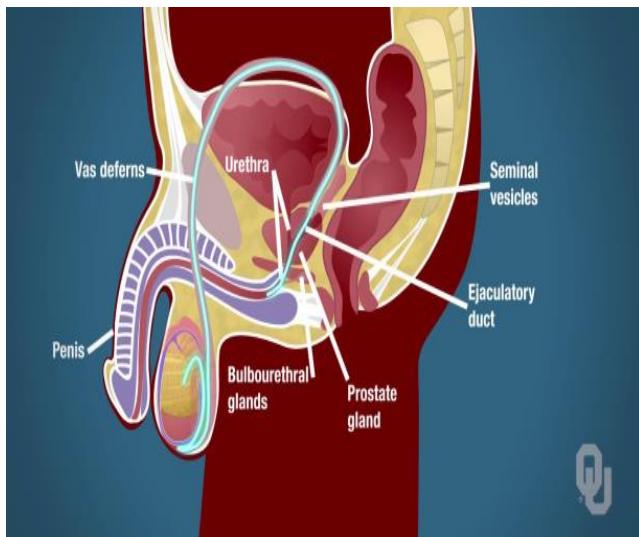
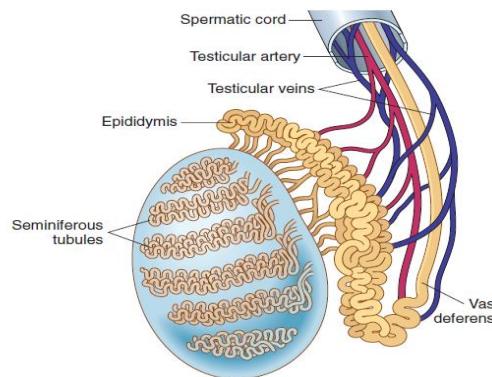
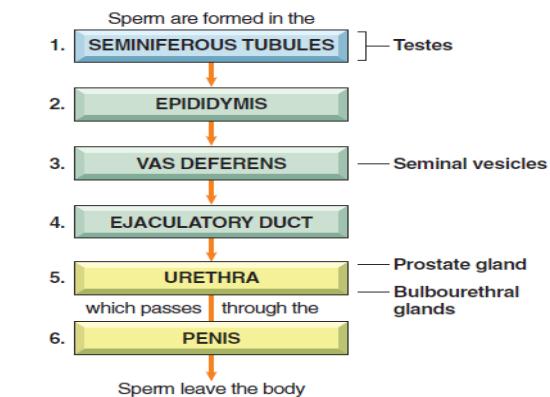
Nephron

- The combination of a glomerulus and a renal tubule forms a unit called a nephron (structural and functional unit). Each kidney contains about 1 million nephrons.
- A nephron has two major components: the
- Renal corpuscle and the renal tubule
- A glomerulus and a glomerular capsule (bowman capsule).
- An afferent arteriole carries blood to the glomerulus
- An efferent arteriole carries the filtered blood from the glomerulus to beds of capillaries (peritubular capillaries)
- Proximal tubule , descending limb
- Loop of Henle, ascending limb, and distal tubule, until it finally reaches the collecting tubule



Structure of the male reproductive system

- Spermatozoon is a male sex cell
- The purpose of the male reproductive system is to create spermatozoa (sperm), transport these sperm through the male reproductive channels, and keep the sperm viable (capable of living).
- The scrotum is an external sac - composed of skin externally - each containing a testis internally
- The testes are filled with tightly coiled seminiferous tubules that produce sperm.
- A comma-shaped structure called the epididymis is connected to the posterior surface of each testis.
- Sperm travel from the seminiferous tubules to the epididymis, where the sperm reach maturation
- The epididymis narrows to form the vas deferens (ductus deferens), which extends into the abdominal cavity.
- The vas deferens crosses the top and continues down the posterior surface of the bladder. At this point the vas deferens joins the seminal vesicles to form the ejaculatory duct.
- Seminal vesicles provide fluid that contains special nutrients to maintain the viability of sperm. This fluid constitutes approximately 60% of the fluid ejaculated during intercourse.
- The ejaculatory duct opens into the urethra near the prostate gland.
- The prostate gland secretes an alkaline substance that protects the sperm from the acidic environment found in the male urethra and the female vagina.
- A duct from the prostate gland also opens into the urethra. Inferior to the prostate are two pea-sized bulbourethral glands (cowper glands) that create this alkaline substance.
- The penis is a cylindrical organ composed of erectile tissue - engorged with blood during sexual excitement - becomes rigid to enter the vagina.
- The urethra travels the length of the penis, and the urethral meatus is at its enlarged tip, the glans penis
- The glans penis is covered by a movable fold of skin called the prepuce (foreskin).
- During ejaculation (the emission of semen), the sphincter at the base of the bladder closes so that urine cannot enter the urethra nor can semen enter the bladder.
- Semen is the thick fluid that contains not only sperm, but also secretions of the testes, prostate, bulbourethral glands, and seminal vesicle



Pathology

Condition Disease	Description
Anuria	An inability to produce urine. Defined as voiding less than 100 ml a day in adults.
Balanoposthitis	Inflammation of the glans penis and foreskin.
Benign prostatic Hyperplasia (BPH)	Enlargement of the prostate gland causing varying degrees of Obstruction of the bladder outlet.
Bladder cancer	A malignancy in the urinary bladder.
Chyluria	Lymph in the urine.
Cryptorchidism, Cryptorchism	A birth defect in which one or both testes have failed to properly descend into the scrotum.
Cystitis	Inflammation or infection of the urinary bladder, typically caused by bacteria.
Cystocele	Herniation of the urinary bladder.

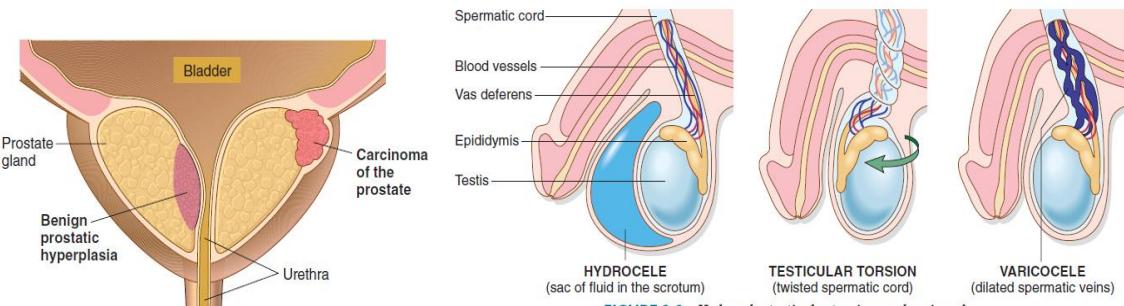
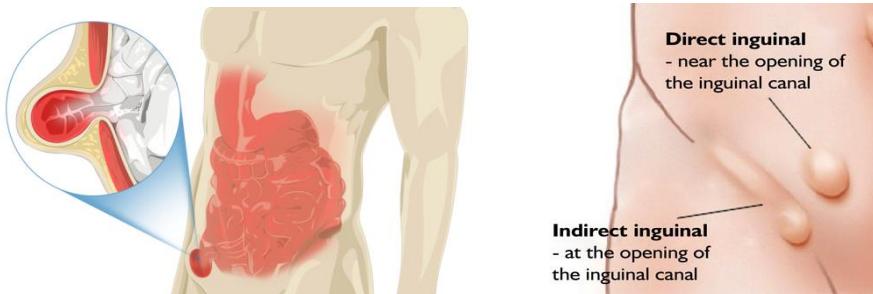


FIGURE 9-8 Hydrocele, testicular torsion, and varicocele.

Dysuria	Painful urination.
Edema	The presence of extracellular water and sodium in cells, tissues, or cavities.
Enuresis	Bed-wetting. Enuresis is normal in the first 2 to 3 years of childhood. It is considered abnormal in older children and adults.
Epididymitis	Inflammation of the epididymis.
Erectile dysfunction	The inability to achieve and/or maintain an erection adequate for sexual intercourse.
Glomerulonephritis	Inflammation of the glomeruli (filtration membranes) resulting in plasma proteins entering the urine.
Glucosuria	Glucose (sugar) in the urine. This may indicate diabetes mellitus. Also called <i>glycosuria</i>.
Hematospermia	Blood in the semen.
Hematuria	Blood in the urine.
Hydrocele	An abnormal collection of fluid in a cavity, most commonly a testis. This condition may be congenital.
Hypertension	Hypertension (high blood pressure) may be secondary to renal disease.
Inguinal hernia	A protrusion of a part of a structure through the abdomen or inguinal ring located in the inguinal region and caused by weakening in a body wall.



Ketonuria	An abnormally high number of ketone bodies in the urine. Ketone bodies accumulate in the urine when the body is using fat, rather than sugar, for energy. This can be a sign of diabetes mellitus.
Nephrolithiasis	Stones or crystalline structures in the urinary tract. Also called <i>urinary calculi</i> and <i>kidney stones</i> .
Nephrotic syndrome	A group of signs and symptoms caused by the severe and chronic inability of the glomerulus to properly filter protein. Symptoms include edema and an abnormal excretion of protein in the urine. Also called <i>nephrosis</i> .
Nocturia	The condition of being awakened at night by the need to urinate.
Oliguria	Below-normal urinary output. Defined as less than 500 ml a day in adults.
Pneumaturia	The passage of gas into the urine. This is a rare disorder.
Polycystic kidney Disease	A group of inherited disorders characterized by multiple fluid-filled sacs both within and on the surface of the kidneys. These cysts reduce the ability of the kidneys to function properly.

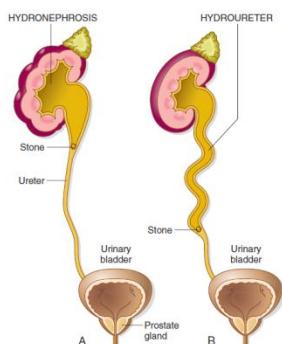
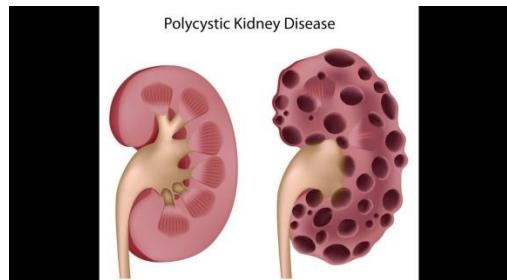


FIGURE 7-8 A. Hydronephrosis caused by a stone (obstruction) in the proximal part of a ureter. Notice the buildup of excess fluid in the kidney. B. Hydroureter with hydronephrosis caused by a stone in the distal part of the ureter.



Polyuria	Excessive urinary output. Defined as approximately 3 l or more of output daily.
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Priapism	An abnormal, painful, and persistent erection.
Prostate cancer, Prostatic cancer	Malignancy of the prostate gland.
Prostatitis	Inflammation of the prostate gland. It can be either acute or chronic. Acute is bacterial; chronic may or may not be bacterial.
Proteinuria	Abnormal excretion of protein in the urine.
Pyelonephritis	Bacterial infection of the renal pelvis and calyces. Can be either acute or chronic.
Renal cell carcinoma	Cancer of the kidneys.
Renal failure	The inability of the kidneys to function properly. Renal failure can be acute or chronic.
Seminoma	A rare type of testicular malignancy typically occurring in young adult males.
Testicular cancer	A malignancy of a testis.
Uremia	The excessive accumulation in the blood of the byproducts of protein metabolism, especially urea. This is a toxic condition.
Urethral carcinoma	Malignancy of a ureter.
Urinary calculi	Stones or crystalline structures in the urinary tract. Also called Nephrolithiasis or kidney stones.
Urinary frequency	The need to void more often than normal. It is generally defined as needing to void more than 7 times a day.
Urinary incontinence	The inability to control urination.
Urinary tract infection (uti)	A general term for any infection (usually microbial) of the urinary tract.
Urinary tract Obstruction	Any condition that blocks a part of the urinary tract, such as a ureter. Also called obstructive uropathy.

- Nephrolithiasis - kidney stones (renal calculi).
- Interstitial nephritis - inflammation of the connective tissue that lies between the renal tubules.
- Pyelonephritis - inflammation of the lining of the renal pelvis and renal parenchyma.

- Renal cell carcinoma (hypernephroma) -cancerous tumor of the kidney in adulthood.

Renal failure:

- renal failure - decrease in excretion of wastes results from impaired filtration function.
- A large number of conditions, including high blood pressure, infection, and diabetes, can lead to renal failure, which may be acute (ARF) or chronic (CRF), reversible or progressive, mild or severe.
- a newer classification of chronic kidney disease (CKD) stages patients according to the level of creatinine clearance and glomerular filtration rate (GFR), ranging from normal (stage 1) to end-stage renal failure (stage 5).
- ESRD – end stage renal disease
- Renal hypertension - high blood pressure resulting from kidney disease.
- Wilms tumor - malignant tumor of the kidney occurring in childhood.
- Bladder cancer- malignant tumor of the urinary bladder.
- Diabetes insipidus (DI)- antidiuretic hormone (ADH) is not secreted, or there is a resistance of the kidney to ADH.
- Diabetes mellitus (DM) - insulin is not secreted adequately or tissues are resistant to its effects.

STD (sexually transmitted disease)

- Chlamydial infection - bacterial invasion (by *chlamydia trachomatis*) of the urethra and reproductive tract.
- Gonorrhoea - inflammation of the genital tract mucosa, caused by infection with gonococci transurethral resection of the prostate (TURP) - excision of benign prostatic hyperplasia using a resectoscope through the urethra.
- Vasectomy - bilateral surgical removal of a part of the vas deferens. (berry-shaped bacteria).
- Herpes genitalis - infection of skin and genital mucosa, caused by the herpes simplex virus (HSV).
- Human papilloma virus (HPV) infection- infection of the skin and mucous membranes in the ano genital region by the human papillomavirus.
- Syphilis - chronic STD caused by a spirochete (spiral-shaped bacterium) – chancre

Diagnostic tests & procedures

Test	Description
Abdominal and Pelvic ultrasonography	Ultrasound is used to examine the viscera, including the urinary system. It is used to locate calculi (stones) and structural abnormalities such as tumors.

Ammonia test, blood	The level of ammonia in the blood is measured. Elevated levels may indicate renal disease.
Biopsy	A specimen of tissue is collected and sent to the lab to be microscopically examined to establish a diagnosis. Biopsies are commonly used to diagnose malignancies such as prostatic cancer.
Blood urea nitrogen (BUN)	The level of urea in the blood is measured. Urea is normally not present in the blood because healthy kidneys filter it out. Its presence in the blood can be a sign of kidney failure.
Creatinine clearance Test	The amount of creatinine excreted in urine is measured over a specific time period, usually 24 hours. Used to evaluate renal functioning.
Cystoscopy (cysto)	A cystoscope is used to visually examine the interior wall of the bladder.
Glomerular filtration Rate (GFR)	The functioning of the glomerular filtration system is evaluated by determining the amount of creatinine excreted over a specific time period, usually 24 hours.
Intravenous Urography (IVU)	A radiopaque contrast medium is injected via iv, and x-rays are taken or a ct scan is performed. This procedure is useful in locating abnormalities of the urinary tract such as blockages. One of the most frequently ordered tests for investigating suspected renal disease or urinary tract dysfunction.
Protein-specific Antigen (PSA) test	Protein-specific antigens in the blood are measured. A high level can be indicative of prostatic cancer; however, high levels can also occur in other types of prostatic disorders.
Pyelography	Similar to intravenous urography, except that the radiopaque contrast medium is introduced directly into the urinary tract. X-rays are then taken.
Radiography of the Urinary system	X-rays are taken of the urinary system to identify structural Abnormalities, predominantly, urinary calculi.
Renal MRI	A magnetic resonance image of the kidneys is generated. Mris generally provide more accurate information about tumors and abnormal structures than other techniques.
Transrectal Ultrasonography (TRUS)	Ultrasound is used to examine the rectal area, particularly the prostate gland, for tumors.
Urethroscopy	A urethroscope is used to visually examine the interior of the urethra.
Urinalysis (UA, U/A)	A series of tests are performed on clean catch urine. See table 16-3.

Urine blood Or hemoglobin test	The urine is checked for the presence of red blood cells and hemoglobin. Blood in urine indicates damage to the kidneys or urinary tract.
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Urine analysis

Test	Description	Normal results
Bacteria	Presence of bacteria indicates a bacterial infection such as cystitis.	None present.
Bilirubin	Bilirubin is a pigment that occurs when hemoglobin, a component of red blood cells, is broken down. Its presence may be a sign of an abnormal gallbladder or liver condition.	Negative.
Color	Color of urine can indicate amount of water in the Body, the presence of blood, etc. Brown or dark-red color can indicate the presence of blood. Cloudy urine may indicate a large number of white blood cells, a sign of infection.	Normal urine is clear And yellow or straw colored.
Glucose	Glucose can indicate diabetes mellitus, a metabolic disorder in which the body cannot properly use carbohydrates.	Negative to dipstick. <500 mg/24 hours.
Ketones	An abnormally large number of ketone bodies occur in the urine when the body is using fat instead of carbohydrates for energy. This may be a symptom of diabetes mellitus.	Negative.
PH	Indicates the acidity or alkalinity of the urine. It can Range from 0 (extremely acidic) to 15 (extremely alkaline). The presence of bacteria can cause urine to become more alkaline.	Typically 6.5 (slightly Acidic), but normal range can be 4.6 to 8.0, depending on diet.
Protein (albumin)	Abnormally large amounts can indicate that the Glomerular membrane is not working properly.	Negative to dipstick. 10-100 mg/24 hours.
Sediment	Sediment can indicate the presence of bacteria, blood cells, epithelial cells, or crystals, all signs of abnormal conditions.	Minimal.
Specific Gravity	Percentage of solids in urine as compared to liquid. In individuals with diabetes mellitus, the specific gravity will be higher than normal because of the presence of sugar in the urine.	1.001-1.035

- Semen analysis - microscopic examination of ejaculated fluid.
- Castration - surgical excision of testicles or ovaries.

- **Circumcision** - surgical procedure to remove the prepuce of the penis.
- **Digital rectal examination(dre)** - finger palpation through the anal canal and rectum to examine the prostate gland.
- **Photoselective vaporization of the prostate (greenlight pvp)** - removal of tissue to treat benign prostatic hyperplasia (bph) using a green light laser (laser turp).

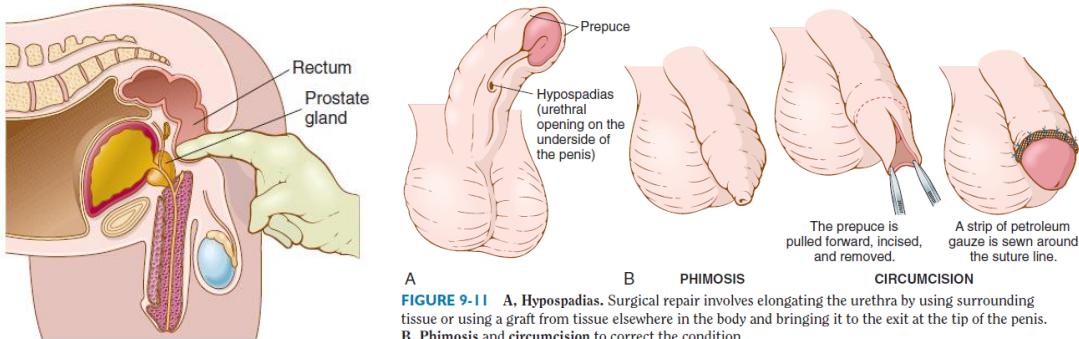


FIGURE 9-11 A, Hypospadias. Surgical repair involves elongating the urethra by using surrounding tissue or using a graft from tissue elsewhere in the body and bringing it to the exit at the tip of the penis. B, Phimosis and circumcision to correct the condition.

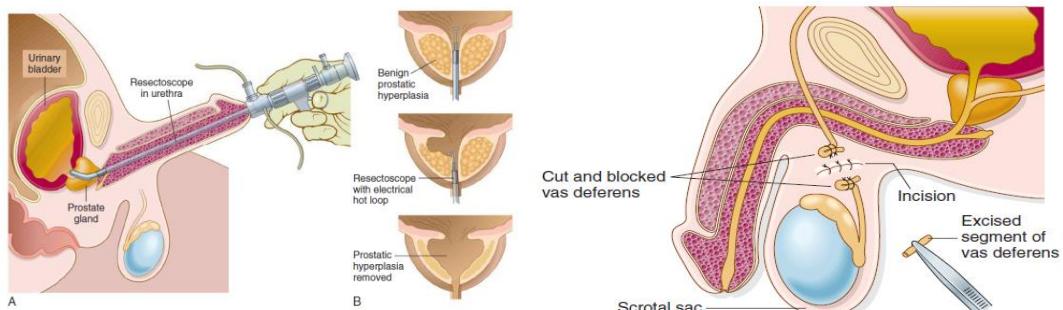


FIGURE 9-14 Transurethral resection of the prostate (TURP). A, The resectoscope contains a light, valves for controlling irrigating fluid, and an electrical loop that cuts tissue and seals blood vessels. B, The urologist uses a wire loop through the resectoscope to remove obstructing tissue one piece at a time. The pieces are carried by the fluid into the bladder and flushed out at the end of the operation.

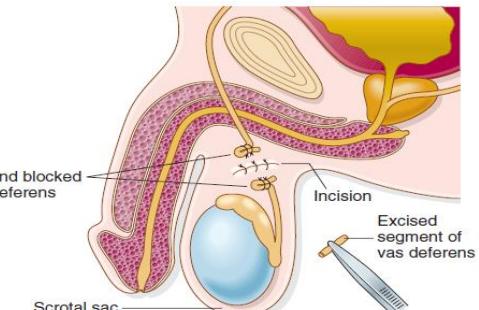


FIGURE 9-15 Vasectomy.

- **Cystoscopy** - direct visualization of the urethra and urinary bladder with an endoscope (cystoscope).

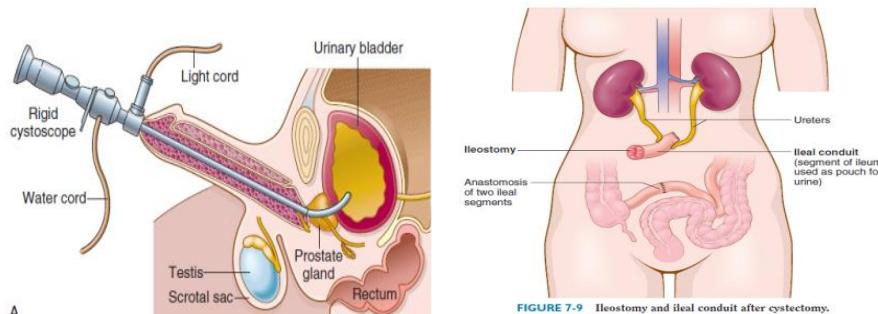
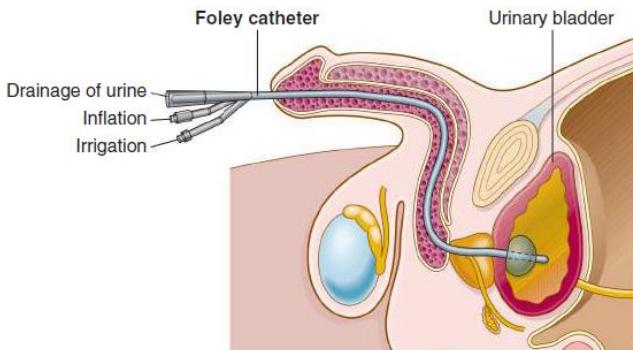


FIGURE 9-9 Ileostomy and ileal conduit after cystectomy.

- **Lithotripsy** - urinary tract stones are crushed. The extracorporeal method uses shock waves directed toward the stone from the outside of the body (extra = outside, corpor/o = body). Abbreviation is ESWL (extracorporeal shock wave lithotripsy).
- **Renal angioplasty** - dilation of narrowed areas in renal arteries.
- **Renal biopsy** - removal of kidney tissue for microscopic examination.

- **Urinary catheterization** - passage of a flexible, tubular instrument through the urethra into the urinary bladder.
- **Renal transplantation** - surgical transfer of a kidney from a donor to a recipient.



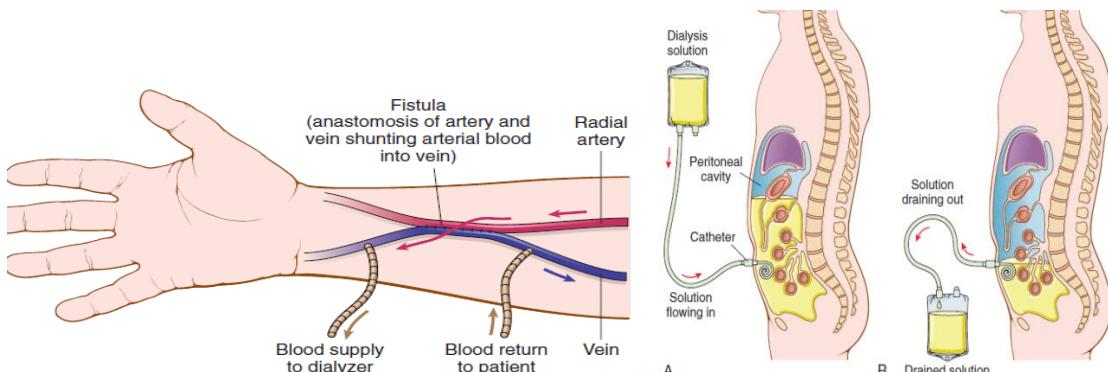
Dialysis

- Dialysis - process of separating nitrogenous waste materials from the blood.
- Dialysis is used to treat acute or chronic renal failure and some cases of drug use.
- There are two methods:

1. Hemodialysis (HD) - uses an artificial kidney machine that receives waste filled blood from the patient's bloodstream, filters it through an artificial porous membrane (dialyzer), and returns the dialyzed blood to the patient's body .

- an arteriovenous fistula (communication between an artery and vein) is created surgically to provide easy access for hemodialysis

Av fistula



2. Peritoneal dialysis (PD) - uses a catheter to introduce fluid into the peritoneal (abdominal) cavity.

- Waste materials, such as urea, in the capillaries of the peritoneum pass out of the bloodstream and into the fluid.
- The fluid (with wastes) is then removed by catheter.
- Continuous ambulatory peritoneal dialysis (CAPD).

Medical terminologies:

Combining form	Meaning
cyst/o	urinary bladder; cyst; sac of fluid

genit/o	genital
glomerul/o	glomerulus
nephro/o	kidney (see also ren/o)
orchi/o	testes
orchid/o	testes
pyel/o	renal pelvis
prostat/o	prostate gland
ren/o	kidney (see also nephro/o)
semin/o	semen
spermat/o	spermatozoa; sperm cells
test/o	testis; testicle (see also testicul/o)
trigon/o	trigone (region of the bladder)
ureter/o	ureter
urethr/o	urethra
urin/o	urine (see also ur/o)
ur/o	urine (see also urin/o)
vesic/o	urinary bladder

Substances and urinary signs and symptoms

Combining form / suffix	Meaning
albumin/o	albumin (a protein in the blood)
azot/o	nitrogen
bacteri/o	bacteria
dips/o	thirst
kal/o	potassium
ket/o, keton/o	ketone bodies (ketoacids and acetone)
lith/o	stone
natr/o	sodium
noct/o	night
olig/o	scanty
-poietin	substance that forms

py/o	pus
-tripsy	crushing
-uria	urination; urine condition

Abbreviations:

Abbreviation	Meaning
AGN	Acute glomerulonephritis
ARF	Acute renal failure
ATN	Acute tubular necrosis
BPH	Benign prostatic hypertrophy, benign prostate hyperplasia
BUN	Blood urea nitrogen
CRF	Chronic renal failure
CVA	Costovertebral angle
CYSTO	Cystoscopy
ESWL	Extracorporeal shock wave lithotripsy
GFR	Glomerular filtration rate
GU	Genitourinary
I&O	Intake and output
IVP	Intravenous pyelogram, intravenous pyelography
IVU	Intravenous urogram, intravenous urography
KUB	Kidneys, ureters, bladder (x-ray)
PD	Peritoneal dialysis
PE	Physical exam
PSA	Prostate-specific antigen
RP	Retrograde pyelogram
SWL	Shock wave lithotripsy
TRUS	Transrectal ultrasonography
TUIP	Transurethral incision of the prostate
TUR	Transurethral resection
TURB	Transurethral resection of the bladder
TURP	Transurethral resection of the prostate
UA, U/A	Urinalysis
UTI	Urinary tract infection
VDRL	Veneral disease research laboratory (test for syphilis)

INTEGUMENTARY SYSTEM

GENERAL TERMS:

- Dermatology
- Dermatologist
- Structure and functions of skin
- Layers of skin
- Glands of the skin
- Hair and Nails
- Skin lesions
- Burns and frost bites
- Rule of Nine
- Neoplasm
- Diseases and conditions of the skin
- Procedures
- Terms and abbreviations

INTEGUMENTARY SYSTEM

- The skin and its accessory structures (hair, nails, and glands) make up the integumentary system of the body
- Integument means covering
- extending over an area of 22 square feet in an average adult
- Largest organ in the body
- Second largest is liver
- The longest bone in the human body is the femur.
- The largest artery is the aorta and the largest vein is the inferior vena cava.
- The largest internal organ is the liver. It is also the heaviest organ.
- The largest external organ, which is also the largest organ in general, is the skin.
- The longest muscle is the sartorius muscle in the thigh.

ANATOMY & PHYSIOLOGY

STRUCTURE

- | | |
|-----------------|---|
| Epidermis | - Thinner superficial layer of skin /
Epithelium - keratin |
| Dermis / corium | - Dense fibrous connective tissue layer-
collagen |
| Hypodermis | - Subcutaneous layer – fat containing
tissue |

FUNCTIONS

1. Protection - Physical barrier that protects underlying tissues from injury, UV light and bacterial invasion.

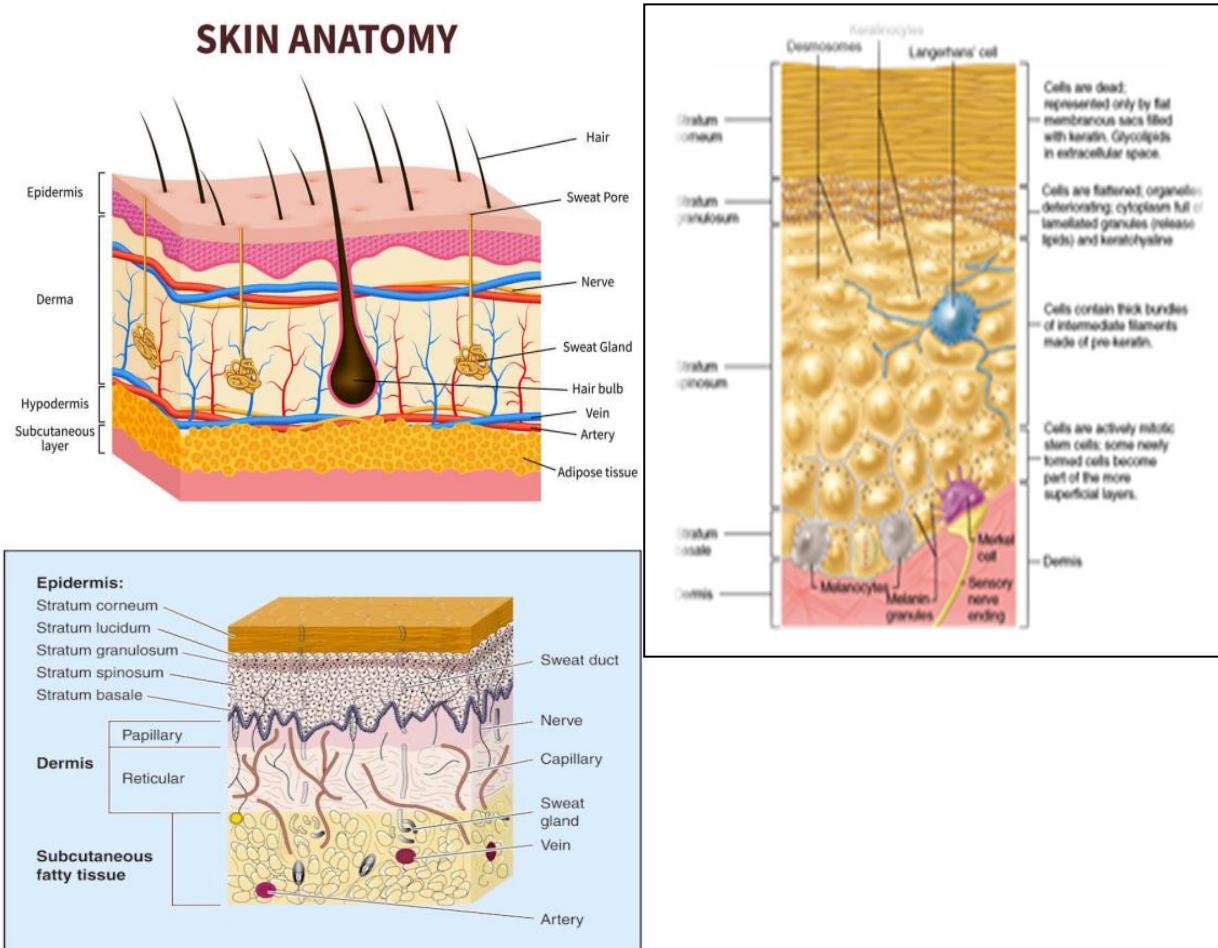
2- Regulation of body temperature - High temperature or strenuous exercise; sweat is evaporated from the skin surface to cool it down. vasodilation (increased blood flow) and vasoconstriction (decreased in blood flow) regulates body temp.

3-Sensation -Nerve endings and receptor cells that detect stimuli to temp., pain, pressure and touch.

4- Excretion - Sweat removes water and small amounts of salt, uric acid and ammonia from the body surface

5- Blood reservoir - Dermis houses an extensive network of blood vessels carrying 8-10% of total blood flow in a resting adult.

6- Synthesis of Vitamin D (cholecalciferol) -UV rays in sunlight stimulate the production of Vit. D. Enzymes in the kidney and liver modify and convert to final form; calcitriol (most active form of Vit. D.) Calcitriol aids in absorption of calcium from foods and is considered a hormone.



5 layers of the epidermis

1- Stratum corneum

- layer has many rows of dead cells filled with keratin
- continuously shed and replaced (desquamation) – shedding / peeling

- effective barrier against light, heat and bacteria
- 20-30 cell layers thick
- dandruff and flakes
- 40 lbs. of skin flakes in a lifetime

2- Stratum lucidum

- seen in thick skin of the palms and soles of feet.
- 3-5 rows of clear flat dead cells
- keratohyalin (precursor) to keratin

3- Stratum granulosum

- 3-5 rows of flattened cells
- nuclei of cells flatten out
- organelles disintegrate cells eventually die
- keratohyalin granules
- lamellated granules secrete glycolipids into extracellular spaces to slow water loss in the epidermis

4- Stratum spinosum: "spiny layer"

- 8-10 rows of polyhedral (many sided) cells
- appearance of prickly spines
- melanin granules and Langerhans' cell predominate

5- Stratum basale / Stratum Germinatum:

- deepest epidermal layer
- attached to dermis
- single row of cells
- mostly columnar keratinocytes
- with rapid mitotic division
- contain merkel cells and melanocytes - 10-25%

Cells in the epidermis:

- keratinocytes
- melanocytes
- Merkel cells
- Langerhans' cells

1- Keratinocytes: most abundant

- produce keratin (fibrous protein)
- protective; waterproofing the skin
- continuous mitosis
- form in the deepest layer called the stratum basale- cells push their way up to the surface where they are dead cells filled with keratin; will slough off.

Regenerates every 25-45 days.

2- Melanocytes: - cells produce brownish/black pigment called melanin. (8% of epidermal cells)

- stratum basale
- branching processes (dendrites)
- melanin accumulates in melanosomes and transported along dendrites of the melanocytes to keratinocytes.
- melanin accumulates on the superficial aspect of the keratinocyte shielding its nucleus from harmful UV light.

- lack of melanin: albino

3- Merkel cells:

- stratum basale
- epidermis of hairless skin
- attach to keratinocytes by desmosomes
- make contact with a sensory neuron ending called a Merkel disc (touch).

4- Langerhans' cells:

- star-shaped cells arising from bone marrow that migrate to epidermis.
- epidermal dendritic cells (macrophages)
- interact with a WBC called a T- helper cell
- easily damaged by UV light.

DERMIS

- flexible and strong connective tissue
- elastic, reticular and collagen fibers
- cells: fibroblasts, macrophages (WBC), mast cells
- nerves, blood and lymphatic vessels
- oil and sweat glands
- Two layers: papillary and reticular

LAYERS OF DERMIS

1- Papillary layer:

- loose connective tissue with nipple like surface projection called dermal papilla.
- capillaries
- contain pain receptors
- contain touch receptors (Meissner's corpuscles)
- dermal ridges- epidermal ridges- pattern called fingerprints

2- Reticular layer:

- dense irregular
- collagen fibers offer strength
- holds water
- dermal tearing causes stretch marks - striae

- Skin color: attributed to melanin, hemoglobin and carotene.
- Race is determined by amount of melanin not of melanocytes.
- Local accumulation of melanin will result in freckles and pigmented moles.
- Melanin is made through interaction with tyrosinase present in melanocytes
- UV light stimulates melanin production. Excessive UV light can damage DNA and cause solar elastosis (elastin fibers clump)
- Carotene is formed from Vit. A and deposits in stratum corneum and imparts an orange tone to skin

HYPODERMIS

- called subcutaneous, Sub-Q or superficial fascia
- anchors skin to underlying structures
- contains adipose tissue and blood vessels
- common site for injection

GLANDS OF SKIN

Two types of glands exist in the integument.

- Sebaceous glands (oil glands)
- Sudoriferous glands (sweat glands)

Sebaceous glands: (holocrine glands)

- connected to hair follicle
- not found on palms and soles of feet
- secretes sebum (fats, cholesterol and proteins)
- keep hair from drying out, keeps skin moist
- whiteheads, blackheads and acne

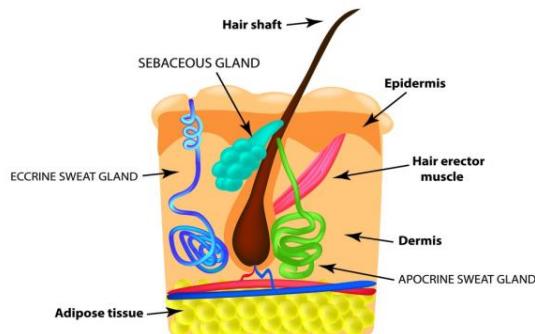
Sudoriferous glands: exocrine glands

- millions located throughout the skin
- two types:
 - eccrine: more common (merocrine)
 - originate in subQ layer
 - duct empties on skin surface
 - palms and soles of feet
 - sweat is watery (99% H₂O)
 - sweating regulated by sympathetic nervous system

Apocrine: axillary and pubic region

- duct empties onto hair follicle
- viscous fluid
- causes body odor when bacteria break it down

GLANDS OF THE SKIN



HAIR STRUCTURE



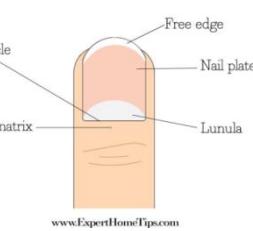
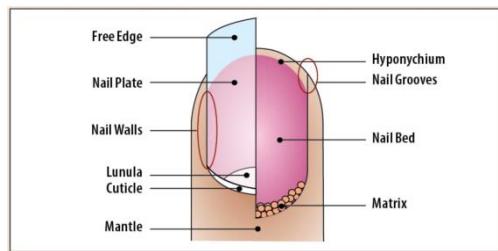
Ceruminous glands: located in ear only

- modified apocrine glands
- originate in Sub Q layer
- ducts open onto External auditory meatus
- produces cerumen (ear wax) : brown sticky substance that prevents foreign material from entering.

HAIR AND NAILS

- Both made up of keratin
- Hair – over entire body except palm and soles
 - ✓ Concentrated in the scalp – 100,000 hairs
 - ✓ HAIR FOLLICLE – Cavity where hair shaft develops
 - ✓ HAIR SHAFT – Part of the hair that protrudes
 - ✓ HAIR ROOT – Part of the hair embedded in the follicle
 - ✓ HAIR GROWTH – 2 phases – Anagen / growth phase
Telogen / resting phase
- Nails – Hardened keratin
 - ✓ Protect the ends of fingers and toes from injury
 - ✓ Nail plate (body): visible portion
 - ✓ Nail root: located under cuticle
 - ✓ Lunula – arch shaped white area (half moon crescent shaped) at the base of nail bed
 - ✓ Nail bed: located under nail plate

A basic anatomy of the nail

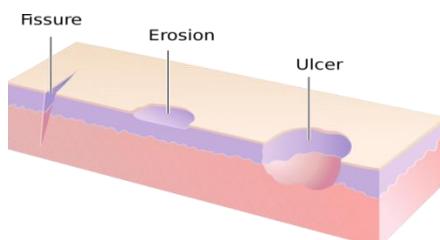
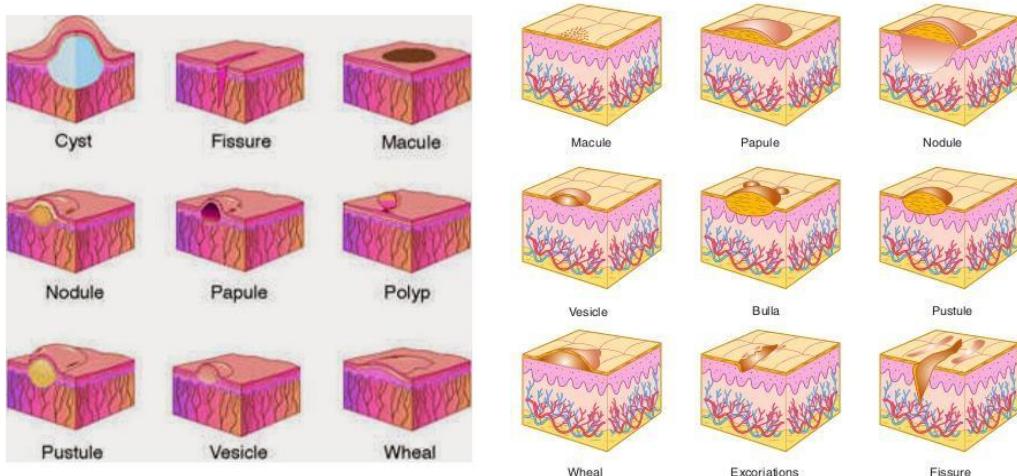


SKIN LESIONS

- Any pathological change in tissue called lesions.
- Causes
 - ✓ Injury
 - ✓ Parasitic infections
 - ✓ Allergy
 - ✓ Bacterial, fungal , viral , yeast infection (Eg *Staphylococcus aureus*, *Streptococcus pyogenes*)

TYPES OF SKIN LESIONS

- **Bulla:** A large blister containing clear fluid – **Vesicle** - greater than or equal to 5mm.
- **Vesicle :** A small elevation of the skin containing clear fluid - less than 5 mm; a blister - chickenpox.
- **Cyst :** A sealed sac containing fluid or semisolid material - has a membrane lining.
- **Fissure:** A deep furrow, slit, or cracklike sore.
- **Macule :** Discolored flat lesion (freckle or flat mole) less than 10 mm
- **Papule :** A small solid elevation of the skin - less than 10 mm
- **Nodule :** A solid elevation of the skin - more than 10 mm – palpable
- **Polyp:** A mushroom like growth - projects outward from the surface
- **Pustule:** A small elevation of the skin containing pus
- **Wheal :** A discolored swollen area of the skin; it is slightly elevated (hives)
- **Ulcer :** A deep open sore on the surface of the skin or mucous membrane -may lead to bleeding and scarring.

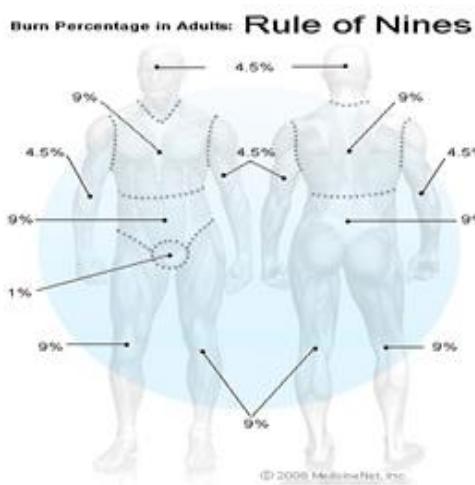


BURNS AND FROST BITES

- A burn is any injury caused by heat
- Burns are one of the most common household injuries
- Burns are characterized by severe skin damage that causes the affected skin cells /tissues to die
- Frostbite is a skin condition caused
- by excessive exposure to cold temperatures. Frostbite damage is divided into three categories of degrees, just like burn damage.
- Burns are categorized on the basis of severity as follows

RULE OF NINE

- “Rule of nine” is used to calculate the large proportion of total burn surface area
- Total is 99% with 1% genitalia coverage
- Head 9%
- Each arm 9%
- Each leg (front and rear) 9%
- Upper torso 9%
- Lower torso 9%
- Genitalia 1%



first-degree burns—superficial epidermal lesions, erythema, hyperesthesia, and no blisters.

second-degree burns (partial-thickness burn injury)—epidermal and dermal lesions, erythema, blisters, and hyperesthesia (Figure 16-11A).

third-degree burns (full-thickness burn injury)—epidermis and dermis are destroyed (necrosis of skin), and subcutaneous layer is damaged, leaving charred, white tissue (Figure 16-11B).



FIGURE 16-11 Burns. A, Second-degree burn. Wound is painful and very sensitive to touch and air currents. B, Third-degree burn showing variable color (deep-red, white, black, and brown). The wound itself is insensate (patient does not respond to pinprick).

NEOPLASM

- Any abnormal growth is a neoplasm
- 2 types of neoplasm → benign (non cancerous)
 - ↓
 - malignant (cancerous)
- Benign neoplasm does not spread to surrounding tissues
- Malignant neoplasm spread to the surrounding tissues

These growths are termed as carcinomas

- Carcinomas are malignant growths composed of mainly epithelial cells
- Skin cancer is one of the most common cancer in humans

Clark Level Classification of Malignant Melanomas

Level	Description
I	Tumour is confined to the epidermis
II	Tumour has invaded underlying papillary dermis
III	Tumour has invaded the junction of papillary and reticular dermis
IV	Tumour has invaded the reticular dermis
V	Tumour has invaded the sub Q fat

Cancerous Skin Lesions

- Basal cell carcinoma- a malignant tumour of the basal cell layer(stratum germinativum) of the epidermis. It is slow growing and rarely metastizes.
- Kaposi sarcoma- a malignant growth characterized by nodules ranging in colour from pink to purple/dark blue. It can invade internal organs and be fatal. Primarily associated with AIDS.
- Malignant melanoma- a malignant growth that is composed of melanocytes. It can metastize to internal organs such as lungs and brain.
- Squamous cell carcinoma- a malignant tumour of the squamous epithelial cells. It can occur *in situ* or can be invasive.

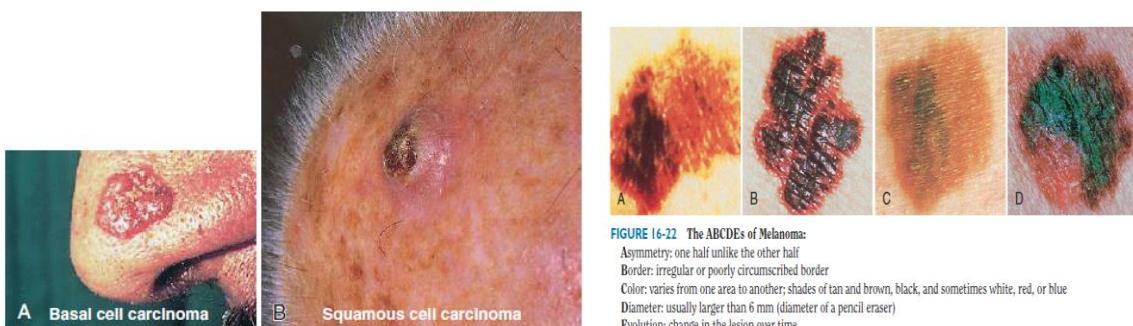


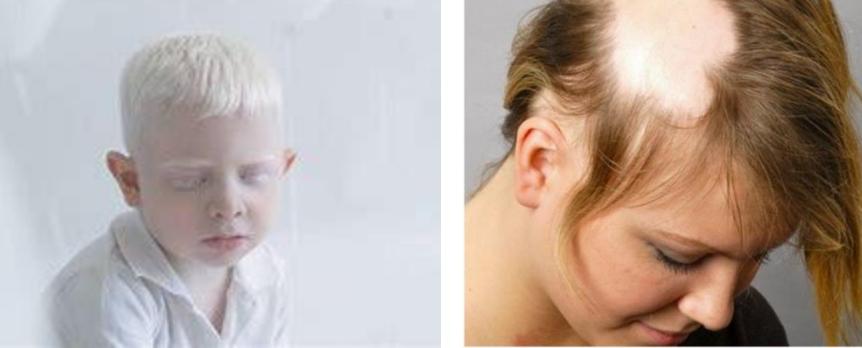
FIGURE 16-22 The ABCDEs of Melanoma:
 Asymmetry: one half unlike the other half
 Border: irregular or poorly circumscribed border
 Color: varies from one area to another; shades of tan and brown, black, and sometimes white, red, or blue
 Diameter: usually larger than 6 mm (diameter of a pencil eraser)
 Evolution: change in the lesion over time

Dermatologic Diseases and Conditions

- Abrasion - Removal or scraping away
- Abscess - A cavity filled with purulent matter (Pus)
- Acne rosacea - inflammatory disorder characterized by papules, pustules, erythema - dilation of small blood vessels on the face – middle age

- **Acne vulgaris** -inflammatory disorder characterized by papules, pustules, and comedones - excessive secretion of sebum and irritation - skin bacteria – puberty & adolescence
- **Actinic lentigines** - Small discolored lesions - by longterm exposure to ultraviolet light or rays - *liver spots*
- **Albinism** - inherited disorder in which the body is unable to produce melanin - skin and hair - white



- 
- The image contains two photographs. The left photograph shows a young child with white hair and pale skin, illustrating albinism. The right photograph shows a person with a shaved head and sparse hair on their scalp, illustrating alopecia.
- **Alopecia** - Loss of hair (total or partial)
 - **Angioma** - swelling or tumor - blood vessels
 - **Anhidrosis** - inability to tolerate heat -lack of sweat glands or malfunctioning sweat glands
 - **Asteatosis** - Dry skin - flaking and itching.
 - **athlete foot** - fungal infection of the foot - *tinea pedis* or *ringworm*
 - **atopic dermatitis** -Inflammation of the skin -from hypersensitivity to an environmental substance – genetic
 - **Atrophy** - decline in the functioning of tissues - wrinkled, thin skin
 - **Birthmark** - A persistent colored lesion noted at or near birth
 - **cafe au lait spot** - A patch of skin having light-brown pigmentation.
 - **Callus** - thickening of the skin that develops - pressure or friction is applied to it over a period of time - often develop on the palms - and soles and can protect the

skin from damage. **Callus** also refers to tissue that forms at the ends of a broken bone and eventually binds them together.



CAFÉ AU LAIT SPOT

- **Candida** - genus of yeast like fungi that can cause rashes and itching- diaper rash and vaginitis
- **Carbuncle** - deep-seated pus-forming staphylococcal infection (several furuncles) - heals slowly and results in a large scar
- **Carbuncle** - small, fleshy growth (*caruncula*.)
- **Cellulitis** -Spreading inflammation of cellular or connective tissue (increased blood flow, presence of white blood cells and edema, and a lack of pus formation.
- **Chancre** - hard sore that breaks down into an ulcer, heals over a period of several weeks - primary lesion associated with syphilis
- **Chickenpox** -contagious disease primarily occurring in children - skin eruptions in the forms of vesicles, papules, macules, crusting and accompanied by severe itching
- **Chloasma** - Irregularly shaped brown patches – face - during pregnancy or as a result of using oral contraceptives -*moth patch or mask of pregnancy*
- **Cicatrix** – scar



CHANCRE

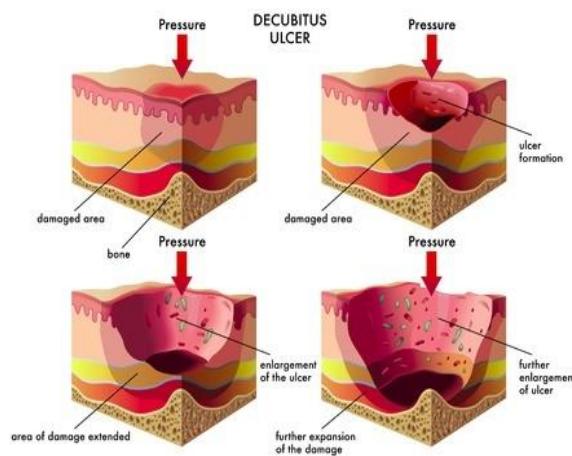
FURUNCLE



Petechia

Ecchymosis

- **comedo, comedos /comedones** -A dilated hair follicle filled with dead cells and oily secretions - **acne vulgaris** – closed(white heads)- open (black heads)
- **contact dermatitis** -localized inflammation -caused by an allergy to poison, ivy, food, soap, skin care products, etc.
- **Contusion** -hemorrhage that occurs beneath unbroken skin (**bruise**)
- **Crust** – scab (dried blood, lymph, and/or pus)
- **Cyanosis** - dark blue or purplish coloration to the skin due to lack of oxygen.
- **decubitus ulcer** -A skin lesion caused by pressure being placed on the skin over an extended period of time (a **bedsore**)
- **Ecchymosis** -irregularly shaped area of discolored tissue –by blood hemorrhaging into the skin.
- **comedo, comedos /comedones** -A dilated hair follicle filled with dead cells and oily secretions - **acne vulgaris** – closed(white heads)- open (black heads)
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- **Eczema** -inflammatory skin disease typically with redness of the skin, vesicles and crusting.
- **Erosion** - loss of all or part of the epidermis
- **Erythema** - Reddish skin (dilation of underlying capillaries)
- **Erythema infectiosum** - mild infectious disease, usually occurring in childhood - reddish rash (*fifth disease*)
- **Erythroderma** – abnormal, widespread reddening of the skin due to dilation of underlying capillaries. Sunburn is one cause of erythroderma
- **Excoriation** - scratch or scrape mark on the skin - covered with a crust
- **Fistula** -abnormal channel or tube that connects two hollow organs / leads from an organ to the skin's surface.
- **Folliculitis** - infection and inflammation of the hair follicles
- **Freckle** - small yellow or brown macule (individuals with light complexions) *ephelis* (pl. *ephelides*).
- **Furuncle** -pus-forming nodular infection originating deep in a hair follicle (*a boil*)
- **Gangrene** -death of tissue (lack of blood supply)
- **Hemangioma** -congenital benign (noncancerous) tumor that consists of a mass of blood vessels
- **Hematoma** -localized mass of blood outside the blood vessel and under the skin's surface
- **herpes simplex (HSV-1) (HSV-2)** - herpes viruses - Type 1 causes the eruption of vesicles on the borders of the lips or nose (cold sores)
Type 2 causes genital lesions (Both types are recurring)
- **herpes zoster** - viral infection characterized by painful vesicles (blisters) along the path of an inflamed nerve (*shingles*)
- **Hirsutism** - Excessive facial and body hair, usually in a female
- **Hyperhidrosis** - Excessive sweating.
- **Diaphoresis?**

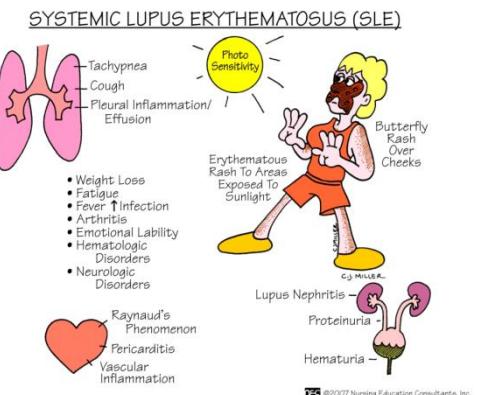
- **Ichthyosis** - Dryness of the skin with scales and flaking - become disfiguring
- **Impetigo** - contagious inflammatory skin disease – bacteria - vesicles and lesions - thick, yellowish crust
- **Jaundice** - skin, whites of the eyes, and associated tissues take on a yellowish color
- **Keloid** - firm, movable mass of scar tissue – trauma, surgery, burns, etc
- **Keratosis** - An abnormal thickening of the skin - by excessive keratin
- **Lentigo** - A brown or black macule - sharp margins ranging from 2 to 4 mm - A type of mole
- **lichen planus** - inflammatory eruption of papules and sometimes bullae - form scaly pruritic patches.
- **Lichenification** - Thickening and hardening of the skin
- **Lipoma** - A benign neoplasm of fat cells
- **Melitis** - An inflammation of the cheek
- **Miliaria** - eruption of tiny vesicles- by the retention of fluid in sweat glands (*heat rash.*)
- **Milium, milia** - keratin cyst caused by blockage of a hair follicle or sweat gland (*whitehead*)
- **Mole** - A localized growth of hyperpigmented skin
- **Mycosis** - any fungus disease.
- **nevus, nevi** (plural) -A congenital discoloration of the skin such as a mole or birthmark.
- **Onycholysis** - A condition in which the nails are loosened from the nailbed.
- **Paronychia** - An inflammation of the skin around the nail
 - bacteria or fungi.
- **Patch** - A flat discolored area of skin greater than 10 mm
 - large macule.
- **Pediculosis** - Infestation by lice causing severe itching.
- **Pemphigus** - A group of distinctive diseases characterized by successive outbreaks of vesicles, bullae, or blisters.
- **petechia** - Minute hemorrhages of the skin - tiny purple or red spots.
- **pityriasis rosea** - An inflammatory skin disease - scaly plaques and patches.
- **plaque** - A slightly elevated lesion greater than 10 mm. It is larger than a papule and can be a group of papules.
- **pruritus** - Itching.
- **Psoriasis** - A chronic, recurrent, inflammatory skin disease resulting in dry scaly red patches covered by silvery-gray scales. The epithelial cells divide at an abnormally rapid rate. The cause is unknown, but a family history of the disease is common.
Age of onset is typically 10 to 40.
- **Purpura** - An area in which blood vessels have hemorrhaged into the skin.

- Rhinophyma - Enlargement of the nose characterized by dilated follicles and caused by overgrowth of sebaceous glands.
- Ringworm - A fungal infection, tinea.
- Rubella - An infectious viral disease accompanied by fever and a red rash. It can cause birth defects in pregnant women - *German measles*.



PSORIASIS

- Scabies - A transmissible skin infection caused by a parasite's (a mite) burrowing into the skin. It is accompanied by extreme itching.
- Scale - A raised plate of epithelium that is abundantly filled with keratin.
- Scar - An area of fibrous tissue that has replaced normal skin after some form of destruction of the dermis.
- Scleroderma - A chronic disease in which the connective tissue hardens and shrinks, causing thickening of the skin.
- Seborrhea - Overactivity of the oil glands leading to excessive sebum.
- Systemic lupus erythematosus (SLE) - A chronic systemic inflammatory disease affecting the connective tissues in the skin, joints, and internal organs. Dermal lesions include an erythema in the shape of butterfly wings across the cheekbones of the face.
- Telangiectasia - Dilation of superficial blood vessels.
- Tinea - A fungal infection. There are several types including tinea corporis (ringworm of the body), tinea capitis (ringworm of the scalp), tinea pedis (athlete foot), tinea barbae (ringworm of the beard), and onychomycosis (ringworm of the nails)
- Tumor - A large nodule or swelling generally greater than 20 mm.
- Urticaria - An allergic reaction that results in the eruption of small itchy patches called wheals. Also called *hives*.



- Varicella** - An infectious viral disease most commonly occurring in children. It causes pustules and itching and is commonly referred to as chickenpox.
- Vitiligo** - Irregularly shaped patches of milky-white nonpigmented skin surrounded by skin with normal pigmentation.
- Wart** - A thickening of the epidermis caused by a virus. Warts typically have a round shape.
- Xanthoma** - A yellowish nodule on the skin composed of fat - on the eyelids.
- Xeroderma** - Excessive dryness of the skin.
- leukoplakia** - White, thickened patches on mucous membrane tissue of the tongue or cheek (evolves to squamous cell carcinoma).
- nevus, nevi** - Pigmented lesion of the skin (MOLES)
- verruca, verrucae** - Epidermal growth (wart) caused by a virus.



FIGURE 16-13 A, Erythema infectiosum - fifth disease. It is marked by fever and an erythematous rash that has a "slapped cheek" appearance on the face and later involving the arms, buttocks, and trunk. It is caused by a parvovirus. B, Hand-foot-and-mouth disease. It is caused by an enterovirus.

DIAGNOSTIC TESTS AND PROCEDURES:

Test	Description
bacterial culture	Samples of purulent tissue are sent to the laboratory and cultured in substances to promote growth. It may then be determined if bacteria are present and, if so, the type(s).
biopsy	A small amount of tissue is removed and sent to the laboratory for microscopic examination to establish a diagnosis. Biopsies are commonly used to diagnose malignant growths. The three types of biopsies are excisional (complete removal of the lesion), incisional (partial removal of the lesion), and punch (partial removal with a special operating instrument that makes a hole in the skin).
darkfield microscopy	Fluid or tissue is obtained from a lesion and placed on a slide. Light is directed obliquely through the slide so that atypical cells will appear bright against a dark background.
frozen section	A tissue specimen is frozen, and then a thin slice is removed for microscopic examination. This procedure allows for rapid diagnosis.
Gram stain	A specific chemical agent is used to stain a slide. After staining, the slide may be examined microscopically to visualize and differentiate types of bacteria.
immunofluorescence tests	Serum or a biopsy specimen is analyzed under the microscope for the presence of specific antibodies.
patch test	A small piece of gauze or filter paper saturated with a test substance is placed on the skin. If the skin reacts, the test is considered positive. This testing allows a substance to be pinpointed as the cause of contact dermatitis.
Sabouraud culture	A tissue specimen is cultured on a medium conducive to growth of pathogenic fungi.
scrapings and KOH solution (fungal)	Scrapings from affected parts of the skin are placed in potassium hydroxide (KOH) and examined under the microscope to determine the presence of superficial fungal infections.
scrapings for parasites	Skin is scraped and placed on a slide with special alcohol or oil. The scraping is examined under a microscope for the presence of a parasite, its eggs, or its excrement.
Tzanck test	Fluid is removed from a vesicle, stained, and examined microscopically for atypical cells to determine if herpes simplex, herpes zoster, or pemphigus vulgaris is present.
viral culture	Fluid is obtained from a lesion and placed in a special substance in order to microscopically observe any viral growth.

THERAPEUTIC PROCEDURES

Procedure	Description
allografting	Transplanting a graft (tissue or organ) obtained from one individual of a species to another individual of the same species.
autografting	Transplanting a graft obtained from one area of the body to another area of the same individual.
chemotherapy	Treating a neoplasm by using drugs in an attempt to eradicate it or reduce its size.
cryosurgery	Using liquid nitrogen or carbon dioxide to achieve freezing temperatures that destroy tissue.
curettage	Scraping an area to remove abnormal tissue or new growths.
debridement	Excising dead tissue from a wound and/or removing any foreign matter.
dermabrasion	Using special sandpaper, wire brushes, or other abrasive materials to remove fine wrinkles, acne scars, tattoos, etc.
electrodesiccation	Using electric current to destroy tissue or close blood vessels in the skin or mucous membranes.
excision	Surgically cutting out all or part of a structure. Tumors are frequently excised.
fulguration	Destroying tissue by using high-frequency electric sparks.
grafting	Transplanting tissue to replace tissue that has been damaged or destroyed due to disease or injury.
incision and drainage (I&D)	Cutting open a lesion and draining its contents.
laser surgery	Using high-energy light beams to remove birthmarks, scars, wrinkles, etc.
Mohs surgery	Microscopically controlled excising in which superficial cancers are removed following rapid killing of the tissue by chemicals.
radiotherapy	Using radiation to treat a disease. In the case of a neoplasm, radiotherapy may be used in an attempt to eradicate it or reduce its size.
skin grafting	Transplanting skin from one area of a patient's or donor's body to a denuded or traumatized area on the patient.
xenografting	Transplanting a graft obtained from an animal of one species to an animal of a different species.

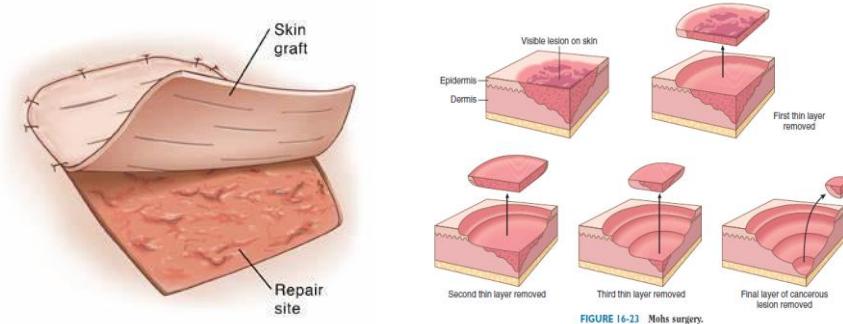


FIGURE 16-23 Mohs surgery.

MOHS SURGERY

- Mohs surgery is a precise surgical technique used to treat skin cancer. During Mohs surgery, thin layers of cancer-containing skin are progressively removed and examined until only cancer-free tissue remains.
- During the surgery, after each removal of tissue and while the patient waits, the tissue is examined for cancer cells. That examination dictates the decision for additional tissue removal. Mohs surgery is the gold standard method for obtaining complete margin control during removal of a skin cancer (complete circumferential peripheral and deep margin assessment - [CCPDMA](#)) using [frozen section histology](#).
- Mohs surgery is also known as Mohs micrographic surgery.

MEDICAL TERMS:

Form	Meaning
adip/o	fat (see also lip/o)
albin/o	white
angi/o	blood or lymph vessels
cutane/o	skin (see also derm/o and dermat/o)
derm/o	skin (see also cutane/o and dermat/o)
dermat/o	skin (see also cutane/o and derm/o)
hemangi/o	blood vessel (see also angi/o)
hydr/o	water; watery
kerat/o	hard; horny tissue
lip/o	lipid; fat (see also adip/o)
melan/o	black
myc/o	fungus
onych/o	fingernail; toenail
phor/o	carrying; a carrier
scler/o	hardening
seb/o	sebum (see also sebace/o)
sebace/o	sebum (see also seb/o)
squam/o	scalelike
sudo/r	sweat; perspiration
xer/o	dry

ABBREVIATIONS:

Abbreviation	Meaning
Bx	biopsy
derm	dermatology
FS	frozen section
HSV-1	herpes simplex virus type 1
HSV-2	herpes simplex virus type 2
I&D	incision and drainage irrigation and debridement irrigation and drainage
KOH	potassium hydroxide
SLE	systemic lupus erythematosus
SQ, subcu	subcutaneous
ung	ointment
UV	ultraviolet

Musculoskeletal system

General terms:

- Orthopedics
- Orthopedists
- Podiatry
- Podiatrist
- Rheumatology
- Rheumatologist
- Chiropractic
- Chiropractor
- Orthopedics is the medical study of the structure of the musculoskeletal system and diseases, deformities, and injuries associated with it- dealing with the correction of deformities of bones or muscles.
- Physicians who specialize in orthopedics are called orthopedists.
- A related specialty, podiatry, is concerned with the structure of the foot and associated conditions and injuries
- A physician who specializes in conditions and injuries of the foot is called a podiatrist.
- Rheumatology is concerned with diseases and conditions of the joints.
- A physician who specializes in rheumatology is called a rheumatologist.
- Chiropractic is a system of healing based on the relationship between bone structure and the function of the nervous system. Chiropractic medicine considers that disease is related to pressure on nerves by spinal misalignment
- A chiropractor is a physician who practices chiropractic. A chiropractor does not perform surgery or prescribe drugs
- Physiatrists are medical doctors whose focus is on rehabilitation after injury or illness to muscles, bones, and nerves.
- A physical therapist is a master's or doctoral degree-prepared health care professional who develops a treatment plan based on a physician's diagnosis. The goals of physical therapy (pt) are to restore function, improve mobility, and relieve pain.

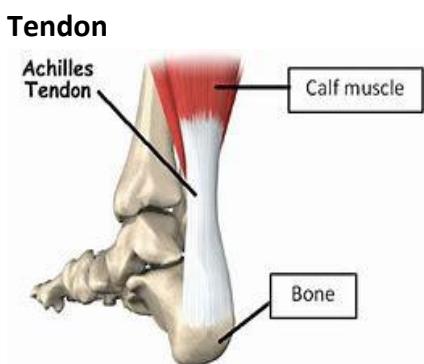
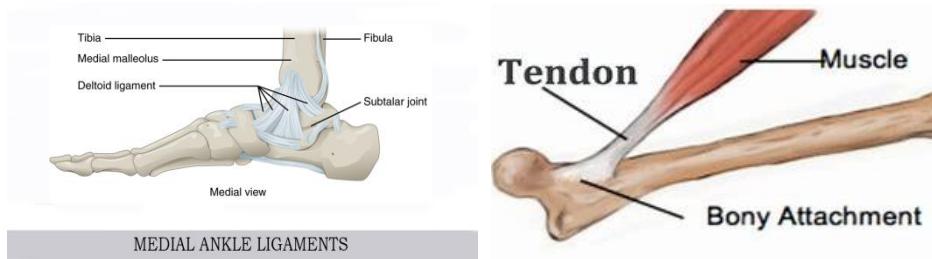
The structure and functions of the musculoskeletal system

- 206 bones
- Provide support for body tissues and serve as a place of attachment for muscles, which allow body movement
- The skeleton also provides protection for internal organs such as the brain, heart, and lungs.
- Skeleton can be divided into two parts

- Axial skeleton
 - Appendicular skeleton
- The axial skeleton consists of the bones of the skull, thorax, and vertebral column. These bones outline body cavities and protect the organs they contain.
 - The appendicular skeleton consists of those bones that are appendages of the axial skeleton, including the bones of the hips, arms, and legs
- Connective tissue**
- The protective and supportive structures of the body consist of connective tissue, including bone, cartilage, tendons, and ligaments.
 - Bone is comprised of fibrous and ground substances and, by weight, is about 75% inorganic and 25% organic material. The inorganic portion contains calcium phosphate along with other substances including carbonate, citrate sodium, and magnesium.
 - Bone also serve as a storehouse for minerals.

Type of connective tissues	Purpose
Bone	<p>Provides support and protection to the rest of the body. Stores minerals.</p> <p>Houses marrow that produces blood cells by way of a process called hemopoiesis.</p>
Cartilage	<p>Provides a firm yet flexible framework for structures such as the external</p> <p>Ears and the lower two thirds of the nose. Provides a lining and cushion for certain joints. Connects certain bones.</p>
Ligament	Attaches bone to bone.
Muscle	Allows for body movement.
Tendon	Attaches muscle to bone.

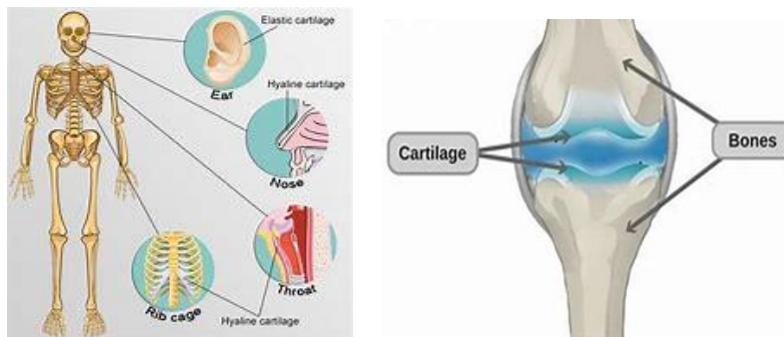
Eg., of ligament

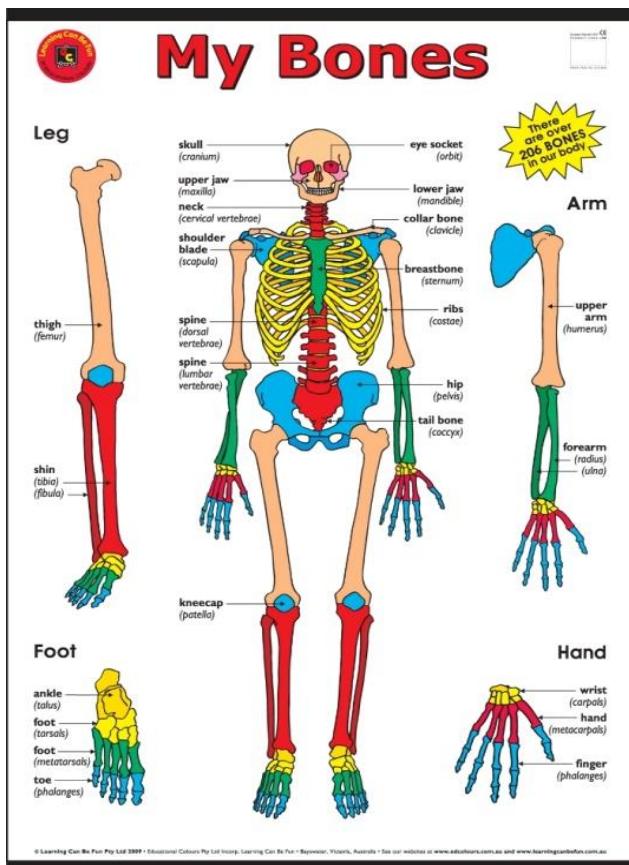


Tendons and ligaments are comprised of fibrous bands of extremely strong connective tissue.

Cartilage

- A second type of connective tissue is cartilage, which is more flexible than bone but still fairly rigid. It provides firm but flexible support for structures such as the external ears, nose, and trachea
- Where bones come together to create joints, the bone is covered with cartilage to cushion the bones from jarring and to provide a smooth surface for joint movement
- Bones, cartilage, ligaments, and tendons all contain collagen, an extremely strong protein. The large amount of collagen in ligaments and tendons is what makes these structures tough and rope like





Bones

There are major types of bones:

- **Long bones**
- **Short bones**
- **Flat bones**
- **Irregular bones**
- **Sesmoid bones**
- Long bones are found in the thigh, lower leg, and upper and lower arm.
- Short bones are found in the wrist ,ankle, toes.
- Flat bones are found covering soft body parts. These bones are the skull, shoulder blades, ribs, and pelvic bones.
- Irregular bones, is a mixture of various complex-shaped bones. These bones tend to be small and include the bones of the middle ear (malleus, incus, and stapes) and the vertebrae.
- Sesamoid bones are small, rounded bones (resembling a sesame seed in shape). They are found near joints, and they increase the efficiency of muscles near a particular joint. The kneecap is the largest example of a sesamoid bone.

Types of bones

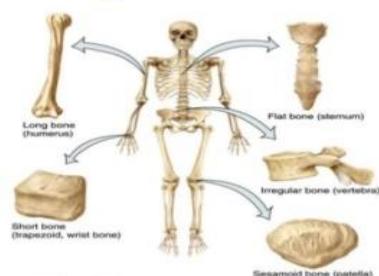
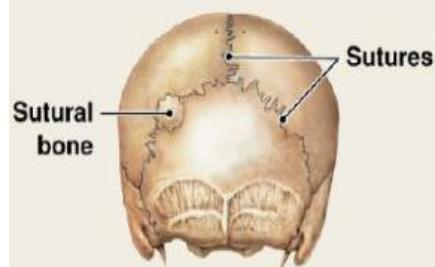


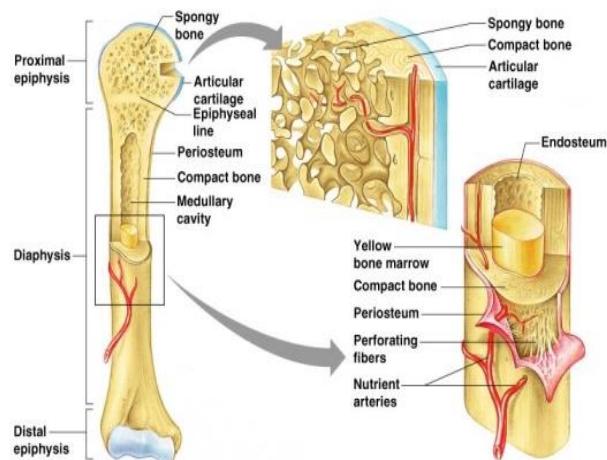
Figure 10.21 Types of bones. © 2014 John Wiley and Sons, Inc. All rights reserved.

Sutural Bones



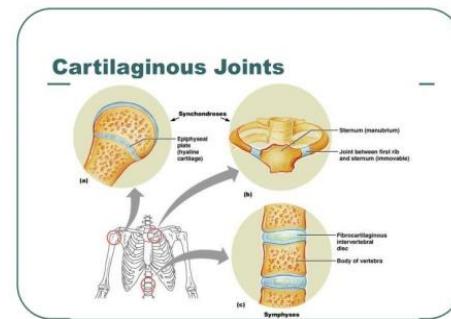
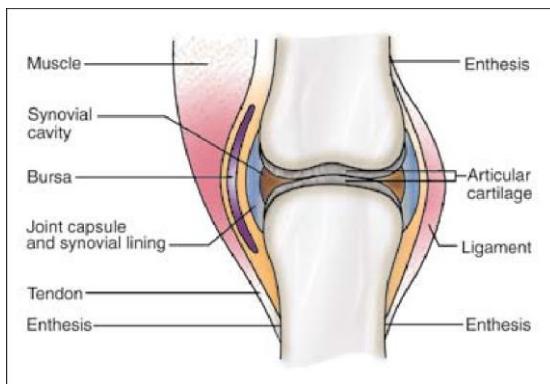
Structure of a long bone

- The long central shaft is called the diaphysis and is comprised of strong, dense compact bone (cortical bone) designed to provide support for the body.
- At each end is an epiphysis, which has a bulbous shape to allow for attachment of muscles and ligaments.
- Epiphyses are comprised of cancellous (spongy) bone
- A layer of articular cartilage covers each epiphysis, providing a cushion to protect joints from being jarred.
- Those parts of the bone that are not covered by the articular cartilage are covered by the periosteum, a dense layer of connective tissue that contains nerves, blood vessels, and lymph vessels.
- At the center of all bones is a cavity filled with a gritty gelatinous substance called marrow.
- In the diaphyses of long bones, this area is called the medullary cavity.
- The surface of the medullary cavity is lined with a thin layer of connective tissue called the endosteum.



Bone marrow

- There are two types of marrow:
- Yellow marrow, which is composed mostly of fat; and
- Red marrow, which is where blood cells are produced by a process called hemopoiesis. Most hematopoiesis takes place in the diaphyses of long bones
- Spaces in cancellous bone contain red bone marrow.
- Both the periosteum and endosteum contain osteoblasts, special bone-forming cells. These cells cause bones to grow and repair themselves.
- a long bone that is still growing has a growth plate, or epiphyseal plate, between each epiphysis and the diaphysis.
- This plate is comprised of cartilage. When bone growth is complete, the cartilage is replaced with bone.
- Short bones are about as wide as they are long, and their core is comprised of cancellous bone (spongy) that is surrounded by a layer of compact tissue.



Joints

- Joints, or articulations, occur at the union of two bones.
- Joints are divided into three categories (structural)
- **synovial joints**
- **cartilaginous joints**
- **fibrous joints**
 - Synovial joints : move freely because the bones are held together loosely and are separated by a synovial cavity.
 - This cavity is filled with synovial fluid that lubricates joint movement and acts as a cushion between the bones.
 - To facilitate smooth movement, synovial fluid-filled sacs called bursae

Synovial cavity & bursa

- What are the different types of synovial joint?
- Synovial joints are further classified into six different categories based on the shape and structure:
 - planar joints (gliding)**
 - hinge joints**

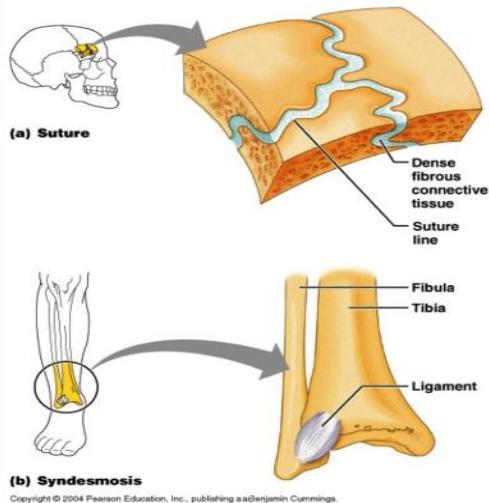
pivot joints

condyloid joints

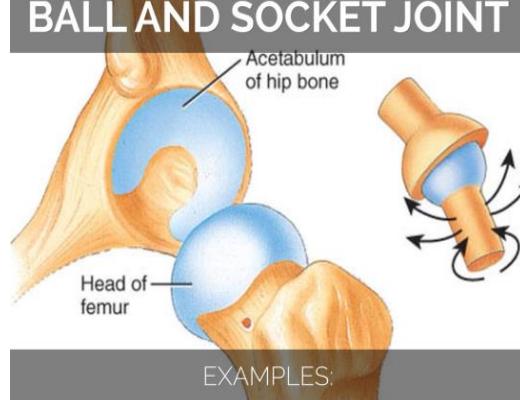
saddle joints

ball-and-socket joints

- **Cartilaginous joints allow slight movement.**
- the bones that form these joints are held together quite firmly by cartilage and ligaments.
- An example of this joint occurs between vertebrae, which are separated by a segment of cartilage called the intervertebral disk.
- This disk serves as a cushion to protect the vertebrae from jarring.
- Fibrous joints are seen between the bones of the skull. Because these bones are joined by layers of fibrous tissue or cartilage, there is little movement between them.



BALL AND SOCKET JOINT



EXAMPLES:

Functional classification of joints

- Functional classification of joints is based on the type and degree of movement permitted.
- There are six types of freely movable joint and are mentioned below with the examples:

Ball and socket joints

- Here, one bone is hooked into the hollow space of another bone. This type of joint helps in rotatory movement. An example ball and socket joint are the shoulders.

Pivotal joints

- In this type of joint, one bone has tapped into the other in such a way that full rotation is not possible.
- This joint aid in sideways and back-forth movement.
- An example of a pivotal joint in the neck.

Hinge joints

- Hinge joints are like door hinges, where only back and forth movement is possible.
- Example of hinge joints is the ankle, elbows, and knee joints.

Condyloid joints

- Condyloid joints are the joints with two axes which permit up-down and side-to-side motions.
- The condyloid joints can be found at the base of the index finger, carpals of the wrist, elbow and the wrist joints.
- This joint is also known as a condylar, or ellipsoid joint.

Saddle joints

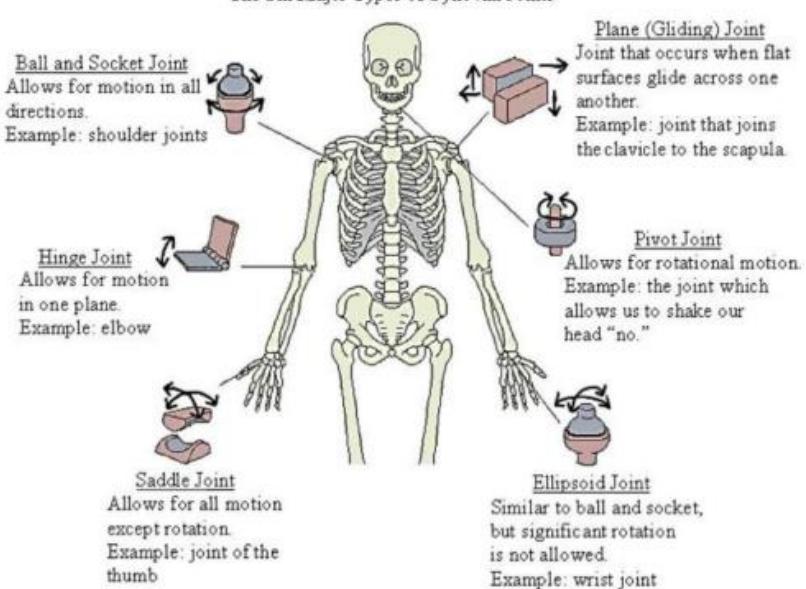
- Saddle joint is the biaxial joint that allows the movement on two planes—flexion/extension and abduction/adduction.
- For example, the thumb is the only bone in the human body having a saddle joint.

Gliding joints

- Gliding joints are a common type of synovial joint.
- It is also known as a plane or planar joint.
- this joint permit two or more round or flat bones to move freely together without any rubbing or crushing of bones.
- This joint is mainly found in those regions where the two bones meet and glide on one another in any of the directions.
- The lower leg to the ankle joint and the forearm to wrist joint are the two main examples of gliding joints.

FIGURE 4.8
The Six Major Types of Synovial Joints

Illus. by Megan Whitaker



Cranium

- The cranium, or skull, protects the brain and related structures.
- The major cranial bones are held together with joints called sutures.
- These bones are not completely joined in a newborn, creating “soft-spots” or fontanelles. As the child matures, fontanelles become smaller and eventually close completely.
- Temporal bone and mandible come together at the temporomandibular joint. This joint receives considerable use when talking and chewing.
- Cranium and face are the two main parts of the skull. The cranium is composed of 8 bones while the face is made up of 14 bones.

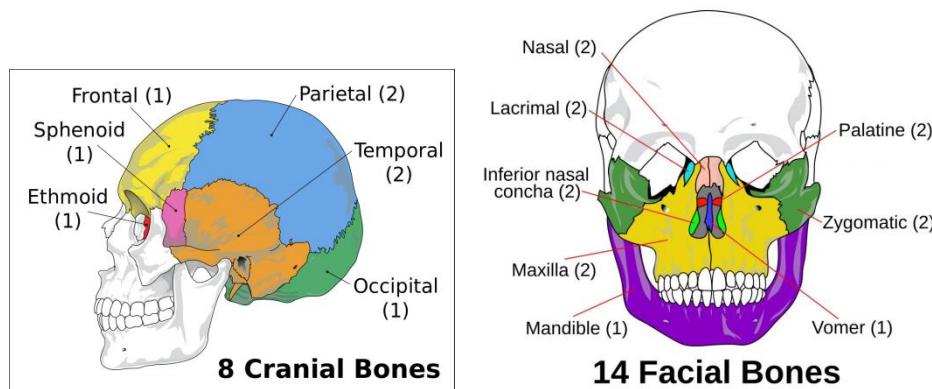


TABLE 15-2 | CRANIAL AND FACIAL BONES

CRANIAL BONES	LOCATION
Ethmoid bone	Supports nasal cavity and eye sockets
Frontal bone	Forehead; part of eye sockets
Occipital bone	Back and base of skull
Parietal bones	Top and sides of skull
Sphenoid bone	Base of skull and behind eyes (bat-shaped bone)
Temporal bones	Lower sides and back of skull
FACIAL BONES	LOCATION
Lacrimal bones	Corners of each eye
Mandible	Lower jawbone
Maxillae	Upper jawbones
Nasal bones	Bridge and septum of nose
Vomer	Nasal septum (thin, flat bone)
Zygomatic bones	Cheek bones

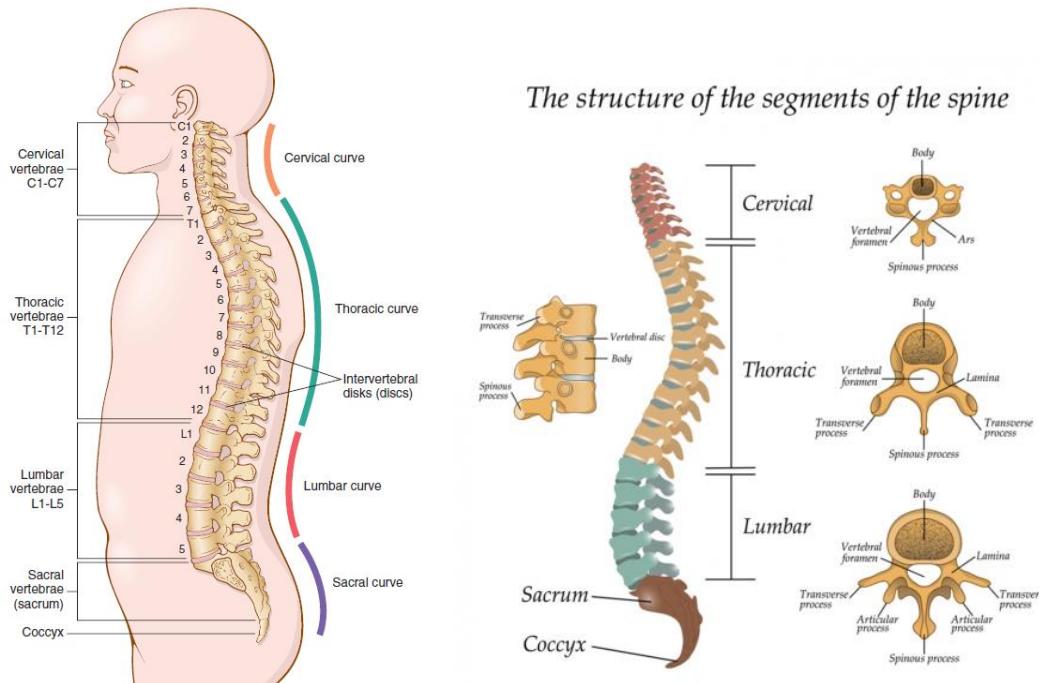
The vertebral column

- The vertebral column (also called the spine or backbone) is a flexible column of 33 small bones called vertebrae.
- In addition to providing support and movement for the trunk and head, the vertebral column protects the spinal cord, which carries nerve impulses between the brain and the rest of the body
- Each vertebra has two components: an anterior solid portion called the body and a posterior segment called the arch.

- The vertebral bodies stack a top one another with intervertebral disks between them to create the column that supports the trunk and cranium.
- The arches create a hollow passage behind the vertebral bodies for the spinal cord to pass through.
- The vertebrae are separated by intervertebral disks comprised of dense connective tissue.

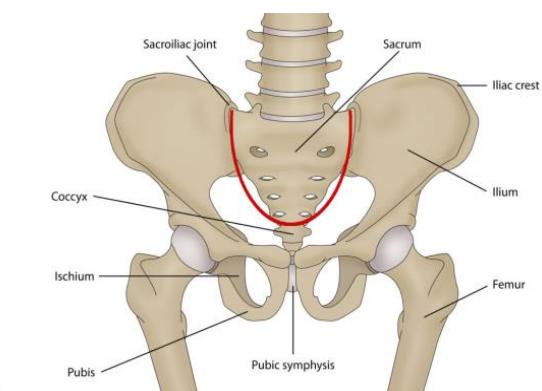
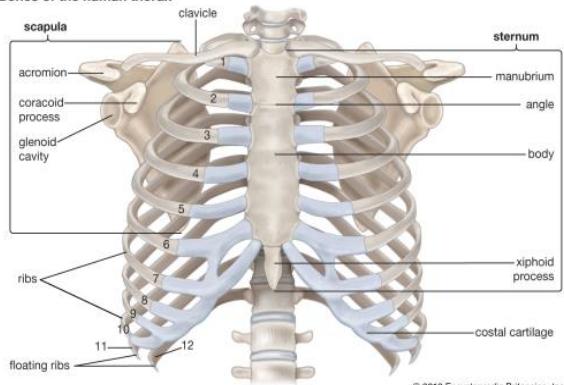
Thorax

- The heart and lungs are protected by the thorax, which is comprised of the sternum (breastbone), the ribs, and the thoracic vertebrae.
- There are 12 pairs of ribs. Each pair is attached to one of the thoracic vertebrae.
- The first seven pairs are called the true ribs. Each of the true ribs is attached to the sternum by a piece of costal cartilage.
- The next five pairs, known as the false ribs, do not attach directly to the sternum and lie inferior to the true ribs.
- The first three pairs of false ribs attach indirectly to the sternum via a band of costal cartilage that fuses into the costal cartilage of the last true rib.
- Below these three pairs lie the last two pairs of false ribs known as floating ribs.
- The floating ribs are attached to the thoracic vertebrae posteriorly but have no costal cartilage and are not attached to the sternum in any way.



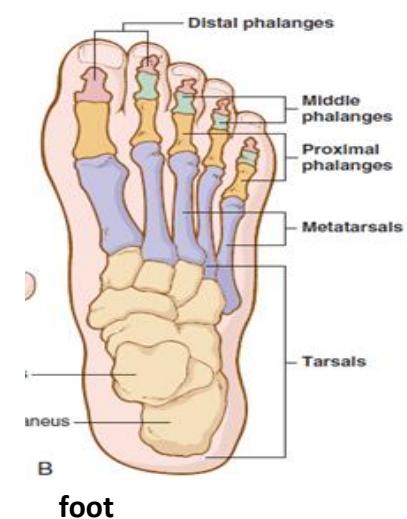
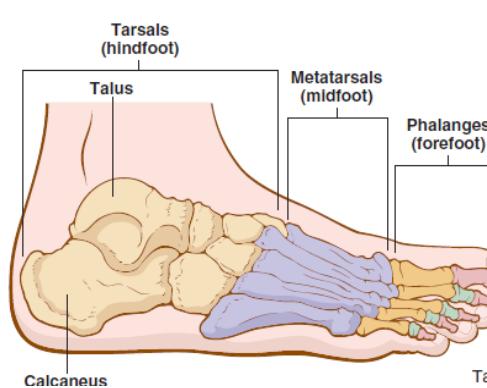
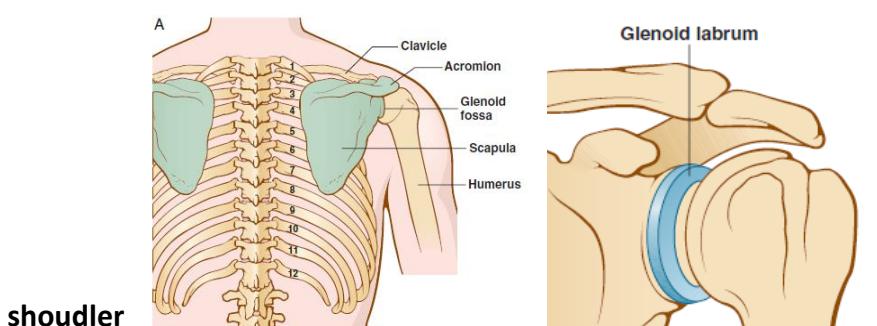
Ribs

Bones of the human thorax



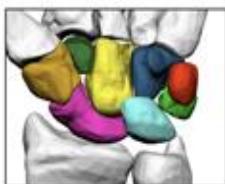
Pelvis

- The pelvic bone, also known as the innominate bone, is a composite of the ilium, ischium, and pubis bones.
- The pelvic bone provides a place of attachment for the thigh bones and serves as a base of support for the spine.
- It also supports the organs of the abdominopelvic cavity, including the urinary bladder, sigmoid colon, rectum, and female reproductive organs.
- The pelvic bones of males and females have significant differences.
- The female pelvis is shallower and wider. This provides support as the uterus grows during pregnancy. It also provides a wider opening for the infant to pass through during childbirth.



Carpal Bones

- Scaphoid
- Lunate
- Triquetrum
- Pisiform
- Trapezium
- Trapezoid
- Capitate
- Hamate



Tarsals

Dorsal view (top of foot); Rt. foot

- 1 = Calcaneus (heel bone)
 2 = Talus (ankle bone)
 3 = Navicular
 4 = Medial Cuneiform
 5 = Intermediate Cuneiform
 6 = Lateral Cuneiform
 7 = Cuboid



Tarsal Bones Inferior view

- Calcaneus
- Talus bone
- Cuboid bone
- Navicular bone
- Cuneiform bones



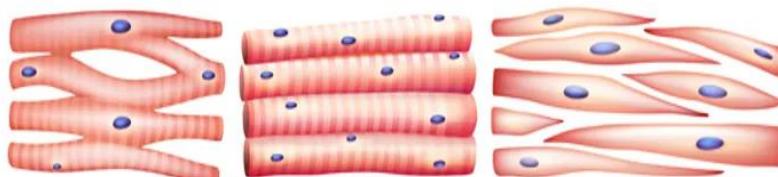
Bone or Process	Common Name	Bone or Process	Common Name
Acetabulum	Hip socket	Metacarpals	Hand bones
Calcaneus	Heel	Metatarsals	Midfoot bones
Carpals	Wrist bones	Olecranon	Elbow
Clavicle	Collar bone	Patella	Kneecap
Coccyx	Tailbone	Phalanges	Finger and toe bones
Cranium	Skull	Pubis	Anterior part of the pelvic bone
Femur	Thigh bone	Radius	Forearm bone—thumb side
Fibula	Smaller of the two lower leg bones	Scapula	Shoulder blade
Humerus	Upper arm bone	Sternum	Breastbone
Ilium	Upper part of pelvic bone	Tarsals	Hindfoot bones
Ischium	Inferior or lower part of the pelvic bone	Tibia	Shin bone—larger of the two lower leg bones
Malleolus	Ankle	Ulna	Forearm bone—little finger side
Mandible	Lower jawbone	Vertebra	Backbone/spine
Maxilla	Upper jawbone		

Muscles

- Muscles are highly specialized tissues that can contract, or become shorter. This contraction is what allows for body movement.
- Two types of movement: voluntary and involuntary.
- Voluntary movement is movement controlled by conscious thought, such as moving an arm or leg.
- Involuntary movement is not ordinarily under conscious control. Examples of involuntary movement are the contractions of heart muscle or the contractions of smooth muscle in the digestive tract.
- Striated muscle makes up the voluntary or skeletal muscles that move all bones, as well as controlling facial expression and eye movements.
- Smooth muscle makes up the involuntary or visceral muscles that move internal organs such as the digestive tract, blood vessels, and secretory ducts leading from glands.

- These muscles are controlled by the autonomic nervous system
- Cardiac muscle is striated in appearance but is like smooth muscle in its action. Its movement cannot be consciously controlled

Types of Muscle



Cardiac muscle

Skeletal muscle

Smooth muscle

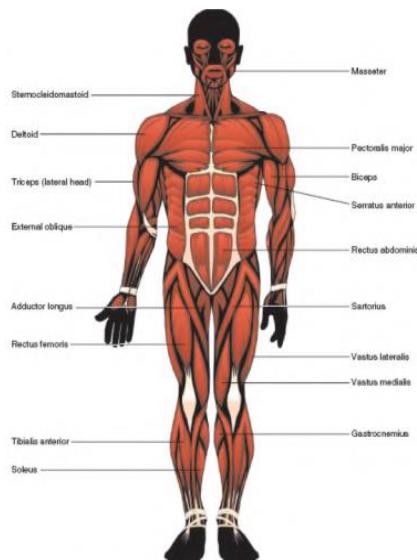


Figure 17-6 Major Muscles (Anterior View)

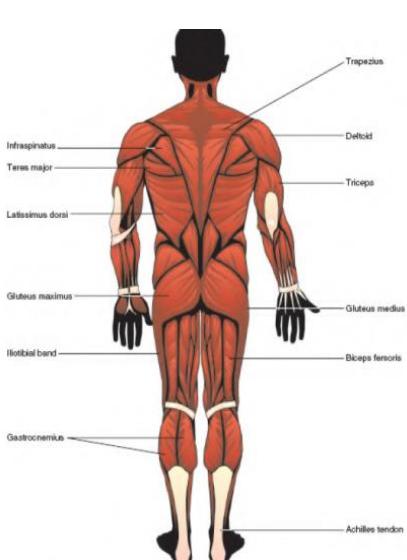


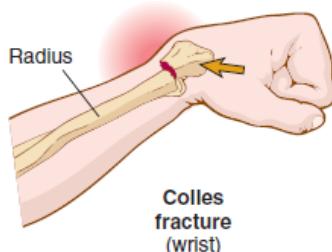
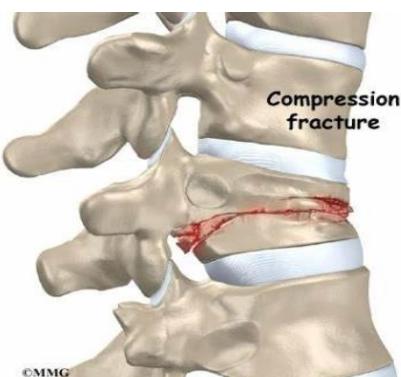
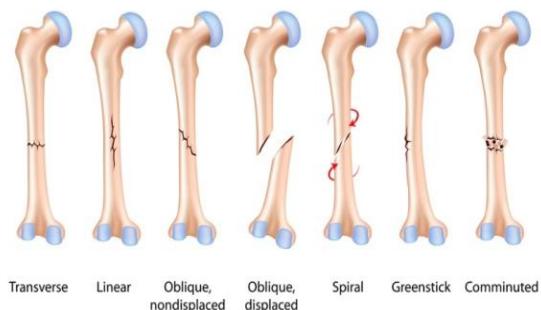
Figure 17-6 (cont.) Major Muscles (Posterior View)

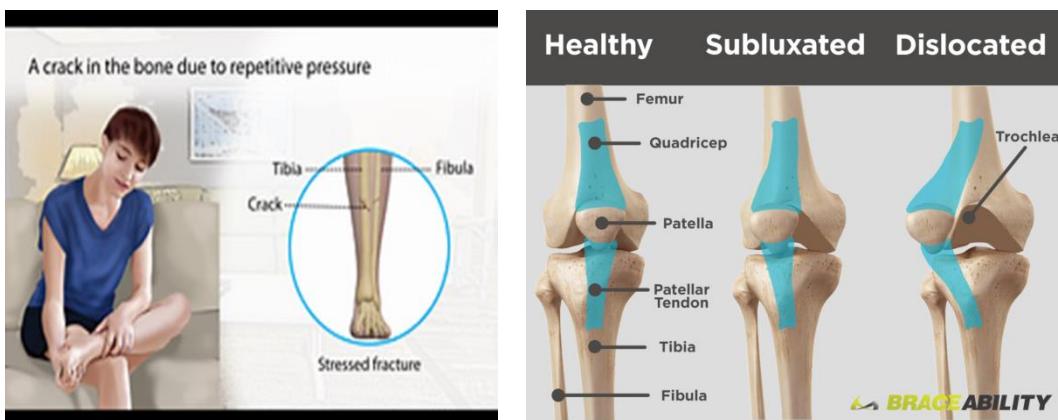
Fractures

- The term fracture is generally used to mean the breaking of bone or cartilage and can have a number of causes such as trauma or osteoporosis.
- Fractures can be classified in many different ways.
- A compound (or open) fracture occurs when fractured bone perforates the skin resulting in a visible wound.
- In a closed (or simple) fracture, the skin has not been broken.
- Another way of describing fractures is by their location on the bone itself:
- Proximal toward the trunk
- Distal away from the trunk
- Midshaft near the middle of the diaphysis (shaft)
- Fractures are also identified by type and direction of the fracture line.
- Fractures of the spine are usually identified by the vertebrae involved.

Term	Description
Comminuted	Fracture involves three or more fragments.
Compound	Fracture perforates the skin.
Compressed	Bone is crushed. Commonly used in reference to vertebrae.
Depressed	Bone is pushed or displaced inward. Commonly used in reference to the skull
Dislocation	Disarrangement of the normal placement of bones at a joint. Is not a fracture
Greenstick	Bone is bent with an incomplete fracture occurring on the convex side of the bone
Hairline	Fine fracture is present, but bone is in perfect alignment.
Impacted	One bone fragment is driven into another bone fragment.
Longitudinal	Fracture is parallel with the long axis of the bone.
Oblique	Fracture occurs at a diagonal to the long axis of the bone.
Pathological	Fracture is caused by a disease process.
Segmental	Two fractures occur in the same bone.
Simple (closed)	Fracture does not break the skin.
Spiral	Fracture spirals like a helix up and around the bone.
Stress fracture	Small break in a bone caused by repeated or prolonged use rather than one-
Transverse	Break is across the bone at a right angle to the long axis.
Colles	Near the wrist at distal end of radius

Types of Bone Fractures

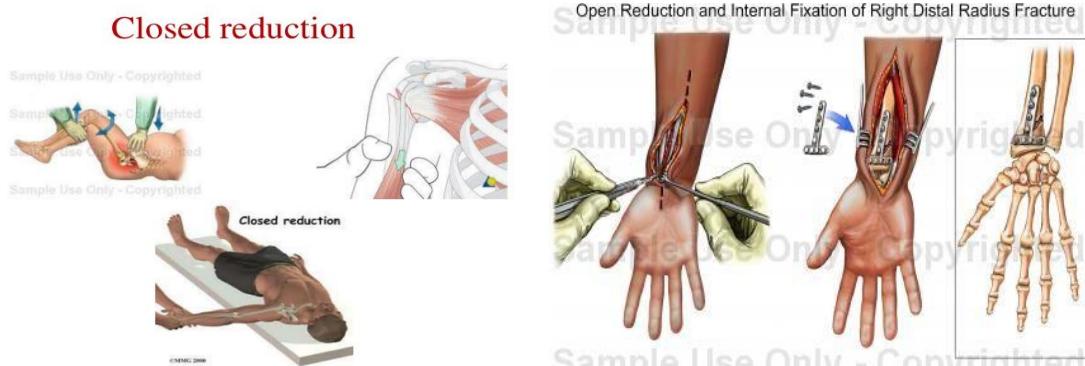




- The Le Fort classification is frequently used to describe fractures of the facial bones.
- Fractures of the epiphyseal plate are described using the Salter-Harris classification of epiphyseal plate injuries

Treatment of fractures

- Treatment of fractures involves reduction, which is restoration of the bone to its normal position.
- A closed reduction is manipulative reduction without a surgical incision;
- In an open reduction, an incision is made for access to the fracture site.
- A cast (solid mold of the body part) is applied to fractures to immobilize the injured bone after a closed reduction.
- The abbreviation ORIF means open reduction/internal fixation. Often this involves insertion of metal plates, screws, rods, or pins to stabilize the bone.



cast



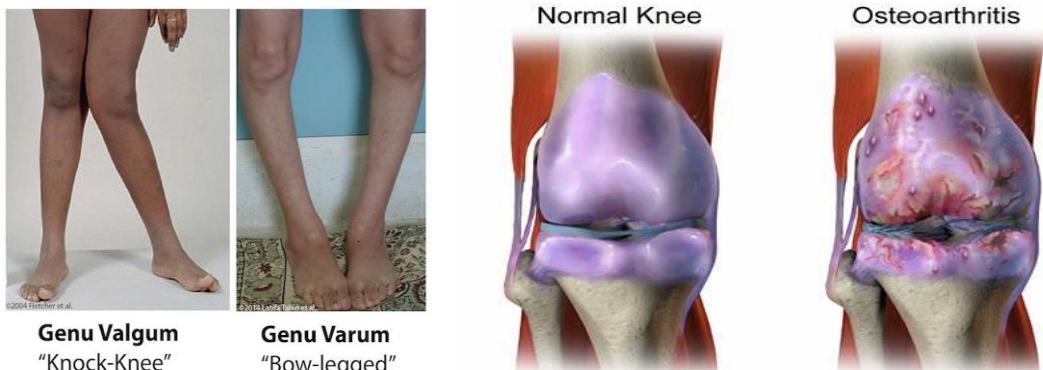
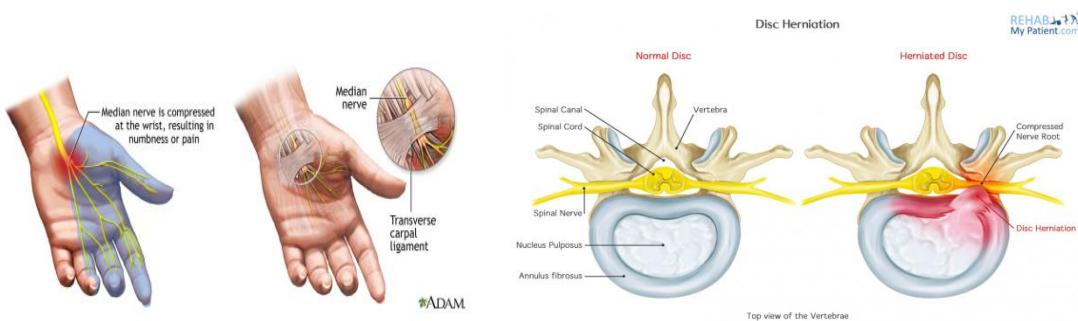
Pathology

Condition or Disease	Description
Achilles tendonitis	Inflammation of the achilles tendon.
Ankylosing Spondylitis	Chronic systemic arthritis involving inflammation and stiffening of the axial skeleton and the large peripheral joints.
Ankylosis	Stiffening or fixation of a joint.
Arthralgia	Pain in a joint. Also called <i>arthrodynia</i> .
Arthritis	A variety of conditions involving inflammation of the joints.
Arthropathy	Any disease that affects a joint.
Articular disease	Any disease involving the joints. These conditions include arthritis, Rheumatoid arthritis, osteoarthritis, gout, and bursitis.
Avascular necrosis	Death of bone tissue caused by inadequate blood supply. Can be caused by several conditions such as trauma, fracture, osteoarthritis, and systemic lupus erythematosus. Can be idiopathic. Also called <i>osteonecrosis</i> .
Bunion	A type of bursitis that affects the joint at the base of the great toe.
Bursitis	An acute or chronic inflammation of the bursa. Occurs most commonly in the shoulders and elbows, but can occur in any bursa.
Carpal tunnel Syndrome (cts)	Compression of the median nerve as it passes through the tunnel in the wrist containing the median nerve and blood vessels. It is frequently caused by repeated flexion and extension of the wrist. Can lead to pain, tingling, and numbness
Claudication Limping.	Usually intermittent.
Discoid lupus Erythematosus (dle)	A chronic disorder of unknown etiology that primarily affects the skin. Characterized by macules, plaques, and scales that appear on the skin.
Ewing tumor	A malignant bone tumor that occurs most commonly in individuals between 10 and 20 years of age. Occurs most often in long bones in the extremities. Tends to involve extensive portions of a bone. Also called ewing sarcoma.

Fibromyalgia	A group of disorders characterized by aching, tenderness, and stiffness of Muscles, tendons, and adjacent soft tissues.
Fracture	Any break in bone or cartilage.
Ganglion	A fluid-filled cyst most commonly attached to a tendon sheath in the wrist, hand, or foot.
Genu valgum (pl. Genuvalgus)	A deformity of the lower extremity characterized by lateral angulation of the leg in relation to the thigh. Also called knock-knee or knocked-kneed.
Genu varum (pl. Genuvarus)	A deformity of the lower extremity characterized by medial angulation of the leg in relation to the thigh. Also called bowleg or bowlegged.
Gout	A metabolic disorder characterized by abnormally high level of uric acid in the blood. Leads to recurrent bouts of acute or chronic arthritis, resulting from deposits of sodium urate crystals in articular cartilage and various connective tissues.
Herniated Intervertebral disk	A rupture in which all or part of the gelatinous central portion of a disk is forced through a weakened outer portion of the disk. It can cause severe back pain. Also called herniated nucleus pulposus.
Infectious arthritis	Inflammation of one or more joints caused by bacterial, fungal, or viral infection.
Kyphosis	An abnormal, exaggerated posterior curvature of the thoracic spine that may result in severe body flexion (forward leaning). Commonly called hunchback or humpback.
Lordosis	An abnormal, exaggerated anterior curvature of the lumbar spine that may result in severe body extension (leaning backward). Commonly called swayback or saddle back.
Lyme disease	A recurrent inflammatory disorder caused by bacteria transmitted by a tick. Characterized by fever, headaches, stiff neck, severe arthritis and cardiac and/or neurologic symptoms.
Metatarsalgia	Pain of the metatarsals in the front part or over the ball of the foot.
Multiple myeloma	Malignant bone tumor involving plasma-producing (hemopoietic) cells in bone marrow. Usually occurs in multiple sites. Overgrowth of the plasma cells disrupts production of other blood components, resulting in anemia, hemorrhage, and recurrent infections. May also cause pain and necrosis (death) of the bone. Also called myeloma or myelomatosis.

Osteoarthritis (OA)	A degenerative condition characterized by erosion of articular cartilage and hypertrophy of bone. Can be caused by acute trauma or chronic use of a joint. Commonly affects weight-bearing joints like the hip or knee. Also called degenerative joint disease and osteoarthritis.
Osteochondroma	A common benign bone tumor. Tends to occur near the ends of long bones. Occurs most commonly in individuals between 10 and 20 years of age.

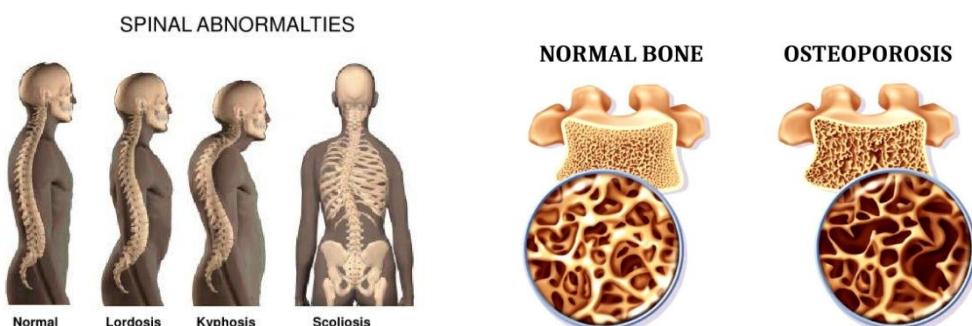
Carpal tunnel syndrome



Osteomyelitis	Inflammation and destruction of bone and bone marrow, caused by bacterial or fungal infections.
Osteoporosis	A generalized progressive loss of bone density. Leads to poor bone structure and skeletal weakness.
Osteosarcoma	A malignant bone tumor. Found most commonly in the knee, but can occur in any bone. Also called <i>osteogenic sarcoma</i> .

Paget disease of Bone	A chronic adult disorder in which hyperactive bone resorption results in thickened and softened areas of localized bone. Also called <i>osteitis deformans</i> .
Polychondritis	Episodic inflammatory condition that destroys cartilage and other connective tissues in a variety of locations including the ears, joints, nose, and heart valves. Association with rheumatoid arthritis and systemic lupus erythematosus suggests an autoimmune mechanism.
Polymyalgia Rheumatica	Muscle condition characterized by severe pain and stiffness in proximal muscle groups without muscle weakness or atrophy. Accompanied by elevated esr.
Polymyositis	Systemic connective tissue disease characterized by inflammation and atrophy of the muscles. Leads to symmetrical weakness.
Posterior femoral Muscle strain	Muscle strain causing acute pain in the posterior thigh. Also called <i>Hamstring tear</i> .
Rheumatoid arthritis (RA)	Chronic condition characterized by inflammation of the peripheral joints, potentially leading to destruction of the joints. The inflammation is nonspecific and usually symmetrical.
Rickets	Childhood disease caused by vitamin d deficiency and lack of exposure to sunlight. Results in softening and bending of bones with associated skeletal deformities. Also called <i>rachitis</i> .
Scoliosis	Abnormal lateral curvature of the spine. Can be idiopathic or hereditary. May be a result of muscle and/or bone deformity or chronic unequal muscle contraction.
Shin splint	Tenderness and pain in the anterior muscles of the lower leg. Frequently caused by muscle damage incurred during sports activities involving running.
Sjogren syndrome (SS)	Chronic, systemic inflammatory disorder associated with rheumatoid arthritis and characterized by dryness of the mucous membranes. May have an autoimmune or genetic etiology.
Spondylitis	Inflammation of one or more vertebrae. Sprain injury to a ligament that occurs when a joint is moved outside its normal range of motion but not far enough to cause dislocation or fracture.

Spur	Abnormal bone formation at the edges of joints. Characteristic of Conditions such as osteoarthritis.
Strain	Injury to connective tissue, usually muscle, caused by overuse or Improper use.
Swelling around Joints	Enlargement around a joint caused by excess accumulation of fluid.
Systemic lupus Erythematosus (SLE)	Chronic inflammatory disease of connective tissue. May affect the joints, kidneys, blood vessel walls, and skin. Cause is unknown, but may have an autoimmune mechanism.
Talipes	Any deformity of the foot that involves the talus, the bone that articulates with the tibia and fibula to create the ankle joint. Also called <i>club foot</i> .
Tendonitis	Inflammation of a tendon. Also called <i>tendinitis</i> .



OSTEOPOROSIS vs OSTEOMALACIA

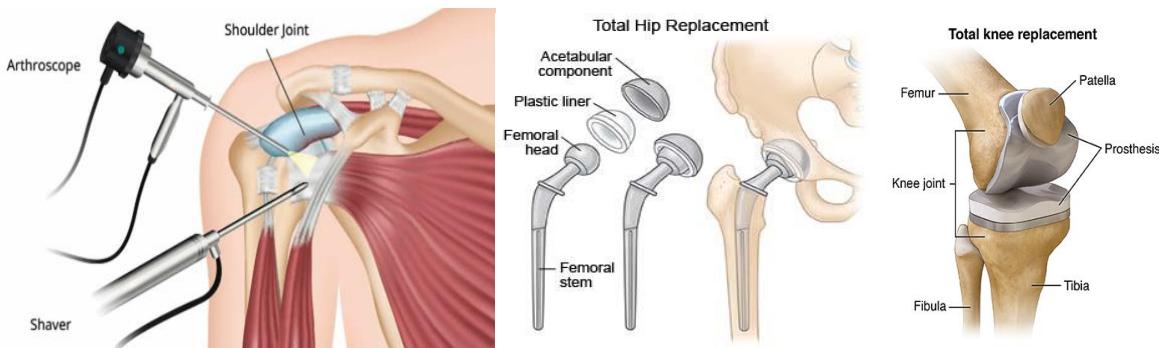
- Bone mass reduced, mineralization normal elderly
- Idiopathic, Endocrine abn., inactivity, disuse, alcoholism, calcium deficiency
- Bone mass variable, mineralization decreases
- Vitamin D or its metab. deficiency, hypophosphatasia syndromes, renal tubular acidosis



Diagnostic tests and procedures:

Test	Description
Alkaline phosphatase (ALP) test	The level of alkaline phosphatase in serum is measured. Elevated
Antinuclear antibody test (ANA)	Blood sample is tested for antinuclear antibodies using an indirect fluorescence antibody (ifa) test. If the ifa test is positive, the ifa pattern is reported and the serum titered. Positive results can be indicative of systemic lupus erythematosus (sle), scleroderma, sjogren syndrome, or raynaud disease.
Arthrography	Radiopaque contrast medium is injected into a joint such as the knee, and x-rays are taken to determine any structural abnormalities.
Arthroscopy	A joint is visually examined by inserting an arthroscope through a small incision. Can be used to differentiate acute or chronic disorders, assess damage, obtain tissue for biopsy, and remove tissue or material that is causing problems. Primarily used to examine the knee.
Bone marrow	A needle is inserted into a bone cavity, and bone marrow is Extracted (aspirated) for microscopic examination. The most common biopsy site is the superior iliac crest of the pelvic bone. This biopsy can be useful in evaluating various malignancies, blood disorders, and infectious diseases.
Biopsy of muscle tissue	Sample of muscle tissue is taken, usually surgically, and examined microscopically.
Blood test	Blood sample is tested for elevated levels of certain types of Proteins and antibodies, which can suggest inflammation or autoimmune processes.
Bone scan	A bone-seeking radioactive tracer is injected into the body. A scanner is used to generate an image of the bones. Abnormal areas typically appear lighter or darker than normal areas. This test is used to detect lesions, fractures, and malignancies. Many disorders can be detected by this procedure but not differentiated.
Calcium test, serum	The level of calcium in serum is measured. Above normal levels may be indicative of certain types of cancers. Below normal levels may indicate depletion of bone mineral content, which can lead to osteoporosis and pathologic fractures.
Creatine kinase (CK)	The level of ck enzyme in serum is measured. Elevated levels may indicate cardiac or skeletal muscle damage.

CT (computed tomography) of a structure in the musculoskeletal system	A computer-generated reconstruction of a specific area is created from a series of x-ray images taken as cross-sectional views of that area. These images (ct scans) are particularly useful in identifying tumors and lesions within bone.
Dual-energy x-ray Absorptiometry (DEXA)	X-ray technique used to determine the density of any bone with minimal radiation. Used to screen for osteoporosis in high-risk individuals. Also called <i>dual x-ray absorptiometry (dxa)</i> .
Electromyography (EMG)	Needle electrodes are inserted into muscle tissue. An oscilloscope records the electrical activity from the muscle. Used to test for muscle disorders and injury. Can be helpful in differentiating between muscle and nerve problems.
Erythrocyte sedimentation Rate (ESR)	The distance (in mm) that red blood cells settle in a test tube after exactly 1 hour is measured. Elevated values are associated with inflammatory conditions (e.g., polymyalgia rheumatica), collagen diseases (e.g., sle), infections, tumors, anemia, and other disorders that alter plasma proteins.
Lactic dehydrogenase (LD)	The level of lactic acid dehydrogenase in serum is measured. Useful in the differential diagnosis of muscular dystrophy.
MRI (magnetic resonance Imaging) of a structure in the musculoskeletal system	Mri uses magnetic energy and radiofrequencies to stimulate body cells to emit radio signals that are converted to images. Because mri shows soft tissue better than hard tissue such as bone, this method is primarily used to identify abnormalities (tumors, lesions, inflammation, injury) of the muscles and other soft tissues.
Radiography of a Musculoskeletal structure	X-rays are taken of a particular body part to identify structural Abnormalities, joint erosion, tumors, fractures, etc.
Rheumatoid factor (RF)	Serum is tested for the presence of the antibodies referred to as rheumatoid factors. These antibodies are present in many individuals with rheumatoid arthritis.
Synovial fluid examination	A needle is used to aspirate synovial fluid from a joint (a Procedure called arthrocentesis). The fluid is viewed with the naked eye for viscosity, color, and clarity. Laboratory examination is performed to determine ph, glucose level, white blood count (wbc), and polymorphonuclear (pmn) leukocyte percentage. Microscopic examination can determine presence of crystals. A culture can be performed to determine presence of bacteria. Various results can indicate noninflammatory, inflammatory, septic, or hemorrhagic disorders.
Uric acid test	Blood sample is examined microscopically to determine the uric acid level. Elevated level is indicative of gout.



Medical terminologies:

Combining forms	Meaning
calc/o, calci/o	calcium
kyph/o	humpback, hunchback (posterior curvature in the thoracic region)
lamin/o	lamina (part of the vertebral arch)
lord/o	curve, swayback (anterior curvature in the lumbar region)
lumb/o	loins, lower back
myel/o	bone marrow
orth/o	straight
oste/o	bone
scoli/o	crooked, bent (lateral curvature)
spondyl/o (used to make words about conditions of the structure)	vertebra
vertebr/o (used to describe the structure itself)	vertebra

suffixes:

suffixes	meaning
-blast	embryonic or immature cell
-clast	to break

-listhesis	slipping
-malacia	softening
-physis	to grow
-porosis	pore, passage
-tome	instrument to cut

Abbreviations:

ABBREVIATION	Meaning
AE	Above the elbow (amputation)
AK	Above the knee (amputation)
ALP	Alkaline phosphatase
ANA	Antinuclear antibody (test)
BE	Below the elbow (amputation)
BK	Below the knee (amputation)
C1 THROUGH C7	Abbreviations for 7 cervical vertebrae
CDH	Congenital dislocation of the hip
CK	Creatine kinase
CTS	Carpal tunnel syndrome
DEXA	Dual-energy x-ray absorptiometry
DJD	Degenerative joint disease
DLE	Discoid lupus erythematosus
DXA	Dual x-ray absorptiometry
EMG	Electromyography

NERVOUS SYSTEM

GENERAL TERMS:

- NEUROLOGY
- NEUROLOGIST
- NEURO SURGEON
- PSYCHIATRY
- PSYCHIATRIST
- DIVISIONS OF NERVOUS SYSTEM
- STRUCTURE AND FUNCTIONS OF NERVOUS SYSTEM
- EXAMINATION
- PATHOLOGY
- DIAGNOSTIC TESTS
- PROCEDURES
- MEDICAL TERMS
- ABBREVIATIONS
- The nervous system is the part of the body that allows for thought and interaction with the outside world and is comprised of the brain, spinal cord, and other nerves which send and receive information throughout the body.
- Neurology is the medical study of the structure of the nervous system, along with related diseases and conditions and their treatment
- A physician who specializes in this area is a neurologist
- Physicians who specialize in neurologic surgery are called neurosurgeons
- Psychiatry encompasses the diagnosis, treatment, and prevention of mental illness.
- A physician who specializes in diagnosing, treating, and preventing mental illness is a psychiatrist.

DIVISIONS OF NERVOUS SYSTEM

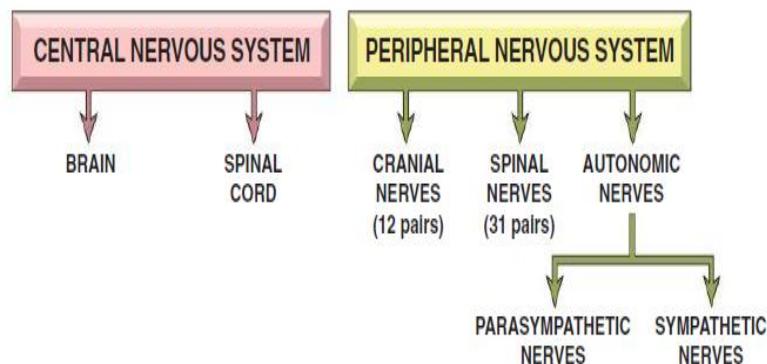


FIGURE 10-4 Divisions of the central nervous system (CNS) and peripheral nervous system (PNS). The autonomic nervous system is a part of the peripheral nervous system.

BRAIN , SPINAL CORD , NERVES

- The brain is responsible
 - for intelligence and thinking
 - response to sensation
 - control of all voluntary movement and many involuntary bodily functions.
 - center for memory and emotion.
- The spinal cord is a conduit for transmitting signals between the brain and peripheral nerves.
- Nerves are responsible for detecting and sending signals for sensation, movement, and involuntary control of bodily functions.
- The nervous system is vital for the proper function and safety of the individual.
- Problems with any part of the nervous system can lead to serious consequences and decreased quality of life.

NEURON

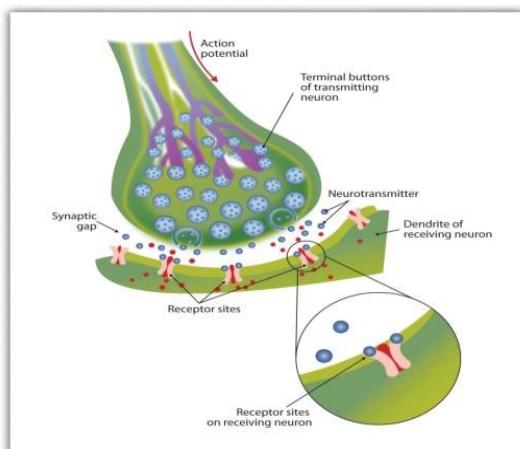
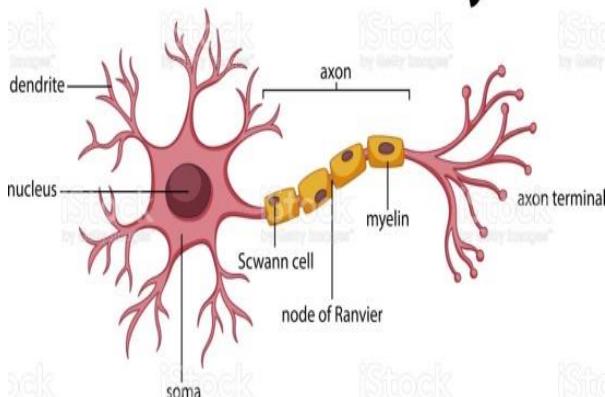
- All nerve tissue, regardless of where it occurs in the body, is comprised of nerve cells called neurons (**STRUCTURAL AND FUNCTIONAL UNIT**)
- Each neuron consists of:
 - a cell body
 - dendrites
 - an axon
- Each nerve cell body has a single nucleus and several dendrites.
- A stimulus begins an impulse in the branching fibers of the neuron, which are
- Dendrites are processes that branch from a cell body. The ends of dendrites have receptors that receive information from other neurons or sensory receptors.
- An axon is a single long fiber that extends from a cell body - conducts impulses either away from or toward the cell body.
- Axons are typically covered by an insulating layer of fatty tissue called a myelin sheath (to insulate the axon and speed transmission of electrical impulses)
- A synapse is a communication between two neurons. The word also refers to the junction where one neuron transmits an impulse to another neuron or to an effector cell.
- Effector tissue is tissue that receives nerve impulses and reacts by secreting or contracting.
- For example, effector tissue in a muscle might cause the muscle to contract, whereas effector tissue in a gland might cause secretion of a hormone.
- **Chemicals called neurotransmitters help transmit impulses across synaptic junctions.**
- The neurotransmitter is released by the axon and travels across the junction to a receiving cell.

- Neurons are the “working” cells of the nervous system; whereas other cells called neuroglia serve supportive and connective functions.
- Unlike neurons, neuroglia do not transmit impulses.

FOUR TYPES OF SUPPORTING OR GLIAL CELLS

- Astrocytes - blood-brain barrier (BBB)?
- Microglial cells
- Oligodendroglial cells (oligodendrocytes)
- ependymal cells

Neuron Anatomy



GLIAL CELLS

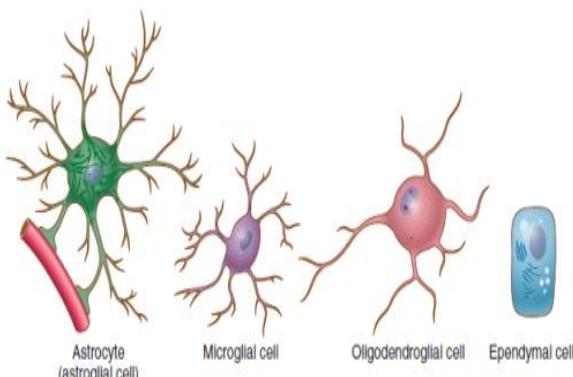


FIGURE 10-6 Glial cells (neuroglial cells). These are the supportive, protective, and connective tissue cells of the CNS. Glial cells are stromal (framework) tissue, whereas neurons carry nervous impulses.

THE BRAIN

- The brain is the most complex organ in the human body. It consists of four major components:
 - cerebrum
 - cerebellum
 - diencephalon
 - brainstem

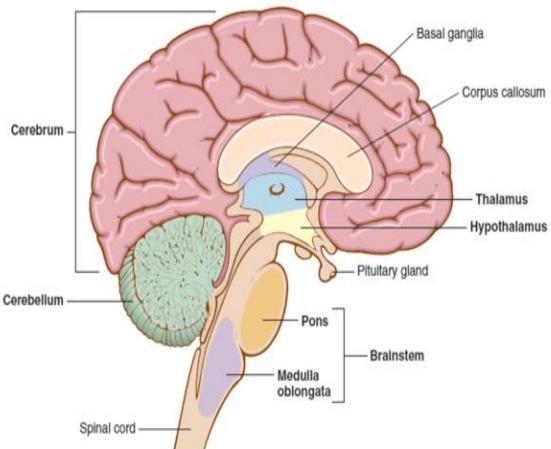
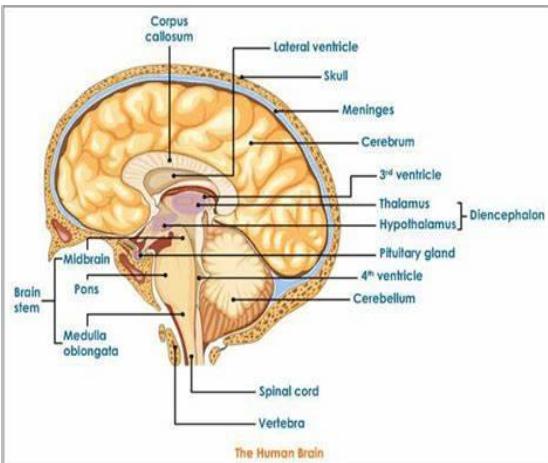
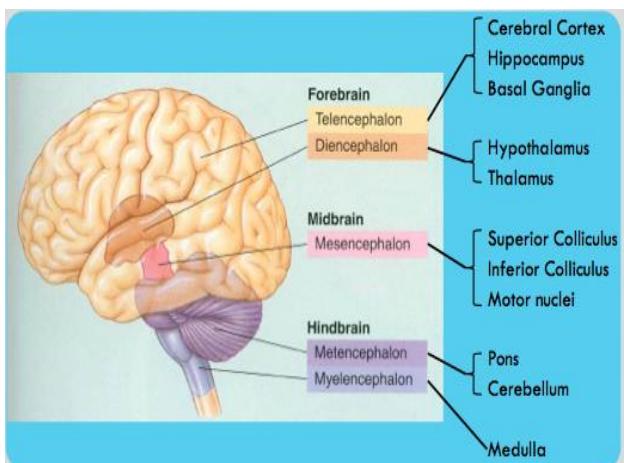


FIGURE 10-9 Parts of the brain: cerebrum, thalamus, hypothalamus, cerebellum, pons, and medulla oblongata. Note the location of the pituitary gland below the hypothalamus. The basal ganglia (a group of cells) regulate intentional movements of the body. The corpus callosum lies in the center of the brain and connects the two hemispheres (halves).

Five Major divisions of the Brain

- 1. Telencephalon] Forebrain
- 2. Diencephalon] Midbrain
- 3. Mesencephalon] Hindbrain
- 4. Metencephalon]
- 5. Myelencephalon]



CEREBRUM

- Superior part of the brain and is the largest structure.
- The cerebrum is responsible for thought processes, memory, judgments, and voluntary movement.
- It is divided into two halves called the *right* and *left hemispheres*.
- These two hemispheres are partially divided by a longitudinal fissure.
- The two hemispheres are joined by the corpus callosum, allowing them to communicate with one another.
- Each hemisphere is divided into the frontal, parietal, temporal, and occipital lobes

The frontal lobe

- responsible for voluntary movement
- Smell
- a variety of thought processes including perception, association, mood, and memory.
- important role in speech

The parietal lobe

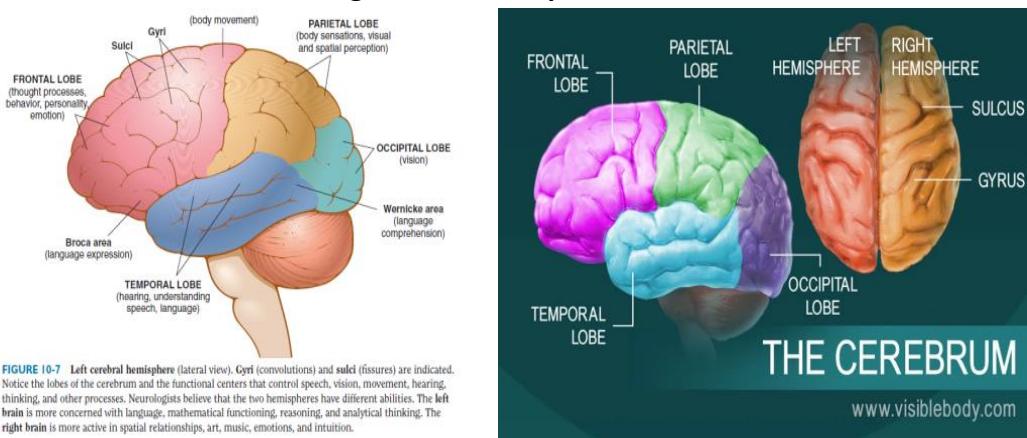
- receives and evaluates a wide variety of sensory input, including touch, pain, taste, and the sense of equilibrium.
- It also is responsible for some aspects of speech

The temporal lobe

- evaluates olfactory and auditory input
- important in memory.

The occipital lobe

- receives and integrates visual input.



CEREBRAL CORTEX

- The entire cerebrum is covered by the cerebral cortex, a thin layer of gray matter containing the cell bodies of the brain cells in the cerebrum.
- The cerebral cortex contains deep folds called gyri, which are separated by furrows called sulci. Gyri greatly increase the surface area of the cerebral cortex.
- The brain tissue underneath the cerebral cortex is called white matter
- white because the numerous axons are covered with myelin sheaths.

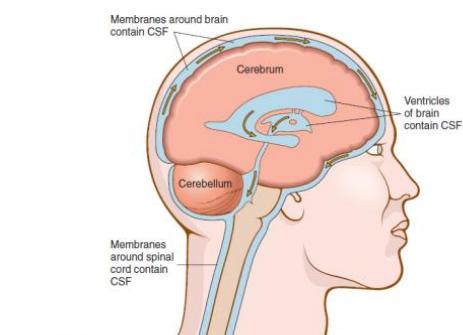
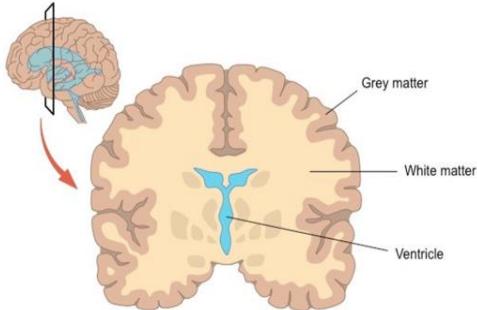


FIGURE 10-8 Circulation of cerebrospinal fluid (CSF) in the brain (ventricles) and around the spinal cord. CSF is formed within the ventricles and circulates between the membranes around the brain and within the spinal cord. CSF empties into the bloodstream through the membranes surrounding the brain and spinal cord.

CSF – CEREBRO SPINAL FLUID

- Within the cerebrum are open spaces called ventricles that contain a clear watery fluid called cerebrospinal fluid (CSF).

- CSF flows throughout the brain and spinal cord and cushions these structures from shock.
- CSF is produced by the choroid plexus (tufts of small capillary vessels) located in the various ventricles in the brain.

CEREBELLUM

- The next largest portion of the brain is the cerebellum.
- It looks like a small ball of yarn, about the size of a golf ball.
- It is in the posterior portion of the brain and is responsible for controlling movement and maintaining equilibrium.

DIENCEPHALON :

- Deep within the brain is the structure known as the diencephalon, which has a number of components, including the thalamus and hypothalamus.
- The thalamus processes sensory impulses (except olfactory impulses) and then relays these impulses to the cerebral cortex.

HYPOTHALAMUS

- The hypothalamus, which is about the size of a large pea, is responsible for regulating body temperature, blood pressure, and heart rate.
- Hormones secreted by the hypothalamus are responsible for controlling the pituitary gland.
- The hypothalamus also governs emotions and needs such as anger, pleasure, hunger, thirst, and sex drive.

BRAIN STEM

- Brainstem consists of three components: **the midbrain, the pons, and the medulla oblongata.**
- The brainstem connects the lower part of the brain with the spinal cord.
- **The midbrain (mesencephalon)**, the superior portion of the brainstem, helps in coordinating eye movements and controlling pupil diameter and lens shape.
- In addition, it provides pathways between the cerebrum and the spinal cord.
- Below the midbrain lies the pons, which relays information between the cerebrum and the cerebellum.
- **The medulla oblongata**
 - most inferior portion of the brainstem
 - 1. Respiratory center—controls muscles of respiration in response to chemicals or other stimuli
 - 2. Cardiac center—slows the heart rate when the heart is beating too rapidly
 - 3. Vasomotor center—affects (constricts or dilates) the muscles in the walls of blood vessels, thus influencing blood pressure
 - SWALLOWING

RAS - Reticular activating system (RAS)

- Within the diencephalon and the upper part of the brainstem is a structure called the reticular activating system (RAS)
- This system interacts with the cerebrum to maintain consciousness.
- If this system is not working properly, an individual can go into a coma (a state of profound unconsciousness from which one cannot be aroused).

TABLE 10-1 | FUNCTIONS OF THE PARTS OF THE BRAIN

Structure	Function(s)
Cerebrum	Thinking, personality, sensations, movements, memory
Thalamus	Relay station ("triage center") for sensory impulses; control of awareness and consciousness
Hypothalamus	Body temperature, sleep, appetite, emotions, control of the pituitary gland
Cerebellum	Coordination of voluntary movements and balance
Pons	Connection of nerves (to the eyes and face)
Medulla oblongata	Nerve fibers cross over, left to right and right to left; contains centers to regulate heart, blood vessels, and respiratory system

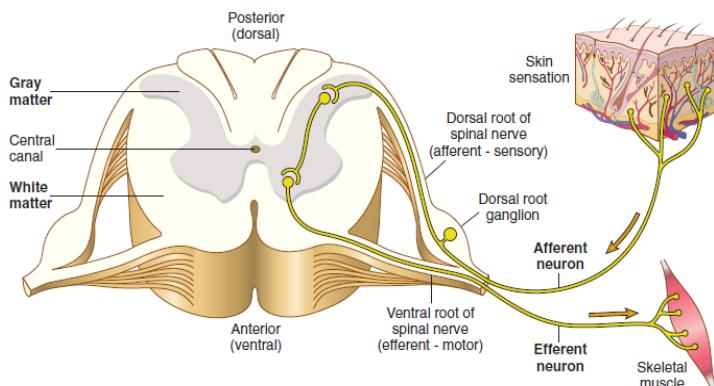


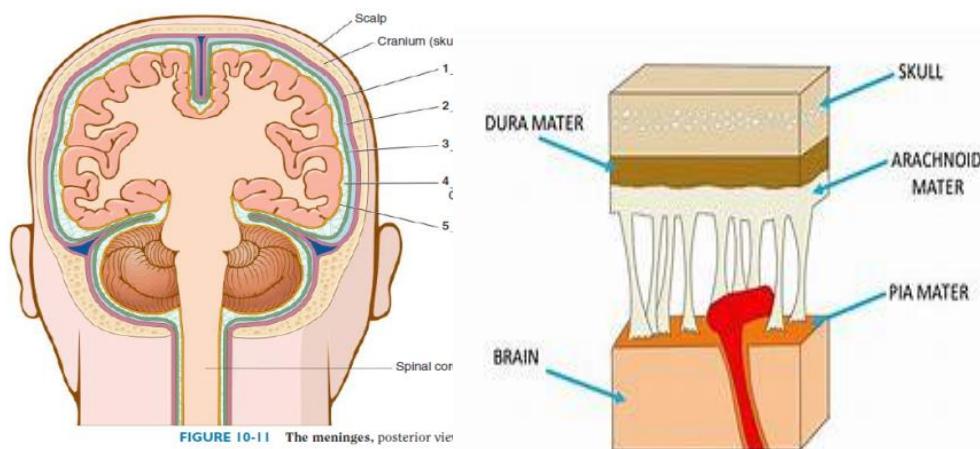
FIGURE 10-10 The spinal cord, showing gray and white matter (transverse view). Afferent neurons bring impulses from a sensory receptor (such as the skin) into the spinal cord. Efferent neurons carry impulses from the spinal cord to effector organs (such as skeletal muscle). The central canal is the space through which CSF travels.

THE SPINAL CORD

- The spinal cord is a cylindrical mass of nerve tissue that extends from the medulla oblongata to the upper lumbar vertebrae.
- It is encased in the vertebral column.
- Motor and sensory nerve pathways emerge from the spine via nerve roots that split and reorganize to become peripheral nerves.
- There are 31 pairs of spinal nerves that emerge from the spinal cord.
- Most of the spinal nerves exit the vertebral column between adjacent vertebrae.

MENINGES

- The brain and spinal cord are surrounded by three layers of connective tissue called meninges.
- The most superficial layer is the dura mater, which is thick and protective.
- The second meningeal layer is the arachnoid membrane.
- Arachnoid means “spiderlike.” This membrane is comprised of web like fibers that provide room for the movement of cerebrospinal fluid (CSF).
- Innermost meninges, the pia mater
- subarachnoid space (b/w arachnoid & pia mater) that is filled with CSF.
- The pia mater is tightly bound to the brain and spinal cord and contains a rich supply of blood vessels



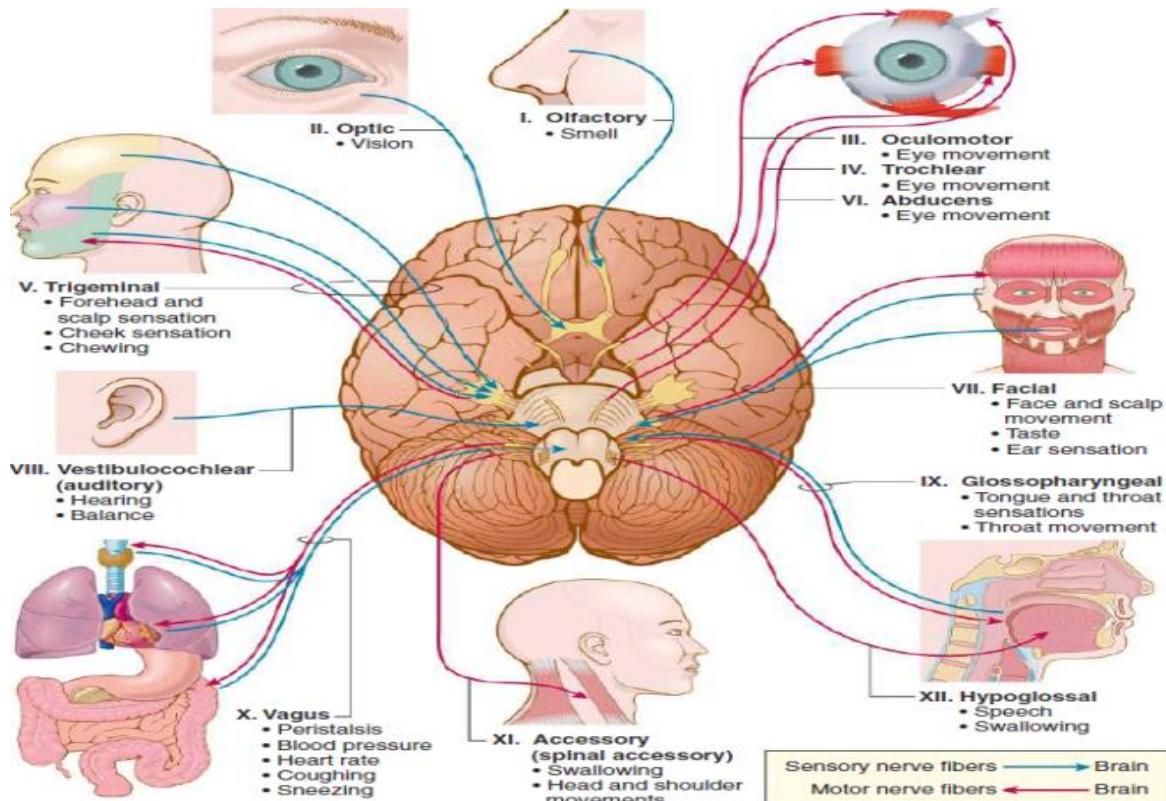
THE PERIPHERAL NERVOUS SYSTEM

- The peripheral nervous system
 - 12 pairs of cranial nerves that exit the base of the skull
 - 31 pairs of spinal nerves that exit the spinal cord.
- Most cranial nerves transmit impulses between the brain and the head and neck.
- However, the tenth cranial nerve (the vagus nerve) carries impulses to and from the chest and abdomen in addition to the head and neck.
- Cranial nerves are identified by the roman numerals I through XII.
- Spinal nerves are categorized by the region of the spinal column from which they emerge and are numbered accordingly.
- A plexus is a large network of nerves in the peripheral nervous system.

CRANIAL NERVES:

Number	Name	Function
I	olfactory	Receives sensory input for smell.
II	optic	Receives sensory input for vision.
III	oculomotor	Moves the eye, raises eyelids, changes pupil size, focuses the lens.

IV	trochlear	Moves the eye.
V	trigeminal	Receives sensory input from skin around the eyes, forehead, scalp, face, mouth, and lips. Also receives sensory input from teeth, and moves mastication muscles for chewing.
VI	abducens	Moves the eye.
VII	facial	Receives sensory input for taste and ear pain. Moves facial muscles. Innervates salivary and tear glands.
VIII	vestibulocochlear (acoustic)	Receives sensory input for hearing and equilibrium.
IX	glossopharyngeal	Receives sensory input for ear pain and temperature, tongue and throat sensations. Moves throat muscles for swallowing. Helps regulate blood pressure.
X	vagus	Receives sensory input from throat, chest, and abdomen. Moves muscles for speech, swallowing, and chest movement. Relays impulses to heart and smooth muscle of visceral organs.
XI	accessory	Moves neck and upper back.
XII	hypoglossal	Moves tongue.



SPINAL NERVES

- Cervical spinal nerves - C1 through C8
- Thoracic spinal nerves - T1 through T12
- Lumbar spinal nerves - L1 through L5
- Sacral spinal nerves - S1 through S5
- Coccygeal - Cx

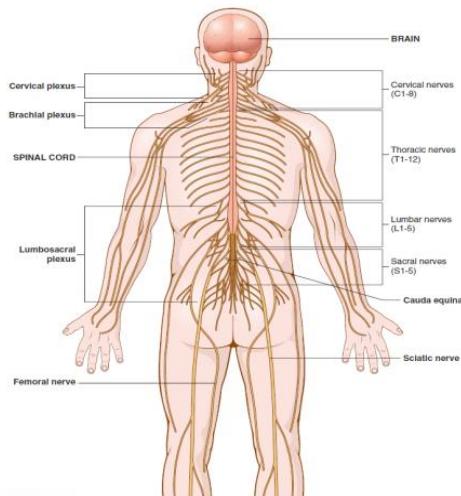
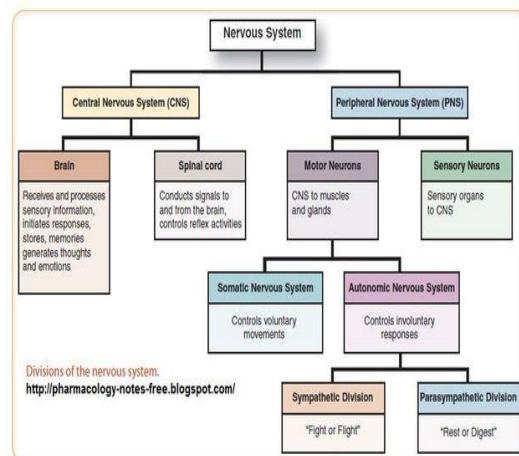


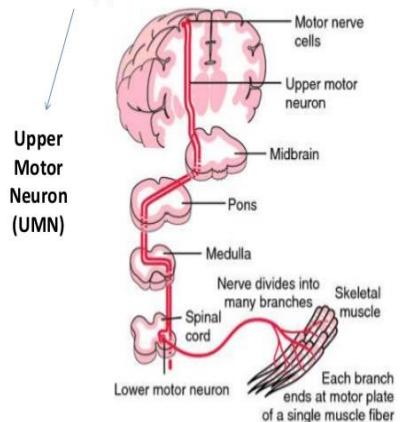
FIGURE 10-1 The brain and the spinal cord, spinal nerves, and spinal plexuses. The femoral nerve is a lumbar nerve leading to and from the thigh (femur). The sciatic nerve is a nerve beginning in a region of the hip. The cauda equina (Latin for "horse's tail") is a bundle of spinal nerves below the end of the spinal cord.



AFFERENT VS EFFERENT NERVES

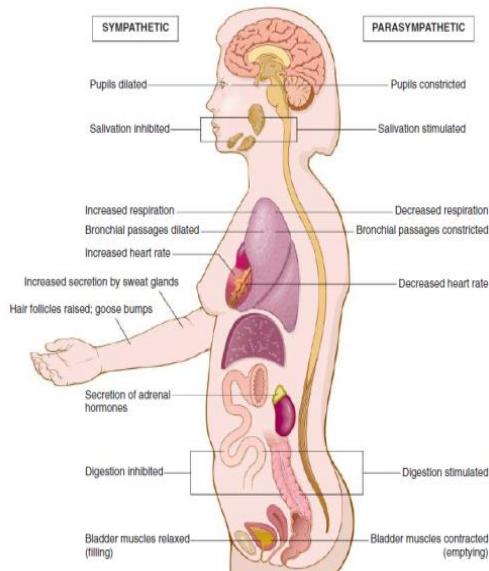
- Nerve fibers can be divided into two broad categories.
- Those fibers that transmit impulses to the CNS are **afferent (sensory)** nerve fibers. These fibers conduct information from the sense organs such as the eyes, ears, skin, and tongue.
- Efferent (motor) nerve fibers transmit impulses from the CNS outward to muscles and glands.
- Some nerves are referred to as ***mixed nerves***, because they contain both afferent and efferent fibers.
- The peripheral nervous system is divided into the **somatic nervous system (SNS)** and the **autonomic nervous system (ANS)**.
- The somatic nervous system
 - controls the skeletal muscles,
 - voluntary motion
 - responsible for parietal sensation.
 - two types of motor nerve pathways (or tracts):
 - upper motor neurons and lower motor neurons.

Types of Motor Neurons



Upper Motor Neuron (UMN)

Lower Motor Neuron (LMN)



- The cell bodies of upper motor neurons
 - motor area of the cerebral cortex and in parts of the brainstem.
 - Upper motor neurons bundle together to form tracts that descend.
 - The corticospinal (pyramidal) tract and the corticobulbar are two such upper motor neuron tracts.
 - The cell bodies of lower motor neurons
 - spinal cord and are called anterior horn cells.
 - The axons of these anterior horn cells transmit signals to the peripheral nerves, and are responsible for skeletal muscle innervation.
 - Nerves that transmit information to and from smooth muscles, cardiac muscles, and gland cells are part of the autonomic nervous system.

AUTONOMIC NERVOUS SYSTEM

- ANS is responsible for involuntary movement, visceral sensation, and the stimulation of gland secretion.
- The ANS
 - sympathetic
 - parasympathetic systems.
- the sympathetic system prepares the body for “fight or flight” responses that require quick energy.
 - increase the heart rate,
 - elevate blood pressure,
 - constrict blood vessels (vasoconstriction),
 - slow peristalsis,
 - increase the level of sugar in the bloodstream.
 - The nerves of the parasympathetic system typically produce an opposite effect:

- they lower blood pressure,
- cause blood vessels to dilate (vasodilation),
- and encourage the gastrointestinal system to function normally.
- Their actions are associated with the body at rest

EXAMINATION

- Cranial nerve I is tested by asking the patient to identify a familiar odor, such as vanilla.
- Proper function of cranial nerve II can be assessed by visual acuity testing, funduscopic exam, and testing the visual fields
- Cranial nerve III is evaluated by testing papillary response to light - (PERRLA).
- Cranial nerve III also controls extraocular movements, along with cranial nerves IV and VI.
- The motor function of cranial nerve V is tested by asking the patient to clench his or her teeth, noting the strength of jaw muscle contraction.
- The sensory portion of cranial nerve V is divided into three zones, designated V1 for ophthalmic, V2 for maxillary, and V3 for mandibular.
- Zone V1 is tested with the corneal reflex, while V2 and V3 are tested with various stimuli to the skin.
- Cranial nerve VII is tested by asking the patient to raise both eyebrows, frown, shut the eyes tightly, show the teeth, smile, and puff out the cheeks.
- Asymmetry in performing these actions may indicate Bell palsy.
- Cranial nerve VIII has both an acoustic (hearing) and vestibular (balance) component. The acoustic function of cranial nerve VIII is tested by assessing hearing.
- Cranial nerves IX and X are examined by listening for a normal voice, having the patient say “ah”, and eliciting a gag reflex.
- Cranial nerve XI is tested by asking the patient to shrug the shoulders, while cranial nerve XII is tested by movements of the tongue.
- Romberg test ?
- An abnormal plantar reflex in individuals past infancy, known as the Babinski sign, is indicative of an upper motor neuron lesion.
- Deep tendon reflexes, or DTRs, are an important subcategory of reflexes. DTRs are involuntary responses caused by striking a tendon

DEEP TENDON RELEXES

Reflex	Stimulus	Normal Response
Achilles (ankle)	strike Achilles tendon	plantar flexion at the ankle
biceps tendon	strike biceps tendon	flexion of elbow joint
Brachioradialis (supinator)	strike brachioradialis tendon	supination and flexion of forearm
patellar (knee)	strike patellar tendon	extension of knee joint

triceps	lightly strike triceps tendon above the	extension of elbow joint
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PATHOLOGY

Condition or Disease	Description
absence seizure	A 10- to 30-second loss of consciousness, typically marked by eyelid fluttering. The patient abruptly stops activity but does not fall. After the seizure, the patient resumes activity without knowledge that the seizure even occurred. Formerly known as <i>petit mal seizures</i> .
agraphia	The inability to write properly in the absence of any physical problems associated with the limbs.
Alzheimer disease	A progressive loss of cognitive function, memory, and ability to calculate. The patient becomes confused and disoriented. Associated with loss of neurons and an excessive number of axonal plaques in the cerebral cortex and subcortical structures.
amnesia	Disturbance in long-term memory, characterized by a partial or total inability to recall past experiences.
amyotrophic lateral sclerosis (ALS)	A progressive disorder resulting in destruction of motor neurons. Also called <i>Lou Gehrig disease</i> .
aphasia	The inability to comprehend or express words due to injury or degeneration of language centers in the cerebral cortex. May affect speech, writing, or sign communication.
apraxia	The inability to perform skilled or purposeful motor acts that were previously learned, despite the willingness and physical ability to perform them. Due to cerebral disorders.
ataxia	The inability to control muscle activity during voluntary movement. Movements become jerky. Caused by disorders affecting the cerebellum or spinal cord.
Bell palsy	Sudden onset of facial paralysis that is typically unilateral and without any known cause. It is believed to be caused by immune disorder or viral disease that affects cranial nerve VII.

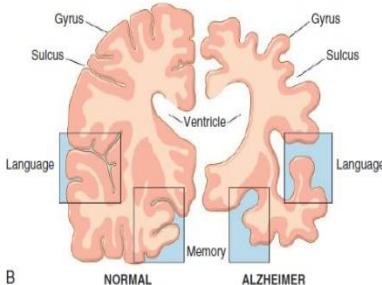


FIGURE 10-15 A, Alzheimer disease. Generalized loss of brain parenchyma (neuronal tissue) results in narrowing of the cerebral gyri and widening of the sulci. B, Cross-sectional comparison of a normal brain and a brain from a person with Alzheimer disease.

benign intracranial hypertension	An increase in intracranial pressure without any evidence of intracranial lesions, obstructions, or infections.
brain death	The complete loss of cerebral and brainstem function characterized by no response to stimuli, loss of reflexes, no spontaneous breathing, and no brain wave activity.
brain tumor	Any intracranial neoplasm. Can be benign or malignant. Symptoms include headaches, vomiting, and changes in mental status typically caused by increased intracranial pressure. Also called <i>intracranial neoplasm</i> .
carpal tunnel syndrome	Compression of the median nerve as it passes through the carpal tunnel in the wrist. It is frequently caused by repeated flexion and extension of the wrist. Can lead to pain, tingling, and numbness of the hand and fingers.
cerebral concussion	A brief loss of awareness or memory lasting from seconds to minutes with no apparent damage to brain structures. Caused by trauma to the head such as a blow or violent shaking.
cerebral contusion	A more severe injury to the head than a concussion. It is typically associated with a loss of consciousness. The skull may be fractured and intracranial bleeding may occur.
cerebral palsy (CP) syndromes	A group of motor disorders resulting in impaired voluntary movement. May be caused by prenatal developmental abnormalities or damage to the central nervous system occurring before 5 years of age.
cerebrovascular accident (CVA)	Disruption in blood supply to the brain due to either hemorrhage or occlusion. Sites in the body where symptoms are noted correlate to the affected areas of the brain that control those sites. Also called cerebrovascular disease or stroke

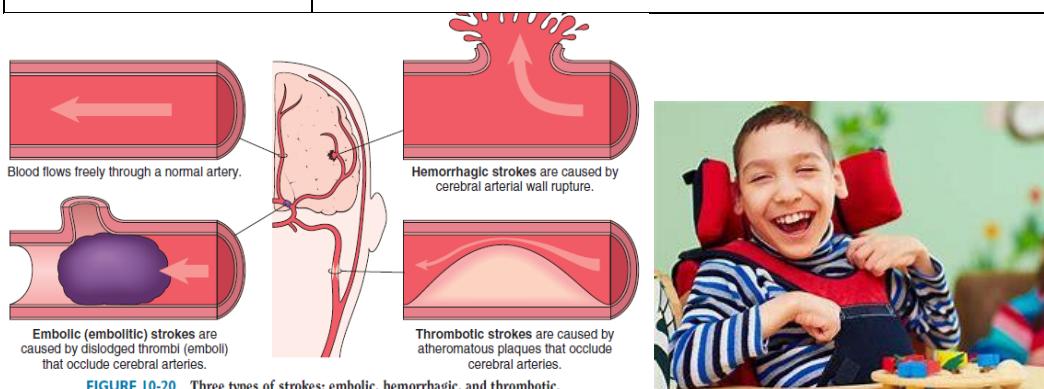


FIGURE 10-20 Three types of strokes: embolic, hemorrhagic, and thrombotic.

cluster headache	Severe, unilateral, periorbital and/or temporal headache that lasts 15 to 180 minutes and occurs up to 8 times a day. Associated with one or more of the following: tearing, stuffy nose, red eyes, contraction of the pupils, and facial sweating. Possibly caused by hypersensitivity to histamine.
coma	A state of profound unconsciousness. The person cannot be aroused and is unresponsive to repeated stimuli.
complex partial seizure	A seizure characterized by motor, sensory, or psychomotor symptoms. The patient also exhibits mental confusion and loses contact with the surroundings for 1 to 2 minutes.
convulsion	A severe spasm or jerking of the arms, legs, body, head, or face. Commonly occurs with various types of seizures.
demyelinating disease	Any disease that destroys or damages many of the myelin sheaths that insulate nerve fibers. Examples include Tay-Sachs and multiple sclerosis.
encephalitis	Inflammation of the brain. Most commonly caused by a virus. Can be caused by a bacterium.
Epilepsy	A chronic disorder characterized by recurrent, paroxysmal seizures caused by excessive firing of neurons in localized areas of the brain. Various types include absence seizures and tonic-clonic seizures.
headache	Pain in any part of the head not correlated to the distribution of any specific nerve. Typically a symptom of another condition. Types of headaches include migraine, cluster, and tension.
hemiparesis	Weakness or paralysis affecting only one side of the body.
herniated disk	A protrusion of the gelatinous central portion of a vertebral disk (nucleus pulposus) through a ruptured portion of the outer part of the disk. Can cause compression or irritation of a spinal nerve root, leading to pain or loss of sensation.
herpes zoster	A viral infection (varicella-zoster virus) of spinal nerve roots and/or nearby aggregations of nerve cell bodies, causing painful vesicles of the skin (blisters) distributed along the path (dermatome) of affected nerves. Also called shingles.
Huntington disease	An inherited disorder that affects movement and causes progressive intellectual degeneration. Usually appears from age 35 to 50 years. Also called Huntington chorea.
hydrocephalus	The presence of excess cerebrospinal fluid resulting in abnormally high intracranial pressure and cerebral ventricular enlargement. May lead to atrophy of the brain and an enlarged cranium.

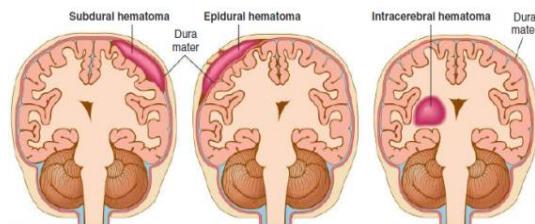
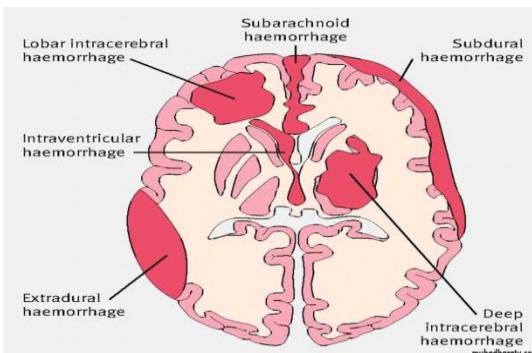
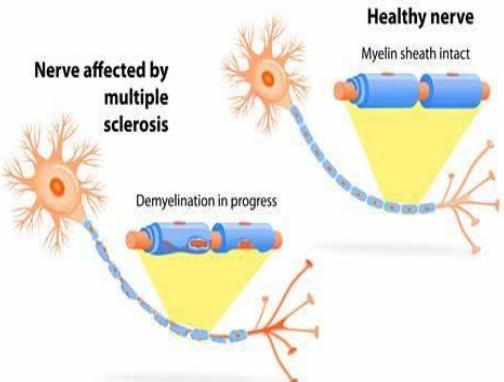


FIGURE 10-12 Hematomas. A **subdural hematoma** results from the tearing of veins between the dura and arachnoid membranes. It often is the result of blunt trauma, such as from blows to the head in boxers or in elderly patients who have fallen out of bed. An **epidural hematoma** occurs between the skull and the dura as the result of a ruptured meningeal artery, usually after a fracture of the skull. An **intracerebral hematoma** is caused by bleeding directly into brain tissue, such as can occur in the case of uncontrolled hypertension (high blood pressure).

hypersomnia	An abnormal increase in the amount of sleep by 25% or more above normal. The person functions normally between sleep intervals.
hypokinesia	Slower-than-normal movement. Also called bradykinesia.
insomnia	A sleep disorder in which it is difficult to fall asleep or to remain asleep, resulting in inadequate sleep.
intracerebral hemorrhage	Bleeding within the brain. If sudden, such as the bursting of a blood vessel, the result can lead to greatly increased intracranial pressure, coma, and death. Causes include head trauma, aneurysms, arteriosclerotic vessels exposed to hypertension, or thrombotic ischemia.
lower motor neuron lesion	Injury to an efferent neuron that is the last nerve to innervate a skeletal muscle.
meningitis	Inflammation of the meninges (membranes) of the brain or spinal cord. Can be caused by a bacterial or viral infection. Severe cases can lead to paralysis, coma, and death.
migraine	A headache lasting 4 to 72 hours with throbbing, intense, unilateral pain. Frequently associated with nausea, vomiting, and unusual sensitivity to light, sound, or smell.
multiple sclerosis (MS)	A slowly progressive disease of the central nervous system characterized by areas of demyelinated nerves (plaques) in the brain and/or spinal cord. Depending on the nerves affected, may cause a wide variety of neurological symptoms. There are typically periods of exacerbation followed by remissions.

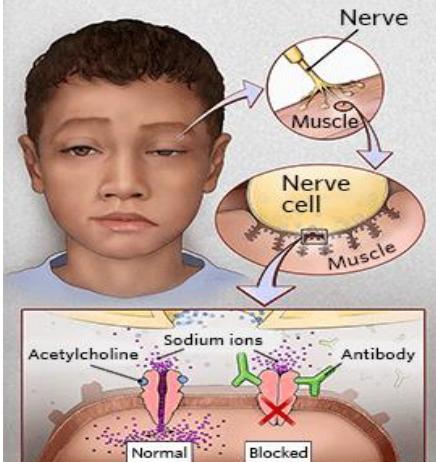
muscular dystrophy	A general term for a group of inherited progressive muscle disorders, resulting in selective muscle weakness. Symptoms typically appear from age 3 to 20 years.
myasthenia gravis	A neuromuscular disorder in which receptors for acetylcholine are destroyed or become dysfunctional due to autoimmune attacks. Leads to episodic muscle weakness. Eventually may cause complete paralysis.

MULTIPLE SCLEROSIS



Nerve affected by multiple sclerosis
Demyelination in progress

Healthy nerve
Myelin sheath intact



Myasthenia Gravis
chronic autoimmune neuromuscular disease characterized by varying degrees of weakness of the skeletal (voluntary) muscles of the body

Dropping of one or both eyelids
Altered speaking
Limited facial expressions
Weakness in the neck, arms and legs
Double vision, which improves or resolves when one eye is closed

SPINA BIFIDA OCCULTA
Posterior vertebrae have not fused.
No herniation of spinal cord or meninges. There may be visible signs on the skin such as a mole, dimple, or patch of hair.

SPINA BIFIDA CYSTICA WITH MENINGOCELE
External protruding sac contains meninges and CSF.

SPINA BIFIDA CYSTICA WITH MYELOMENINGOCELE
External sac contains meninges, CSF, and the spinal cord. Often associated with hydrocephalus and paralysis.

myelocele	Abnormal protrusion of the spinal cord into an external sac. May occur in spina bifida.
narcolepsy	A sleep disorder characterized by sudden, involuntary episodes of sleep that occur during normal waking hours. Rare version of hypersomnia.
nerve root disorders	Any disorder of a spinal nerve root. Typically caused by chronic pressure or invasion of the root due to trauma, tumor, or degenerative diseases such as osteoarthritis. Symptoms may involve motor and/or sensory functions. Also called <i>radiculopathy</i> .

neuralgia	Severe, throbbing or stabbing pain along the path of a nerve.
neuritis	Inflammation of a nerve.
neurofibromatosis	A genetic disorder characterized by growth of neurofibromas (benign tumors) anywhere along peripheral nerves. May cause substantial disfigurement, bone erosion, and nerve compression.
pain	An unpleasant, subjective sensation related to actual or potential damage to nerves and/or body tissue. The perception or response to pain is quite subjective and varies widely from individual to individual. Pain can be acute or chronic.
papilledema	Edema of the optic disk, usually caused by abnormally high intracranial pressure.
paralysis	Loss or impairment of motor function due to injury or disease affecting nerve supply. May also involve sensation and autonomic functions.
paraplegia	Paralysis of the lower limbs which may involve the lower trunk.
paresis	Partial or incomplete paralysis.

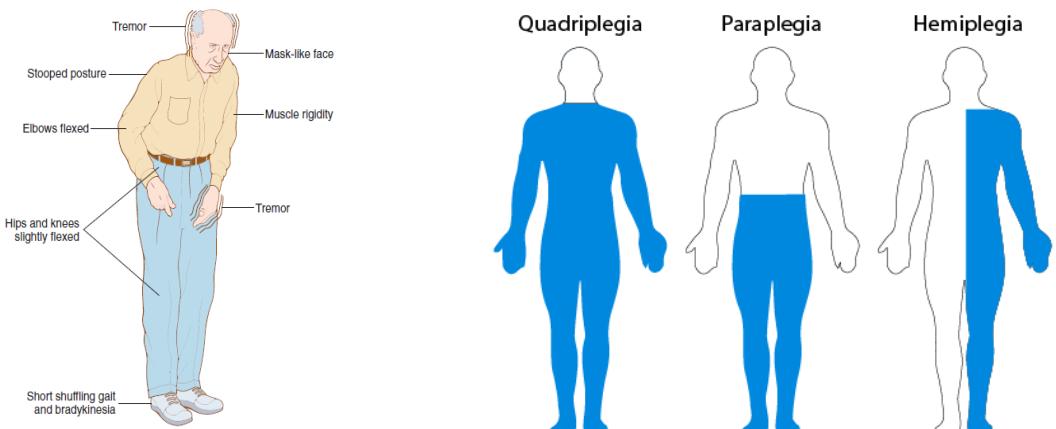


FIGURE 10-18 Primary symptoms of Parkinson disease are tremors in hands, arms, legs, jaw, and face; rigidity or stiffness of limbs and trunk; bradykinesia (shuffling gait), stooped posture, and masklike facies.

Parkinson disease	A slowly progressive neurologic disorder affecting the brain's ability to control movement. Caused by deficiency of the neuroinhibitor dopamine due to degenerative, vascular, or inflammatory changes in specialized gray matter structures in the brain. Characterized by slow and decreased movement, resting tremor, and muscular rigidity.
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peripheral neuropathy	Any disorder or destruction of nerves of the PNS.
persistent vegetative state (PVS)	Loss of self-awareness due to cerebral damage or dysfunction, usually caused by trauma or stroke. Diencephalon and brainstem functions remain, preserving autonomic and motor reflexes
quadriplegia	Paralysis of all four limbs.
rabies	An acute infectious disease caused by a neurotropic virus often present in saliva and typically transmitted by the bite of an infected animal such as a dog, skunk, or bat. Affects the CNS, causing aggressiveness and madness. Eventually leads to paralysis and death.
sciatica	Pain in the lower back and hip that radiates down the back of the thigh.
simple partial seizure	A seizure characterized by motor, sensory, or psychomotor symptoms. The patient remains conscious.
spina bifida	A congenital defect in which the vertebral column has not properly closed during embryological development. In some instances, a sac containing meninges and part of the spinal cord (myelocele) may protrude from the lower thoracic, lumbar, or sacral area. It typically causes varying degrees of paralysis below the involved area. Hydrocephalus and genitourinary problems are common associated conditions.
spinal cord compression	Any excessive pressure on the spinal cord. May be caused by trauma, bony protrusions into the spinal canal, or a neoplasm. Can cause pain, weakness, numbness, and paralysis.
spinal cord injury	Any damage to the spinal cord. May be temporary or permanent. Causes include hemorrhage, any injury that severs or damages the spinal cord, or any injury or condition that causes swelling around the spinal cord. Can result in partial or complete motor and sensory loss. Depending on the level of involvement, can cause paraplegia or quadriplegia.
spinal cord neoplasm	A tumor that compresses the spinal cord. Can be benign or malignant.
stupor	The state of impaired consciousness. Patient is markedly unreactive to the environment and can be temporarily aroused only by intense, repeated stimulation.
subarachnoid hemorrhage (SAH)	Sudden bleeding into the subarachnoid space, the open area filled with CSF located between the arachnoid membrane and pia mater. Most commonly caused by head trauma or rupture of a congenital aneurysm.
syncope	Loss of consciousness due to inadequate blood flow to the brain. Also called <i>fainting</i> .

Tay-Sachs disease	Inherited lipid disorder found in Jewish families of Eastern European origin. Caused by an enzyme deficiency, resulting in accumulation of specialized lipids in brain cells. Symptoms occur early in life and include retardation, paralysis, and blindness. Death may occur by age 3 or 4 years.
tension headache	A mild to moderately severe, bilateral headache that lasts 30 minutes to 7 days. Not associated with nausea, vomiting, or unusual sensitivity to light, sound, or smell.
tic	Repetitive, nonrhythmic, involuntary movements that can be suppressed voluntarily for only brief periods. Examples include involuntary blinking and so-called "nervous mannerisms." Tend to be more prominent under stress.
tonic-clonic seizure	A seizure characterized by a sudden outcry followed by loss of consciousness, collapse, increased muscle tone, and then repetitive and rhythmical twitching and jerking of the limbs.
Tourette syndrome	An inherited disorder involving multiple motor and vocal tics. Begins in childhood. Vocal tics may include grunts, barks, and compulsory words.
transient ischemic attack (TIA)	A temporary neurologic abnormality caused by sudden and brief loss of blood flow to the brain due to emboli, thrombi, or stenosed artery. Symptoms are similar to stroke but are transient.
tremor	Rhythmic movement of a body part produced by alternating contraction and relaxation of opposing muscles. Usually involuntary.
trigeminal neuralgia	Severe lancing pain in the face. Lasts from seconds to 2 minutes. Typically follows distribution of one or more branches of the trigeminal nerve (cranial nerve V). Also called tic douloureux.
upper motor neuron lesion	Injury to an efferent neuron whose cell body is in the motor area of the cerebral cortex or in the brainstem.

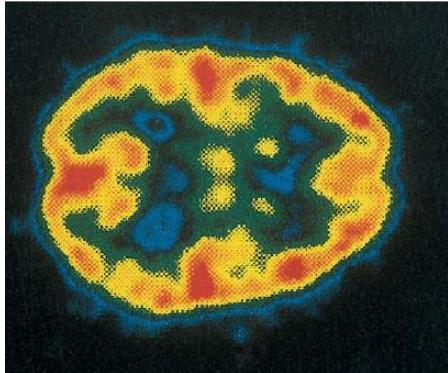


FIGURE 10-21 Cerebral aneurysm.



GLIAL BLASTOMA

DIAG TESTS & PROCEDURES

Test	Description
biopsy of nerve tissue	A specimen of nerve tissue is collected and examined microscopically to establish a diagnosis. Commonly used to diagnosis malignant growths.
cerebral angiography	X-rays of the brain are taken after a radiopaque substance is injected into the cerebral circulatory system. Visualizes arterial and venous circulation in the brain.
cerebrospinal fluid (CSF) analysis	A sample of cerebrospinal fluid is analyzed for its composition, including the quantities of substances such as glucose, protein, albumin, and urea nitrogen present. White blood count and pH are obtained. It may be cultured for bacteria. Its color and clarity are noted (CSF is normally clear). These tests are useful in diagnosing trauma and abnormalities such as tumors and infections.
CT (computed tomography) of the brain	A computer-generated reconstruction of the brain is created from a series of x-ray images taken as cross-sections of the brain. These images (CT scans) are particularly valuable in differentiating the various tissues within the brain, such as tumors and lesions. In the case of a cerebrovascular accident (CVA), it can determine if a stroke is caused by blockage or hemorrhage.
Electroencephalography (EEG)	The electrical potentials of the brain are recorded. Electrical changes associated with epilepsy, sleep disorders, tumors, hemorrhages, etc., can be detected. Also used to determine "brain death," which produces a flat or silent EEG pattern.

Electromyography (EMG)	Electrical activity in muscle is graphically recorded after electrical stimulation. Useful in evaluating neuromuscular disorders.
lumbar puncture (LP)	A needle is inserted between lumbar vertebrae into the subarachnoid space of the spinal column. Cerebrospinal fluid (CSF) can be withdrawn for analysis. A device can also be attached to the needle to measure CSF pressure. Also called analysis of cerebrospinal fluid or spinal tap.

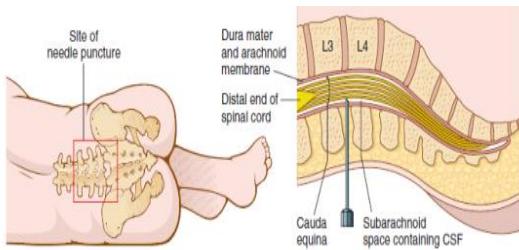


FIGURE 10-23 Lumbar puncture. The patient lies laterally, with the knees drawn up to the abdomen and the chin brought down to the chest. This position increases the spaces between the vertebrae. The lumbar puncture needle is inserted between the third and fourth (or the fourth and fifth) lumbar vertebrae and then is advanced to enter the subarachnoid space.

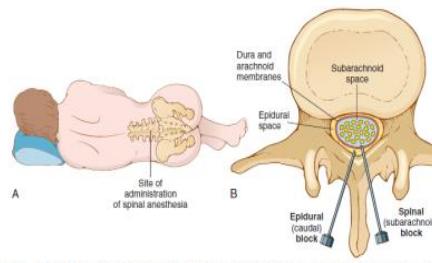


FIGURE 10-13 A, Positioning of a patient for spinal anesthesia. B, Cross-sectional view of the spinal cord showing injection sites for epidural and spinal blocks (anesthesia). Epidural (caudal) anesthesia is achieved by injecting an agent into the epidural space and is commonly used in obstetrics. Spinal anesthesia is achieved by injecting a local anesthetic into the subarachnoid space. Patients may experience loss of sensation and paralysis of feet, legs, and abdomen.

MRI (magnetic resonance imaging)	Magnetic energy and radiofrequencies are used to stimulate body cells to emit radio signals that are converted to images. MRI can differentiate various tissues, such as tumors and inflammatory sites. In the case of cerebrovascular accident (CVA), it can determine if a stroke is caused by blockage or hemorrhage. It is also useful in identifying plaques associated with multiple sclerosis.
myelography	X-rays of the spinal cord are taken after injection of a contrast material into the spinal canal. Visualizes abnormalities such as a herniated disk or spinal cord tumors.
ultrasonography of the brain	Ultrasound is used to detect tumors, cerebral hemorrhages, and cerebral blood flow.

MEDICAL TERMINOLOGIES:

Form	Meaning
cerebr/o	cerebrum
crani/o	cranium (skull)
encephal/o	brain
gangli/o	nervous
mening/o	membranes; meninges
myel/o	spinal cord; bone marrow
neur/o	nerve

ABBREVIATIONS:

Abbreviation	Meaning
ADD	attention deficit disorder
ALS	amyotrophic lateral sclerosis
ANS	autonomic nervous system
CNS	central nervous system
CP	cerebral palsy
CSF	cerebrospinal fluid
CVA	cerebrovascular accident
CVD	cerebrovascular disease
DTR	deep tendon reflex
EEG	electroencephalogram, electroencephalography
EMG	electromyogram, electromyography
HNP	herniated nucleus pulposus
LOC	loss of consciousness
LP	lumbar puncture
MMSE	Mini-Mental Status Exam
MS	multiple sclerosis
PNS	peripheral nervous system
PVS	persistent vegetative state
RAS	reticular activating system
SAH	subarachnoid hemorrhage
SNS	somatic nervous system
TIA	transient ischemic attack

PSYCHIATRIC CONDITIONS:

Classification	Description	Examples
anxiety disorders	Conditions that occur in individuals suffering from severe anxiety.	panic attack, phobic disorders, obsessive-compulsive disorder, post- traumatic stress disorder, and anxiety due to a physical disorder or substance
dissociative disorders	Conditions in which one or more components of an individual's memory, perception, or identity become disconnected from other components.	amnesia, fugue, identity disorder, and depersonalization disorder

drug use and dependencies	Conditions characterized by physical and/or psychological dependencies caused by repeated drug use.	May involve various drugs, including alcohol, cocaine, opioids, amphetamine, hallucinogens, and cannabis (marijuana)
eating disorders	Disorders characterized by severely abnormal eating patterns and behaviors.	anorexia nervosa, bulimia, binge eating
mood disorders (affective disorders)	Recurrent and pervasive disturbances of an individual's mental state.	depression, bipolar disorder (swings between mania and depression), mania, dysthymic disorder
personality disorders	Conditions characterized by inflexible ongoing personality traits that deviate from cultural norms, causing stress and inability to function properly in society.	various personality types, including paranoid, schizoid, antisocial, hysterical, dependent, obsessivecompulsive, passiveaggressive, and depressive
psychosexual disorders	Physical or emotional disturbances that interfere with sexual enjoyment and fulfillment. Also, sexual behaviors that violate cultural norms.	sexual dysfunction, gender identity disorders, pedophilia, exhibitionism, voyeurism, fetishism
schizophrenic disorders	The most severe category of mental illness. Characterized by psychotic symptoms such as delusions, hallucinations, and inappropriate behavior.	schizophrenia, delusional disorder, schizoaffective disorder
somatoform disorders (psychosomatic)	Psychiatric disorders characterized by physical symptoms that can only be partially explained by physical conditions.	somatization disorder, hypochondriasis, conversion disorder, pain disorder
suicidal behavior	Behavior related to the wish, intent, or attempt to die.	Suicide gestures, suicide attempts, completed suicide, assisted suicide

MEDICAL TERMS IN PSYCHIATRY:

Form	Meaning	Example(s)
anxi/o	distressed; uneasy, anxious	anxiety, anxiolytic
hallucin/o	wander in mind	hallucinogen, hallucination
ment/o	mind	mentality
phren/o	mind	schizophrenia, phrenocardia
psych/o	mind	psychology, psychosis
schiz/o	split	schizoid, schizoaffective
somat/o	body	psychosomatic, somatoform

ABBREVIATIONS:

Abbreviation	Meaning
ADD	attention deficit disorder
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
ECT	electroconvulsive therapy
IQ	intelligence quotient
MMPI	Minnesota Multiphasic Personality Inventory
SAD	seasonal affective disorder
TAT	Thematic Apperception Test
WAIS-R	Wechsler Adult Intelligence Scale- Revised
WISC-R	Wechsler Intelligence Scale for Children-Revised

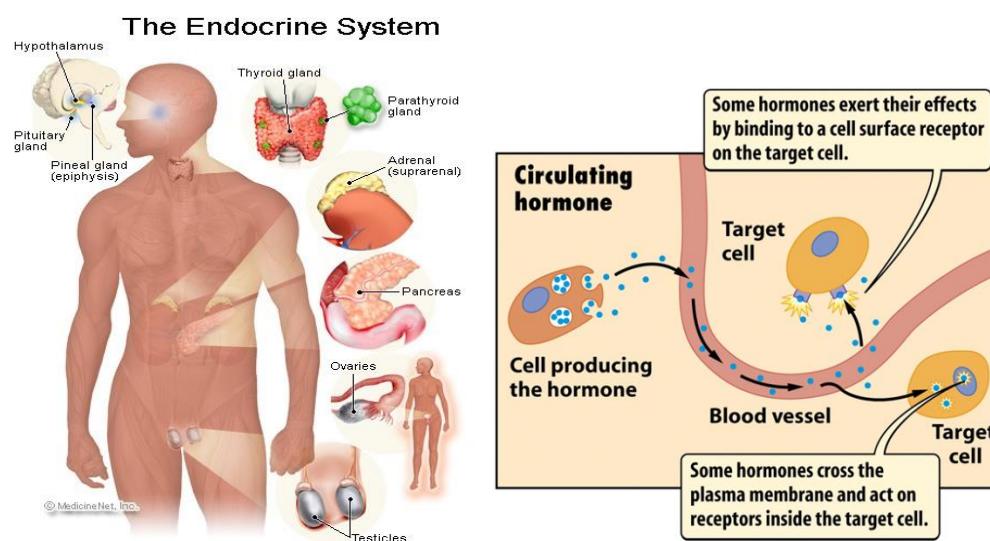
Endocrine system

General terms:

- Endocrinology
- Endocrinologist
- Structure and functions of endocrine system
- Pathology
- Diagnostic tests and procedures
- Medical terms
- Abbreviations
- Endocrinology is the medical study of the structure and workings of the endocrine system, the associated diseases and conditions, and their treatment.
- A physician who specializes in the diagnosis and treatment of endocrine disorders is called an endocrinologist.
- The functions of the body are regulated by two major control systems: the nervous system, and the endocrine system.
- The endocrine system, also called the hormonal system

Functions of endocrine system

- Regulates the metabolic functions of the body including the rates of chemical reactions in cells
- Secretion of chemical substances called hormones, growth, and homeostasis.
- Allows the body to coordinate the actions of many organs at the same time, and it is vital to normal growth and survival



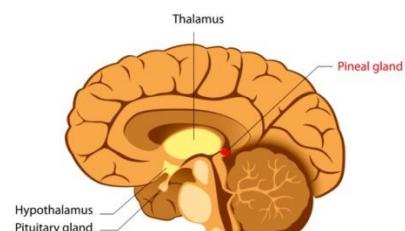
Gland

- A gland is any organized collection of cells that secrete or excrete a substance.
- The body contains two types of glands: endocrine glands and exocrine glands.
- The endocrine glands secrete chemical substances directly into the bloodstream.
- On the other hand, the exocrine glands send their output through ducts.

- The endocrine system consists of glands that secrete hormones.
- They are connected in a functional sense through hormones, chemical messengers that are carried by the blood from glands to the cells upon which they act.
- Each hormone binds with particular receptors, which are contained in specific target tissues.
- Each hormone has its own receptor, and the two interact much like a lock and key.
- When a hormone binds with its receptor, the receptor initiates specific biological activities.

TABLE I8-1 ENDOCRINE TISSUE (APART FROM MAJOR GLANDS): LOCATION, SECRETION, AND ACTION

Location	Secretion	Action
Body cells	Prostaglandins	Aggregation of platelets Contract uterus Lower acid secretion in stomach Lower blood pressure
Gastrointestinal tract	Cholecystokinin Gastrin Secretin	Contracts gallbladder Stimulates gastric secretion Stimulates pancreatic enzymes
Kidney	Erythropoietin	Stimulates erythrocyte production
Pineal gland	Melatonin	Induces sleep and affects mood
Placenta	Human chorionic gonadotropin	Sustains pregnancy
Skin	Vitamin D	Affects absorption of calcium

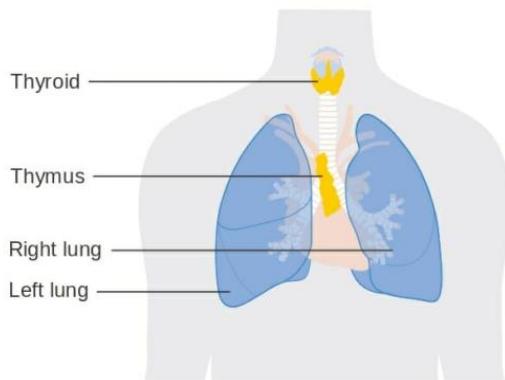


Endocrine glands

- [1] thyroid gland
- [2] parathyroid glands (four glands)
- [3] adrenal glands (one pair)
- [4] pancreas (islets of langerhans)
- [5] pituitary gland
- [6] ovaries in female (one pair)
- [7] testes in male (one pair)
- [8] pineal gland
- [9] thymus gland

Pineal gland

- The pineal and the thymus glands, are included as endocrine glands because they are ductless
- The pineal gland, located in the central portion of the brain, secretes melatonin.
- Melatonin functions to support the body's "biological clock" and is thought to induce sleep.



Thymus gland

- The thymus gland is located behind the sternum, and like the pineal gland, little is known about it.
- It secretes thymosin, which promotes the development and functioning of the immune system in newborns.
- This gland is relatively large in a child but shrinks as one ages.

Thyroid gland

- Composed of a right and a left lobe on either side of the trachea
- Just below a large piece of cartilage called the thyroid cartilage (Adam's apple)
- The isthmus of the thyroid gland is a narrow strip of glandular tissue that connects the two lobes on the ventral (anterior) surface of the trachea

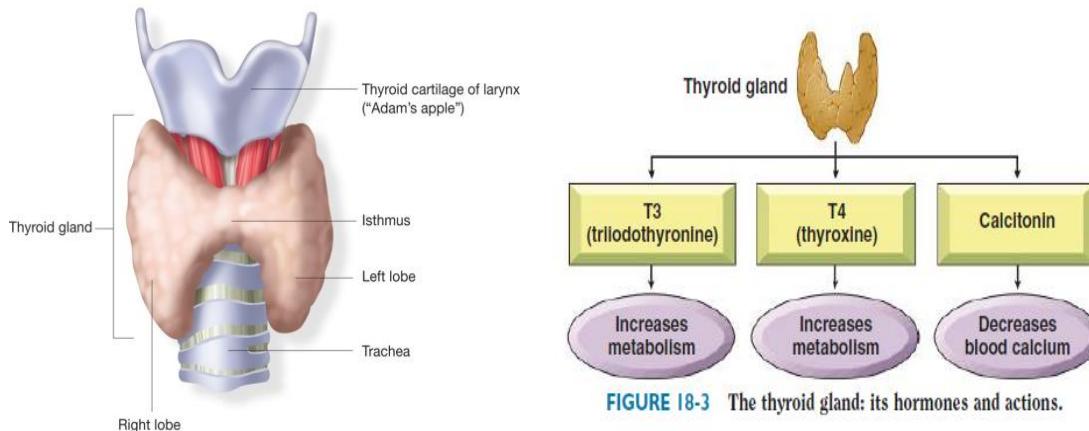
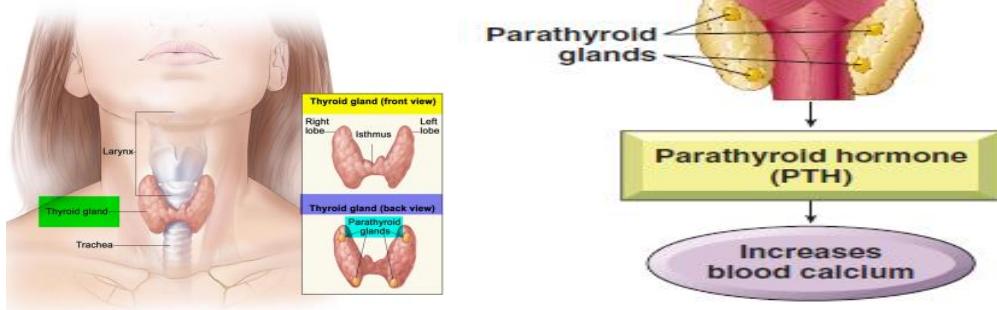


FIGURE 18-3 The thyroid gland: its hormones and actions.

Parathyroid glands

- The parathyroid glands are four small oval bodies located on the dorsal aspect of the thyroid gland. Also called parathormone

Anatomy of the Thyroid and Parathyroid Glands



Adrenal glands

- The adrenal glands are two small glands, one on top of each kidney
- Each gland consists of two parts:
 - An outer portion, the adrenal cortex and
 - An inner portion, the adrenal medulla.
- The adrenal cortex and adrenal medulla are two glands in one, secreting different hormones.

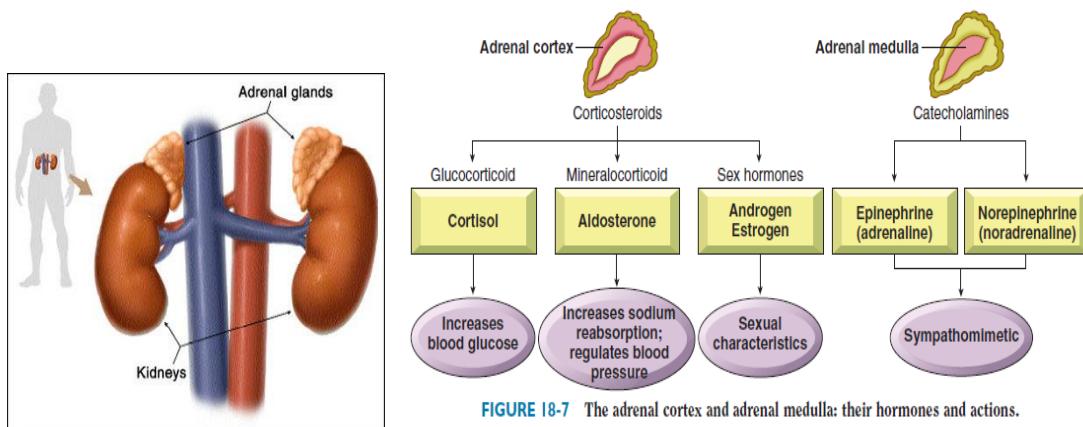
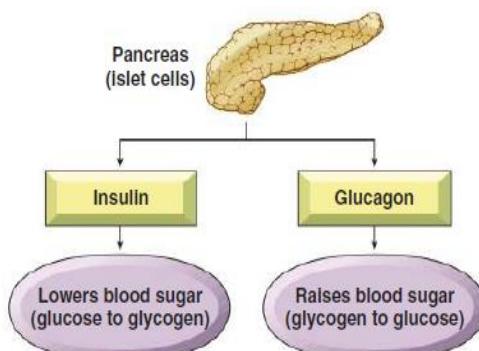
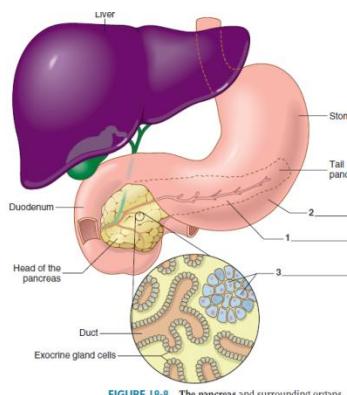


FIGURE 18-7 The adrenal cortex and adrenal medulla: their hormones and actions.

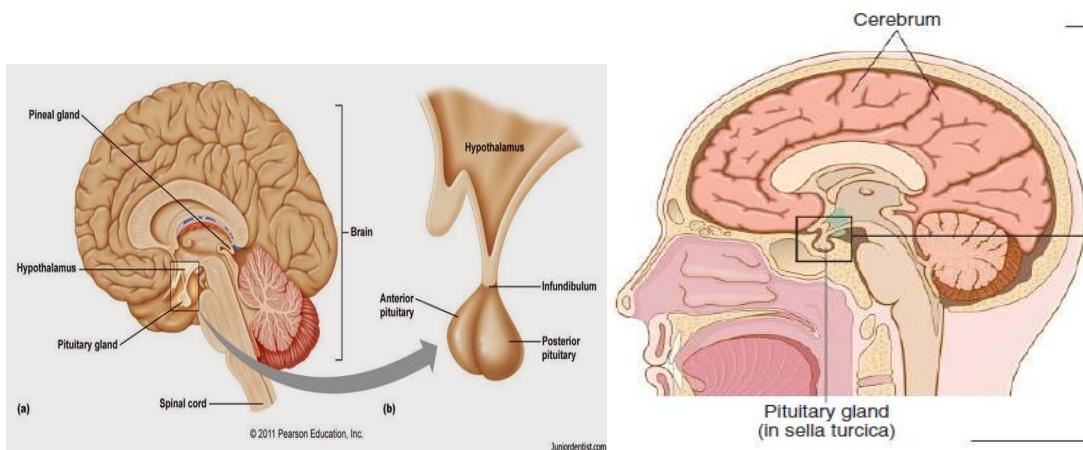
Pancreas

- The pancreas is located near and partly behind the stomach in the region of the first and second lumbar vertebrae
- The endocrine tissue of the pancreas consists of specialized hormone-producing cells called the islets of Langerhans or islet cells.
- More than 98% of the pancreas consists of exocrine cells (glands and ducts). These cells secrete digestive enzymes into the gastrointestinal tract.
- The islets of Langerhans produce insulin (produced by beta cells) and glucagon (produced by alpha cells). Both play a role regulating blood glucose (sugar) levels.
- Homeostasis



Hypothalamus and pituitary

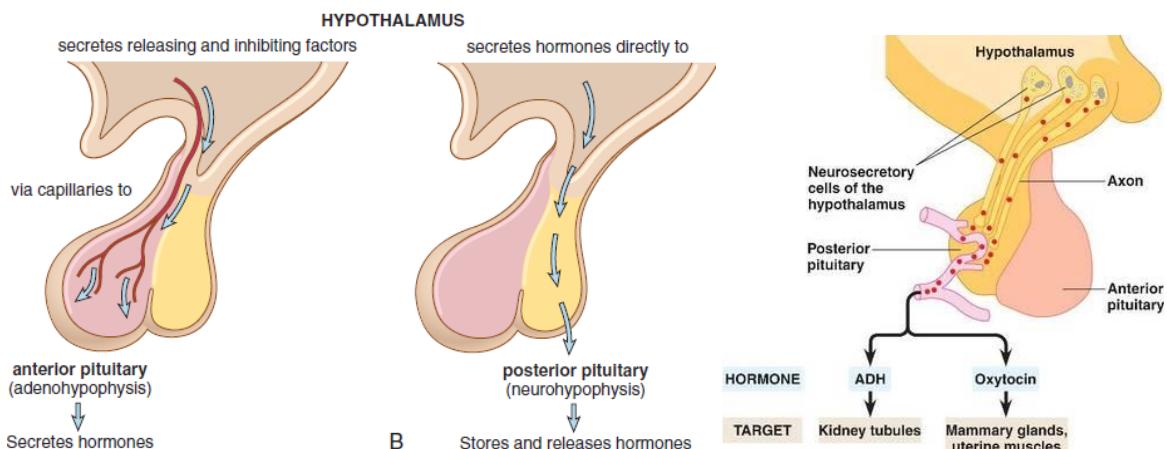
- The hypothalamus is part of the brain, but it is considered an endocrine gland because it releases its hormones into the blood to act at sites outside the brain.
- The primary function of the hypothalamus is to control the actions of the pituitary gland.
- the pituitary gland sits in the sella turcica, a bony cavity at the base of the brain.
- Physiologically, the pituitary gland is divided into the anterior pituitary gland (adenohypophysis) and the posterior pituitary gland (neurohypophysis).



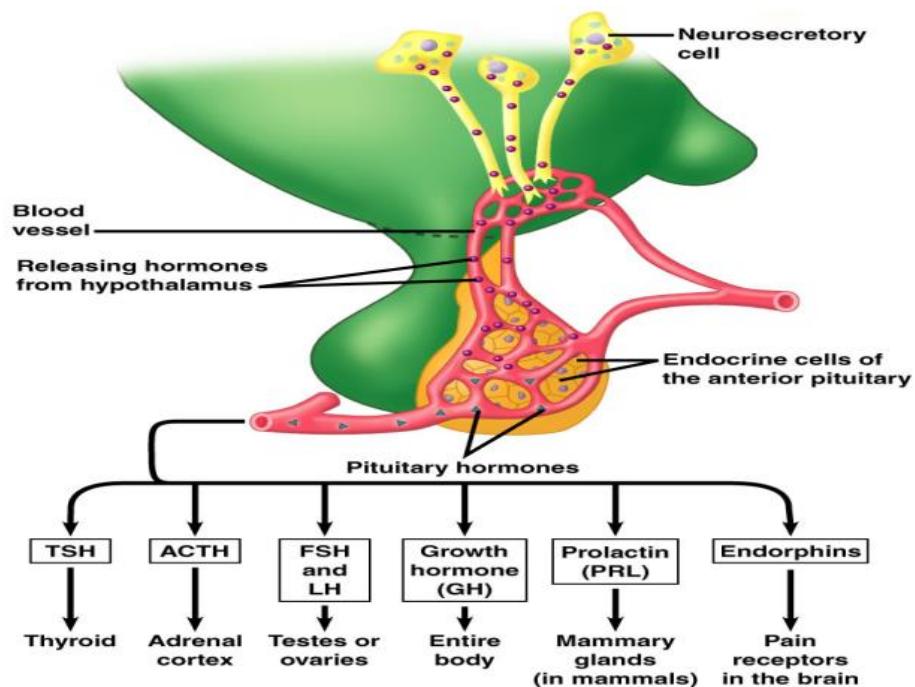
- Pituitary gland - “master gland”**
- Instructions for other glands to secrete hormones.
- Hypothalamus directs the behavior of the pituitary gland
- The hypothalamus receives instructions from the central nervous system concerning what hormones the pituitary should secrete.
- Because the release of these hormones is controlled by neurons, they are called neuro hormones
- Hypothalamic-releasing hormones
 - CORTICOTROPIN-RELEASING HORMONE (CRH) – STIMULATES ACTH
 - GONADOTROPIN-RELEASING HORMONE (GNRH) - STIMULATES LH, FSH, PRL (PROLACTIN)

- GROWTH HORMONE-RELEASING HORMONE (GHRH) - GH (GROWTH HORMONE)
- THYROTROPIN-RELEASING HORMONE (TRH) - TSH, PRL
- Hypothalamic inhibiting hormones
 - DOPAMINE – INHIBITS PRL, LH, FSH, TSH
 - SOMATOSTATIN – INHIBITS GH, TSH

neurohypophysis



adenohypophysis



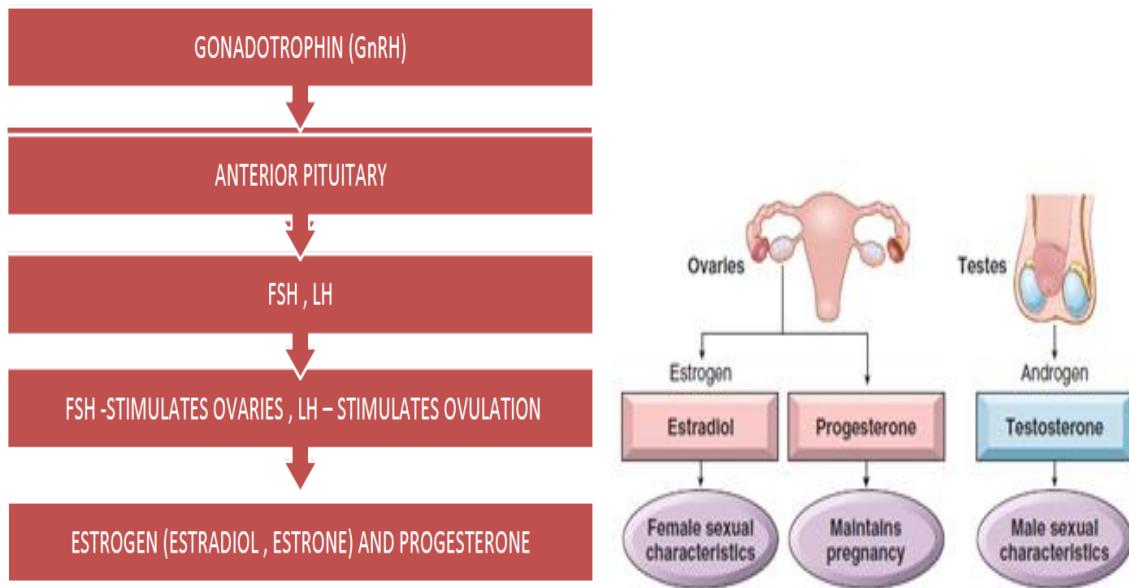
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Ovaries

- The ovaries are two small glands located in the lower abdominal region of the female.

- The ovaries produce the female gamete, the ovum, as well as hormones that are responsible for female sex characteristics and regulation of the menstrual cycle.

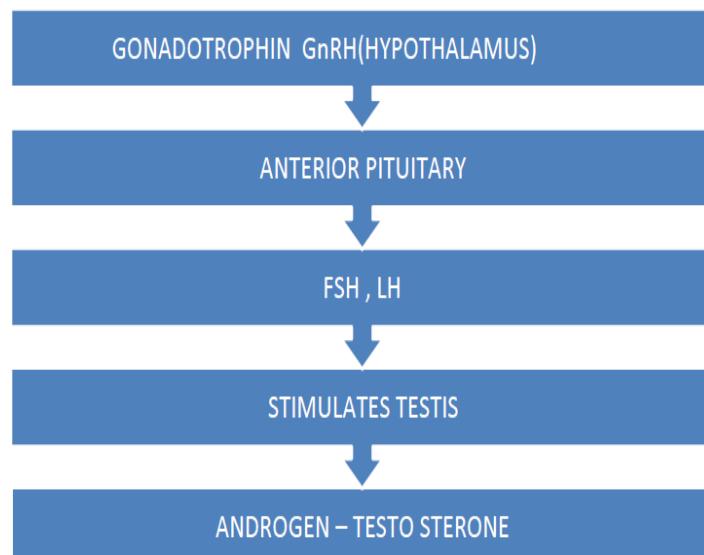
Ovarian hormones



Testes

- The testes are two small ovoid glands suspended from the inguinal region of the male by the spermatic cord and surrounded by the scrotal sac.
- The testes produce the male gametes, spermatozoa, as well as the male hormone called testosterone.

Testicular hormones



Summary

TABLE 18-2 MAJOR ENDOCRINE GLANDS: THE HORMONES THEY PRODUCE AND THEIR ACTIONS		
Endocrine Gland	Hormone	Action
Thyroid	<ul style="list-style-type: none"> Thyroxine (T4); triiodothyronine (T3) Calcitonin 	<ul style="list-style-type: none"> Increases metabolism in body cells Decreases blood calcium
Parathyroids	<ul style="list-style-type: none"> Parathyroid hormone 	<ul style="list-style-type: none"> Increases blood calcium
Adrenals	<ul style="list-style-type: none"> Cortisol (glucocorticoid) Aldosterone (mineralocorticoid) Androgens, estrogens (sex hormones) Epinephrine (adrenaline) Norepinephrine (noradrenaline) 	<ul style="list-style-type: none"> Increases blood sugar Increases reabsorption of sodium Secondary sex characteristics Sympathomimetic Sympathomimetic
Pancreas		
Islet cells	<ul style="list-style-type: none"> Insulin Glucagon 	<ul style="list-style-type: none"> Decreases blood sugar (glucose to glycogen) Increases blood sugar (glycogen to glucose)
Pituitary	<ul style="list-style-type: none"> Growth hormone (GH) (somatotropin) Thyroid-stimulating hormone (TSH) Adrenocorticotrophic hormone (ACTH) Gonadotropins Follicle-stimulating hormone (FSH) Luteinizing hormone (LH) Prolactin (PRL) Antidiuretic hormone (ADH) (vasopressin) Oxytocin 	<ul style="list-style-type: none"> Increases bone and tissue growth Stimulates thyroid gland and thyroxine secretion Stimulates adrenal cortex, especially cortisol secretion
		<ul style="list-style-type: none"> Oogenesis and spermatogenesis Promotes ovulation; testosterone secretion Promotes growth of breast tissue and milk secretion Stimulates reabsorption of water by kidney tubules Stimulates contraction of the uterus during labor and childbirth
Ovaries	<ul style="list-style-type: none"> Estrogens Progesterone 	<ul style="list-style-type: none"> Promote development of ova and female secondary sex characteristics Prepares and maintains the uterus in pregnancy
Testes	<ul style="list-style-type: none"> Testosterone 	<ul style="list-style-type: none"> Promotes development of sperm and male secondary sex characteristics

Metabolism

- Metabolism is the total of all chemical and physical changes that occur in body tissue, and it must be closely regulated to maintain homeostasis.
- It consists of two processes: anabolism and catabolism.
- Anabolism involves building complex substances (proteins) from simple substances. It requires energy and occurs in all cells as they maintain themselves, divide to form new cells, and produce substances such as hormones.
- Catabolism is the process of breaking down larger molecules into smaller ones, resulting in the release of energy

Pathology

Thyroid gland

- Enlargement of the thyroid gland is goiter
- Endemic (en- = in; dem/o = people) goiter occurs in certain regions 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 formation of nodules and adenomas



FIGURE 18-15 **A.** Goiter. Notice the wide neck, indicating enlargement of the thyroid gland. Goiter comes from the Latin *guttur*, meaning throat. **B.** Exophthalmos in Graves disease. Note the staring or startled expression resulting from periorbital edema (swelling of tissue around the eyeball or orbit of the eye). Exophthalmos usually persists despite treatment of Graves disease.

Hypersecretion

- **Hyperthyroidism – over activity of the thyroid gland; thyrotoxicosis.**
- **The most common form of this condition is graves disease (resulting from autoimmune processes) - exophthalmos (protrusion of the eyeballs, or proptosis)**

Hyposecretion

- **Hypothyroidism - underactivity of the thyroid gland- thyroidectomy, thyroiditis, endemic goiter, destruction of the gland by irradiation**
- **Myxedema is advanced hypothyroidism in adulthood.**
- **Cretinism, extreme hypothyroidism during infancy and childhood leads to a lack of normal physical and mental growth.**

Neoplasms

- **Thyroid carcinoma - cancer of the thyroid gland.**

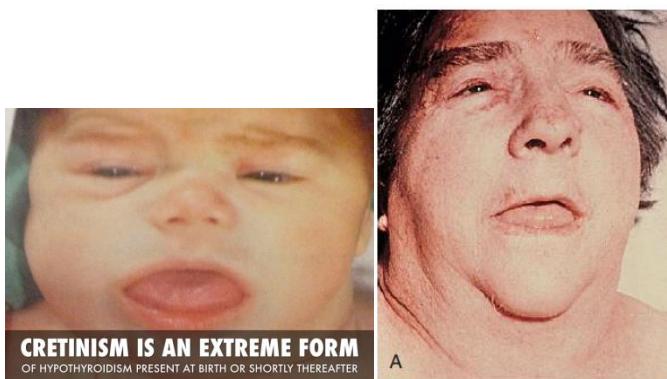


FIGURE 18-16 **A.** Myxedema. Note the dull, puffy, yellowed skin; coarse, sparse hair; prominent tongue.

Parathyroid glands

Hypersecretion

- **Hyperparathyroidism - excessive production of parathormone.**

Hyposecretion

- **Hypoparathyroidism - deficient production of parathyroid hormone - tetany (constant muscle contraction).**

Adrenal cortex

Hypersecretion

- Adrenal virilism - excessive secretion of adrenal androgens.
- Adrenal hyperplasia - or more commonly adrenal adenomas or carcinomas can cause virilization in adult women. Signs and symptoms include amenorrhea, hirsutism (excessive hair on the face and body), acne, and deepening of the voice.
- Cushing syndrome - group of signs and symptoms produced by excess cortisol from the adrenal cortex.

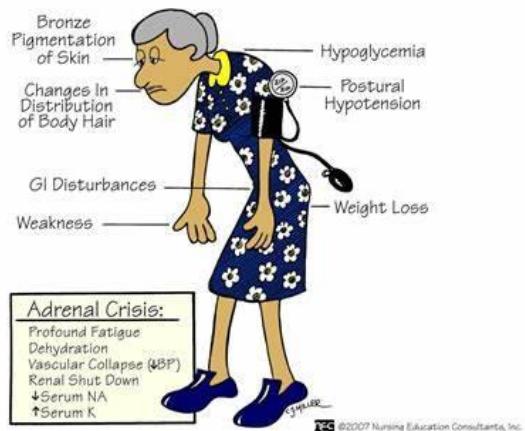


B, Cushing syndrome. Elevated plasma levels of cortisol (steroids) produce obesity, rounded facial appearance (moon-face), thin skin that bruises easily, and muscle weakness.

Hyposecretion

- Addison disease – hypo functioning of the adrenal cortex.

ADDISON'S DISEASE



Adrenal medulla

Hypersecretion

- Pheochromocytoma - benign tumor of the adrenal medulla; tumor cells stain a dark or dusky (phe/o) color (chrom/o).

Pancreas

Hypersecretion

- hyperinsulinism - excess secretion of insulin causing hypoglycemia.

Hyposecretion

- diabetes mellitus (DM) - lack of insulin secretion or resistance of insulin in promoting sugar, starch, and fat metabolism in cells.

- Type 1 diabetes is an autoimmune disease. Autoantibodies against normal pancreatic islet cells are present
- Type 2 diabetes - patients often are older, and usually there is a family history of type 2 diabetes. Obesity is very common

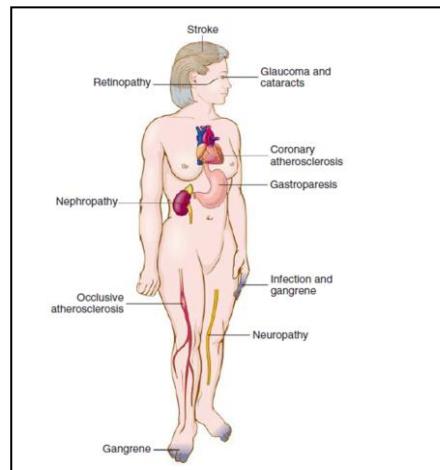
TABLE 18-3 | COMPARISON OF TYPE 1 AND TYPE 2 DIABETES MELLITUS

Category	Type 1*	Type 2†
Clinical features	Usually occurs before age 30 Abrupt, rapid onset of symptoms Little or no insulin production Thin or normal body weight at onset Ketoacidosis often occurs	Usually occurs after age 30 Gradual onset; asymptomatic Insulin usually present 85% are obese Ketoacidosis seldom occurs
Symptoms	Polyuria (glycosuria promotes loss of water) Polydipsia (dehydration causes thirst) Polyphagia (tissue breakdown causes hunger)	Polyuria sometimes seen Polydipsia sometimes seen Polyphagia sometimes seen
Treatment	Insulin	Diet (weight loss); oral hypoglycemics or insulin

Primary complication of DM:

- hyperglycemia
- Leads to ketoacidosis
- Hypoglycemia
- Insulin shock
 - (overdose of insulin)
- Primary complication of DM:
- Hyperglycemia
- Leads to ketoacidosis
- Hypoglycemia
- Insulin shock
 - (overdose of insulin)

secondary complications of DM



Category	Description
Type 1 immune mediated diabetes	Formerly known as insulin-dependent diabetes mellitus (IDDM). Requires the use of insulin since the pancreas produces little to none. Occurs typically during childhood or adolescence; most common type of diabetes mellitus diagnosed before age 30.
Type 2	Formerly known as non-insulin-dependent diabetes mellitus (niddm).affects the way in which the body uses food. Typically diagnosed in patients over 30 years of age.
Type 3	Diabetes mellitus with other conditions or syndromes.
Type 4 impaired glucose tolerance	Glucose levels between normal and diabetic.
Type 5 gestational	A carbohydrate intolerance that develops in 2% to 5% of all pregnancies

Pituitary gland: anterior lobe

Hypersecretion

- Acromegaly - hypersecretion of growth hormone from the anterior pituitary after puberty, leading to enlargement of extremities.
- Gigantism - hypersecretion of growth hormone from the anterior pituitary before puberty, leading to abnormal overgrowth of body tissues.

Hyposecretion

- Dwarfism - congenital hyposecretion of growth hormone; hypopituitary dwarfism.
- Panhypopituitarism - deficiency of all pituitary hormones.

Pituitary gland: posterior lobe

Hypersecretion

- Syndrome of inappropriate ADH (SIADH) -excessive secretion of antidiuretic hormone (leading to water retention and low sodium levels in the body)

Hyposecretion

- Diabetes insipidus (DI) - insufficient secretion of antidiuretic hormone (vasopressin).
- Insipidus means tasteless, reflecting the condition of dilute urine, as opposed to mellitus, meaning sweet or like honey, reflecting the sugar content of urine in diabetes mellitus.

TABLE 18-4 ABNORMAL CONDITIONS OF ENDOCRINE GLANDS

Endocrine Gland	Hypersecretion	Hyposecretion
Adrenal cortex	<ul style="list-style-type: none"> • Adrenal virilism • Cushing syndrome 	<ul style="list-style-type: none"> • Addison disease
Adrenal medulla	<ul style="list-style-type: none"> • Pheochromocytoma 	
Pancreas	<ul style="list-style-type: none"> • Hyperinsulinism 	<ul style="list-style-type: none"> • Diabetes mellitus
Parathyroid glands	<ul style="list-style-type: none"> • Hyperparathyroidism (hypercalcemia, osteoporosis, kidney stones) 	<ul style="list-style-type: none"> • Hypoparathyroidism (tetany, hypocalcemia)
Pituitary—anterior lobe	<ul style="list-style-type: none"> • Acromegaly • Gigantism 	<ul style="list-style-type: none"> • Dwarfism • Panhypopituitarism
Pituitary—posterior lobe	<ul style="list-style-type: none"> • Syndrome of inappropriate antidiuretic hormone 	<ul style="list-style-type: none"> • Diabetes insipidus
Thyroid gland	<ul style="list-style-type: none"> • Exophthalmic goiter (Graves disease, thyrotoxicosis) • Nodular (adenomatous) goiter 	<ul style="list-style-type: none"> • Cretinism (children) • Endemic goiter • Myxedema (adults)

Summary

Condition or Disease	Description
Acidosis	Blood pH is below normal (less than 7.34) and is therefore acidic.
Acromegaly	Hypersecretion of pituitary growth hormone in adults whose growth is complete, leading to thickening of skull bones and peripheral body parts.

Addison disease	Also known as adrenocortical insufficiency because the adrenal cortex atrophies. Characterized by weight loss, weakness, fatigue, hypoglycemia, and heart changes.
Adenoma	A benign neoplasm of cells that may function as a gland.
Alkalosis	Blood ph is above normal (greater than 7.45) and is therefore basic, or alkalotic.
Cretinism	Hypothyroidism in infants that may lead to abnormalities if left Untreated.
Cushing syndrome	Hyperfunction of the adrenal cortex that leads to such symptoms as Moon face, trunkal obesity, weakness, hypertension, kidney damage, psychiatric disturbances, and others.
Dehydration	Excess loss of water from the body.
Diabetes insipidus	Chronic excretion of large amounts of dilute urine, usually due to Inadequate vasopressin (ADH).
Diabetes mellitus (DM)	Disease in which plasma glucose control is defective because of Insulin deficiency or decreased target-cell response to insulin.
Diabetic ketoacidosis	Acute, life-threatening emergency in type 1 diabetes characterized by Increased plasma glucose and ketones, high urinary loss, and metabolic acidosis, which may lead to coma and death. Also called <i>diabetic acidosis</i> or <i>diabetic coma</i> .
Diuresis	Increase in urine excretion; can be indicative of diabetes mellitus or a Sign of chronic interstitial nephritis.
Dwarfism	The condition of being abnormally undersized. There are many types And causes, one of which is lack of growth hormone.
Euthyroid goiter	An enlargement of the thyroid gland, not due to neoplasm. Also Called a goiter.
Galactorrhea	The secretion of milky discharge, primarily in women and rarely in Men.
Gigantism	A condition of abnormal size or overgrowth of the entire body or any Of its parts, which can be due to excess growth hormone occurring prior to the fusing of endplates to bones.
Glucosuria	Urine with an abnormal concentration of glucose. Also called Glycosuria.
Graves disease	An autoimmune disorder characterized by an increase in metabolic Rate, weakness, severe weight loss, goiter, exophthalmus, or pretibial (shin) myxedema.

Hashimoto thyroiditis	Hypothyroidism due to autoimmune destruction of the thyroid gland.
Hirsutism	An abnormal amount of hair, particularly in women.
Hypercalcemia	Excessive calcium in the serum, almost always caused by Hyperparathyroidism or malignancy.
Hyperglycemia	Plasma glucose concentration increased above normal levels, which is The common feature of diabetes mellitus, and can lead to organ and tissue damage.
Hyperkalemia	High serum potassium often due to a defect in renal excretory ability, Which may lead to cardiac toxicity, flaccid paralysis, and hypoventilation.
Hyperlipidemia	Several types of disorders characterized by increased levels of Lipoproteins in the plasma. Can lead to cardiovascular disease. Also called hyperlipoproteinemia.
Hypernatremia	High plasma sodium that may lead to thirst, weakness, fatigue, Neurological deficits, and occasionally coma or death.
Hyperparathyroidism	Excessive amounts of parathyroid hormone, resulting in Hypercalcemia, and leading to disturbances of bones, kidneys, intestines, and the central nervous system.
Hyperpituitarism	Excessive secretion of hormones from the anterior lobe of the Pituitary gland. It can lead to growth-related conditions such as acromegaly and gigantism.
Hyperthyroidism	Excessive activity of the thyroid gland with an increase in secretion of Thyroid hormone, resulting in weight loss, weakness, and other symptoms.
Hypocalcemia	Low total serum calcium, which may result in muscle spasms, Lethargy, and acute confusion. May also be chronic.
Hypoglycemia	Plasma glucose concentration is below normal levels.
Hypokalemia	Low serum potassium, which may lead to heart arrhythmias, muscle weakness, mental changes, and death.
Hypolipidemia	A below normal level of plasma lipoprotein. May be associated with cardiovascular disease. Also called hypolipoproteinemia.
Hyponatremia	Low plasma sodium. Acutely it may cause coma, seizures, and death.
Hypoparathyroidism	Deficient secretion of parathyroid hormones, resulting in severe Muscle spasms due to hypocalcemia.
Hypopituitarism	Deficient secretion of hormones by the anterior lobe of the pituitary gland. It can lead to insufficient secretion of lh, fsh, gh, and tsh.

Hypothyroidism	Diminished activity of the thyroid gland with a decrease in production of thyroid hormones.
Metabolic acidosis	Decreased ph and bicarbonate concentration in the body fluids caused by accumulation of acids or abnormal loss of bases.
Metabolic alkalosis	Increased ph due to high bicarbonate concentration in body fluids from excessive intake of alkaline substances and loss of acid through urination or vomiting.
Multiple endocrine Neoplasia (MEN)	Inherited disorder of three distinct types, characterized by tumors of multiple endocrine glands as well as neural tumors. Also called sipple syndrome.
Myxedema	Hypothyroidism developed during adulthood and characterized by hard edema of subcutaneous tissues, fatigue, mental slowness, cold intolerance, muscle weakness, and dry hair.
Obesity	Excessive accumulation of fat in the body.
Papillary carcinoma	The most common type of thyroid cancer.
Pheochromocytoma	A neoplasm of the adrenal medulla (chromaffin cells) leading to Increased epinephrine and norepinephrine secretion and resulting in severe hypertension.
Polyphagia	The condition of hunger or increase in appetite.
Respiratory acidosis	Acidosis (too much acid) caused by retention of carbon dioxide, due to inadequate pulmonary ventilation.
Respiratory alkalosis	Alkalosis (too much base) resulting from abnormal loss of co2 due to hyperventilation.
Tay-sachs disease	An inherited fatal disorder characterized by the body's inability to properly process fat with deposition of fats in central and peripheral nerves.
Tetany	Muscle twitches or spasms resulting from an increase in nerve Impulses due to hypocalcemia.
Thyroid cancer	Carcinoma of the thyroid gland. There are four main types: papillary, follicular, medullary, and undifferentiated.
Thyroiditis	Inflammation of the thyroid.
Thyrotoxicosis	A disease caused by excessive quantities of thyroid hormones.

Laboratory tests

- Fasting plasma glucose(FPG) - also known as fasting blood sugar test. Measures circulating glucose level in a patient who has fasted at least 8 hours.
- RBS , PPBS

- The glycosylated hemoglobin (HbA1C) test - by measuring the percentage of red blood cells with glucose attached, monitors long-term glucose control. A high level indicates poor glucose control in diabetic patients.
- Serum and urine tests - measurement of hormones, electrolytes, glucose, and other substances in serum (blood) and urine as indicators of endocrine function
- Thyroid function tests - measurement of T3, T4, AND TSH in the bloodstream.
- Exophthalmometry -measurement of eyeball protrusion (as in graves disease) with an exophthalmometer
- Computed tomography (CT) SCAN - x-ray imaging of endocrine glands in cross section and other views, to assess size and infiltration by tumor.
- Magnetic resonance imaging (MRI) - magnetic waves produce images of the hypothalamus and pituitary gland to locate abnormalities.
- Thyroid scan - scanner detects radioactivity and visualizes the thyroid gland.
- Ultrasound examination - sound waves show images of endocrine organs.

Combining forms:

Form	Meaning
aden/o	gland
adren/o	adrenal glands (see also adrenal/o)
adrenal/o	adrenal glands (see also adren/o)
andr/o	male
calc/o	calcium
gluc/o	sugar (see also glyc/o)
glyc/o	sugar (see also gluc/o)
gonad/o	sex glands
hormon/o	hormone
pancreat/o	pancreas
parathyroid/o	parathyroid gland
pituitar/o	pituitary gland
thym/o	thymus
thyro/o	thyroid gland (see also thyroid/o)
Thyroid/o	Thyroid gland (see also thyro/o)

SUFFIXES		PREFIXES	
SUFFIX	MEANING	PREFIX	MEANING
-agon	assemble, gather together	eu-	good, normal
-emia	blood condition	hyper-	excessive; above
-in, -ine	substance	hypo-	deficient; below; under; less than normal
-tropin	stimulating the function of (to turn or act on)	oxy-	rapid, sharp, acid
-uria	urine condition	pan-	all
		poly-	many or increased
		tetra-	four
		tri-	three

Abbreviations:

Abbreviation	Meaning
ABGS	Arterial blood gases
ACTH	Adrenocorticotrophic hormone
ADH	Antidiuretic hormone
BS	Blood sugar
CA	Calcium
DI	Diabetes insipidus
DKA	Diabetic ketoacidosis
DM	Diabetes mellitus

NA	Sodium
NIDDM	Non-insulin-dependent diabetes mellitus
NPH	Neutral protamine hagedorn (insulin)
OGTT	Oral glucose tolerance test
OXT, OXY	Oxytocin
PBI	Protein-bound iodine
PGH	Pituitary growth hormone
PRL	Prolactin
PTH	Parathyroid hormone
RAI	Radioactive iodine
RAIU	Radioactive iodine uptake
RH	Releasing hormone
T ₃	Triiodothyronine
T ₄	Thyroxine
TSH	Thyroid-stimulating hormone

FBS	Fasting blood sugar
FSH	Follicle-stimulating hormone
GH	Growth hormone
HGH	Human growth hormone
GTT	Glucose tolerance test
IDDM	Insulin-dependent-diabetes
IGT	Impaired glucose tolerance
K	Potassium
LDL	Low-density lipoprotein
LH	Luteinizing hormone
MEN	Multiple endocrine neoplasia

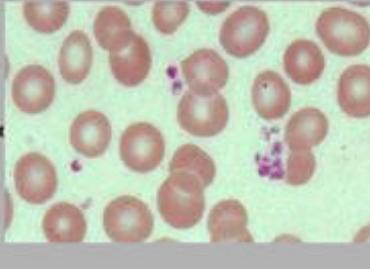
BLOOD SYSTEM

BLOOD:

- Blood is a constantly circulating fluid providing the body with nutrition, oxygen, and waste removal.
- Blood is mostly liquid, with numerous cells and proteins suspended in it, making blood "thicker" than pure water.
- The average person has about 5 liters (more than a gallon) of blood.
- A liquid called plasma makes up about half of the content of blood.
- Plasma contains proteins that help blood to clot, transport substances through the blood, and perform other functions.
- Blood plasma also contains glucose and other dissolved nutrients.
- About half of blood volume is composed of blood cells:
 - Red blood cells, which carry oxygen to the tissues
 - White blood cells, which fight infections
 - Platelets, smaller cells that help blood to clot
- Blood is conducted through blood vessels (arteries and veins). Blood is prevented from clotting in the blood vessels by their smoothness, and the finely tuned balance of clotting factors.

Major Functions of Blood

- The body contains 4 to 6 liters of blood with an average pH of 7.35 to 7.45.
Functions include:
- Transport Oxygen, Carbon Dioxide, Nutrients, Hormones, Heat, and Metabolic Wastes
- Regulation of pH, Body temperature, and water content of cells
- Protection against blood loss through clotting
- Protection against diseases through phagocytic white blood cells and antibodies





Red blood cell
(erythrocyte)



White blood cell
(leucocyte)



Platelet
(thrombocyte)

FUNCTIONS

- Maintains a constant environment for the other living tissues of the body.
- Transports chemical messengers called hormones from their sites of secretion in glands.
- Blood contains proteins, white blood cells and antibodies that fight infection, and platelets (thrombocytes) and other proteins that help the blood to clot.

COMPOSITION AND FORMATION OF BLOOD

- Blood is composed of cells, or formed elements, suspended in a clear, straw-colored liquid called plasma.

- The cells normally constitute 45% of the blood volume and include erythrocytes (red blood cells), leukocytes (white blood cells), and platelets or thrombocytes (clotting cells).
- The remaining 55% of blood is plasma, a solution of water, proteins, sugar, salts, hormones, lipids, and vitamins.

BLOOD CELLS

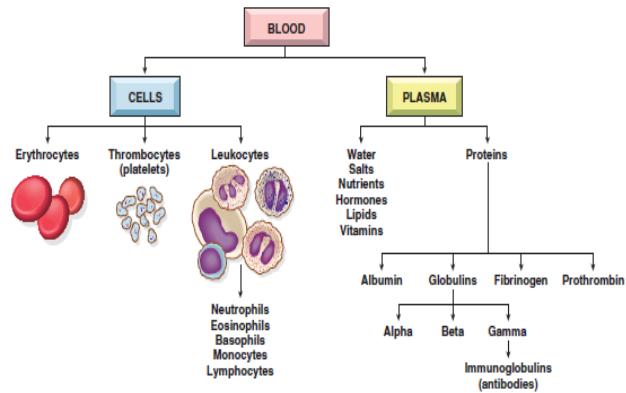
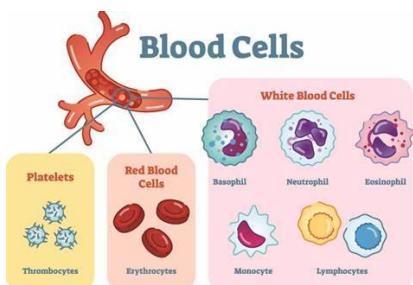
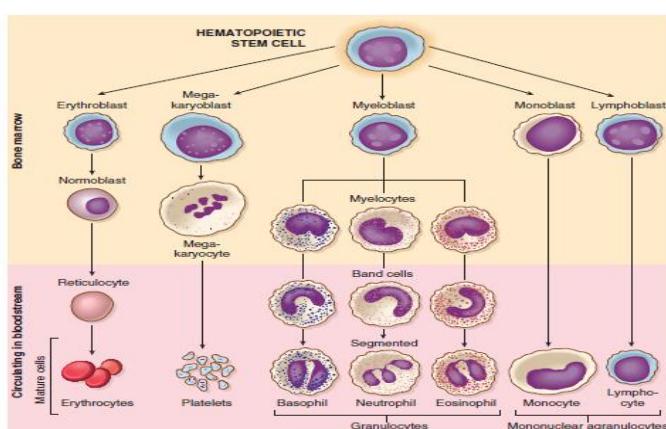


FIGURE 13-7 The composition of blood.

ORIGINATION OF BLOOD CELLS

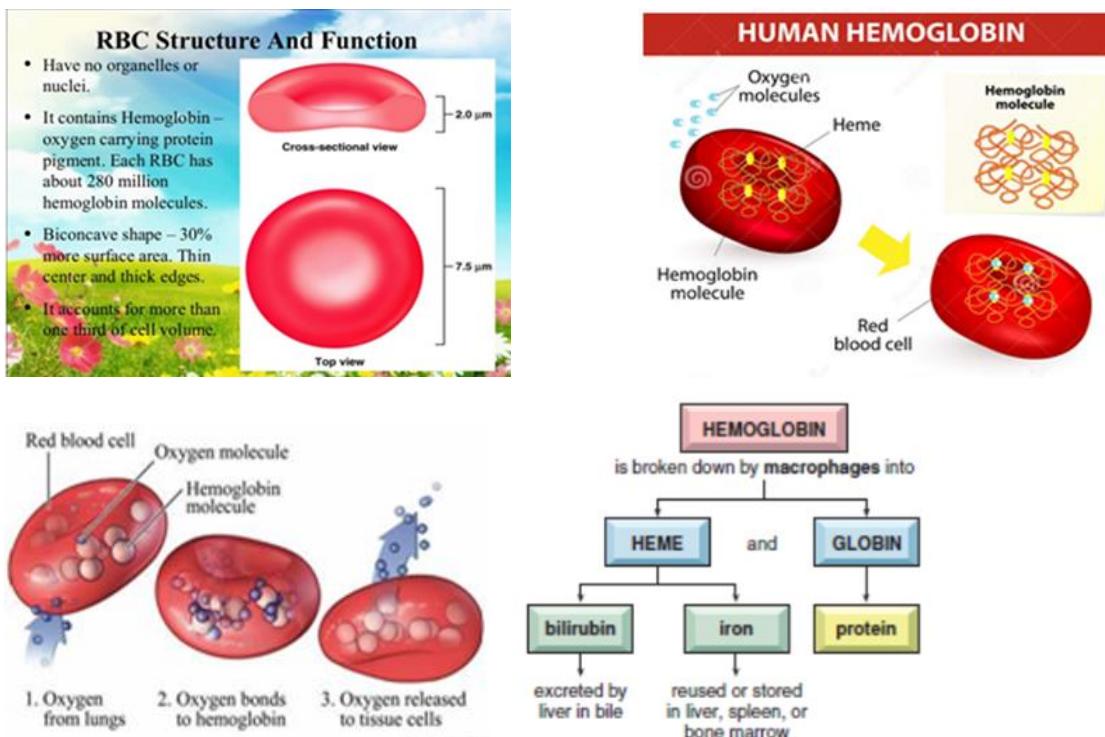
- All blood cells originate in the marrow cavity of bones.
- Arise from the same blood-forming or hematopoietic stem cells.
- Under the influence of proteins in the blood and bone marrow, stem cells change their size and shape to become specialized or differentiated.
- In this process, the cells change in size from large (immature cells) to small (mature forms), and the cell nucleus shrinks (in red cells, the nucleus actually disappears).

HEMATOPOIESIS



RBC / ERYTHROCYTES

- Shape of a biconcave disk (a depressed or hollow surface on each side of the cell, resembling a cough drop with a thin central portion).
- No nucleus
- Contains unique protein hemoglobin
- Composed of heme (iron-containing pigment)
- Globin (protein).
- Hemoglobin enables the erythrocyte to carry oxygen.
- The combination of oxygen and hemoglobin (oxyhemoglobin) produces the bright red color of blood.
- Originates in the bone marrow.
- The hormone called erythropoietin (secreted by the kidneys) stimulates their production (-poiesis means formation).
- Role of transporting gases for about 120 days in the bloodstream.



RBC & HB BREAKDOWN

- Macrophages (in the spleen, liver, and bone marrow) destroy the worn-out erythrocytes. This process is called hemolysis.
- 4 to 6 million per μl of blood.
- Macrophages break down erythrocytes and hemoglobin into heme and globin (protein) portions.
- The heme releases iron and decomposes to bilirubin (a yellow-orange pigment).
- The iron in hemoglobin - forms new red cells or is stored in the spleen, liver, or bone marrow.

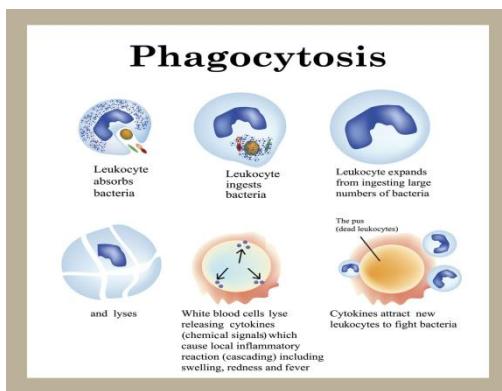
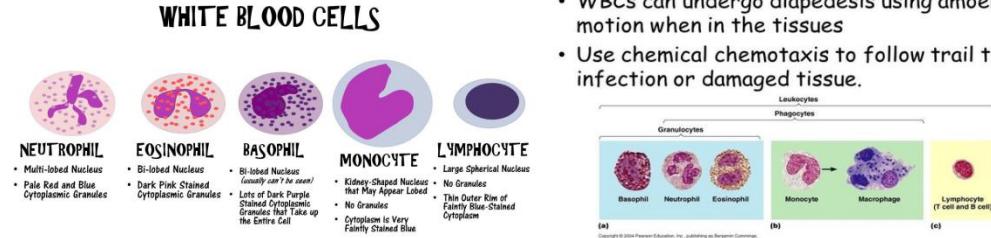
- Bilirubin is excreted into bile by the liver - enters the small intestine via the common bile duct.
- Finally, excreted in the stool, where its color changes to brown.

WBC / LEUKOCYTES

- White blood cells (7000 to 9000 cells per μl of blood)
- 2 TYPES OF WBC – GRANULOCYTES AND AGRANULOCYTES
- 3 polymorphonuclear granulocytic leukocytes (neutrophil, eosinophil, and basophil)
- 2 mononuclear agranulocytic leukocytes (lymphocyte and monocyte).
- The granulocytes, or polymorphonuclear leukocytes (pmns), are the most numerous (about 60%).

Leukocytes Structure

- WBCs have a nucleus and other organelles.
- WBCs can undergo diapedesis using amoeboid motion when in the tissues
- Use chemical chemotaxis to follow trail to infection or damaged tissue.



POLYMORPHONUCLEAR GRANULOCYTES

- Basophils contain granules - stain dark blue with a basic (alkaline) dye.
 - contain heparin (an anticoagulant substance)
 - And histamine (a chemical released in allergic Responses)
- Eosinophils contain granules - stain with eosin, a red Acidic dye.
 - increase in allergic responses and engulf Substances that trigger the allergies.
- Neutrophils contain granules - neutral
 - pale color.

- phagocytes

(phag/o means to eat or swallow)

- Specific proteins called colony-stimulating factors (CSFs) promote the growth of granulocytes in bone marrow.

MONONUCLEAR LEUKOCYTES

- Mononuclear leukocytes - one large nucleus
 - a few granules
 - lymphocytes and monocytes
- Lymphocytes - bone marrow and lymph nodes
 - circulate both in the bloodstream and the lymphatic System.
- Lymphocytes - role in the immune response - against infection.
 - directly attack foreign matter – produce antibodies that Neutralize and can lead to the destruction of foreign Antigens (bacteria and viruses).
- Monocytes - phagocytic cells
 - also fight disease.
 - they move from the bloodstream into tissues & dispose of dead and dying cells, tissue debris by phagocytosis.

PLATELETS (THROMBOCYTES)

- Platelets - blood cell fragments
 - bone marrow
 - originate from giant cells multilobed Nuclei called megakaryocytes (large bone Marrow cell)
- Tiny fragments of a megakaryocyte break off to form platelets. The main function of platelets is to help blood to clot.

PLATELET STRUCTURE:

Normal human platelets are:

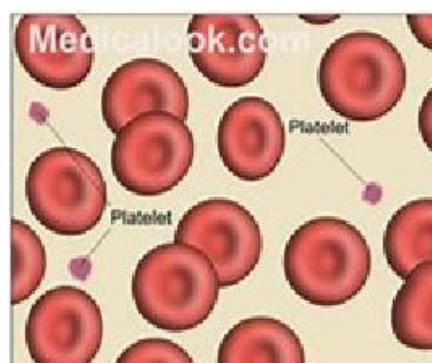
Size: Small in size ($0.5 \times 3.0 \mu\text{m}$)

Shape:

- Discoid in shape have a mean volume of 7–11 fL.
- Anucleated.

Number: They circulate in relatively high numbers (between 150 and $400 \times 10^9 / \text{L}$).

Life span: Their lifespan is approximately 10 days (9 – 12 days).

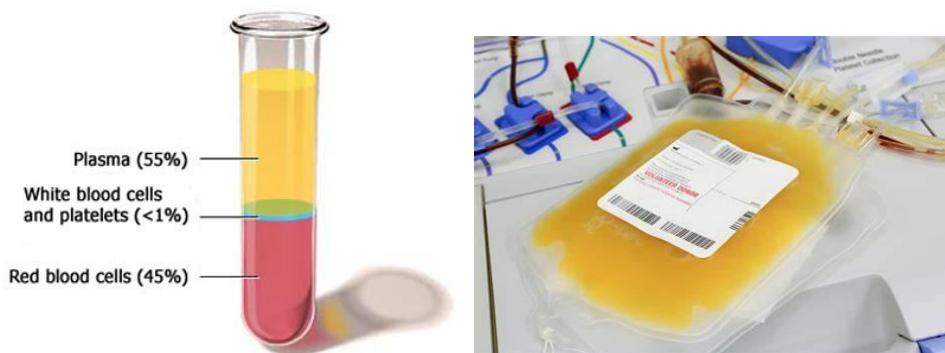


General function of platelet

- The function of platelets is the maintenance of hemostasis.
- Platelets helps in blood clotting.
- Wound repair
- Platelets secrete platelet-derived growth factor (PDGF).
- Granule secretion.
- Adhesion and aggregation.
- Pro-coagulation.
- Cytokine signalling.
- Phagocytosis.
- Transport of enzyme and proteins critical to clotting.
- Formation of a platelet plug to slow blood loss.
- Contraction of a clot after it has formed, which then reduces the size of the vessel break.

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 (and concentration) of water in the blood.
- What is Edema?
- **Globulins - plasma protein.**
- There are alpha, beta, and gamma globulins.
- Immunoglobulins (gamma glob).
- Examples : immunoglobulin antibodies are IgG (found
In high concentration in plasma)
- IgA (found in breast milk, saliva, tears, and respiratory mucus).
- Other immunoglobulins are IgM, IgD, and IgE.
- Plasmapheresis (-apheresis means to remove) is the process of separating plasma from cells and then removing the plasma from the patient.

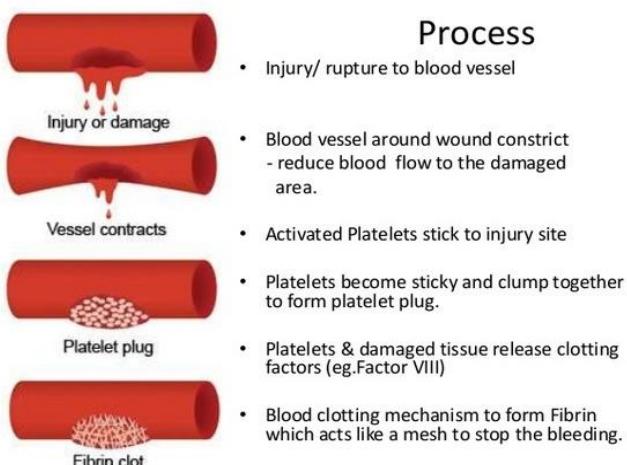


BLOOD GROUP

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	Anti-B	Anti-A	None	Anti-B and Anti-A
Antigens present	A antigen	B antigen	A and B antigens	None

UNIVERSAL DONOR ? UNIVERSAL RECEPTOR?

BLOOD CLOTTING MECHANISM



FACTORS OF BLOOD CLOTTING?

PATHOLOGY

- Any abnormal or pathologic condition of the blood - blood dyscrasia (disease).
- **Anemia** - Deficiency in erythrocytes or hemoglobin.
- **Aplastic anemia** - Failure of blood cell production in the bone marrow – Pancytopenia
- **Hemolytic anemia** - Reduction in red cells due to excessive destruction – Eg : congenital spherocytic anemia (hereditary spherocytosis)
- **Pernicious anemia** - Lack of mature erythrocytes caused by inability to absorb vitamin B12 into the bloodstream.
- **Sickle cell anemia** - Hereditary disorder of abnormal hemoglobin producing sickle-shaped erythrocytes and hemolysis.
- **Thalassemia** - Inherited defect in ability to produce hemoglobin, leading to hypochromia. *Thalassa* is a Greek word meaning sea.
- **Hemochromatosis** - Excess iron deposits throughout the body.
- **Polycythemia vera** - General increase in red blood cells (erythremia).

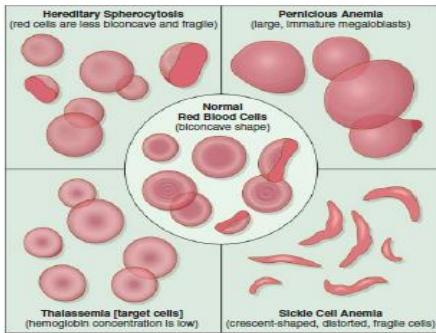


TABLE I3-3 | ABNORMALITIES OF RED BLOOD CELL MORPHOLOGY

Abnormality	Description
Anisocytosis	Cells are unequal in size
Hypochromia	Cells have reduced color (less hemoglobin)
Macrocytosis	Cells are large
Microcytosis	Cells are small
Poikilocytosis	Cells are irregularly shaped
Spherocytosis	Cells are rounded

DISORDERS OF BLOOD CLOTTING

- **Hemophilia** - Excessive bleeding caused by hereditary lack of blood clotting factors (factor VIII or IX) necessary for blood clotting.
- **Purpura** - Multiple pinpoint hemorrhages and accumulation of blood under the skin
- **Petechiae** - are tiny purple or red flat spots appearing on the skin as a result of hemorrhages.
- **Ecchymoses** - are larger blue or purplish patches on the skin (bruises)
- **Purpura** - can be caused by having too few platelets (thrombocytopenia). The cause may be immunologic, meaning the body produces an antiplatelet factor that harms its own platelets.
- **Autoimmune thrombocytopenic purpura** - is a condition in which a patient makes an antibody that destroys platelets. Bleeding time is prolonged; splenectomy (the spleen is the site of platelet destruction) and drug therapy with corticosteroids are common treatment.



FIGURE 13-12 Lower limbs of a male with hemophilia showing the effect of recurrent hemorrhage into the knees. (Courtesy Dr. G. Dolan, University Hospital, Nottingham, UK.)



FIGURE 13-13 A. Petechiae result from bleeding from capillaries or small arterioles. B, Ecchymoses are larger and more extensive than petechiae.

- **Leukemia** - Increase in cancerous white blood cells (leukocytes).

Four types of leukemia are:

1. **Acute myelogenous (myelocytic) leukemia (AML)**- Immature granulocytes (myeloblasts) predominate.
2. **Acute lymphocytic leukemia (ALL)** - Immature lymphocytes (lymphoblasts) Predominate.
3. **Chronic myelogenous (myelocytic) leukemia (CML)** - Both mature and Immature granulocytes are present in large numbers in the marrow and Blood.

4. Chronic lymphocytic leukemia (CLL) - Abnormal numbers of relatively mature lymphocytes predominate in the marrow, lymph nodes, and spleen.

- Remission - disappearance of signs and symptoms of disease.
- Relapse - occurs when disease symptoms and signs reappear, necessitating further treatment
- RX - Transplantation of normal bone marrow
- **Granulocytosis** - Abnormal increase in granulocytes in the blood
- **Eosinophilia** - Higher than normal level of eosinophils.
- **Basophilia** - Higher than normal level of basophils.
- **Mononucleosis** - Infectious disease marked by increased numbers of mononuclear leukocytes and enlarged cervical lymph nodes. Transmitted by the Epstein-Barr virus (EBV).

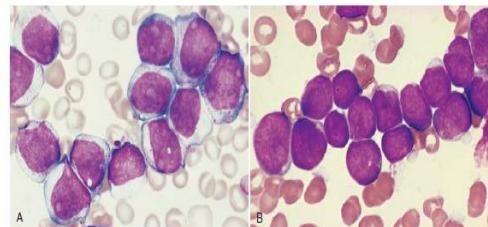
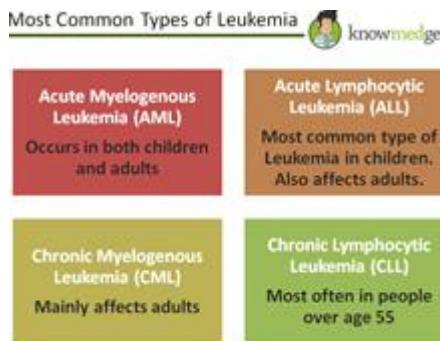


FIGURE 13-14 Acute leukemia. **A.** Acute myeloblastic leukemia (AML). Myeloblasts (immature granulocytes) predominate. There are large cells with small granules in their cytoplasm. AML affects primarily adults. A majority of patients achieve remission with intensive chemotherapy, but relapse is common. Hematopoietic stem cell transplantation may be a curative therapy. **B.** Acute lymphoblastic leukemia (ALL). Lymphoblasts (immature lymphocytes) predominate. ALL is a disease of children and young adults. Most children are cured with chemotherapy. (Courtesy Dr. Robert W. McKenna, Department of Pathology, University of Texas Southwestern Medical School, Dallas.)

DISEASE OF BONE MARROW CELLS

- Multiple myeloma - Malignant neoplasm of bone marrow. The malignant cells (lymphocytes that produce antibodies) destroy bone tissue and cause overproduction of immunoglobulins, including Bence Jones protein, an immunoglobulin fragment found in urine.
- Drugs such as thalidomide and Velcade (bortezomib) are palliative (relieving symptoms) and stop disease progression, which improves the outlook for this disease.
- Autologous bone marrow transplantation (ABMT), in which the patient serves as his or her own donor for stem cells, may lead to prolonged remission.
- Hemorrhage (bleeding): Blood leaking out of blood vessels may be obvious, as from a wound penetrating the skin. Internal bleeding (such as into the intestines, or after a car accident) may not be immediately apparent.
- Hematoma: A collection of blood inside the body tissues. Internal bleeding often causes a hematoma.
- Disseminated intravascular coagulation (DIC): An uncontrolled process of simultaneous bleeding and clotting in very small blood vessels. DIC usually results from severe infections or cancer.

- Septicemia is a serious bloodstream infection. Septicemia is a bacterial infection that spreads into the bloodstream.
- Sepsis is the body's response to that infection, during which the immune system will trigger extreme, and potentially dangerous, whole-body inflammation.
- Sepsis can also cause blood clots to form in your organs and in your arms, legs, fingers and toes — leading to varying degrees of organ failure and tissue death (gangrene).
- If sepsis progresses to septic shock, blood pressure drops dramatically. This may lead to death.

LABORATORY TESTS

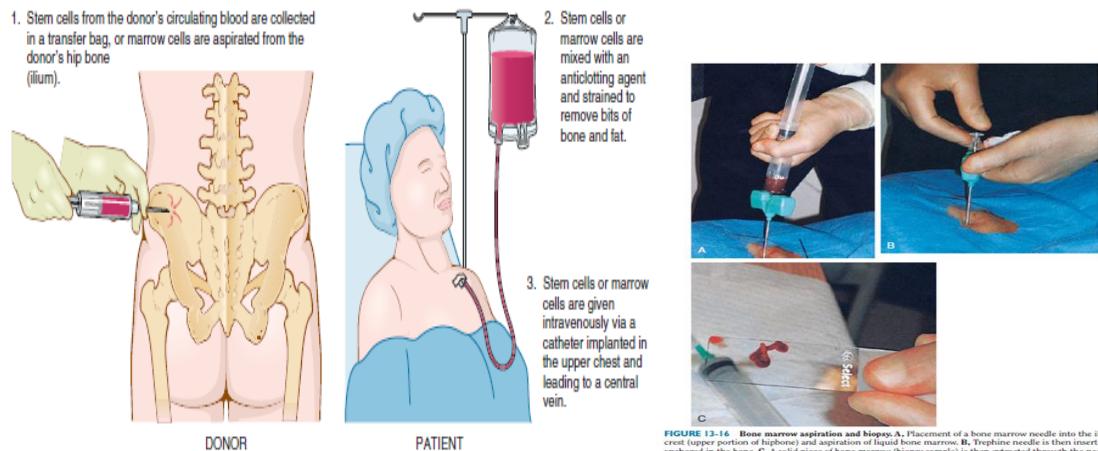
- Antiglobulin test (Coombs test) - Test for the presence of antibodies that coat and damage erythrocytes.
- Bleeding time - Time required for blood to stop flowing from a tiny puncture wound.
- Coagulation time - Time required for venous blood to clot in a test tube.
- Complete blood count (CBC) - Determination of numbers of blood cells, hemoglobin concentration, hematocrit, and red cell values—MCH, MCV, MCHC
- Erythrocyte sedimentation rate (ESR) - Speed at which erythrocytes settle out of plasma.
- Hematocrit (Hct)- Percentage of erythrocytes in a volume of blood.
- Hemoglobin test (H, Hg, Hgb, HGB) - Total amount of hemoglobin in a sample of peripheral blood.
- Platelet count - Number of platelets per cubic millimeter (mm³) or microliter (μ l) of blood.
- Prothrombin time (PT) - Test of the ability of blood to clot.
- Partial thromboplastin time (PTT)
- Red blood cell count (RBC) - Number of erythrocytes per cubic millimeter (mm³) or microliter (μ l) of blood.
- Red blood cell morphology - Microscopic examination of a stained blood smear to determine the shape of individual red cells.
- WBC Count- Number of leukocytes per cubic millimeter (mm³) or microliter (μ l) of blood.
- White blood cell differential [count] - Percentages of different types of leukocytes in the blood.

CLINICAL PROCEDURES

- Apheresis - Separation of blood into component parts and removal of a Select portion from the blood.
- Blood transfusion - Whole blood or cells are taken from a donor and Infused into a patient.

- **Bone marrow biopsy** - Microscopic examination of a core of bone marrow
Removed with a needle.
- **Hematopoietic stem cell transplantation** - Peripheral stem cells from a compatible donor are administered to a Recipient- Patients with malignancies, such as AML, ALL, CLL, CML, lymphoma and multiple myeloma, are candidates for this treatment
- In autologous stem cell transplantation, the patient's own stem cells are collected, stored, and reinfused after potent chemotherapy
- **Bone marrow transplantation**

HEMATOPOIETIC AND BONE MARROW TRANSPLANTATION



MEDICAL TERMINOLOGIES

COMBINING FORM	MEANING
bas/o	base (<i>alkaline</i>,
chrom/o	color
coagul/o	clotting
cyt/o	cell
eosin/o	red, dawn, rosy
erythr/o	red
granul/o	granules
hem/o	blood
hemoglobin/o	hemoglobin
is/o	same, equa
kary/o	nucleus
leuk/o	white
mon/o	one, single

morph/o	shape, form
myel/o	bone marrow
neutr/o	neutral (neither base nor acid)
nucle/o	nucleus
phag/o	eat, swallow
poikil/o	varied, irregular
sider/o	iron
spher/o	globe, round
thromb/o	clot

SUFFIXES

-apheresis	removal, a carrying away
-blast	immature cell, embryonic
-cytosis	abnormal condition of cells (increase in cells)
-emia	blood condition
-gen	giving rise to; producing
-globin, -globulin	protein
-lytic	pertaining to destruction
-oid	derived or originating from
-osis	abnormal condition
-penia	deficiency
-phage	eat, swallow
-philia	attraction for (an

	increase in cell numbers)
-phoresis	carrying, transmission
-poiesis	formation
-stasis	stop, control

ABBREVIATIONS:

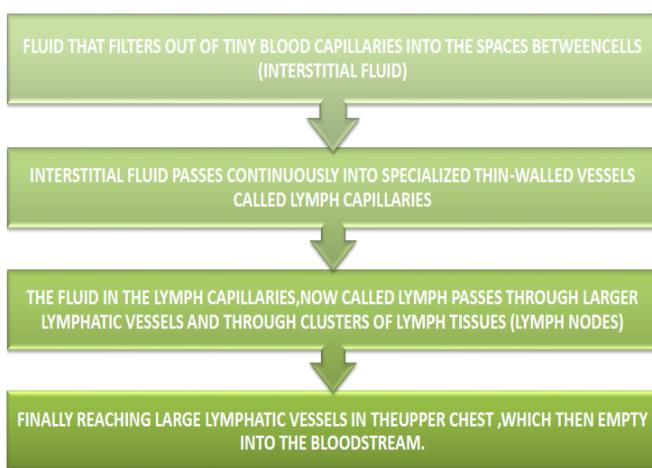
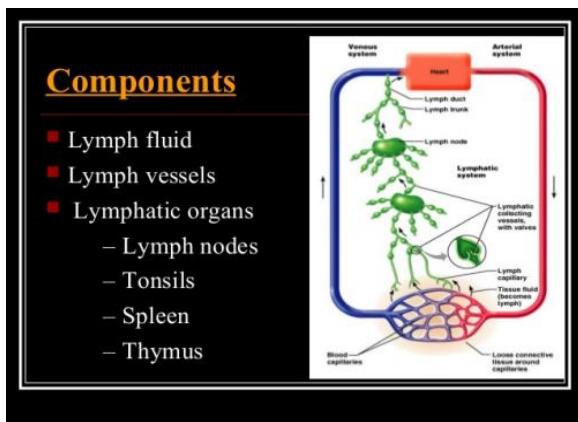
ABBREVIATION	MEANING
Ab	Antibody
ABMT	Autologous bone marrow Transplantation
ABO	Four main blood types—A, B, AB, and O
ALL	Acute lymphocytic leukemia
AML	Acute myelogenous leukemia
ASCT	Autologous stem cell transplantation
BMT	Bone marrow transplantation
CBC	Complete blood count
CLL	Chronic lymphocytic leukemia
CML	Chronic myelogenous leukemia
DIC	Disseminated intravascular Coagulation
Diff	Differential count (white blood cells)
EBV	Epstein-Barr virus; cause of Mononucleosis
Eos	Eosinophils
EPO	Erythropoietin
ESR	Erythrocyte sedimentation rate
Fe	Iron
G-CSF	Granulocyte colony-stimulating factor—
GM-CSF	Granulocyte-macrophage colonystimulating Factor
G/dl	Gram per deciliter
Hct	Hematocrit

Hgb, HGB	Hemoglobin
H and H	Hemoglobin and hematocrit
IgA, IgD, IgE, IgG, IgM	Immunoglobulins
Lymphs	Lymphocytes
MCH	Mean corpuscular hemoglobin
MCHC	Mean corpuscular hemoglobin Concentration—
MCV	Mean corpuscular volume
MDS	Myelodysplastic syndrome
mm ³	Cubic millimeter
Mono	Monocyte
Polys, PMNs, PMNIs	Polymorphonuclear leukocytes; Neutrophils, eosinophils, basophils
PTT	Partial thromboplastin time
RBC	Red blood cell; red blood cell count
Sed rate	Erythrocyte sedimentation rate
MI	Microliter
WBC	White blood cell; white blood cell count
WNL	Within normal limits

Lymphatic system

Lymph

- Lymph is a clear, watery fluid that surrounds body cells and flows in a system of thin walled lymph vessels (the lymphatic system) that extends throughout the body.
- Lymph differs from blood
- Lymph fluid does not contain erythrocytes or platelets, but it is rich in two types of white blood cells (leukocytes): lymphocytes and monocytes
- The liquid part of lymph is similar to blood plasma in that it contains water, salts, sugar, and wastes of metabolism such as urea and creatinine, but it differs in that it contains less protein
- Lymph actually originates from the blood.



Lymphatic flow

- Lymph capillaries - begin at the spaces around cells throughout the body - they are thin-walled tubes.
- Lymph capillaries carry lymph from the tissue spaces to larger lymph vessels . Lymph vessels have thicker walls than those of lymph capillaries and, like veins,

contain valves so that lymph flows in only one direction, toward the thoracic cavity.

- Collections of stationary lymph tissue, called lymph nodes, are located along the path of the lymph vessels.
- Lymph vessels all lead toward the thoracic cavity and empty into two large ducts in the upper chest. These are the right lymphatic duct and the thoracic duct.
- The thoracic duct drains the lower body and the left side of the head
- The right lymphatic duct drains the right side of the head and the chest (a much smaller area)
- Both ducts carry the lymph into large veins in the neck, where the lymph then enters the bloodstream.

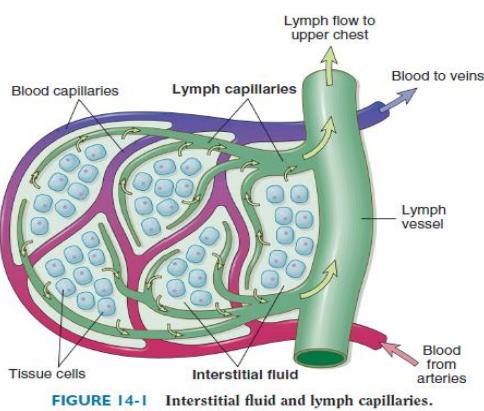


FIGURE 14-1 Interstitial fluid and lymph capillaries.

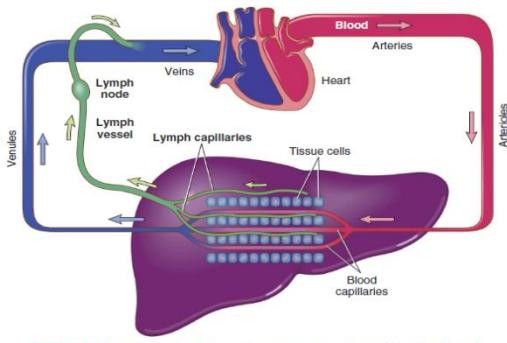
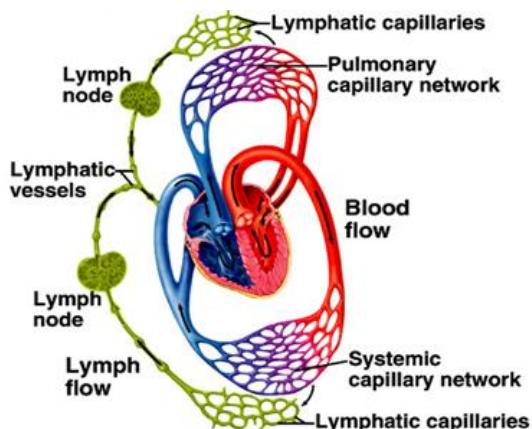


FIGURE 14-2 Relationship between the circulatory systems of blood and lymph.

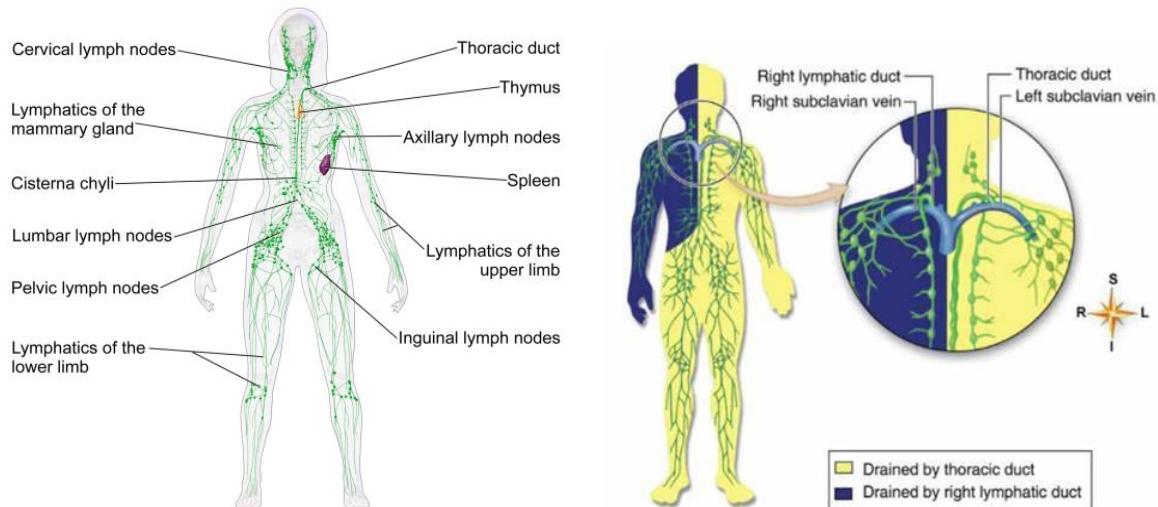
TABLE 14-1 | LYMPH AND BLOOD

Lymph (colorless)	Blood (red)
NO PUMP	PUMP
Fluid moved along by muscle movement and valves	Heart pumps blood through blood vessels
WHITE BLOOD CELLS	ALL BLOOD CELLS
Lymphocytes	Erythrocytes (give blood its red color)
Monocytes	Leukocytes
	Platelets
INTERSTITIAL FLUID	PLASMA
Water	Water
Less protein and other plasma components	Proteins
Lipids (fats) from small intestine	Salts, nutrients, lipids, and wastes

Lymph nodes

- Major sites of lymph node concentration are
 - Cervical (neck)
 - Axillary (armpit)
 - Mediastinal (chest)
 - Mesenteric (intestinal)
 - Paraaortic (lumbar)
 - Inguinal (groin).

- remember that tonsils are masses of lymph tissue in the throat near the back of the mouth (oropharynx), and adenoids are enlarged lymph tissue in the part of the throat near the nasal passages (nasopharynx).



- Lymph nodes – fights disease**
 - Produce lymphocytes – b & t
 - Contains macrophages – phagocytose
- Lymph nodes also fight disease when specialized lymphocytes called b lymphocytes (b cells), which are present in the nodes, produce antibodies.
- Other lymphocytes present in nodes are t lymphocytes (t cells). They attack bacteria and foreign cells by accurately recognizing a cell as foreign and destroying it.
- B cells mature in bone marrow, while t cells originate in the thymus gland.

Spleen and thymus gland

- Specialized organs that are also a part of the lymphatic system.
- The spleen is located in the left upper quadrant of the abdomen, next to the stomach.
- Important functions:
 - Destruction of old erythrocytes by macrophages
 - Filtration of microorganisms and other foreign material from the blood.
 - Activation of lymphocytes.
 - Storage of blood, especially erythrocytes and platelets.

Thymus gland

- The thymus gland is a lymphatic organ located in the upper mediastinum between the lungs.
- During fetal life and childhood it is quite large, but it becomes smaller with age.
- The thymus gland is composed of nests of lymphoid cells

- It plays an important role in the body's ability to protect itself from disease (immunity), especially in fetal life and during the early years of growth.
- The thymus gland is important in development of an effective immune system in childhood.

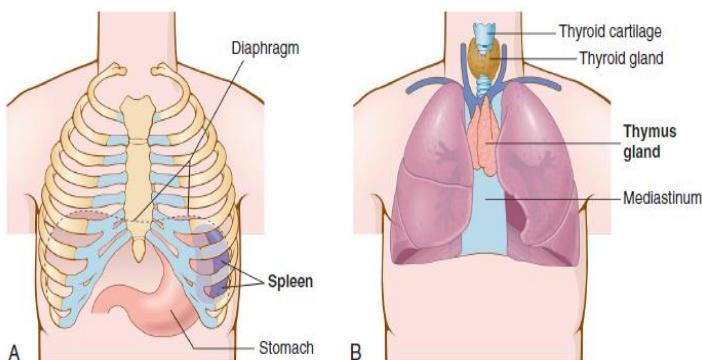


FIGURE 14-5 A, Spleen and adjacent structures. B, Thymus gland in its location in the mediastinum between the lungs.

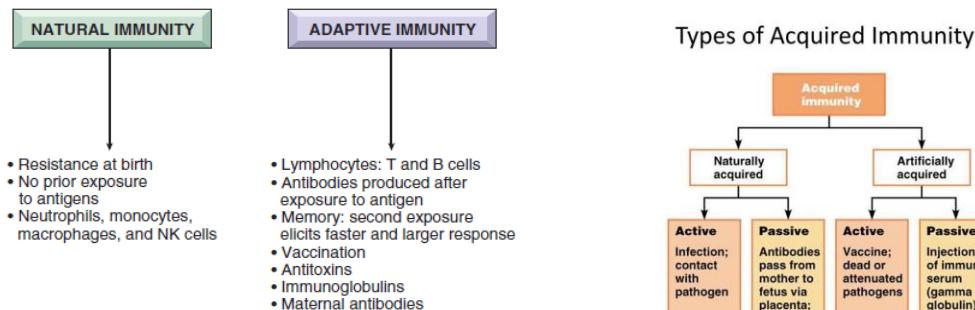
Functions of lymphatic system

- First, it is a drainage system to transport needed proteins and fluid that have leaked out of the blood capillaries (and into the interstitial fluid) back to the bloodstream via the veins.
- second, the lymphatic vessels in the intestines absorb lipids (fats) from the small intestine and transport them to the bloodstream.
- A third function of the lymphatic system relates to the immune system: the defense of the body against foreign organisms such as bacteria and viruses.
- Lymphocytes and monocytes
- Lymph nodes
- Organs such as the spleen and thymus gland
- Protect the body by producing antibodies and by mounting a cellular attack on foreign cells and organisms.

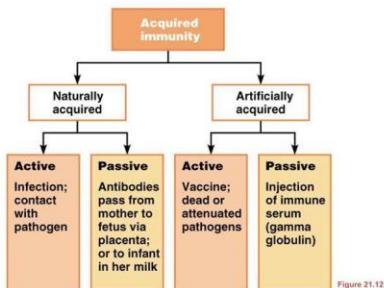
Immune system

- The immune system is specialized to defend the body against antigens (such as toxins, bacterial proteins, or foreign blood cells).
- This system includes leukocytes such as neutrophils, monocytes, and macrophages, which are phagocytotes found in blood and tissues throughout the body.
- In addition, lymphoid organs, such as the lymph nodes, spleen, thymus gland, tonsils, and adenoids, produce lymphocytes and antibodies

Types of immunity



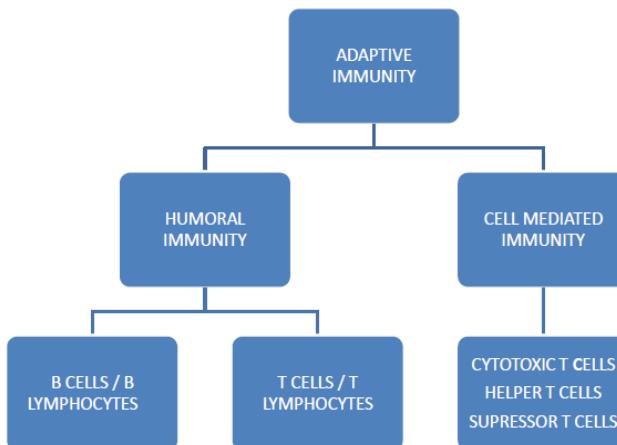
Types of Acquired Immunity



Immunity

- Immunity is the body's ability to resist foreign organisms and toxins that damage tissues and organs**
- Natural immunity is resistance present at birth. It is not dependent on prior exposure to an antigen (infectious agent).**
- In addition to natural immunity, a healthy person can develop adaptive immunity. This is the body's ability to recognize and remember specific antigens in an immune response.**

Adaptive immunity



Humoral immunity

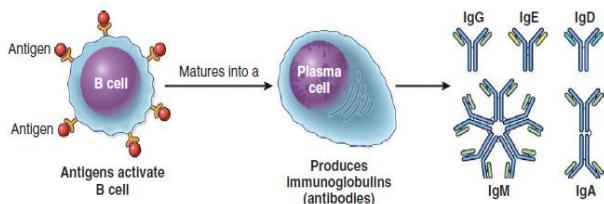


FIGURE 14-7 Humoral immunity: B cell, plasma cell, and immunoglobulins.

B CELLS → Mature into plasma cells and secrete antibodies — Immunoglobulins (IgM, IgA, IgE, IgD, IgG)

Cell mediated immunity

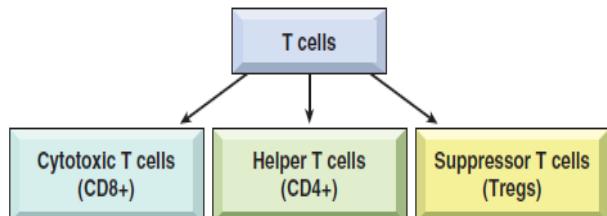


FIGURE 14-8 Cell-mediated immunity: Types of T cells.

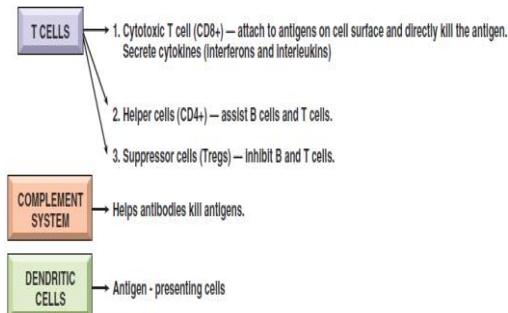


FIGURE 14-9 Functions of B cells, T cells, complement, and dendritic cells.

Pathology

- Severe combined immunodeficiency disease (**SCID**) - affected infants are born with a deficiency of b cells and t cells, resulting in a lack of immunity.
- Acquired immunodeficiency syndrome (**AIDS**) - group of clinical signs and symptoms associated with suppression of the immune system and marked by opportunistic infections, secondary neoplasms, and neurologic problems
- Caused by human immunodeficiency virus (**HIV**). HIV destroys helper t cells (also known as CD4+ cells, containing the CD4 protein antigen).
- Infectious diseases associated with aids are called **opportunistic infections**
- Opportunistic infections with aids
 - Candidiasis
 - Cryptococcal infection (**crypto**)
 - Cryptosporidiosis
 - Cytomegalovirus (**CMV**) infection
 - Herpes simplex
 - Histoplasmosis (**histo**)
 - *Mycobacterium aviumintracellulare(mai) complex infection*
 - *Pneumocystis pneumonia (PCP)*
 - Toxoplasmosis (**toxo**)
 - Tuberculosis (**TB**)
- Malignancies associated with aids are kaposi sarcoma (a cancer arising from the lining cells of capillaries that produces dark purplish skin nodules) and lymphoma (cancer of lymph nodes).
- Wasting syndrome, marked by weight loss and decrease in muscular strength, appetite, and mental activity, also may occur with aids
- Persons who were exposed to HIV and now have antibodies in their blood against this virus are **HIV-positive**

- Transmission of HIV may occur By three routes: sexual contact, blood inoculation (through sharing of contaminated needles, accidental needlesticks, or contact with contaminated blood or blood products), and passage of the virus from infected mothers to their newborns

TABLE 14-3 | COMMON ROUTES OF TRANSMISSION OF AIDS VIRUS

Route	People Affected
Receptive oral and anal intercourse	Men and women
Receptive vaginal intercourse	Women
Sharing of needles and equipment (users of intravenous drugs)	Men and women
Contaminated blood (for transfusion) or blood products	Men and women (in hemophiliacs)
From mother; in utero or via breast feeding	Neonates



LYMPHEDEMA



- Hypersensitivity – undesirable reaction produced by our immune system
- Includes allergy and autoimmunity
- Allergy - abnormal hypersensitivity acquired by exposure to an antigen.
- Allergic rhinitis
- Systemic anaphylaxis (life-threatening)
- Asthma (pollens, dust, molds)
- Hives (caused by food or drugs)
- atopic dermatitis(rash from soaps, cosmetics, chemicals) – genetic / family history – also known as eczema
- Malignancies
- Lymphoma - malignant tumor of lymph nodes and lymph tissue.
- Hodgkin disease—malignant tumor of lymphoid tissue in the spleen and lymph nodes.
- This disease is characterized by lymphadenopathy (lymph nodes enlarge), splenomegaly, fever, weakness, and loss of weight and appetite
- Reed-sternberg cell found
- Non-hodgkin lymphomas—these include follicular lymphoma (composed of collections of small lymphocytes in a follicle or nodule arrangement) and large cell

lymphoma (composed of large lymphocytes that infiltrate nodes and tissues diffusely).

- Non-hodgkin lymphomas are mostly b cell lymphomas and rarely t cell malignancies.

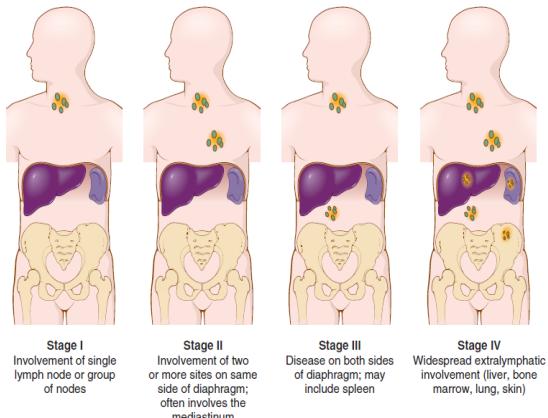


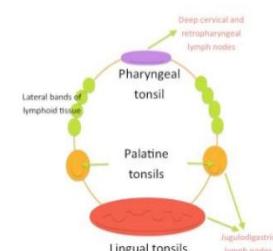
FIGURE 14-13 Staging of Hodgkin disease involves assessing the extent of spread of the disease. Lymph node biopsies, laparotomy with liver and lymph node biopsies, and splenectomy may be necessary for staging.

TABLE 13-7 Differences between Hodgkin and Non-Hodgkin Lymphomas

Hodgkin Lymphoma	Non-Hodgkin Lymphoma
More often localized to a single axial group of nodes (cervical, mediastinal, para-aortic)	More frequent involvement of multiple peripheral nodes
Orderly spread by contiguity	Noncontiguous spread
Mesenteric nodes and Waldeyer ring rarely involved	Waldeyer ring and mesenteric nodes commonly involved
Extra-nodal presentation rare	Extra-nodal presentation common

Waldeyer's Ring

- **Waldeyer's tonsillar ring includes**
 1. Adenoid tonsil
 2. Two tubal tonsils
 3. Two palatine tonsils
 4. Lingual tonsil.



- **Multiple myeloma - malignant tumor of bone marrow cells.**
- **Thymoma - malignant tumor of the thymus gland.**

Laboratory tests

- CD4+ cell count
- Elisa cell count (enzyme-linked immunosorbent assay)
- Detect anti-hiv antibodies
- Confirmed with a western blot test
- Immunoelectrophoresis - test that separates immunoglobulins (IgM, IgG, IgE, IgA, IgD).
- Viral load test - measurement of the amount of aids virus (HIV) in the bloodstream.
- Computed tomography (CT) scan - x-ray imaging produces cross-sectional and other views of anatomic structures.

Immunotherapy

- **Immunotherapy is the use of antibodies, b cells (producing antibodies), and t cells to treat disease such as cancer. Types of immunotherapy are:**
- **Monoclonal antibodies (MoAb)**

- Vaccines (contain antigens (proteins) from a patient's tumor cells)
- Transfer of immune cells

Medical terminologies:

Combining forms	Meaning
immun/o	protection
lymph/o	lymph
lymphaden/o	lymph node (gland)
splen/o	spleen
thym/o	thymus gland
tox/o	poison

prefixes

ana-	again, anew
inter-	between

Abbreviations:

Abbreviation	Meaning
AIDS	Acquired immunodeficiency syndrome
CD4+ CELL	Helper t cell
CD8+ CELL	Cd8+ cell
CMV	Cytomegalovirus
CRYPTO	<i>Cryptococcus</i>
ELISA	Enzyme-linked immunosorbent Assay
HAART	Highly active antiretroviral therapy
HD	Hodgkin disease
HISTO	Histoplasmosis
HIV	Human immunodeficiency virus
HSV	Herpes simplex virus
IGA, IGD, IGE, IGG, IGM	Immunoglobulins
KS	Kaposi sarcoma
MAI	<i>Mycobacterium avium-intracellulare</i> (mai) complex
MOAB	Monoclonal antibody
NHL	Non-hodgkin lymphoma
PCP	<i>Pneumocystis pneumonia</i>
SCID	Severe combined immunodeficiency Disease
TOXO	Toxoplasmosis

ICD – 10 CM

- **INTRODUCTION**
- **CONVENTIONS**
- **GENERAL GUIDELINES**
- **U.S. Federal Government's Department of Health and Human Services (DHHS)**
 - Centers for Medicare and Medicaid Services (CMS)
 - National Center for Health Statistics (NCHS)
- **provide the following guidelines for coding and reporting**
- **The ICD-10-CM is a morbidity classification published by the United States for classifying diagnoses and reason for visits in all health care settings**
- **ICD-10-CM is based on the ICD-10, the statistical classification of disease published by the World Health Organization (WHO).**
- **Approved by the four organizations**
 - **the American Hospital Association (AHA)**
 - **the American Health Information Management Association (AHIMA),**
 - **CMS, and**
 - **NCHS.**
- **Adherence to these guidelines when assigning ICD-10-CM diagnosis codes is required under the Health Insurance Portability and Accountability Act (HIPAA).**
- **The term encounter is used for all settings, including hospital admissions**
- **The term provider is used throughout the guidelines to mean physician or any qualified health care practitioner who is legally accountable for establishing the patient's diagnosis**
- **Patient ?**
- **Payer?**

ICD 10 CM CODE

- **ICD-10-CM codes have 3 to 7 digit alphanumeric codes.**
- **ICD-10-CM codes describe diseases, illnesses, injuries, procedures, and signs/symptoms.**
- **ICD – 10 CM vs ICD – 10 PCS**

Two Sets of Codes are Being Replaced

ICD-10-CM	ICD-10-PCS
<ul style="list-style-type: none"> • Diagnosis Coding System – Used to report the patient's condition (i.e., what's wrong with the patient) • Direct replacement for ICD-9-CM Volumes 1 & 2 • Will be used in all settings – hospital inpatient, hospital outpatient, physician office, etc. • Like ICD-9-CM, developed and maintained by the World Health Organization (WHO) and the National Center for Health Statistics within the Centers for Disease Control 	<ul style="list-style-type: none"> • Procedure Coding System – Used to report surgical procedures performed • Direct replacement for ICD-9-CM Volume 3 • Only used in a hospital inpatient setting (<u>and only for reporting facility services</u>) • Like ICD-9-CM Volume 3, ICD-10-PCS was developed and is maintained by CMS

Comparing ICD-9-CM & ICD-10-CM

ICD-10-CM differs from ICD-9-CM in its organization and structure, code composition, and level of detail.	
ICD-9-CM	ICD-10-CM
<ul style="list-style-type: none"> • Consists of three to five characters • First digit is alpha or delta (E or V) • Second, third, fourth, and fifth digits are numeric • Always at least three digits • Decimal placed after the first three characters 	<ul style="list-style-type: none"> • Consists of three to seven characters • First digit is alpha • All letters are used except for U • Second and third digits are numeric • Fourth, fifth, sixth, and seventh digit can be alpha or numeric • Decimal placed after the first three characters
Code Structure of the ICD-10-CM versus ICD-9-CM	
ICD-10-CM codes may consist of up to seven digits, with the seventh digit extensions representing visit encounter or sequela for injuries and external causes.	
ICD-9-CM Format	ICD-10-CM Format
XXX XX	XXX . XXX X
<ul style="list-style-type: none"> ➢ First three digits represents the category ➢ Fourth and fifth digit represents etiology, anatomic site, manifestation 	<ul style="list-style-type: none"> ➢ First three digits represents the category ➢ Fourth, fifth, and sixth digit represents etiology, anatomic site, severity ➢ Seventh digit represents the extension



SECTIONS IN ICD 10 CM:

- ICD 10 CM guidelines are organized into sections.
 - SECTION I
 - SECTION II
 - SECTION III
 - SECTION IV
 - SECTION I
 - the structure and conventions
 - general guidelines
 - chapter-specific guidelines
 - SECTION II
 - guidelines for selection of principal diagnosis for non-outpatient settings.
 - SECTION III
 - guidelines for reporting additional diagnoses in non-outpatient settings.
 - SECTION IV
 - outpatient coding and reporting.

THE ALPHABETIC INDEX AND TABULAR LIST

The ICD-10-CM is divided into the Alphabetic Index, an alphabetical list of terms and their corresponding code, and the Tabular List, a structured list of codes divided into chapters based on body system or condition. Chemicals.

ALPHABETIC INDEX

- The alphabetic index consists of following parts:
 - Index of Diseases and Injuries
 - Table of Neoplasms
 - Table of Drugs and Chemicals.
 - Index of External Causes of Injury
 - Main term
 - represent diseases or injuries,
 - Subterms
 - represent site, type, or etiology of the diseases or injuries



PATTERN OF THE ALPHABETIC INDEX

- Main term – They are set far left of the margin, in bold type, and capitalized.
 - Subterms – They are indented one standard indentation to the right, under the main term, printed in regular type, lower-case.
 - Specific subterms – They are indented farther right and listed in alphabetical order.
 - Dash – This is listed at the end of an index entry and indicates that additional characters are necessary.

Eg : Metrorrhagia N92.1 (main term)

- climacteric N92.4 (subterm)
 - menopausal N92.4 (subterm)
 - postpartum NEC (following delivery of placenta O72.1 (subterm) delayed or secondary O72.1 (more specific subterm)

• Numeric Entries

• The subterm entries for various words indicating numbers or those of numerical characters appear first under the appropriate main term.

• They are listed in alphabetical order in the spelled format.

• For instance, "Damage, nerve, fifth" will come before "Damage, nerve, third."

• Eg: Check Acute Gastritis
 - Gastritis, acute.

• **Exceptions to this include:**
 - Congenital conditions are usually listed under the main term "Anomaly" rather than under the name of the condition or disease.
 - Pregnancy and childbirth complications are often found under such terms as "Delivery," "Puerperal," and "Pregnancy." They could also be listed under the main term for the condition that causes the complication where the subterm is referenced, as with "complicating pregnancy."
 - Late effects or complications related to an earlier condition are listed under "Sequelae."

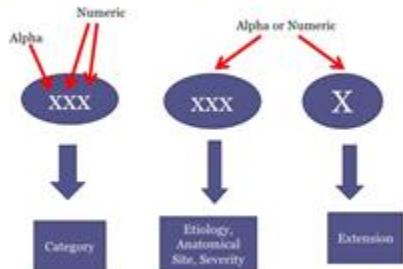
- The majority of medical and/or surgical care complications are listed under the term "Complications" rather than under the condition's name.

mesoconus D19.1	congenital u/r/n
omentum D19.1	esophageal (congenital) D17.8
peritoneum D19.1	hiatal hernia D17.8
specified site NEC D19.7	hernia D17.8
unspecified site D19.9	hernia D17.8
bipolar C46.9	Hemoglobinopathy
benign	Methemoglobinuria — see Hemoglobinuria
mesentery D19.1	Methemoglobinuria D71.10
mesocolon D19.1	Methemoglobinuria — septic (suppurative)
omentum D19.1	Methemoglobinuria F45.8
peritoneum D19.1	Mesenteritis — see also Endometritis
pleura D19.8	mesenteritis D17.8
specified site NEC D19.7	Mesoperitoneitis — see Peritonitis, pelvic, female
unspecified site D19.9	Metrostasis N62.1
epithelial C46.9	Metrostasis N62.1
benign	Metrostasis N62.1
mesentery D19.1	Metrostasis N62.1
mesocolon D19.1	Metrostasis N62.1
omentum D19.1	Metrostasis N62.1
peritoneum D19.1	Metrostasis N62.1
pleura D19.8	Metrostasis N62.1
specified site NEC D19.7	Metrostasis N62.1
unspecified site D19.9	Metrostasis N62.1
fibrous C46.9	Metrostasis N62.1
benign	Metrostasis N62.1
mesentery D19.1	Metrostasis N62.1
mesocolon D19.1	Metrostasis N62.1
omentum D19.1	Metrostasis N62.1
peritoneum D19.1	Metrostasis N62.1
pleura D19.8	Metrostasis N62.1
specified site NEC D19.7	Metrostasis N62.1
unspecified site D19.9	Metrostasis N62.1
site classification	Mesenteritis — see Endometritis
liver C45.7	Meyer-Schwartz and Weyers syndrome Q77.8
lung C45.7	Meyer's anomaly (congenital) F94
mesothium C45.7	alcohol F10.26
mesentery C46.1	Milk (diseases of) Q28
mesocolon C46.1	Milk, jaw — see Loose, body, joint
specifc site NEC D19.7	liver (regional) D72
unspecified site D19.9	Migraine (common) Q87.2
	Migraine (dispositio) G43.89
	with refractory migraine G43.919
	without tension migraine G43.911
	with aura (acute-onset) prolonged (typical) without headache G43.91
	with status migrainous G43.119
	without status migrainous G43.119
	intracranial G43.119
	with status migrainous G43.119
	Micromeningocele — see also Disorder, retina, maculopathy
	diabetic — see E80-E13 with .31
	Micromeningopathy (peripheral) I73.9

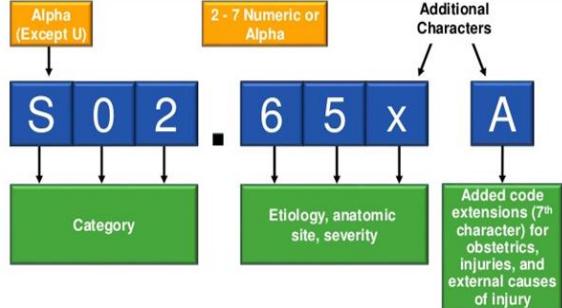
CODE STRUCTURE

- All ICD-10-CM codes have an alphanumeric structure where all codes begin with a letter.
- ICD 10 CM – Tabular list contains
- Category – 3 characters
- Subcategory - each level of subdivision after a category is a subcategory
- Code - The final level of subdivision is a code.

ICD-10-CM Format



ICD-10-CM Characters and Extensions

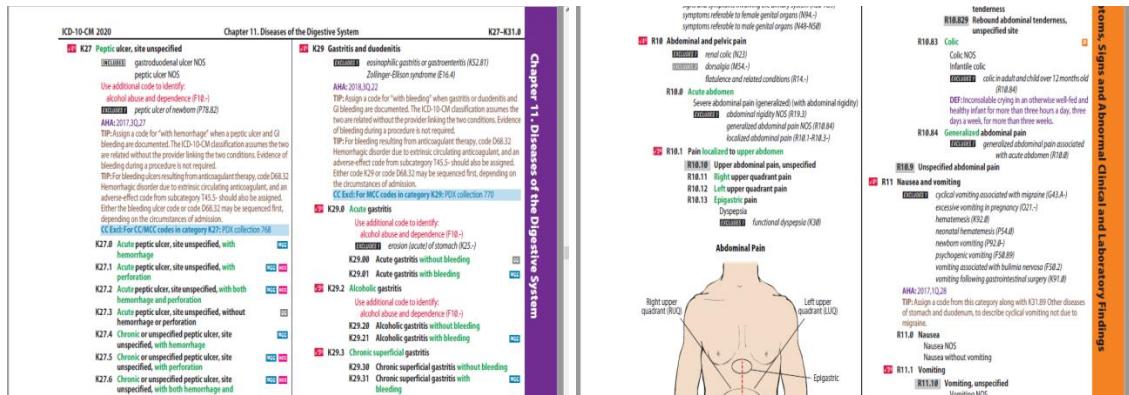


Now U is used for COVID 19

Example of Code Structure

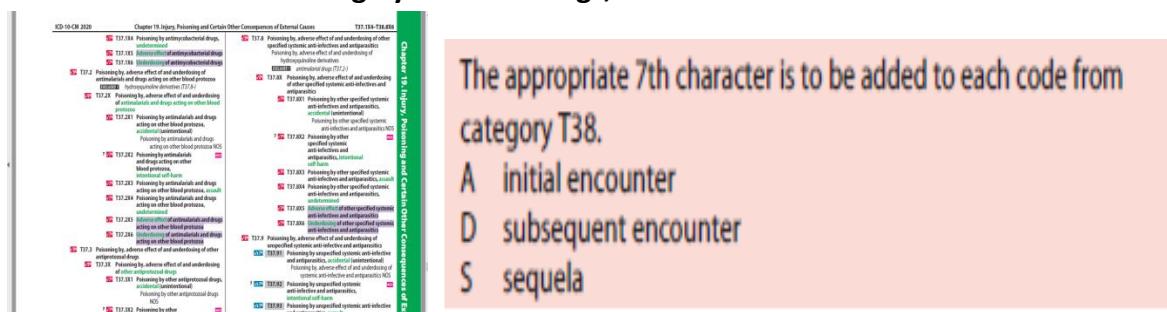
- K29 Gastritis and duodenitis (category)
 - K29.0 Acute gastritis (subcategory)
 - K29.00 Acute gastritis without bleeding (code)
- R10 Abdominal and pelvic pain
 - R10.8 Other abdominal pain (subcategory)
 - R10.811 Abdominal tenderness (subcategory)
 - R10.811 Right upper quadrant tenderness (code)

- Codes that have applicable 7th characters are still referred to as codes, not subcategories
- A code that has an applicable 7th character is considered invalid without the 7th character
- ICD-10-CM uses an indented format



PLACE HOLDER CHARACTER:

- the letter "x" is used as the fifth character dummy placeholder for many six-character codes, as in T37.5x1 (poisoning by antiviral drugs, accidental).
- This is done to allow for expansion in the future, where the sixth character has a specific use.
- The sixth character in these categories represents the indent: accidental, assault, intentional self-harm, undetermined, underdosing, or adverse effect.
- Example of Use of Placeholder*
- T37.5x1 = Poisoning by antiviral drugs, accidental
- T37.5x2 = Poisoning by antiviral drugs, intentional self-harm



The appropriate 7th character is to be added to each code from category T38.

A initial encounter

D subsequent encounter

S sequela

SEVENTH-CHARACTER EXTENSIONS:

- A: Initial encounter
- D: Subsequent encounter
- S: Sequela

ICD – 10 CM STANDARD CODING PROCESS

Standard Coding Process

- Identify main term(s)
- Look up main term(s) in Alphabetic Index
- Look through subterms if applicable
- Review all additional lines & subterms that may continue to next column
- Refer to all parenthetical terms

Grey shaded vertical lines – provide guidance for indented subterms & additional subterms

Review all instructional notes & references

- “see,” “see also,” “see category”
- “with” or “without”
- “omit code”
- “due to”
- “code by site” – **NEW TO ICD-10-CM**

Reminder – Do not code from the index

Locate & **confirm** code(s) in Tabular List

Read & follow instructions

- “Includes” & “Excludes” notes
- “Use additional code”
- “Code first underlying disease”
- “Code also”
- Character requirements (4th, 5th, 6th & 7th extensions)
- Age or gender

Refer to Official Guidelines to verify rule(s)

Confirm & assign code(s) to highest level of specificity (number of characters) supported in documentation

List on claim form in priority (or sequence) per coding guidelines

Example

– Acute Upper Respiratory Infection

- Infection
- Respiratory
- Upper
- Acute
- **Code – J06.9**

Index – Volume 2

Alphabetic order

- Can search by condition, disease, sign, symptom, etc
- **Anatomical site will refer you to “see condition”**

Index to Diseases & Injury

Neoplasm Table

Table of Drugs & Chemicals

Index to External Causes of Injury

Main Terms

- Identify disease or condition of site (for injuries)
- Main terms are listed in **bold type** & start with an **uppercase letter**

Examples of main term headings

- Complications
- Late Effect(s) or **Sequelae** (new for ICD-10)
- Fracture
- Pneumonia

- **Follow cross references like “see also” & “see”**

- **Modifiers and subterms are located under Main term**

Cross-Reference Terms

See (Condition, Category) – Mandatory instruction that the coder must look elsewhere for an alternative term. Coding cannot be completed without following this instruction

See also – Coder must review another main term if information documented in record is not reflected under main term

- An indented structure is used
 - See shaded lines in index which line up indented terms
- "See category" – The "see category" cross-reference offers the coder a category number. This is listed in the Tabular List, where the coder selects a code from the available options.
- Example: The entry "Examination, prenatal" directs the coder to category O34.

Laryngotracheobronchitis	— see Bronchitis
Larynx, laryngeal	— see condition
Lassa fever	A96.2
Lassitude	— see Weakness
Late	
	talker R62.0
	walker R62.0
Late effect(s)	— see Sequelae
Latent	— see condition
Laterocession	— see Lateroversion
Lateroflexion	— see Lateroversion
Lateroversion	
	cervix — see Lateroversion, uterus
	uterus, uterine (cervix) (postinfectious) (postpartum old) N85.4
	congenital Q51.818
	in pregnancy or childbirth O34.59- <input checked="" type="checkbox"/>
Lathyrism	— see Poisoning, food, noxious, plant
Launois' syndrome	(pituitary gigantism) E22.0
Launois-Bensaude adenolipomatosis	E88.89
Laurence-Moon (-Bardet)-Biedl syndrome	Q87.8
Lax, laxity	— see also Relaxation
	ligament (ous) — see also Disorder, ligament
	familial M35.7
	knee — see Derangement, knee

Table of Drugs & Chemicals

Used to define code by the toxic effect (i.e., poisoning) from a specific drug, medication or solution

Search by name of drug or medication

- Brand name
- Generic name

Table of Drugs & Chemicals

Substance	Poisoning, Accidental (Unintentional)	Poisoning, Intentional Self-Harm	Poisoning, Assault	Poisoning, Undetermined	Adverse Effect	Under-dosing
Arthropod (venomous) NEC	T63.481	T63.482	T63.483	T63.484	----	----
Articaine	T41.3X1	T41.3X2	T41.3X3	T41.3X4	T41.3X5	T41.3X6
Asbestos	T57.8X1	T57.8X2	T57.8X3	T57.8X4	----	----
As cardiol	T37.4X1	T37.4X2	T37.4X3	T37.4X4	T37.4X5	T37.4X6
As corbic acid	T45.2X1	T45.2X2	T45.2X3	T45.2X4	T45.2X5	T45.2X6
As iaticos ide	T49.0X1	T49.0X2	T49.0X3	T49.0X4	T49.0X5	T49.0X6
As paraginase	T45.1X1	T45.1X2	T45.1X3	T45.1X4	T45.1X5	T45.1X6
As pidium (oleores in)	T37.4X1	T37.4X2	T37.4X3	T37.4X4	T37.4X5	T37.4X6
Aspirin (aluminum) (soluble)	T39.011	T39.012	T39.013	T39.014	T39.015	T39.016
Aspoxicillin	T36.0X1	T36.0X2	T36.0X3	T36.0X4	T36.0X5	T36.0X6

Neoplasm Table

Search by anatomical site where neoplasm is located

Columns will detail Primary, Secondary (metastasis) or Ca in Situ malignancy

Additional columns will detail benign neoplasms, those with uncertain behavior & unspecified

Information **must** be documented in medical record (i.e., chart note, pathology report)

	Malignant Primary	Malignant Secondary	Ca in situ	Benign	Uncertain	Unspecified Behavior
Neoplasm, neoplastic – continued						
anorectum, anorectal (junction)	C21.8	C78.5	D01.3	D12.9	D37.8	D49.0
anteorbital fossa or space	C76.4	C79.89	D04.6	D36.7	D48.7	D49.89
antrum (Highmore) (maxillary)	C31.0	C78.39	D02.3	D14.0	D38.5	D49.1
pyloric	C16.3	C78.89	D00.2	D13.1	D37.1	D49.0
tympanicum	C30.1	C78.39	D02.3	D14.0	D38.5	D49.1
anus, anal canal	C21.0	C78.5	D01.3	D12.9	D37.8	D49.0
cloacogenic zone	C21.1	C78.5	D01.3	D12.9	D37.8	D49.0
margin – see also Neoplasm, anus, skin	C21.2	C78.5	D01.3	D12.9	D37.8	D49.0
overlapping lesion with rectosigmoid junction or rectum	C21.8	----	----	----	----	----
skin	C44.500	C79.2	D04.5	D23.5	D48.5	D49.2
basal cell carcinoma	C44.510	----	----	----	----	----
specified type NEC	C44.590	----	----	----	----	----
squamous cell carcinoma	C44.520	----	----	----	----	----

Abbreviations

NEC – Not Elsewhere Classified

Used when

- Coder has **specific documented information**, but there is **no separate or specific code available** to represent condition documented in medical record

Non-Essential Modifiers

- Words that follow main term
- Are always in parenthesis
- Provide additional information for main term
- The presence or absence of these modifiers **has no effect** on selection of the code for term

Example

- Pneumonia (acute)(double)(migratory)(purulent)(septic) (unresolved)

Abbreviations

NOS – Not Otherwise Specified

Used when

- Coder **lacks or does not have** specific documented information
- Equivalent to “unspecified”

NOS codes should never be used routinely as a means to avoid having to search for a more specific term

Essential Modifiers

- Subterms that modify main term
 - Are listed below main term in alphabetical order (exception of “with” & “without”)
- Indented two additional spaces to the right
- Regular type & starts with a lowercase letter

Example

- Pneumonia
 - With
 - Influenza – see Influenza, with, pneumonia
 - Lung abscess

Eponyms & Synonyms

Eponyms

- Diseases or syndromes named for a person (i.e., who discovered the illness)
- Listed as a main term under both name of person & disease or syndrome

Example

- Guillain-Barre' Syndrome (look up Guillain or Syndrome)

Synonyms

- Escherichia coli (E. coli)

TABULAR LIST:

Tabular List

Numerical listing of codes **divided into 21 chapters**

Code structure

- **3rd characters** – main code/category. May be primary code if no further specificity is required
- **4th character** – After decimal point. Defines site, etiology & manifestation
- **5th & 6th characters** – further specificity
- **7th character** – Required if instructed in Tabular section, identifies status of care

Characters Add Specificity

- Additional characters are added to “main category” (three character code depending on code instructions)

Example

- S52 **Main category** for “Fracture of Forearm”
- S52.**5** **Subcategory code** for unspecified “Fracture of the lower (or distal) end of radius”
- S52.**52** **Sub classification code** for “Torus fracture of lower (or distal) end of radius

Characters Add Specificity

Example

- S52.521 **Sub classification code for "Torus fracture of lower (or distal) end of right radius"**
- S52.521A **Adding the required 7th character "A"** specifies the type of encounter or stage of healing - "Torus fracture of lower end of right radius, **initial encounter for closed fracture**

Character "x" is used as a placeholder

Allows for future expansion

Fills empty characters for codes that require the full seven characters

- T15.02XD – Foreign body in cornea, left eye, subsequent encounter

New Features – 7th Character

S50 Superficial injury of elbow and forearm

[EXCLUDES2] Superficial injury of wrist and hand (S60.-)
The appropriate 7th character is to be added to each code from Category S50.

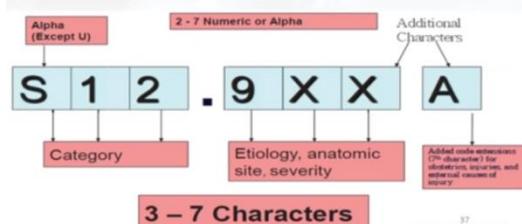
- A initial encounter
- D subsequent encounter
- S sequel

S50.0 Contusion of elbow

- S50.00 Contusion of unspecified elbow
- S50.01 Contusion of right elbow
- S50.02 Contusion of left elbow

ICD-10-CM structure

- Up to seven digits
- First digit = always alpha, except "U"
- Second digit = always numeric
- All other digits = combination (Watch O/O, 5/S, I/I)



INSTRUCTIONAL NOTES:

- Define terms
- Provide direction and instruction

Instructional Notes

• “Includes”

This note appears immediately under a three-digit code title at beginning of chapter or section.
Further defines or clarifies content of category

J32 Chronic sinusitis

- [INCLUDES] sinus abscess
- sinus empyema
- sinus infection
- sinus suppuration

Use additional code to identify:

- exposure to environmental tobacco smoke (Z77.22)
- exposure to tobacco smoke in the perinatal period (P96.81)
- history of tobacco use (Z87.891)
- infectious agent (B95-B97)

Instructional Notes

“Excludes”

- Terms following the word “excludes” are not classified to code under which it is found
- May indicate another code more fully describes a diagnosis

J32 Chronic sinusitis

- [INCLUDES] sinus abscess
- sinus empyema
- sinus infection
- sinus suppuration

Use additional code to identify:

- exposure to environmental tobacco smoke (Z77.22)
- exposure to tobacco smoke in the perinatal period (P96.81)
- history of tobacco use (Z87.891)
- infectious agent (B95-B97)
- occupational exposure to environmental tobacco smoke (Z57.31)
- tobacco dependence (F17.1)
- tobacco use (Z72.0)

[EXCLUDES] acute sinusitis (J0-J9)

J32.0 Chronic maxillary sinusitis

Antritis (chronic)

EXCLUDES1

- A type 1 Excludes note is a pure excludes note. It means "NOT CODED HERE!" An Excludes1 note indicates that the code excluded should never be used at the same time as the code above the Excludes1 note.
- An Excludes1 is used when two conditions cannot occur together, such as a congenital form versus an acquired form of the same condition.

EXCLUDES2

- A type 2 Excludes note represents "Not included here."

- When an Excludes2 note appears under a code, it is acceptable to use both the code and the excluded code together, when appropriate.

Instructional Notes		Instructional Notes – “Code First”
– “Code first”		
<ul style="list-style-type: none"> The instruction is to code underlying disease (etiology) first (i.e., “code first”) Manifestation code is sequenced as secondary diagnosis Manifestation codes may never be used alone or sequenced as principal diagnosis 		<p>N18 Chronic kidney disease (CKD) Code first any associated: diabetic chronic kidney disease (E08.22, E09.22, E10.22, E11.22) (E13.22) hypertensive chronic kidney disease (I12-, I13-) use additional code to identify kidney transplant status, if applicable, (Z94.0)</p> <p>N18.1 Chronic kidney disease, stage 1 N18.2 Chronic kidney disease, stage 2 (mild) N18.3 Chronic kidney disease, stage 3 (moderate) N18.4 Chronic kidney disease, stage 4 (severe) N18.5 Chronic kidney disease, stage 5 [EXCLUDES1] chronic kidney disease, stage 5 requiring chronic dialysis (N18.6)</p>

Instructional Notes	
“Use additional code”	
This instruction signals coder that an additional code should be used when documentation states both etiology & manifestation of disease	
<p>E10.2 Type 1 diabetes mellitus with kidney complications E10.21 Type 1 diabetes mellitus with diabetic nephropathy Type 1 diabetes mellitus with intercapillary glomerulosclerosis Type 1 diabetes mellitus with intracapillary glomerulonephrosis Type 1 diabetes mellitus with Kimmelstiel-Wilson disease</p> <p>E10.22 Type 1 diabetes mellitus with diabetic chronic kidney disease Use additional code to identify stage of chronic kidney disease (N18.1-N18.6)</p> <p>E10.29 Type 1 diabetes mellitus with other diabetic kidney complication Type 1 diabetes mellitus with renal tubular degeneration</p>	
57	

"CODE ALSO" NOTE – This note indicates that two codes may be required to adequately describe a particular condition.

- The sequencing order relies on the encounter purpose and the severity of the condition.
- "Code also" note – This note indicates that two codes may be required to adequately describe a particular condition.
- The sequencing order relies on the encounter purpose and the severity of the condition.

- Laterality
 - Left, right & bilateral
- The 5th code character will be defined as follows
 - Right side = 1
 - Left side = 2
 - Bilateral = 3
 - Unspecified = 0 or 9

Laterality – Examples
– C50.511 – Malignant neoplasm of lower-outer quadrant of right female breast
– L89.022 – Pressure ulcer of left elbow, stage II

Punctuation – Brackets & Parentheses

- [] - Brackets enclose synonyms, alternative terminology or explanatory phrases
- Also to indicate manifestation codes in index

- () - Parentheses enclose supplementary words, called nonessential modifiers, which may be present in descriptor of a code without affecting code to which it is assigned

Punctuation – Brackets & Parentheses

Index listing for electrocardiogram

- Abnormal, Abnormality, abnormalities
- Electrocardiogram [ECG] [EKG] R94.31

Tabular listing for R94.31

- Abnormal electrocardiogram [ECG] [EKG]

Index listing for acute laryngitis

- Laryngitis (acute)(edematous)(fibrinous)(infective) (infiltrative) (malignant)(membranous)...J04.0

Punctuation – Brackets & Parentheses

Examples

- Amyloid Heart (**disease**) E85.4 [I43]
 - Tells coder two codes will be reported
 - I43 is listed in [brackets] & will be secondary code reported
- Verify code in Tabular List
 - *Italicized* instruction under I43 tells coder to *Code First underlying disease, such as*
 - Amyloidosis (E85.-)

COLONS – The ICD-10-CM uses colons in the Tabular List in the inclusion and exclusion notes.

- They are listed after an incomplete term that needs one or more modifiers.

Example:

- N92.6 Irregular menstruation, unspecified

Irregular bleeding NOS

Irregular periods NOS

Excludes 1: irregular menstruation with:

lengthened intervals or scanty bleeding (N91.3-N91.5)

shortened intervals or excessive bleeding (N92.1)

Sequela (Late Effects)

- Reflects residual effect or condition produced by an acute phase of illness or injury
- No time limit applies
- Generally requires two codes
 - Condition or nature of the sequela (cause of the sequela) is coded first
 - Sequela (late effect) is coded second

Exception: if instructed to code a manifestation or combination code includes sequela

Multiple Coding

- Use of more than one code to fully identify components of a complex diagnostic statement
- A complex statement is one that involves connecting words or phrases such as “associated with,” “due to,” “incidental to,” or “secondary to”
- Is required for certain conditions that are not subject to rules of combination coding
- Identified in Tabular List by instruction to “use additional” or “code first underlying disease”

Combination Codes

- A single code used to classify two diagnoses or a diagnosis with an associated secondary process (manifestation) or complication
- Only the combination code is assigned when that code fully identifies the diagnostic conditions involved or when Tabular/Alphabetical Index so directs

Example

- E10.610 – Type 1 diabetes mellitus **with diabetic neuropathic arthropathy**
- Describes type, body system & manifestation

DVN

RELATIONAL TERMS

- Relational terms of ICD-10-CM include "and," "with"
- And" – The word "and" means both "and" and "or" when it is found in the code title.
- "With" – The word "with" means "associated with" or "due to" when it is found in the code title and as an instructional note in the Tabular List.
- In the Alphabetic Index, the word "with" is sequenced immediately following the main term.
- "Due to" – The words "due to" in both the Tabular List and the Alphabetic Index means that there is a causal relationship between two conditions.
- This assumption occurs when both conditions are present or when the diagnostic statement indicates this relationship.

Signs & Symptoms

- May be coded when they are the reason for testing
- When provider has **not made** a definitive final diagnosis
- Signs & symptoms that are a routine part of a known disease process are not coded separately unless otherwise instructed in Tabular listing

Aftercare Codes – Fractures or Injuries

- Assign after initial, acute treatment is completed
- Used in post acute settings
- Patient is admitted to LTC for ongoing care during healing or recovery phase
- List acute injury code with 7th character "D"
- **Aftercare Z codes are NOT used for injuries**

Aftercare Coding – Examples

- **Example A**
 - Patient status post hip replacement
 - Admitted to LTC for rehabilitation
 - **S72.111D – Subsequent encounter for closed fracture with routine healing**
- **Example B**
 - Patient status post fracture of acute pelvic fracture
 - Admitted to LTC for rehabilitation
 - **S32.9XXD – Fracture/unspecified/lumbosacral spine & pelvis, subsequent encounter for routine healing**

Primary Diagnosis – Section II

- Primary diagnosis = reason for continued stay in LTC
 - May be same as principal diagnosis (i.e., Parkinson's disease)
 - Is required to support therapy services
- Example**
- The pneumonia would be sequenced as second diagnosis as reason for therapy

"Additional Diagnoses" – Section III

- "All conditions that coexist at the time of admission, that develop subsequently, or that affect the treatment received and/or the length of stay"
- Applies to LTC setting
- Do not report conditions that are resolved or from previous admissions that have no bearing on the current stay
- Historical diagnoses (Z80-Z87) may be used if there is impact on current care or treatment

ICD-10-CM Official Guidelines for Coding and Reporting, Section III, Pages 100-101

10 STEPS TO CORRECT CODING

1. IDENTIFY THE REASON FOR THE VISIT / ENCOUNTER
2. CONSULT ALPHABETIC INDEX FIRST
3. LOCATE THE MAIN ENTRY
4. SCAN SUBTERM ENTRIES
5. PAY CLOSE ATTENTION TO INDEX INSTRUCTIONS
 - I. PARANTHESIS
 - II. BRACKETS
 - III. DEFAULT CODES
 - IV. SEE, SEE ALSO
 - V. OMIT CODE
 - VI. WITH
 - VII. DUE TO
 - VIII. NEC
 - IX. NOS
 - X. CHECK ADDITIONAL SYMBOL CODE
6. CHOOSE A POTENTIAL CODE AND LOCATE IT IN THE TABULAR LIST
7. READ ALL THE INSTRUCTIONS IN THE TABULAR LIST
 - INCLUDES
 - EXCLUDES 1 AND EXCLUDES 2
 - PLACE HOLDER X
 - 7TH CHARACTER
8. CONVENTIONS AND GUIDELINES
9. CONFIRM AND ASSIGN THE CODE
10. SEQUENCE CODES CORRECTLY

ICD 10 CM

CHAPTER SPECIFIC CODING GUIDELINES

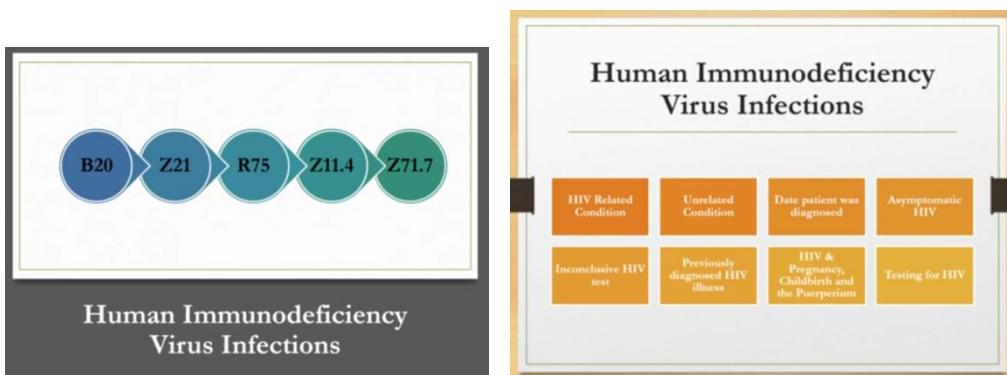
- In Addition To General Coding Guidelines, There Are Guidelines For Specific Diagnoses And/Or Conditions In The Classification.
- Unless Otherwise Indicated, These Guidelines Apply To All Health Care Settings.

Chapter 1: Certain Infectious and Parasitic Diseases (A00-B99), U07.1



a. Human Immunodeficiency Virus (HIV) Infections

- 1) The Provider's Diagnostic Statement That The Patient Is HIV Positive, Or Has An HIV-Related Illness Is Sufficient.



2) Selection And Sequencing Of HIV Codes

(A) Patient Admitted For HIV-Related Condition

- Principal Diagnosis - B20 (Human Immunodeficiency Virus [HIV] Disease) Followed By Additional Diagnosis Codes For HIV Related Condition

(B) Patient With HIV Disease Admitted For Unrelated Condition

- Admitted For An Unrelated Condition (Such As A Traumatic Injury), The Code For The Unrelated Condition (E.G., The Nature Of Injury Code) Should Be The Principal Diagnosis – B20 – HIV Related Condition



(C) Whether The Patient Is Newly Diagnosed Or Has Had Previous Admissions/Encounters For HIV Conditions - Irrelevant To The Sequencing Decision

(D) Asymptomatic Human Immunodeficiency Virus

- Z21 - Without Any Documentation Of Symptoms - HIV Positive, Known HIV, HIV Test Positive
- But – Aids , Pt Treated For Any HIV Related Illness, Having Any Condition Resulting From His / Her Positive Status – Use B20

(E) Patients With Inconclusive HIV Serology

- But No Definitive Diagnosis Or Manifestations Of The Illness
- Code R75 - Inconclusive Laboratory Evidence Of Human Immunodeficiency Virus [HIV].

(F) Previously Diagnosed HIV-Related Illness

- Code B20
- Never Be Assigned To R75 Or Z21

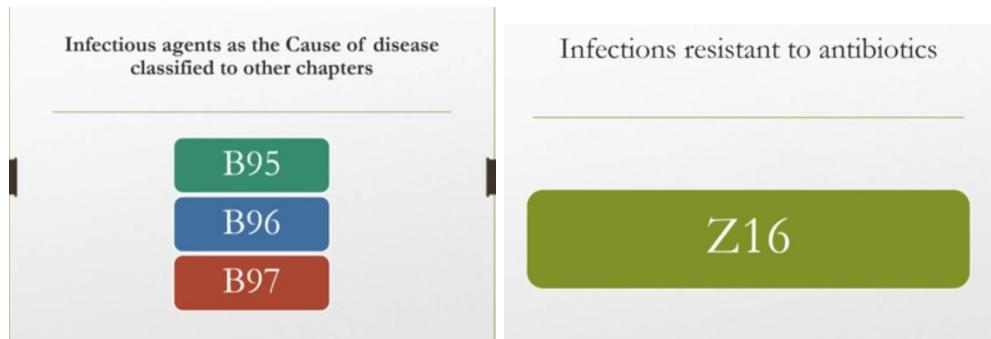
(G) HIV Infection In Pregnancy, Childbirth And The Puerperium

- A Principal Diagnosis Code Of O98.7-, Human Immunodeficiency [HIV] Disease Complicating Pregnancy, Childbirth And The Puerperium.
- Followed By B20 And The Code(S) For The HIV-Related Illness(Es).
- Chapter 15 Always Take Sequencing Priority.
- Asymptomatic HIV Infection Status Admitted (Or Presenting For A Health Care Encounter) -
- O98.7- And Z21.

(H) Encounters For Testing For HIV

- To Determine His/Her HIV Status - Use Code Z11.4, Encounter For Screening For Human Immunodeficiency Virus [HIV] – Additional Code For Any Associated High Risk Behavior.
- With Signs Or Symptoms Is Being Seen For HIV Testing - Code The Signs And Symptoms - Additional Counseling Code Z71.7, Human Immunodeficiency Virus [HIV] Counseling, May Be Used If Counseling Is Provided During The Encounter For The Test
- When A Patient Returns To Be Informed Of His/Her HIV Test Results - The Test Result Is Negative, Use Code Z71.7, Human Immunodeficiency Virus [HIV] Counseling.
- If The Results Are Positive, See Previous Guidelines And Assign Codes As Appropriate.

b. Infectious agents as the cause of diseases classified to other chapters



A Code From Category B95, Streptococcus, Staphylococcus, And Enterococcus

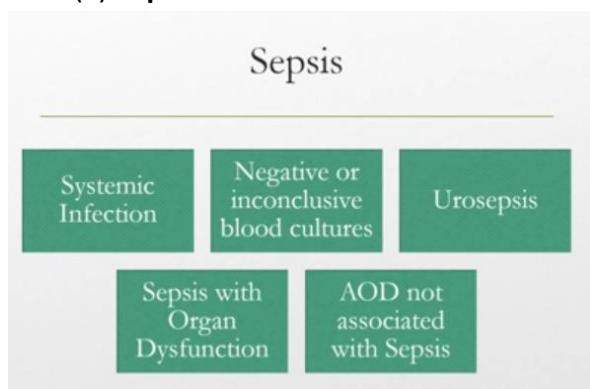
- **B96, Other Bacterial Agents As The Cause Of Diseases Classified To Other Chapters, Or**
- **B97, Viral Agents As The Cause Of Diseases Classified To Other Chapters, Is To Be Used As An Additional Code To Identify The Organism.**

c. Infections resistant to antibiotics

Assign A Code From Category Z16, Resistance To Antimicrobial Drugs, Following The Infection Code Only If The Infection Code Does Not Identify Drug Resistance

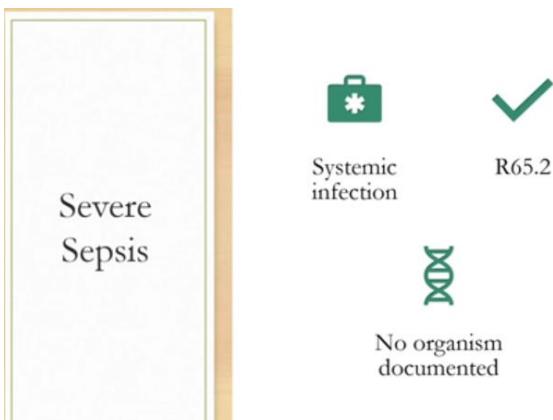
d. Sepsis, Severe Sepsis, and Septic Shock

- 1) **Coding of Sepsis and Severe Sepsis**
 - (a) **Sepsis**



- **For A Diagnosis Of Sepsis, Assign The Appropriate Code For The Underlying Systemic Infection - Assign Code A41.9, Sepsis, Unspecified Organism.**
- **Negative Or Inconclusive Blood Cultures And Sepsis – Query The Provider**
- **Urosepsis – Non Specific Term – Query The Provider**
- **Sepsis With Organ Dysfunction – Code For Severe Sepsis**
- **Acute Organ Dysfunction That Is Not Clearly Associated With The Sepsis – Do Not Code Severe Sepsis R65.2 – Query The Provider**

(b) Severe sepsis



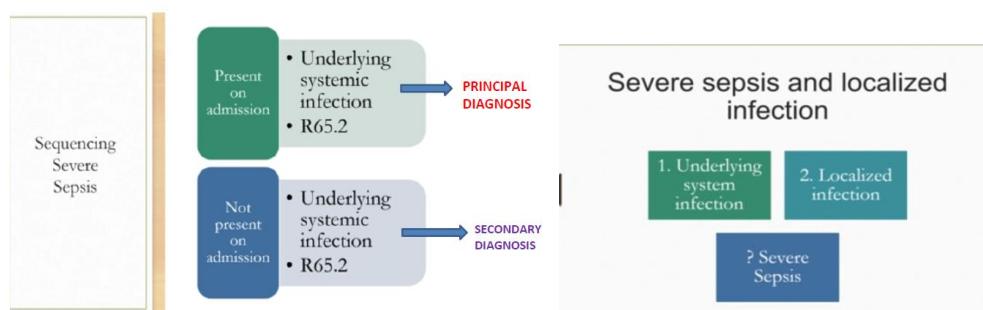
- First A Code For The Underlying Systemic Infection – A41.9 (If Org Not Mentioned)
- Followed By A Code From Subcategory R65.2, Severe Sepsis.
- Additional Code(S) For The Associated Acute Organ Dysfunction Are Also Required.

2) Septic shock



- For Cases Of Septic Shock
- The Code For The Systemic Infection Should Be Sequenced First
- Followed By Code R65.21, Severe Sepsis With Septic Shock
- Or Code T81.12, Post Procedural Septic Shock.
- Any Additional Codes For The Other Acute Organ Dysfunctions Should Also Be Assigned.

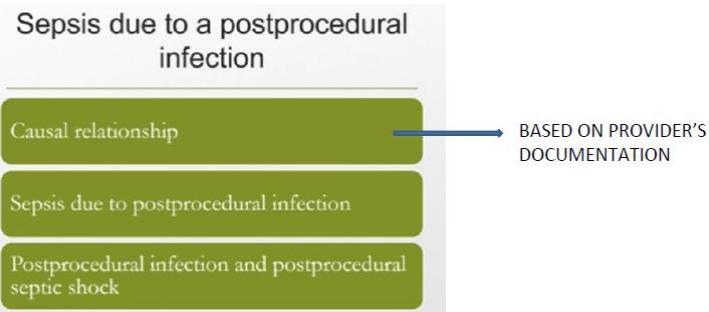
3) Sequencing of severe sepsis



4) Sepsis or severe sepsis with a localized infection

1. Reason For Admission – Sepsis / Severe Sepsis + Localized Infection – Code Sepsis First , Secondary Code For Localized Infection, R65.2 If Present
2. Admitted With Localized Infection , Sepsis Not Developed Until After Admission – Code For Localised Infection First, Followed By Sepsis / Severe Sepsis Codes

5) Sepsis due to a postprocedural infection



- **T81.40, To T81.43 Infection Following A Procedure**
- **O86.00 To O86.03, Infection Of Obstetric Surgical Wound, That Identifies The Site Of The Infection Should Be Coded First, If Known.**
- **Assign An Additional Code For Sepsis Following A Procedure (T81.44) Or**
- **Sepsis Following An Obstetrical Procedure (O86.04).**
- **Use An Additional Code To Identify The Infectious Agent**
- **If The Patient Has Severe Sepsis - R65.2 + Additional Code(S) For Any Acute Organ Dysfunction.**
- **For Infections Following Infusion, Transfusion, Therapeutic Injection, Or Immunization, A Code From Subcategory T80.2**
- **T88.0-, Infection Following Immunization, Should Be Coded First, Followed By The Code For The Specific Infection.**
- **R65.2 + Organ Dysfunction If Present**
- **Postprocedural Infection And Postprocedural Septic Shock**
- **Sepsis Due To A Postprocedural Infection, Followed By Code T81.12-, Postprocedural Septic Shock.**
- **Additional Code(S) Should Be Assigned For Any Acute Organ Dysfunction**

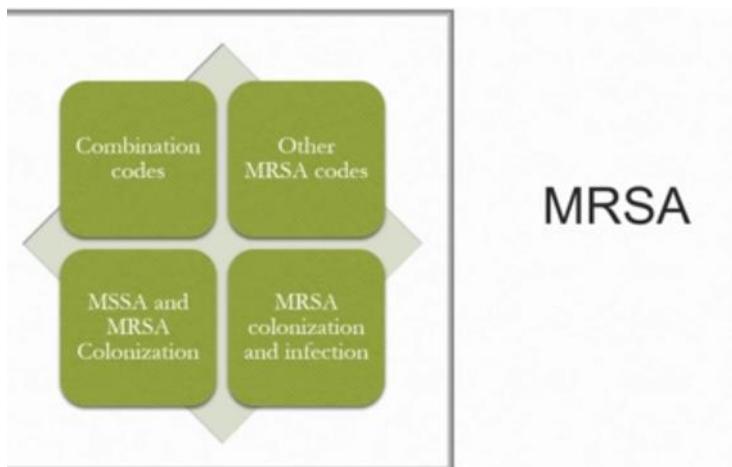
6) Sepsis and severe sepsis associated with a noninfectious process (condition)



- **Non Infectious Condition – Trauma / Burns**

- First – Code Condition
- Second – Infection
- R65.2 + Organ Dysfunction If Present

e. Methicillin Resistant Staphylococcus aureus (MRSA) Conditions



METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) CONDITIONS

- 1) Selection And Sequencing Of MRSA Codes
 - (A) Combination Codes For MRSA Infection
- Infection Due To MRSA With Causal Organism – Eg. Sepsis , Pneumonia – Combination Code
- E.G., Code A41.02, Sepsis Due To Methicillin Resistant Staphylococcus Aureus
- Code J15.212, Pneumonia Due To Methicillin Resistant Staphylococcus Aureus.
- B95.62 – Do Not Assign As Additional Diagnosis- As The Cause Of Diseases Classified Elsewhere
- Z16.11 – Do Not Assign As Additional Diagnosis- Resistance To Penicillins –
- (B) OTHER CODES FOR MRSA INFECTION
 - Current Infection Due To MRSA – If , No Combo Code – Assign Condition And MRSA Code (B95.62)
- (C) Methicillin Susceptible Staphylococcus Aureus (MSSA) And MRSA Colonization
 - Colonization Means That MSSA Or Msra Is Present On Or In The Body Without Necessarily Causing Illness
 - Assign Code Z22.322, Carrier Or Suspected Carrier Of Methicillin Resistant Staphylococcus Aureus, For Patients Documented As Having MRSA Colonization.
 - Assign Code Z22.321, Carrier Or Suspected Carrier Of Methicillin Susceptible Staphylococcus Aureus, For Patients Documented As Having MSSA Colonization
- (D) MRSA COLONIZATION AND INFECTION
 - If A Patient Is Documented As Having Both MRSA Colonization And Infection During A Hospital Admission - Code Z22.322 (Carrier Or Suspected Carrier Of



Methicillin Resistant Staphylococcus Aureus + A Code For The MRSA Infection May Both Be Assigned.

f. Zika virus infections

Zika Virus Infections

Code confirmed cases **Types of confirmation** **Contact with (suspected) exposure**

- **1) Code Only Confirmed Cases**
- **Code Only A Confirmed Diagnosis Of Zika Virus (A92.5, Zika Virus Disease) As Documented By The Provider.**
- **This Is An Exception To The Hospital Inpatient Guideline Section II, H. In This Context, “Confirmation” Does Not Require Documentation Of The Type Of Test Performed; The Provider’s Diagnostic Statement That The Condition Is Confirmed Is Sufficient.**
- **If The Provider Documents “Suspected”, “Possible” Or “Probable” Zika - Do Not Assign Code A92.5.**
- **Assign A Code(S) Explaining The Reason For Encounter (Such As Fever, Rash, Or Joint Pain) Or**
- **Z20.821, Contact With And (Suspected) Exposure To Zika Virus.**

g. Coronavirus infections

- **Infections Due To SARS – COV2**
- **April 1, 2020 Through September 30, 2020**
- **A) Code Only A Confirmed Diagnosis Of The 2019 Novel Coronavirus Disease (Covid-19)**
 - **As Documented By The Provider,**
 - **Documentation Of A Positive Covid-19 Test Result, Or A Presumptive Positive Covid-19 Test Result (Tested Positive For A Virus At A Local Or State Level)**
- **For A Confirmed Diagnosis, Assign Code U07.1, Covid-19..**
- **If The Provider Documents “Suspected,” “Possible,” “Probable,” Or “Inconclusive” Covid19, Do Not Assign Code U07.1.**
 - **Assign A Code(S) Explaining The Reason For Encounter (Such As Fever) Or**
 - **Z20.828, Contact With And (Suspected) Exposure To Other Viral Communicable Diseases.**

B) Sequencing Of Codes

- When Covid-19 Meets The Definition Of Principal Diagnosis, Code U07.1, Covid-19, Should Be Sequenced First, Followed By The Appropriate Codes For Associated Manifestations,
- Except In The Case Of Obstetrics Patients As Indicated For Covid-19 In Pregnancy, Childbirth, And The Puerperium. (Chap 15)
- Progresses To Sepsis – Follow Guidelines Of Sepsis, Severe Sepsis And Septic Shock.

C) Acute Respiratory Illness Due To Covid-19

(I) Pneumonia - Due To The 2019 Novel Coronavirus (Covid-19) –

- Assign Codes U07.1, Covid-19, And
- J12.89, Other Viral Pneumonia.

(II) Acute Bronchitis - Due To Covid-19

- Assign Codes U07.1, And
- J20.8, Acute Bronchitis Due To Other Specified Organisms.

Bronchitis Not Otherwise Specified (NOS) Due To Covid-19

- Code U07.1 And
- J40, Bronchitis, Not Specified As Acute Or Chronic.

(III) Lower Respiratory Infection

- The Covid-19 Is Documented As Being Associated With A LRI, Not Otherwise Specified (NOS), Or An Acute Respiratory Infection, NOS,
 - Codes U07.1 And
 - J22, Unspecified Acute Lower Respiratory Infection, Should Be Assigned.
- If The Covid-19 Is Documented As Being With A Respiratory Infection, NOS,
 - Codes U07.1 And
 - J98.8, Other Specified Respiratory Disorders, Should Be Assigned.

(IV) Acute Respiratory Distress Syndrome (ARDS)

- For Acute Respiratory Distress Syndrome (ARDS) Due To Covid-19,
 - Assign Codes U07.1, And
 - J80, Acute Respiratory Distress Syndrome.

D) Exposure To Covid-19

- Possible Exposure To Covid 19 , But Ruled Out After Evaluation
 - Assign Code Z03.818, Encounter For Observation For Suspected Exposure To Other Biological Agents Ruled Out.
- Actual Exposure To Someone Who Is Confirmed Or Suspected (Not Ruled Out) To Have Covid 19
- Exposed Individual Test Negative / Unknown -
 - Assign Code Z20.828, Contact With And (Suspected) Exposure To Other Viral Communicable Diseases.
- If Positive – Follow The Guidelines



E) Screening For Covid-19

- For Asymptomatic Individuals – Screened For Covid 19 –
 - No Known Exposure To The Virus
 - Test Results – Negative / Unknown
 - Assign Code Z11.59, Encounter For Screening For Other Viral Diseases.
- For Individuals Who Are Being Screened Due To A Possible Or Actual Exposure To Covid-19, See Guideline D).

F) Signs And Symptoms Without Definitive Diagnosis Of Covid-19

1. Assign Code For Each Of The Presenting Signs And Symptoms Such As:
 - R05 Cough
 - R06.02 Shortness Of Breath
 - R50.9 Fever, Unspecified
2. With Signs/Symptoms Associated With Covid-19 Also Has An Actual Or Suspected Contact With Or Exposure To Someone Who Has Covid-19,
 - Assign Z20.828, Contact With And (Suspected) Exposure To Other Viral Communicable Diseases, As An Additional Code

G) Asymptomatic Individuals Who Test Positive For Covid-19

- For Asymptomatic Individuals Who Test Positive For Covid-19 - Assign Code U07.1.

Chapter 15: Pregnancy, Childbirth, And The Puerperium (O00-O9A)

- Principal Diagnosis Code Of O98.5-, Other Viral Diseases Complicating Pregnancy, Childbirth And The Puerperium,
- Followed By Code U07.1, Covid-19, And
- The Appropriate Codes For Associated Manifestation(S).
- Codes From Chapter 15 Always Take Sequencing Priority.

COVID 19	U07.1
Possible Exposure Covid 19	Z03.818
Actual Exposure With Confirmed Covid 19	Z20.828
Pneumonia Due To Covid 19	U07.1 , J12.89
Acute Bronchitis D/T Covid 19	U07.1, J20.8
Bronchitis NOS D/T Covid 19	U07.1 , J40

Acute LRI Or NOS With Covid 19	U07.1, J22
Respiratory Infection NOS With Covid 19	U07.1, J98.8
ARDS D/T COVID 19	U07.1, J80
Pregnancy	O98.5 -, U07.1 , Manifestation Codes

Chapter 2: Neoplasms (C00-D49)

General guidelines

- To Properly Code A Neoplasm
- It Is Necessary To Determine From The Record If The Neoplasm Is Benign, In-Situ, Malignant, Or Of Uncertain Histologic Behavior.
- If Malignant, Any Secondary (Metastatic) Sites Should Also Be Determined
- Primary Malignant Neoplasms Overlapping Site Boundaries (Next To Each Other) - Subcategory/Code .8 ('Overlapping Lesion')
- For Multiple Neoplasms Of The Same Site That Are Not Contiguous (Tumors In Different Quadrants Of The Same Breast) - Codes For Each Site Should Be Assigned.
- Malignant Neoplasm Of Ectopic Tissue
 - Malignant Neoplasms Of Ectopic Tissue Are To Be Coded To The Site Of Origin Mentioned
 - E.G., Ectopic Pancreatic Malignant Neoplasms Involving The Stomach Are Coded To Malignant Neoplasm Of Pancreas, Unspecified (C25.9).
- If The Histological Term Is Documented, That Term Should Be Referenced First, Rather Than Going Immediately To The Neoplasm Table - "Adenoma," Refer To The Term In The Alphabetic Index To Review The Entries Under This Term And The Instructional Note To "See Also Neoplasm, By Site, Benign."

A.Treatment Directed At Malignancy – Malignancy As Principal Diagnosis

B. Treatment of secondary site

- Pt Is Admitted Because Of A Primary Malignancy With Metastasis And Treatment Directed Towards Secondary Site – Secondary Neoplasm As Principal Diagnosis

C. Coding And Sequencing Of Complications:

- Admitted With Anemia Associated With Malignancy And Treatment Only For Anemia – Mg As Principal Diag + Anemia Code (D63.0 – Anemia In Neoplastic Disease)
- Anemia Associated With Chemotherapy, Immunotherapy And Radiation Therapy
 - Treatment Only For Anemia
 - Code Anemia +Neoplasm +Adverse Effect

- **T45.1x5-, Adverse Effect Of Antineoplastic And Immunosuppressive Drugs.**
- **Y84.2, Radiological Procedure And Radiotherapy As The Cause Of Abnormal Reaction Of The Patient, Or Of Later Complication,**
- **Management Of Dehydration Due To The Malignancy – Treatment Towards Dehydration**
 - **Code First Dehydration + Malignancy**
- **Treatment Of A Complication Resulting From A Surgical Procedure – Treatment For Complication**
 - **Complication As Principal Diagnosis**
- **Primary Malignancy Previously Excised – There Is No Evidence Of Any Existing Primary Malignancy**
 - **Code Z85 (Personal History Of Malignant Neoplasm)**

E. Admissions/Encounters involving chemotherapy, immunotherapy and radiation therapy

- **Patient Admission/Encounter Solely For Administration Of Chemotherapy, Immunotherapy And Radiation Therapy –**
- **Z51.0, Encounter For Antineoplastic Radiation Therapy**
- **Z51.11, Encounter For Antineoplastic Chemotherapy**
- **Z51.12, Encounter For Antineoplastic Immunotherapy As The First-Listed Or Principal Diagnosis.**
- **If A Patient Admission/Encounter Is For The Insertion Or Implantation Of Radioactive Elements (E.G., Brachytherapy) - Malignancy Is Sequenced As The Principal Or First-Listed Diagnosis. Code Z51.0 Should Not Be Assigned.**
- **Pt Receives More Than One Of These Therapies During Same Admission – Assign More Than One Of These Codes In Any Sequence**
- **Disseminated Malignant Neoplasm, Unspecified - Code C80.0**
- **Encounter For Treatment Of Primary Malignancy – Assign Primary Site First**
- **Encounter For Treatment Of Secondary Malignancy – Assign Secondary Site First**
- **Malignant Neoplasm In A Pregnant Patient - O9A.1-, Malignant Neoplasm Complicating Pregnancy, Childbirth, And The Puerperium As First Code + Malignancy Code**
- **Complication From Surgical Procedure For Treatment Of A Neoplasm – Complication Code + Malignancy / Personal History**
- **Pathologic Fracture Due To A Neoplasm - Treatment Is For Fracture, A Code From Subcategory M84.5, Pathological Fracture In Neoplastic Disease + Followed By The Code For The Neoplasm.**
- **Current Malignancy Versus Personal History Of Malignancy**
 - **Primary Mg Excised But Treatment Is Continued – Code For Primary Malignancy**

- Primary Mg Eradicated And No Further Treatment – Code Z85
- Leukemia, Multiple Myeloma, And Malignant Plasma Cell Neoplasms In Remission Versus Personal History
 - The Categories For Leukemia, And Category C90, Multiple Myeloma And Malignant Plasma Cell Neoplasms – Indicates Remission.
 - There Are Also Codes Z85.6, Personal History Of Leukemia, And
 - Z85.79, Personal History Of Other Malignant Neoplasms Of Lymphoid, Hematopoietic And Related Tissues
- Malignant Neoplasm Associated With Transplanted Organ - Coded As A Transplant Complication.
 1. T86.-, Complications Of Transplanted Organs And Tissue,
 2. C80.2, Malignant Neoplasm Associated With Transplanted Organ.
 3. Use An Additional Code For The Specific Malignancy.

Chapter 4: Endocrine, Nutritional, and Metabolic Diseases (E00-E89)

A. Diabetes Mellitus

- Combination Codes
- Include The Type Of Diabetes Mellitus
- The Body System Affected
- The Complications Affecting That Body System.
- Sequenced Based On The Reason For A Particular Encounter.

TYPES OF CODES IN DM

- E08 – Due To Underlying Condition
- E09 – Drug Or Chemical Induced
- E10 – Type 1
- E11 – Type 2
- E13 – Other Specified DM

Type 1 Diabetes Mellitus Is Also Referred To As Juvenile Diabetes.

Type Of DM Not Mentioned – Default Code – Type 2 (E11. -)

Use Of Insulin And Hypoglycemics – Long Term Use Of Insulin And Hypoglycemics

- Type Of DM Not Mentioned But Use Of Insulin Mentioned – E11 + Z79 (Identify The Long-Term (Current) Use Of Insulin Or Oral Hypoglycemic Drug)
- Patient Is Treated With Both Oral Medications And Insulin, Only The Code For Long-Term (Current) Use Of Insulin Should Be Assigned
- Code Z79.4 Should Not Be Assigned If Insulin Is Given Temporarily

Complications Due To Insulin Pump Malfunction

- Under Dose Due To Insulin Pump Failure
- Over Dose Due To Insulin Pump Failure
- Under Dose Due To Insulin Pump Failure

- T85.6, Mechanical Complication Of Other Specified Internal And External Prosthetic Devices, Implants And Grafts, That Specifies The Type Of Pump Malfunction, As The Principal Or First-Listed Code
- T38.3x6-, Underdosing Of Insulin And Oral Hypoglycemic [Antidiabetic] Drugs
- Type Of DM
- Associated Complications
- Overdose Of Insulin Due To Insulin Pump Failure
 - T85.6-, Mechanical Complication Of Other Specified Internal And External Prosthetic Devices, Implants And Grafts, Followed By Code
 - T38.3x1-, Poisoning By Insulin And Oral Hypoglycemic [Antidiabetic] Drugs, Accidental (Unintentional).

Secondary Diabetes Mellitus

- E08 , E09 , E13
- Secondary Diabetes Is Always Caused By Another Condition Or Event (E.G., Cystic Fibrosis, Malignant Neoplasm Of Pancreas, Pancreatectomy, Adverse Effect Of Drug, Or Poisoning).

(A) Secondary Diabetes Mellitus And The Use Of Insulin Or Oral Hypoglycemic Drugs

- Code Secondary DM + Z79.4

(B) Assigning And Sequencing Secondary Diabetes Codes And Its Causes

- (I) Secondary Diabetes Mellitus Due To Pancreatectomy –
 - Assign Code E89.1, Postprocedural Hypoinsulinemia+ E13 + Z90.41, Acquired Absence Of Pancreas
- (II) Secondary Diabetes Due To Drugs
 - Caused By An Adverse Effect Of Correctly Administered Medications
 - Poisoning Or
 - Sequela Of Poisoning.

Chapter 5: Mental, Behavioral And Neurodevelopmental Disorders (F01 – F99)

A. Pain Disorders Related To Psychological Factors

- F45.41, For Pain That Is Exclusively Related To Psychological Disorders And G89 Should Not Be Assigned
- Code F45.42, Pain Disorders With Related Psychological Factors + Used With A Code From Category G89 If Documented

B. Mental And Behavioral Disorders Due To Psychoactive Substance Use

- 1) In Remission - Mental And Behavioral Disorders Due To Psychoactive Substance Use (Categories F10-F19 With -.11, -.21) Requires The Provider's Clinical Judgment
- Mild Substance Use Disorders - Substance Abuse In Remission

- Moderate Or Severe Substance Use Disorders - Substance Dependence In Remission.
- 2) Psychoactive Substance Use, Abuse And Dependence
- When The Provider Documentation Refers To Use, Abuse And Dependence Of The Same Substance (E.G. Alcohol, Opioid, Cannabis, Etc.), Only One Code Should Be Assigned To Identify The Pattern Of Use Based On The Following Hierarchy:
 - Use And Abuse - Abuse
 - Abuse And Dependence - Dependence
 - Use, Abuse And Dependence – Dependence
 - Use And Dependence - Dependence
- 3) Psychoactive Substance Use, Unspecified
 - Unspecified Psychoactive Substance Use (F10.9-, F11.9-, F12.9-, F13.9-, F14.9-, F15.9-, F16.9-, F18.9-, F19.9-)
 - Only Be Assigned Based On Provider Documentation And When They Meet The Definition Of A Reportable Diagnosis

C. Factitious Disorder

- F68.1-, Factitious Disorder Imposed On Self
- F68.A, Factitious Disorder Imposed On Another,
- For The Victim Of A Patient Suffering From Msbp - Assign The Appropriate Code From Categories T74, Adult And Child Abuse, Neglect And Other Maltreatment, Confirmed,
- T76, Adult And Child Abuse, Neglect And Other Maltreatment, Suspected.

Chapter 6: Diseases Of The Nervous System (G00-G99)

A. Dominant/Nondominant Side

- G81, Hemiplegia And Hemiparesis
- G83.1, Monoplegia Of Lower Limb
- G83.2, Monoplegia Of Upper Limb
- G83.3, Monoplegia, Unspecified

Identify Dominant / Non Dominant Side Is Affected

- Affected Side – Not Documented As Dominant / Non Dominant
 - Code Selection Is As Follows:
- For Ambidextrous Patients, The Default Should Be Dominant.
- If The Left Side Is Affected, The Default Is Non-Dominant.
- If The Right Side Is Affected, The Default Is Dominant.

B. Pain - Category G89

- General Coding Information:
 - Acute / Chronic
 - Post Thoracotomy Pain

- Post Procedural Pain
- Neoplasm Related
- Underlying Definitive Diagnosis Known – Do Not Code G89

(Unless Reason For Encounter Is For Pain Control /Mgt)

- Procedure Aimed At Treating The Underlying Condition
- Eg : Spinal Fusion , Kyphoplasty – Code For Condition

(Vertebral Fracture /Spinal Stenosis) – Do Not Code G89

Pain – As Principal / First Listed Diagnosis

- Pain Control / Pain Management
 - E.G., A Patient With Displaced Intervertebral Disc, Nerve Impingement And Severe Back Pain Presents For Injection Of Steroid Into Spinal Canal – Code From G89 + Underlying Cause Of Pain
- Insertion Of Neuro Stimulator – Pain Code As Primary
- Treatment Is For Underlying Condition + Insertion Of Neuro Stimulator During Same Encounter – Code For Condition First + Pain Code

(B) Use Of Category G89 Codes In Conjunction With Site Specific Pain Codes

- (I) Assigning Category G89 And Site-Specific Pain Codes – Eg: If The Code Describes The Site Of The Pain, But Does Not Fully Describe Whether The Pain Is Acute Or Chronic – Assign Both Codes
- (ii) Sequencing Of Category G89 Codes With Site-Specific Pain Codes
 - Encounter For Pain Control / Mgt – Code G89 First + Specific Site Of Pain
- Encounter For Any Other Reason Except Pain Control / Mgt – Relative Definitive Diagnosis Not Confirmed By Provider – Code For Specific Site Of Pain First + G89

Postoperative Pain

- Not Associated With Specific Postoperative Complication – Code G89
 - Associated With Specific Postoperative Complication (Painful Wire Sutures) – Code For Complication First + G89 (G89.18 Or G89.28) To Identify Acute / Chronic Pain

Neoplasm Related Pain

- Code G89.3
- Encounter For Pain Mgt – Code For Pain First
- Encounter For Mgt Of Neoplasm – Code For Neoplasm First
- Central Pain Syndrome (G89.0)
- Chronic Pain Syndrome (G89.4) (Different From Chronic Pain)

Chapter 7: Diseases Of The Eye And Adnexa (H00-H59)

a. Glaucoma

1) Assigning Glaucoma Codes

- Type Of Glaucoma

- Affected Eye
- Stage

2) Bilateral Glaucoma With Same Type And Stage

- Same Type And Same Stage – Code - Type Of Glaucoma – Bilateral – Stage (7th Character) - H40.1333
- Same Type And Same Stage – But No Classification Code For Bilateral – (H40.10 , H40.20)- Report Only One Code With Appropriate Stage (7th Character) - H40.10X4

3) Bilateral Glaucoma Stage With Different Types Or Stages

- Bilateral Glaucoma – Each Eye With Diff Types And Stages – Classification Distinguishes Laterality - Code For Each Eye
- Bilateral Glaucoma – Each Eye With Different Type– Classification Not Distinguishes Laterality – Assign One Code For Each Type With Appropriate Stage – H40.20X1, H40.10X1
- Same Type But Different Stage – No Laterality – Assign The Code For Each Eye With Appropriate Specified Stage For Each Eye – H40.10X1, H40.10X2

4) Patient Admitted With Glaucoma And Stage Evolves During The Admission

- The Stage Progresses During The Admission, Assign The Code For Highest Stage Documented.

5) Indeterminate Stage Glaucoma

- Assignment Of The Seventh Character “4” For “Indeterminate Stage” Should Be Based On The Clinical Documentation.

B. Blindness/ Low Vision

- Both Eyes Is Documented - Visual Impairment Category Is Not Documented - Code H54.3, Unqualified Visual Loss, Both Eyes.
- One Eye Is Documented But The Visual Impairment Category Is Not Documented - Code From H54.6-, Unqualified Visual Loss, One Eye.
- If “Blindness” Or “Visual Loss” Is Documented Without Any Information About Whether One Or Both Eyes Are Affected - Code H54.7, Unspecified Visual Loss.

Chapter 9: Diseases Of The Circulatory System (I00-I99)

- a. Hypertension
 - The Classification Presumes A Causal Relationship Between Hypertension And Heart Involvement And Between Hypertension And Kidney Involvement, As The Two Conditions Are Linked By The Term “With” In The Alphabetic Index.
 - These Conditions Should Be Coded As Related Even In The Absence Of Provider Documentation
 - Unless The Documentation Clearly States The Conditions Are Unrelated
- 1) Hypertension With Heart Disease
 - Code From Category I11 (Primary)

- Use Additional Code(S) From Category I50, Heart Failure, To Identify The Type(S) Of Heart Failure In Those Patients With Heart Failure.
- If The Provider Has Documented Heart Conditions Are Unrelated To The Hypertension- Sequence According To Circumstances Of Encounter

2) Hypertensive Chronic Kidney Disease

- Hypertensive Chronic Kidney Disease – Assign Code From Category I12 (Primary)
- Assign CKD – N18 (Secondary)
- No Relation Documented – Do Not Assign I12
- Hypertensive Chronic Kidney Disease + Acute Renal Failure – Additional Code For ARF Assigned

3) Hypertensive Heart And Chronic Kidney Disease

- Hypertensive Heart And Chronic Kidney Disease – I13 (Primary)
- Heart Failure – I50 (Type)
- CKD – N18 (Stage)
- Do Not Assign Individual Codes
- CKD + ARF – Add Code For ARF

4) Hypertensive Cerebrovascular Disease

- Assign Code From Categories I60-I69,
- Followed By Hypertension Code

5) Hypertensive Retinopathy

- Subcategory H35.0 (Background Retinopathy And Retinal Vascular Changes)
- Category I10 – I15 (Hypertensive Disease To Include The Systemic Hypertension)
- Sequencing Based On Reason For Encounter

6) Hypertension, Secondary

- Two Codes – Etiology + I15 (For Hypertension)
- Sequencing Based On Encounter

7) Hypertension, Transient

- R03.0, Elevated Blood Pressure Reading Without Diagnosis Of Hypertension
- Assign Code O13.-, Gestational [Pregnancy-Induced] Hypertension Without Significant Proteinuria,
- O14.-, Pre-Eclampsia, For Transient Hypertension Of Pregnancy.

8) Hypertension, Controlled

- I10-I15, Hypertensive Diseases.

9) Hypertension, Uncontrolled (Not Responding To Current Treatment)

I10-I15, Hypertensive Diseases

10) Hypertensive Crisis

- Category I16 - Hypertensive Crisis
- Documented Hypertensive Urgency, Hypertensive Emergency Or Unspecified Hypertensive Crisis

- **Code Also Any Identified Hypertensive Disease (I10-I15).**
- **Sequencing Based On Encounter**

11) Pulmonary Hypertension

- **Category I27 – Other Pulmonary Heart Diseases**
- **For Secondary Pulmonary Hypertension (I27.1, I27.2-),**
- **Code Also Any Associated Conditions Or Adverse Effects Of Drugs Or Toxins**
- **The Sequencing Is Based On The Reason For The Encounter, Except For Adverse Effects Of Drugs**

B. Atherosclerotic Coronary Artery Disease And Angina

- **Combination Codes**
- **I25.11 (Atherosclerotic Heart Disease Of Native Coronary Artery With Angina Pectoris)**
- **I25.7 (Atherosclerosis Of Coronary Artery Bypass Graft(S) And Coronary Artery Of Transplanted Heart With Angina Pectoris)**
- **Cad With Admission For AMI – Code For AMI First**
- **C. Intraoperative And Postprocedural Cerebrovascular Accident**
- **Medical Record Documentation**
- **An Infarction Or Hemorrhage**
- **Intraoperatively Or Postoperatively.**
- **Cerebral Hemorrhage - Code Assignment Depends On The Type Of Procedure Performed**
- **D. Sequelae Of Cerebrovascular Disease**
- **1) Category I69, Sequelae Of Cerebrovascular Disease - Hemiplegia, Hemiparesis And Monoplegia**
- **2) Codes From Category I69 With Codes From I60-I67 – Both Coded When There Is A Current CVA And Deficits From Old CVA**
- **3) Codes From Category I69 And Personal History Of Transient Ischemic Attack (Tia) And Cerebral Infarction (Z86.73) – Do Not Code I69 If No Neurologic Deficits**

E. Acute Myocardial Infarction (AMI)

- 1) Type 1 St Elevation Myocardial Infarction (STEMI) And Non-St Elevation Myocardial Infarction (NSTEMI)**
- **Type 1 Acute Myocardial Infarction - Identify The Site, Such As Anterolateral Wall Or True Posterior Wall**
- **Subcategories I21.0-I21.2 And Code I21.3 Are Used For Type 1 STEMI**
- **Code I21.4, Non-St Elevation (NSTEMI) Myocardial Infarction, Is Used For Type 1 NSTEMI And Nontransmural Mis.**
- **If A Type 1 NSTEMI Evolves To STEMI – Code STEMI**
- **If A Type 1 STEMI Converts To NSTEMI Due To Thrombolytic Therapy – Still Coded As STEMI**

- Encounter When MI - Equal To, Or Less Than, Four Weeks Old – Continue To Report Code From I21
 - After The 4 Week Time Frame (Still Receiving Care) – After Care Codes Assigned
 - For Old Or Healed Myocardial Infarctions Not Requiring Further Care, Code I25.2, Old Myocardial Infarction
- 2) Acute Myocardial Infarction, Unspecified**
- Code I21.9, Acute Myocardial Infarction, Unspecified
 - If Only Type 1 STEMI Or Transmural MI Without The Site Is Documented, Assign Code I21.3
- 3) AMI Documented As Nontransmural Or Subendocardial But Site Provided**
- Still Coded As A Subendocardial Ami.
- 4) Subsequent Acute Myocardial Infarction**
- I22, Subsequent St Elevation (STEMI) And Non-St Elevation (NSTEMI) Myocardial Infarction (Has A New AMI Within The 4 Week Time Frame Of The Initial AMI – Type 1 / Unspecified)
 - I22 And I21 Used Together – Based On Encounter
 - Do Not Assign Code I22 For Subsequent Myocardial Infarctions Other Than Type 1 Or Unspecified.
 - For Subsequent Type 2 AMI - Assign Only Code I21.A1
 - For Subsequent Type 4 Or Type 5 AMI - Assign Only Code I21.A9.
 - If A Subsequent Myocardial Infarction Of One Type Occurs Within 4 Weeks Of A Myocardial Infarction Of A Different Type - Assign Category I21 To Identify Each Type.
 - Do Not Assign A Code From I22.
 - Codes From Category I22 Should Only Be Assigned If Both The Initial And Subsequent Myocardial Infarctions Are Type 1 Or Unspecified.
- 5) Other Types Of Myocardial Infarction**
- Type 1 Myocardial Infarctions Are Assigned To Codes I21.0-I21.4.
 - Type 2 Myocardial Infarction (Myocardial Infarction Due To Demand Ischemia Or Secondary To Ischemic Imbalance) Is Assigned To Code I21.A1 – Underlying Cause Coded First
 - If A Type 2 AMI Is Described As NSTEMI OR STEMI, Only Assign Code I21.A1
 - Codes I21.01-I21.- Only For Type 1 AMIS.
 - Acute Myocardial Infarctions Type 3, 4a, 4b, 4c And 5 Are Assigned To Code I21.A9 (Other MI)
 - "Code Also" And "Code First – Follow For Complications And For Coding Post Procedural MI

10. Chapter 10: Diseases Of The Respiratory System (J00-J99)

A. Chronic Obstructive Pulmonary Disease [COPD] And Asthma

- 1) Acute Exacerbation Of Chronic Obstructive Bronchitis And Asthma - J44 And J45

B. Acute Respiratory Failure

- As Principal Diagnosis -

- J96.0, Acute Respiratory Failure
- J96.2, Acute And Chronic Respiratory Failure – Coded First As A Reason For Admission
- Exception – Obstetrics, Poisoning, Hiv , Newborn)
- As Secondary Diagnosis
- – Respiratory Failure After Admission/ If Does Not Meet The Principal Diag
- 3) Sequencing Of Acute Respiratory Failure And Another Acute Condition
- Respiratory Failure And Another Acute Condition, (E.G., Myocardial Infarction, Cerebrovascular Accident, Aspiration Pneumonia) -
- The Principal Diagnosis Depends On Circumstances
- If Unclear – Query The Provider

C. Influenza Due To Certain Identified Influenza Viruses

- Code Only Confirmed Cases – Provider Documentation
- J09 - Certain Identified Viruses
- J10 - Other Identified Viruses
- “Suspected” Or “Possible” Or “Probable” - J11 – Unidentified Virus

D. Ventilator Associated Pneumonia (VAP)

1) Documentation Of Ventilator Associated Pneumonia

- Code J95.851, Ventilator Associated Pneumonia – Provider Documentation Must.
- Additional Code To Identify The Organism (E.G., Pseudomonas Aeruginosa - Code B96.5
- Do Not Code J95.851 For Pt Has Pneumonia And On Mechanical Ventilator

2) Ventilator Associated Pneumonia Develops After Admission

- A Patient May Be Admitted With One Type Of Pneumonia And Develop VAP.
- Principal Diagnosis- Pneumonia Due To Organism – J12 –J18
- Add Code For VAP – J95.851 If Documented VAP

Chapter 12: Diseases Of The Skin And Subcutaneous Tissue (L00-L99)

a. Pressure Ulcer Stage Codes

1) Pressure Ulcer Stages

- L89 – Site And Stage
- Stages – Based On Severity
- Stages 1 – 4 ,Deep Tissue Pressure Injury , Unspecified Stage , Unstageable.

2) Unstageable Pressure Ulcers

- (L89.--0) – Based On Documentation
- Pressure Ulcers Whose Stage Cannot Be Clinically Determined

3) Documented Pressure Ulcer Stage

- For Clinical Terms Describing The Stage That Are Not Found In The Alphabetic Index,
- And There Is No Documentation Of The Stage, The Provider Should Be Queried

4) Patients Admitted With Pressure Ulcers Documented As Healed

- Healed At The Time Of Admission.
- No Code

5) Pressure Ulcers Documented As Healing

- Assigned Based On The Documentation In The Medical Record.
- No Information About The Stage – Unspecified
- Unclear Current / New Ulcer / Treated For A Healing Pressure Ulcer – Query The Provider
- Ulcer Present On Admission & Healed At Time Of Discharge – Code Site And Stage Present On Admission

6) Patient Admitted With Pressure Ulcer Evolving Into Another Stage During The Admission

- Admitted To An Inpatient Hospital With A Pressure Ulcer At One Stage And It Progresses To A Higher Stage
- 2 Separate Codes
- One Code – Site And Stage On Admission
- Second Code – Same Site And Highest Stage During Stay

7) Pressure-Induced Deep Tissue Damage / Deep Tissue Pressure Injury

- L89.--6

B. Non-Pressure Chronic Ulcers

- 1) Patients Admitted With Non-Pressure Ulcers Documented As Healed – No Code
- 2) Non-Pressure Ulcers Documented As Healing – Based On Documentation / Same As Healing Pressure Ulcer
- 3) Patient Admitted With Non-Pressure Ulcer That Progresses To Another Severity Level During The Admission
 - 2 Codes

Chapter 13: Diseases Of The Musculoskeletal System And Connective Tissue (M00-M99)

A. Site And Laterality

- Site – Bone , Joint , Muscle Involved

- More Than One Bone / Joint / Muscle – Assign Multiple Site Code
- No Multiple Site Code – Code For Different Sites (Multiple Coding)
- Bone Versus Joint
- The Bone May Be Affected At The Upper Or Lower End
- – Site Taken As Bone

B. Acute Traumatic Versus Chronic Or Recurrent Musculoskeletal Conditions

- Recurrent / Chronic Bone, Joint Or Muscle Conditions – Chap 13
- Any Current, Acute Injury – Chapter 19 (Injury)
- Unclear - Query

C. Coding Of Pathologic Fractures

- 7th Character A – Active Treatment
- 7th Character D - Routine Care - Healing Or Recovery Phase.
- Malunions, Nonunions, And Sequelae
- D. Osteoporosis
- Category M81 - Without Current Pathological Fracture
- Category M80 - With Current Pathological Fracture
- Identify Site
- History Of Osteoporosis Fractures, Status Code Z87.310 (Personal History Of (Healed) Osteoporosis Fracture)

Chapter 14: Diseases Of Genitourinary System (N00-N99)

A. Chronic Kidney Disease

- 1) Stages Of Chronic Kidney Disease (CKD)
- Based On Severity.
- Stages 1-5.
- End Stage Renal Disease (ESRD) / Stage 6
- 2) Chronic Kidney Disease And Kidney Transplant Status
- Kidney Transplant + But Still Having CKD
- N18 Code For The Patient's Stage Of CKD
- Code Z94.0, Kidney Transplant Status.

3) Chronic Kidney Disease With Other Conditions

- CKD + Diabetes Mellitus And Hypertension.
- Based On The Conventions In The Tabular List.

Chapter 15: Pregnancy, Childbirth, And The Puerperium (O00-O9A)

- a. General Rules For Obstetric Cases
- Sequencing Priority Over Codes From Other Chapters.

- Pregnancy Is Incidental To The Encounter, Then Code Z33.1, Pregnant State, Incidental
- Chapter 15 Codes Used Only On The Maternal Record – Never On Newborn
- Assignment Of The Final Character For Trimester – Based On Provider Documentation
- Selection Of Trimester For Inpatient Admissions That Encompass More Than One Trimester –
 - Code Trimester When The Complication Developed
 - Developed Prior To The Current Admission – Code Trimester At Time Of Admission
- Unspecified Trimester – Rarely Used
- 7th Character For Fetus Identification - O31, O32, O33.3 - O33.6, O35, O36, O40, O41, O60.1, O60.2, O64, And O69

B. Selection Of OB Principal Or First-Listed Diagnosis

1) Routine Outpatient Prenatal Visits -

- Z34, Encounter For Supervision Of Normal Pregnancy, Should Be Used As The First-Listed Diagnosis

2) Supervision Of High-Risk Pregnancy

- Routine Prenatal Outpatient Visits With High Risk - Category O09, Supervision Of High-Risk Pregnancy,
- Outcome Of Delivery - Category Z37, Outcome Of Delivery
- Pre-Existing Hypertension In Pregnancy –
- O10, Pre-Existing Hypertension Complicating Pregnancy
- Add A Secondary Code – Hypertension , Heart Failure, CKD

E. Fetal Conditions Affecting The Management Of The Mother

- 1) Categories O35, Maternal Care For Known Or Suspected Fetal Abnormality And Damage, And O36, Maternal Care For Other Fetal Problems,

2) In Utero Surgery -

- Category O35
- Do Not Code From Chap 16

F. HIV Infection In Pregnancy, Childbirth And The Puerperium -

- HIV Related Illness - Subcategory O98.7-, B20
- Asymptomatic HIV - O98.7- And Z21

G. Diabetes Mellitus In Pregnancy

- Category O24, Diabetes Mellitus In Pregnancy, Childbirth, And The Puerperium, First,
- Followed By (E08- E13)

I. Gestational (Pregnancy Induced) Diabetes

- Gestational (Pregnancy Induced) Diabetes Can Occur During The Second And Third Trimester Of Pregnancy In Women Who Were Not Diabetic Prior To Pregnancy

- **Code O24.4, Gestational Diabetes Mellitus**
- **Do Not Code O24, Z79.4, Z79.84**
- **An Abnormal Glucose Tolerance In Pregnancy -O99.81**

Puerperal Sepsis

- **Code O85, Puerperal Sepsis**
- **B95-B96**
- **If Severe Sepsis Documented – R65.2**
- **Organ Dysfunction Code**

Poisoning, Toxic Effects, Adverse Effects And Underdosing In A Pregnant Patient

- **O9A.2 (First Code)**
- **Injury, Poisoning, Toxic Effect, Adverse Effect Or Underdosing Code**
- **Condition Code**
- **Normal Delivery, Code O80**
- **Encounter For Full Term Uncomplicated Delivery**
- **Always A Principal Diagnosis**
- **Outcome Of Delivery For O80 - Z37.0, Single Live Birth, Is The Only Outcome Of Delivery Code Appropriate For Use With O80.**

Peripartum - Last Month Of Pregnancy To Five Months Postpartum.

Postpartum Period - After Delivery And Continues For Six Weeks Following Delivery

- **Routine Postpartum Care -**
- **Code Z39.0, Encounter For Care And Examination Of Mother Immediately After Delivery, Should Be Assigned As The Principal Diagnosis.**
- **Pregnancy Associated Cardiomyopathy – O93.0**
- **Sequelae Of Complication Of Pregnancy, Childbirth, And The Puerperium - O94**
- **Top- Termination Of Pregnancy**
- **Abortion With Liveborn Fetus**
- **Assign Code Z33.2, Encounter For Elective Termination Of Pregnancy And**
- **A Code From Category Z37, Outcome Of Delivery.**
- **Retained Products Of Conception Following An Abortion – O03.4 /O07.4**

Abuse In A Pregnant Patient

- **O9A.3, Physical Abuse Complicating Pregnancy, Childbirth, And The Puerperium,**
- **O9A.4, Sexual Abuse**
- **O9A.5, Psychological Abuse , Should Be Sequenced First**
- **Code For Associated Current Injury**

Chapter 16: Certain Conditions Originating In The Perinatal Period (P00-P96)

The Perinatal Period Is Defined As Before Birth Through The 28th Day Following Birth

A. General Perinatal Rules

- Chapter 16 Codes - Never For Use On The Maternal Record.
- Principal Diagnosis For Birth Record - Z38, Liveborn Infants According To Place Of Birth And Type Of Delivery, As The Principal Diagnosis (Initial Birth Record Only)
- Perinatal Condition, The Code From Chapter 16 Should Be Sequenced First.
- A Condition Originated In The Perinatal Period, And Continue Throughout The Life Of The Patient – Code Perinatal Code Regardless Of Age
- Birth Process Or Community Acquired Conditions – Default Is Birth Process (If Not Documented)
 - Community Acquired – Do Not Assign Chap 16 Codes
- All Clinically Significant Conditions Noted On Routine Newborn Examination Should Be Coded.

Prematurity And Fetal Growth Retardation

- P05, Disorders Of Newborn Related To Slow Fetal Growth And Fetal Malnutrition,
- P07, Disorders Of Newborn Related To Short Gestation And Low Birth Weight, Not Elsewhere Classified (Based On Birth Weight And Estimated Gestational Age)
- Birth Weight And Gestational Age Documented – 2 Codes – Code For Birth Weight First And Followed By Gest Age
- Low Birth Weight And Immaturity – P07

Bacterial Sepsis Of Newborn

- P36 - Bacterial Sepsis Of Newborn, Includes Congenital Sepsis (Principal Diag)
- Congenital / Acquired – Not Documented – Default Is Congenital
- If P36 Includes Causal Organism – Do Not Code From B95 / B96
- If Not Included – Code B95/B96 With P36
- If Severe Sepsis – Use Additional Code R65.2 And Organ Failure Code

Chapter 17: Congenital Malformations, Deformations, And Chromosomal Abnormalities (Q00-Q99)

- Q00-Q99, Congenital Malformations, Deformations, And Chromosomal Abnormalities
- Abnormality Does Not Have A Unique Code Assignment – Additional Code For Manifestations
- Manifestations Are Inherent – Do Not Assign Separate Codes For Manifestations
- Chapter 17 May Be Used Throughout The Life Of The Patient
- Deformity Has Been Corrected – Personal History Code
- For Birth Admission – Z38 (First) + Q00- Q99

Chapter 18: Symptoms, Signs, And Abnormal Clinical And Laboratory Findings, Not Elsewhere Classified (R00-R99)



- A. Use Of Symptom Codes – No Related Definitive Diagnosis
- B. Use Of A Symptom Code With A Definitive Diagnosis Code - Not Routinely Associated With That Diagnosis
 - Definitive Diagnosis As Principal Code
 - Associated Routinely - No Separate Code For S/S
- C. Combination Codes That Include Symptoms – Do Not Assign Additional Code For S/S
- D. Repeated Falls
 - Code R29.6, Repeated Falls (Reason For Fall Being Investigated)
 - Code Z91.81, History Of Falling (Past And Risk For Future Falls)
 - R29.6 And Z91.81 May Be Assigned Together (When Appropriate)
- E. Coma Scale -
 - The Coma Scale Codes (R40.2-)
 - Used In Conjunction With Traumatic Brain Injury Codes, Acute Cerebrovascular Disease Or Sequelae Of Cerebrovascular Disease Codes.
 - Used In Trauma Registries
 - Assess The Status Of The Central Nervous System For Other Non-Trauma Conditions (ICU)
 - Should Be Sequenced After The Diagnosis Code(S).
 - Assign Code R40.24, Glasgow Coma Scale, When Total Score Is Documented
 - Do Not Code Medically Induced Coma Or A Sedated Patient
- F. SIRS Due To Non-Infectious Process
 - Such As Trauma, Malignant Neoplasm, Or Pancreatitis.
 - Code For The Underlying Condition, Such As An Injury
 - Code R65.10, SYSTEMIC INFLAMMATORY RESPONSE SYNDROME (SIRS) Of Non-Infectious Origin Without Acute Organ Dysfunction
 - Code R65.11, Systemic Inflammatory Response Syndrome (SIRS) Of Non-Infectious Origin With Acute Organ Dysfunction + Organ Dysfunction Code
 - Unclear - Query
- G. Death NOS – R99
- H. NIHSS STROKE SCALE
 - The NIH Stroke Scale (NIHSS) Codes (R29.7- -) Can Be Used In Conjunction With Acute Stroke Codes (I63) To Identify The Patient's Neurological Status And The Severity Of The Stroke.
 - The Stroke Scale Codes Should Be Sequenced After The Acute Stroke Diagnosis Code(S).

Chapter 19: Injury, Poisoning, And Certain Other Consequences Of External Causes (S00-T88)

A. Application Of 7th Characters In Chapter 19

- Most Categories In This Chapter Have Three 7th Character Values (With The Exception Of Fractures)
- A - Initial Encounter
- D - Subsequent Encounter
- S - Sequela.

B. Coding Of Injuries

- Assign Separate Codes For Each Injury
- Combination Code – Do Not Assign Separate Code
- Traumatic Injury Codes (S00-T14.9) Are Not To Be Used For Normal, Healing Surgical Wounds Or To Identify Complications Of Surgical Wounds.

1) Superficial Injuries

- Abrasions / Contusions – Not Coded When Associated With Severe Injury

2) Primary Injury With Damage To Nerves/Blood Vessels

- Primary Injury Results In Minor Damage To Nerves/ Blood Vessels –
- Code Primary Injury As Principal Diag And Assign Additional Code For Injury To Nerves (S04) / Blood Vessels (S15)
- Primary Injury To Nerves / Blood Vessels – That Should Be Sequenced First.

3) Iatrogenic Injuries

- Injury Codes From Chapter 19 Should Not Be Assigned For Injuries That Occur During, Or As A Result Of, A Medical Intervention.
- Assign The Appropriate Complication Code(S)

C. Coding Of Traumatic Fractures

- The Principles Of Multiple Coding Of Injuries Followed
- Fractures Of Specified Sites Are Coded Individually By Site
- A Fracture Not Indicated As Open Or Closed - Coded To Closed
- Not Documented As Displaced / Not Displaced – Code Displaced

More Specific Guidelines

- 1) Initial Vs. Subsequent Encounter For Fractures
 - Appropriate 7th Character For Initial Encounter A - For Each Encounter Where The Patient Is Receiving Active Treatment For The Fracture
 - Subsequent Care For Encounters – D – Routine Healing
 - G – Delayed Healing
 - Care Of Complications Of Fractures, Such As Malunion And Nonunion, Should Be Reported With The Appropriate 7th Character For Subsequent Care With Nonunion (K)
 - Subsequent Care With Malunion (P)

- 2) Multiple Fractures Sequencing
 - Sequenced In Accordance With The Severity Of The Fracture.

- 3) Physeal Fractures

- Assign Only The Code Identifying The Type Of Physeal Fracture.
- Do Not Assign A Separate Code To Identify The Specific Bone That Is Fractured.

D. Coding Of Burns And Corrosions

- The ICD-10-CM Makes A Distinction Between Burns And Corrosions.
- The Burn Codes - For Thermal Burns, Electricity And Radiation Except Sunburns, That Come From A Heat Source, Such As A Fire Or Hot Appliance.
- Corrosions Are Burns Due To Chemicals.
- The Guidelines Are The Same For Burns And Corrosions.
- Current Burns (T20-T25)
 - Depth
 - Extent
 - Agent (X Code)
- Classification By Depth:
 - First Degree (Erythema)
 - Second Degree (Blistering)
 - Third Degree (Full-Thickness Involvement). – Black Eschar
- Burns Of The Eye And Internal Organs (T26-T28) Are
 - Classified By Site, But Not By Degree.

1) Sequencing Of Burn And Related Condition Codes

- Code The Highest Degree Of Burn When More Than One Burn Is Present.
- Has Both Internal And External Burns – Sequencing Based On Circumstances Of Encounter
- Admitted For Burn Injuries And Other Related Conditions - Sequencing Based On Circumstances Of Encounter

2) Burns Of The Same Anatomic Site – Only One Code (Highest Degree Of Burn)

3) Non-Healing Burns –

- Coded As Acute Burns
- Necrosis Of Burned Skin – Coded As Non Healed Burn

4) Infected Burn – Add Code For Infection

5) Assign Separate Codes For Each Burn Site

- Category T30, Burn And Corrosion
- Unspecified Code – Rarely Used
- Burns Of Multiple Sites – If Documentation Not Specifies The Individual Sites

6) Burns And Corrosions Classified According To Extent Of Body Surface Involved

- Category T31, Burns Classified According To Extent Of Body Surface Involved
- T32, Corrosions Classified According To Extent Of Body Surface Involved,
- Categories T31 And T32 Are Based On The Classic “Rule Of Nines” To Estimate Body Surface
- Identify - Extent Of Body Surface In Percentage And Degree Of Burns

- Head And Neck Are Assigned Nine Percent,
- Each Arm Nine Percent,
- Each Leg 18 Percent,
- The Anterior Trunk 18 Percent,
- Posterior Trunk 18 Percent, And
- Genitalia One Percent.
- Providers May Change These Percentage Assignments Where Necessary To Accommodate Infants And Children Who Have Proportionately Larger Heads Than Adults, And Patients Who Have Large Buttocks, Thighs, Or Abdomen That Involve Burns.

7) Encounters For Treatment Of Sequela Of Burns

- i.e., Scars Or Joint Contractures
- A Burn Or Corrosion Code With The 7th Character "S"

8) Sequelae With A Late Effect Code And Current Burn

- Code With 7th Character "A" Or "D"
- Code With 7th Character "S"
- Coded Together - (When Both A Current Burn And Sequelae Of An Old Burn Exist).

9) Use Of An External Cause Code With Burns And Corrosions

- To Identify The Source And Intent Of The Burn, As Well As The Place Where It Occurred

E. Adverse Effects, Poisoning, Underdosing And Toxic Effects

- Codes In Categories T36-T65 Are Combination Codes That Include The Substance That Was Taken As Well As The Intent.
- 1) Do Not Code Directly From The Table Of Drugs – Refer Back Tabular List
- 2) Use As Many Codes As Necessary To Describe – All Drugs / Medicinal/ Biological Substances\
- 3) If The Same Code Would Describe The Causative Agent - For More Than One Adverse Reaction / Poisoning, Toxic Effect Or Underdosing – Code Only Once
- 4) If Two Or More Drugs, Medicinal Or Biological Substances – Code Each Unless A Combination Code Available.
- If Multiple Unspecified Drugs, Medicinal Or Biological Substances Were Taken – Code From Subcategory T50.91

(a) Adverse Effect

- (T36-T50)
- for example T36.0X5
- Examples of the nature of an adverse effect are
- tachycardia, delirium, gastrointestinal hemorrhaging, vomiting, hypokalemia, hepatitis, renal failure, or respiratory failure

(B) Poisoning

- E.G., Overdose, Wrong Substance Given Or Taken In Error, Wrong Route Of Administration
- T36-T50
- Accidental, Intentional Self-Harm, Assault And Undetermined – 5th / 6th Character
- Unknown Or Unspecified Intent – Code As Accidental
- Undetermined Intent – Based On Documentation
- Code For Manifestations Of All Poisonings
- Diagnosis Of Abuse Or Dependence Documented – Code That Also.
- Examples Of Poisoning Include:
 - (I) Error Was Made In Drug Prescription
 - (II) Overdose Of A Drug Intentionally Taken
 - (III) Non Prescribed Drug Taken With Correctly
 - (IV) Interaction Of Drug(S) And Alcohol

(C) Underdosing -

- Taking Less Of A Medication Than Prescribed
- Discontinuing The Use Of A Prescribed Medication On The Patient's Own Initiative
- T36-T50 (Fifth Or Sixth Character "6").
- Codes For Underdosing Should Never Be Assigned As Principal Or First-Listed Codes.
- Relapse Or Exacerbation Of The Medical Condition – Due To Under Dose – Code The Condition
- Noncompliance (Z91.12-, Z91.13- And Z91.14-) Or Complication Of Care (Y63.6-Y63.9) Codes Are To Be Used With An Underdosing Code To Indicate Intent, If Known.

(D) Toxic Effects

- When A Harmful Substance Is Ingested Or Comes In Contact With A Person, This Is Classified As A Toxic Effect.
- Categories T51-T65.
- Toxic Effect Codes Have An Associated Intent: Accidental, Intentional Self-Harm, Assault And Undetermined.

F. Adult And Child Abuse, Neglect And Other Maltreatment

Sequence First The Appropriate Code From Categories T74, Adult And Child Abuse, Neglect And Other Maltreatment, Confirmed)

- T76, Adult And Child Abuse, Neglect And Other Maltreatment, Suspected) For Abuse, Neglect And Other Maltreatment,
- + Mental Health Or Injury Code(S).

Confirmed Abuse Or Neglect -

- External Cause Code From The Assault Section (X92-Y09) For Cause Of Injury

- A Perpetrator Code (Y07) Should Be Added When The Perpetrator Of The Abuse Is Known
- Do Not Report External Cause Or Perpetrator Code – Suspected Abuse/ Neglect Suspected Cases Ruled Out During Encounter
 - Z04.71, Encounter For Examination And Observation Following Alleged Physical Adult Abuse, Ruled Out, Or
 - Z04.72, Encounter For Examination And Observation Following Alleged Child Physical Abuse, Ruled Out, Should Be Used,
 - Z04.41, Encounter For Examination And Observation Following Alleged Adult Rape
 - Z04.42, Encounter For Examination And Observation Following Alleged Child Rape,
 - Z04.81, Encounter For Examination And Observation Of Victim Following Forced Sexual Exploitation,
 - Z04.82, Encounter For Examination And Observation Of Victim Following Forced Labor Exploitation,
 - Not A Code From T76.
- Pain Due To Medical Devices / Implants Or Grafts Left In A Surgical Site
 - Code From Chap 19
 - Additional Code For Pain – Acute / Chronic Due To Presence Of The Device, Implant Or Graft (G89.18 Or G89.28).

Transplant Complications Other Than Kidney

- Two Codes
- The Appropriate Code From Category T86
- Secondary Code That Identifies The Complication.

Kidney Transplant Complications

- Code T86.1- Should Be Assigned For Documented Complications Of A Kidney Transplant – Failure / Rejection / Other Complication
- Not Assigned For Post Kidney Transplant Patients Who Have Chronic Kidney Disease
- The Appropriate Complication Code From Chapter 9 Would Be Assigned For A Vascular Intraoperative Or Postprocedural Complication
- Unless The Complication Is Specifically Indexed To A T Code In Chapter 19

Chapter 20: External Causes Of Morbidity (V00-Y99)

- Never Sequenced First
- Injury Research And Evaluation Of Injury Prevention Strategies
- How The Injury – Caused ,
- The Intent
- The Place Where The Event Occurred
- The Activity Of The Patient At The Time Of The Event

- The Person's Status
- Separate Alphabetic Index
- Y92 – Place Of Occurrence Of The External Cause
- Y93 – Activity Code

Chapter 21: Factors Influencing Health Status And Contact With Health Services (Z00-Z99)

- Z Codes May Be Used As Either A First-Listed (Principal Diagnosis Code In The Inpatient Setting)
- Or A Secondary Code, Depending On The Circumstances Of The Encounter.
- Certain Z Codes May Only Be Used As First-Listed Or Principal Diagnosis.
- Z Codes Indicate A Reason For An Encounter

1) Contact/Exposure – Z20 (Communicable Diseases)

- Z77, Other Contact With And (Suspected) Exposures Hazardous To Health, Indicates Contact With And Suspected Exposures Hazardous To Health.

2) Inoculations And Vaccinations - Code Z23

3) Status - Status Codes Indicate That A Patient Is Either A Carrier Of A Disease Or Has The Sequelae Or Residual Of A Past Disease Or Condition.

- A Status Code Should Not Be Used With A Diagnosis Code If Information Provided By Status Code
- Eg: Z94.1, Heart Transplant Status, Should Not Be Used With A Code From Subcategory T86.2, Complications Of Heart Transplant.

4) History (Of) – Personal / Family

5) Screening

6) Observation - The Observation Codes Are To Be Used As Principal Diagnosis Only.

- The Only Exception To This Is When The Principal Diagnosis Is Required To Be A Code From Category Z38, Liveborn Infants According To Place Of Birth And Type Of Delivery.
- Then A Code From Category Z05, Encounter For Observation And Evaluation Of Newborn For Suspected Diseases And Conditions Ruled Out, Is Sequenced After The Z38 Code
- Codes From Subcategory Z03.7, Encounter For Suspected Maternal And Fetal Conditions Ruled Out, May Either Be Used As A First-Listed Or As An Additional Code Assignment Depending On The Case.

7) Aftercare

- When The Initial Treatment Of A Disease Has Been Performed And The Patient Requires Continued Care During The Healing Or Recovery Phase, Or For The Long-Term Consequences Of The Disease.
- If Treatment Is Directed At A Current, Acute Disease – Do Not Assign After Care Code

- Exceptions
- Z51.0, Encounter For Antineoplastic Radiation Therapy, And
- Codes From Subcategory Z51.1, Encounter For Antineoplastic Chemotherapy And Immunotherapy.
- These Codes Are To Be First-Listed, Followed By The Diagnosis Code When A Patient's Encounter Is Solely To Receive Radiation Therapy, Chemotherapy, Or Immunotherapy For The Treatment Of A Neoplasm
- The Aftercare Z Codes Should Also Not Be Used For Aftercare For Injuries. For Aftercare Of An Injury, Assign The Acute Injury Code With The Appropriate 7th Character (For Subsequent Encounter).
- The Aftercare Codes Are Generally First-Listed To Explain The Specific Reason For The Encounter

8) Follow-Up

- Used To Explain Continuing Surveillance Following Completed Treatment Of A Disease, Condition, Or Injury.
- The Follow-Up Code Is Sequenced First, Followed By The History Code.
- A Follow-Up Code May Be Used To Explain Multiple Visits (In Place Of Diagnosis)

9) Donor – Z52

10) Counseling

11) Encounters For Obstetrical And Reproductive Services

12) Newborns And Infants

13) Routine And Administrative Examinations - A General Check-Up, Or, Examinations For Administrative Purposes, Such As, A Pre-Employment Physical

- Prophylactic Organ Removal
- Z Codes That May Only Be Principal/First-Listed Diagnosis

CPT INTRODUCTION

- CURRENT PROCEDURAL TERMINOLOGY
- 4TH EDITION
- FIVE DIGIT CODE
- REPORTING PROCEDURES AND SERVICES
- TERM PROCEDURE – USED TO DESCRIBE SERVICES INCLUDING DIAGNOSTIC TESTS
- CPT is maintained and annually updated by the American Medical Association (AMA)

CPT

- ▶ Updated annually
- ▶ Notifications sent in early fall
- ▶ Effective January 1
- ▶ Coding changes
 - Additions
 - Deletions
 - Changes or revisions



CPT codes are a list of descriptive terms, guidelines, and identifying codes for reporting medical services and procedures.

- The purpose of CPT is to provide a uniform language that describes medical, surgical, and diagnostic services.
- Used as an effective communication among physicians, patients and third party payers

ORGANISATION OF CPT

- Introduction
- Category I – 6 sections
- Section guidelines
- Section table of contents
- Notes
- Category II codes
- Category III codes
- Appendices A- P
- Index

SYMBOLS:

Symbol	Explanation
Bullet (●)	A bullet (●) before a code means the code is new to the CPT book for that particular edition
Triangle (▲)	A triangle (▲) means the description for the code has been changed or modified since the previous revision of the CPT book
Horizontal triangles (▶◀)	Horizontal triangles (▶◀) placed at the beginning and end of a descriptive entry indicate that it contains new or revised wording
Plus sign (+)	Add-on codes are annotated by a plus sign (+)
🚫	This symbol is used to identify codes that are exempt from the use of modifier -51
🕒	Reference to <i>CPT Assistant, Clinical Examples in Radiology and CPT Changes</i> book
⚡	The lightning bolt indicates codes for vaccines that are pending FDA approval
⌚	This symbol is used to identify codes that include conscious (moderate) sedation
○	The open circle symbol indicates a reinstated or recycled code
#	The pound sign (#) indicates an out-of-numerical sequence code

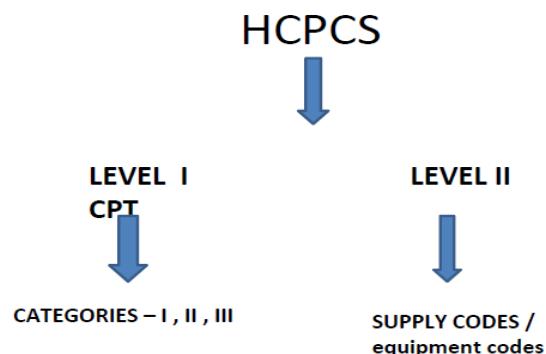
CPT INDEX:

HCPCS

Index

- ▶ Located at the back of the CPT Manual
- ▶ Organized by Main terms
 - Procedure or service
 - Organ or other anatomic site
 - Condition
 - Synonyms, Eponyms or abbreviations
- Subterms modify the main term

- ▶ Level I – CPT
 - Category I – Main sections of CPT
 - Category II – not mandatory; tracking codes
 - Category III – collect statistical data; temporary codes
- ▶ Level II – National Codes
 - Used to bill for services not in Level I and supplies and equipment



- **CPT® Category I**—the largest body of codes consisting of those commonly used by providers to report their services and procedures – 6 sections
- **CPT® Category II**—supplemental tracking codes used for performance management (Ends with letter F)- 0025F
- **CPT® Category III**—temporary codes used to report emerging and experimental services and procedures (Ends with letter T) – 0017T



CATEGORY I

- The 6 main sections of CPT® Category I codes are
- Evaluation & Management Services (99201 – 99499)
- Anesthesia Services (01000 – 01999)
- Surgery (10021 – 69990) – further broken into body area or system within this code range
- Radiology Services (70010 – 79999)
- Pathology and Laboratory Services (80047 – 89398)
- Medical Services and Procedures (90281 – 99607)
- Evaluation and Management Services E&M
- These services are for the visit portion of a patient encounter.
- They have their own set of instructions on selection of the appropriate code.

APPENDIXES

- Appendix A= Modifiers
- Appendix B= Summary of Additions, Deletions and Revisions
- Appendix C= Clinical Examples
- Appendix D= Summary of Add-on Codes
- Appendix E= Summary of Modifier -51 exempt
- Appendix F= Summary of Modifier -63 exempt
- Appendix G= Summary of codes that include moderate sedation
- Appendix H= Alpha listing of Performance Measures
- Appendix I= Genetic Testing Modifiers
- Appendix J= Electrodagnostic Medicine listing of Sensory, Motor and Mixed Nerves
- Appendix K= Products pending FDA approval
- Appendix L= Vascular Family Listing
- Appendix M= Crosswalk from Deleted Codes
- Appendix N= Summary of Resequenced Codes
- Appendix O –Multianalyte Assays with Algorithmic Analyses and Proprietary Laboratory Analyses
- Appendix P - CPT Codes That May Be Used For Synchronous Telemedicine Services

GUIDELINES

- At the beginning of each section are specific guidelines on how to choose the appropriate code within the section.
- Example: Radiology explains how supervision and interpretation codes should be coded

- At the beginning of each code set are guidelines on using the codes within the set
- Example: Laparoscopy heading states, Surgical laparoscopy always includes diagnostic laparoscopy. To report a diagnostic laparoscopy (peritoneoscopy) (separate procedure), use 49320

HOW TO SELECT A PROCEDURE CODE

- Select the name of the procedure from the index of the CPT book
- Using the code set listed in the index review the verbiage of the code within the body of the CPT book

Example:

Appendectomy

1. Index shows code range 44950-44960
2. Go to 44950 and review the individual codes to find the appropriate code for the procedure performed

CPT Assistant

On each code there is a listing for the CPT Assistant this is to show you where to go in the AMA monthly publication. (This is for more clarification on the code, if needed.)

44950 Appendectomy;

CPT Assistant Feb 92:22, Sep 96:4, Aug 02:2, Nov 08:7



MODIFIERS

- Modifiers are used to “modify” the code that is chosen for a given procedure.
- These are listed in the front cover of the CPT book with a description
- Example:
- 51 Multiple Procedure
- 52 Reduced Service

PLACE OF SERVICE

- The first page of the CPT book (no page number designation) is a list of locations.
 - These locations indicate where the procedure was performed
 - These are selected by the “coder” and they print on the CMS 1500 form for billing
- Example:
- 11 Office
- 21 Inpatient Hospital



USING THE CODE

- Once you have selected the procedure code for the service, place of service, and modifiers (if necessary)
- Add the diagnosis code for that procedure
- The charge will be entered into your “billing” system and printed or electronically filed to the appropriate insurance company for payment.

CPT MODIFIERS

MODIFIERS

- Modifier - as the name implies a modifier will modify a service / procedure or an item under certain circumstances for appropriate reimbursement.
- Modifiers may add information or change the description according to the physician documentation to give more specificity for the service or procedure rendered.
- Appending of an appropriate modifier will effectively respond to reimbursement.
- Modifier are two digit codes and are categorized into two levels
- 1. Level I Modifiers: Normally known as CPT Modifiers and consists of two numeric digits and are updated annually by AMA - American Medical Association.
- 2. Level II Modifiers: Normally known as HCPCS Modifiers and consists of two digits (Alpha / Alphanumeric characters) in the sequence AA through VP. These modifiers are annually updated by CMS - Centres for Medicare and Medicaid Services.

LIST OF LEVEL I MODIFIERS:

Modifier	Description
22	Unusual procedural services
23	Unusual anesthesia
24	Unrelated evaluation and management service by the same physician during a postoperative period
25	Significant, separately identifiable E&M service by the same physician on the same day of the procedure or service
26	Professional component
27	Multiple outpatient hospital E&M encounters on the same date
32	Mandated services
47	Anesthesia by surgeons
50	Bilateral procedure
51	Multiple procedures
52	Reduced services
53	Discontinued procedure

54	Surgical care only
55	Postoperative management only
56	Preoperative management only
57	Decision for surgery
58	Staged or related procedure or service by the same physician during postoperative period
59	Distinct procedural service XE-Separate Encounter XP-Separate Practitioner XS-Separate Organ/Structure XU-Unusual Separate Service
62	Two surgeons
63	Procedure performed on infants less than 4 kg.
66	Surgical team
73	Discontinued outpatient procedure prior to anesthesia administration
74	Discontinued outpatient procedure after anesthesia administration
76	Repeat procedure by same physician
77	Repeat procedure by another physician
78	Unplanned return to the operating room for a related procedure during the postoperative period
79	Unrelated procedures or service by the same physician during the postoperative period
80	Assistant surgeon
81	Minimum assistant surgeon
82	Assistant surgeon (when qualified resident surgeon not available)
90	Reference (outside) laboratory
91	Repeat clinical diagnostic laboratory test
95	Synchronous Telemedicine Service Rendered Via a Real- Time Interactive Audio and Video Telecommunications System

MODIFIERS APPROVED FOR HOSPITAL OUTPATIENT USE (CPT)

27 Multiple Outpatient Hospital E/M Encounters on the Same Date

73 Discontinued Out-Patient Hospital/Ambulatory Surgery Center (ASC) Procedure Prior to the Administration of Anesthesia

74 Discontinue Out-Patient Hospital/Ambulatory Surgery Cener (ASC) Procedure After Administration of Anesthesia

25, 33, 50, 52, 58, 59, 73, 74, 76, 77, 78, 79, 91



ANESTHESIA MODIFIERS

- P1** A normal healthy patient
- P2** A patient with mild systemic disease
- P3** A patient with severe systemic disease
- P4** A patient with severe systemic disease that is a constant threat to life
- P5** A moribund patient who is not expected to survive without the operation
- P6** A declared brain-dead patient whose organs are being removed for donor purposes

HCPCS LEVEL II MODIFIERS:

- E1** Upper left, eyelid
- E2** Lower left, eyelid
- E3** Upper right, eyelid
- E4** Lower right, eyelid
- F1** Left hand, second digit
- F2** Left hand, third digit
- F3** Left hand, fourth digit
- F4** Left hand, fifth digit
- F5** Right hand, thumb
- F6** Right hand, second digit
- F7** Right hand, third digit
- F8** Right hand, fourth digit
- F9** Right hand, fifth digit
- FA** Left hand, thumb
- T1** Left foot, second digit
- T2** Left foot, third digit
- T3** Left foot, fourth digit
- T4** Left foot, fifth digit
- T5** Right foot, great toe
- LC** Left circumflex coronary artery
- LD** Left anterior descending coronary artery
- LT** Left side
- RC** Right coronary artery
- RT** Right side



ALL THE BEST