Component I: **CORE**

Module 3: **Medical Terminology/ Basic Anatomy & Physiology**

Purpose: **To prepare the learner to have a basic understanding of anatomy and physiology with a focus on the circulatory system.**

Suggested Time Frame: **8 hours**

Objectives: **Upon the completion of this module, the learner will be able to:**

1. List medical terminology definitions.
2. Explain general anatomy and physiology principles.
3. List body disorders and diagnostic tests.
4. Discuss the circulatory system.
5. Discuss blood and its connection to phlebotomy.

Resources:

References:

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Tortora, G. and Grabowski, S. (2003) Principles of Anatomy and Physiology. 10th edition. John Wiley & Sons

Component I: **CORE**

Module 3: **Medical Terminology/ Basic Anatomy & Physiology**

Topic 1: **Medical Terminology**

Purpose: **To prepare the learner with a basic understanding of medical terminology.**

Suggested Time Frame: **30 minutes**

Objectives: **Upon the completion of this module, the learner will be able to:**

1. Discuss body part roots.
2. Discuss the uses prefixes and suffixes.
3. Discuss commonly used abbreviations and symbols.

Vocabulary:

See Appendix 3.1

References:

Module 3: Medical Terminology/ Basic Anatomy & Physiology **Topic 1: Medical Terminology**

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Discuss body part roots. A. Angi/o - blood and lymph vessels B. Appendic/o - append, appendix C. Arteri/o - artery D. Arthr/o - joint E. Bronch/o - bronchus F. Cardi/o - heart G. Cerebr/o - cerebrum H. Cervic/o - neck I. Cholecyst/o - gallbladder J. Crani/o - cranium K. Cyst/o - bladder L. Dent/o - teeth M. Derm/o - skin N. Esophag/o - esophagus O. Gastr/o - stomach P. Hepa. Hepat/o - liver Q. Lepar/o - abdomen R. My/o - muscle S. Nuer/o - nerve T. Nephr/o - kidney U. Oophor/o - ovary V. Ophthalm/o - eye W. Phleb/o - vein X. Pleur/o - pleura Y. Pod/o - foot Z. Psych/o - mind AA. Ren/o - kidney BB. Rhin/o - nose CC. Thyr/o - thyroid	• Look up the meaning of each of the following roots in a medical dictionary. • Spell the listed roots accurately. • Pronounce the roots correctly. • Using a medical dictionary, find, list, and define one word that begins with each of these roots. • Use each of these words in a sentence. • Appendix 3.1 for complete list
2. Discuss the uses prefixes and suffixes. A. Disease conditions 1. Surgical procedures suffixes a. "-ectomy" - to cut out, to remove b. "-ostomy" - to create a new permanent opening c. "-otomy" - cutting into d. "-plasty" - surgical repair e. "-centesis" - surgical puncture to remove fluid. 2. Disease or condition suffixes a. "-osis" - a condition of b. "-itis" - inflammation of c. "-pathy" - any disease of d. "-algis" - pain e. "-orrhea" - flow or discharge	• Look up meaning of each in a medical dictionary. • List and define one word that combines any root from topic 1 with the 10 suffixes • Use each of these words in a sentence. • Correctly spell each of these words. • In a medical dictionary, find, list and define two words that begin with each of the prefixes. • Use each of these words in a sentence.

Objectives & Content	Recommended Teaching Strategies & Evaluation
3. Prefixes a. "a-, an-, ar-" -without or not b. "ante-" -before c. "anti-" -against d. "hemo-" - blood e. "hyper-" - high, too much, excessive f. "hypo-" - low, too little g. "inter-" - between h. "intra-" - within B. Body Parts 1. Prefixes and suffixes a. "dys" - painful, difficult b. "poly" - many, much c. "post" - following, after d. "pre" - before e. "-lysis" - destruction f. "-oma" - tumor, new growth 2. Prefixes, roots, and suffixes a. "hem/o, hem/a" - blood b. "py/o" - pus c. "scler/o" - hardening d. "-stasis" - slowed down, stopped e. "thromb/o" - clot f. "ur, ur/o, -uris" - urine	• Correctly spell each of these words.
3. Discuss commonly used abbreviations and symbols. A. Periods are not commonly used after letters of an abbreviation. 1. alt hor - alternate hours 2. amb - ambulatory B. Metric math symbols 1. All begin with a lower case letter 2. Basic units are abbreviated by their first initial. C. All chemical symbols are acceptable D. The Latin equivalent is given in parenthesis for information only.	Use handout of abbreviations in glossary.

Component I: **CORE**

Module 3: **Medical Terminology/Basic Anatomy & Physiology**

Topic 2: **General Anatomy & Physiology Concepts**

Purpose: **To prepare the learner with a basic understanding of general anatomy and physiology concepts.**

Suggested Time Frame: **2 hours**

Objectives: **Upon the completion of this module, the learner will be able to:**

1. Spell and define the key terms.
2. List in order of increasing complexity the levels of organization of the body.
3. Describe anatomical position.
4. Apply directional terms to describe the body and the relationships of body parts.
5. Identify the four body planes.
6. Label the major body cavities.

Vocabulary:

Adipose
Afferent
Atoms
Anabolism
Anatomical
Amino acids
Anterior
Appendicular skeleton
Axial skeleton
Cardiovascular system
Cavity
Connective tissue
Chemical
Cell body
Central Nervous System
Cutaneous membrane
Cytoplasm
Catabolism
Chromosome
Contractibility
Cardiac
Dermis
Digestive system
DNA
Efferent
Endocrine
Epidermis
Epithelial tissue
Enzyme
Exocrine
Extremity
Fibrous
Gene
Hemopoietic tissue
Hormone
Integument
Involuntary
Joint
Lateral
Ligament
Lymphatic system
Macroscopic
Mitochondria
Molecule
Medial
Metabolism
Motor neuron
Mucous membrane
Muscle
Neuron
Neurotransmitter
Nucleus
Organ
Peripheral nervous system
Protein
Plasma Membrane
Posterior
Reproductive system
Respiratory system
Ribosomes
RNA
Sebaceous gland
Sensory Neuron
Serous membrane
Sudoriferous gland
Synapse
Tissue
Urinary system
Voluntary

* Definitions are within the module only

References:

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Spell and define the key terms. A. Review the terms. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context.	Lecture
2. List in order of increasing complexity the levels of organization of the body. A. Chemical 1. Atoms 2. Molecules B. Common cell structures 1. Smallest living structural units of living things discovered by Robert Hook 2. Two types: a. Animal b. Plants 3. Cell membrane or plasma membrane (humans) a. Regulates what passes in or out of a cell b. Surrounds and protects the cell c. Site of contact between cell and environment. 4. Cytoplasm material outside the nucleus carries on the work of the cell. a. Mitochondria - power plant, produces energy by catabolism. b. Endoplasmic Reticulum process anabolism. i. Anabolism and catabolism are the processes known as metabolism ii. Ribosomes assemble amino acids, protein synthesis, enzymes iii. Golgi apparatus is the packing house - stores protein iv. Lysosomes - cellular digestive system 5. Nucleus a. Controlling structure of a cell (brain) b. Directs reproduction of the cell c. Determines structure and differentiation of cell. i. Contains DNA or RNA ii. Chromosomes iii. Genes iv. Nucleoli - dense region of nucleus, formation of ribosomes C. Common cell types	Lecture Levels of Body Organization - Appendix 3.2 Parts of a Cell - Appendix 3.3 Body System Illustrations: • Skeletal System - Appendix 3.4 • Circulatory System - Appendix 3.5 • Muscular System - Appendix 3.6 • Nervous System - Appendix 3.7 • Respiratory System - Appendix 3.8 • Urinary System - Appendix 3.9 • Lymphatic System - Appendix 3.10 Models

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Muscle cell a. Three types: skeletal, cardiac, smooth b. High degree of contractibility 2. Epithelial cell a. Simple squamous: thin, alveoli of lungs b. Stratified squamous: tightly packed skin, mucous membranes c. Simple columnar: single layer, stomach and intestines d. Stratified transitional: body areas of stress, bladder e. Pseudostratified: basement membrane, trachea f. Cuboidal: forms tubules, glands 3. Nerve cell 4. Adipose cell: stores lipids, fat cells 5. Blood cells - refer to topic 5 D. Tissues 1. Organization of many similar cells that act together to perform a common function. 2. Epithelial tissue a. Lines internal organs, blood vessels, protects the body b. Three shapes of cells i. Squamous ii. Cuboidal iii. Columnar c. Arrangements: simple, stratified, pseudostratified 3. Muscle tissue: contracts to produce movement a. Skeletal voluntary b. Smooth involuntary c. Cardiac 4. Nerve tissue: nerve cells, transmit electrical impulses a. Neurons b. Cell body c. Axon d. Dendrite 5. Connective tissue a. Most abundant, most varied b. Found in skin, membranes, muscles, bones, internal organs, nerves c. Forms supporting framework d. Areolar connective tissue, most widely distributed, (glue) e. Adipose connective tissue (fat) f. Fibrous connective tissue (collagen, tendons)	

Objectives & Content	Recommended Teaching Strategies & Evaluation
g. Bone and cartilage h. Blood and hemopoietic tissue E. Organs 1. Organ structures made of two or more kinds of tissue that perform a more complex function than tissue alone a. Heart b. Lungs c. Liver d. Spleen e. Kidneys f. Brain g. Skin h. Esophagus i. Gallbladder j. Stomach k. Eyes l. Salivary glands m. Reproductive Organs n. Glands F. Body Systems 1. Integumentary: largest organ of body, protects against bacterial invasion, dehydration, and harmful sun rays. a. Membranes i. Serous membrane • Parietal lines the body cavities • Visceral covers organs i. Mucus membranes • Lines body surfaces opening to exterior • Respiratory, urinary, & reproductive systems ii. Cutaneous membrane, skin • Epidermis: thin, outer most layer, melanocytes, no blood vessels no nerves. • Dermis: dense, middle layer, blood vessels, nerves, finger prints, elastic fibers • Subcutaneous: thick, fatty layer b. Hair: made of keratin, sac that holds hair, hair follicle	

Objectives & Content	Recommended Teaching Strategies & Evaluation
i. 5 million on body i. 100,00 on head, cutting no effect on growth ii. Not on palms and soles of feet iii. Arrector pili muscle: pulls hair follicle, formation of "goose bumps". c. Nails: hard keratin, on distal phalange of hands and feet d. Sense receptors, heat, cold, pressure e. Glands i. Sebaceous (oil) glands: lubricates skin and hair ii. Sudoriferous (sweat) glands: mixture of water, salts and waste, cools the body 2. Skeletal: comprised of bones, cartilage and joints a. Gives body shape, support and protection b. Hemopoiesis: blood cell formation. c. Movement/leverage d. Mineral storage e. Bones: 206 in adult, classified by shape. i. Flat: rib and skull ii. Irregular: vertebrae and facial iii. Long: femur, tibia, fibula, humerus, radius, ulna iv. Short: carpals and tarsals f. Bones of importance in blood collection. i. Distal phalanx finger ii. Calcaneus foot g. Axial skeleton consists of bones of skull, spinal column, and chest h. Appendicular consists of bones in upper and lower extremities. i. Arms, wrists, shoulder ii. Hip, legs, and feet i. Joints: permit flexion, extension, abduction, adduction, and rotation. j. Ligaments hold bones at joints together. 3. Circulatory System: see topic 4 for detail 4. Muscular: comprised of all the muscles of the body, over 600 a. Muscles attached to skeletal system consist of 40% of the body b. Muscles form walls of blood vessels c. Form walls of organs (heart, GI tract) d. Maintains posture	

Objectives & Content	Recommended Teaching Strategies & Evaluation
e. Produce heat f. Skeletal muscles attached to bone (voluntary control) g. Lining walls of blood vessels and organs (involuntary control) h. Cardiac muscle forms wall of heart (involuntary control) 5. Nervous system provides communication network a. Coordinates activities of body systems with electrical impulses and chemical substances. b. Detects sensations internal and external c. Provides communication network d. Thoughts and emotions e. 2 main divisions i. Central Nervous System (CNS): brain and spinal cord ii. Peripheral Nervous System (PNS): cranial nerves and spinal nerves f. Meninges: 3 layers • Dura mater • Arachnoid • Pia g. Cerebral Spinal Fluid (CSF) h. Neuron: individual nerve cell, microscopic i. Dendrite ii. Cell Body iii. Axon iv. Nucleus v. Synapse i. Ganglion: nerve cell bodies outside brain and spinal cord i. Sensory neurons transmit impulses toward brain and spinal cord (afferent) ii. Motor neurons transmit impulses away from the brain and spinal cord (efferent) iii. Myelin sheath: fatty tissue covering axon • White matter = brain and PNS • No myelin sheath = gray matter • Neurilemma myelin sheath on peripheral	

Objectives & Content	Recommended Teaching Strategies & Evaluation
nerves iv. Synapse v. Neurotransmitter vi. Nerve: a macroscopic bundle of dendrites and axons vii. Neuroglia j. Nerves arising out of the brachial plexus. i. Axillary - supplies the deltoid and teres minor muscles. ii. Musculocuyaneous - supplies the flexors of the arm. iii. Radial - supplies the muscles on the posterior aspect of the arm and forearm. iv. Median - supplies most of the muscles of the anterior forearm and some of the muscles of the hand. v. Ulnar - supplies the anteromedial muscles of the forearm an most of the muscles of the hand. 6. Endocrine: communication and control a. Glands that secrete hormones into bloodstream or empty onto a surface or into a cavity. b. Two types of glands: endocrine and exocrine i. Endocrine: products secrete directly into the bloodstream. ii. Exocrine secretes into a duct. c. Pituitary gland is the master gland: stimulates other glands to produce hormones as needed. i. Anterior ii. Posterior d. Hormones are chemical substances that effect metabolism, growth, fluid and electrolyte balance, acid-base balance, personality, and how you react to stress. i. Oxytocin hormone: uterine contractions ii. Antidiuretic hormone (ADH): retention of H_2O iii. Thyroid-stimulating hormone (TSH): stimulates thyroid to produce thyroid hormone. iv. Adrenocorticotropic hormone (ACTH: follicle stimulating hormone	

Objectives & Content	Recommended Teaching Strategies & Evaluation
v. Luteinizing hormone: melanocytes-stimulating hormone vi. Prolactin: human growth hormone 7. Respiratory i. Nose ii. Pharynx iii. Larynx iv. Trachea v. Bronchi vi. Lungs 8. Digestive a. Primary organs i. Mouth ii. Pharynx iii. Esophagus iv. Stomach • Small intestine • Large intestine • Rectum b. Accessory organs i. Teeth ii. Salivary glands iii. Tongue iv. Liver v. Gallbladder vi. Pancreas vii. Appendix 9. Urinary a. Kidneys b. Ureters c. Urinary bladder d. Urethra 10. Reproductive a. Male i. Testes ii. Vas deferens iii. Urethra iv. Prostate v. Penis vi. Scrotum b. Female i. Ovaries ii. Fallopian tubes iii. Uterus iv. Vagina v. Vulva	

Objectives & Content	Recommended Teaching Strategies & Evaluation
vi. Breasts 11. Lymphatic a. Lymph nodes b. Lymph vessels c. Thymus d. Spleen e. Tonsils 12. Cardiovascular a. Heart b. Blood vessels	
3. Describe anatomical position. A. Standing erect B. Head facing forwards C. Arms at the sides D. Palms facing forwards E. Feet together and facing forwards F. When describing the direction or the location of a given point of the body, always refer to the body as if the patient is in the anatomical position, regardless of physical body position.	Lecture Anatomical Position - Appendix 3.11 Volunteers
4. Apply directional terms to describe the body and the relationships of body parts. A. Directional terms describe the relationship of an area or part of the body with respect to the rest of the body or part. B. Terms 1. Anterior (ventral) refers to the front. 2. Posterior (dorsal) refers to the back. 3. External (superficial) means on or near the surface of the body. 4. Internal (deep) means within or near the center of the body 5. Medial means toward the midline or middle. 6. Lateral means towards the side. 7. Proximal means nearest to the center of the body, origin, or point of attachment. 8. Distal means farthest from the center of the body, origin, or point of attachment. 9. Superior (cranial) means higher, or above or toward the head. 10. Inferior (caudal) means beneath, or lower or away from the head.	Lecture Directional Terms - Appendix 3.12
5. Identify the four body planes. A. A body plane is a flat surface resulting from a real or	Lecture Human Body Planes - Appendix

Objectives & Content	Recommended Teaching Strategies & Evaluation
imaginary cut through a body in the normal anatomic position. B. Body areas are referred to with respect to the body planes. C. Planes 1. Frontal plane divides the body vertically into front and back portions 2. Sagittal plane divides the body vertically into front and back portions 3. Midsagittal (medial) plane divides the body into EQUAL right and left portions. 4. Transverse plane divides the body horizontally into upper and lower portions.	3.13
6. Label the major body cavities. A. Large, hollow spaces inside the body. B. Various organs are housed in body cavities. C. Dorsal cavities are located at the back of the body. 1. Cranial cavity houses the brain. 2. Spinal cavity encases the spinal cord. D. Ventral cavities are located at the front of the body. 1. Thoracic cavity houses the heart and lungs primarily. 2. Abdominopelvic cavity is separated from thoracic cavity by the diaphragm. a. Abdominal cavity houses numerous organs. i. Stomach i. Liver ii. Pancreas iii. Gallbladder iv. Spleen v. Kidneys. b. Pelvic cavity primarily houses the urinary bladder and the reproductive organs.	Lecture Anatomical Atlas - Appendix 3.14

Topic 3: Disorders & Diagnostic Tests

Purpose: To prepare the learner with a basic understanding of general anatomy and physiology concepts.

Suggested Time Frame: 2 hours

Objectives: Upon the completion of this module, the learner will be able to:

1. Spell and define key terms
2. Describe common disorders associated with each body system.
3. State the common diagnostic tests associated with each body system.

Vocabulary:

Benign	Malignant	Atrophy
Inflammation	Overexertion	Secretion
Lethargy	Hypotension	Hypertension
Insulin	Melanoma	Virus
Spasm	Rigidity	Barrel chest

* Definitions are within the module only

References:

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Tortora, G. and Grabowski, S. (2003) Principles of Anatomy and Physiology. 10th edition. John Wiley & Sons

Anatomy & Physiology **Tests**

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Spell and define the key terms. A. Review the terms. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context.	Lecture
2. Describe common disorders associated with each body system. A. Skeletal system 1. Arthritis a. Characterized by inflammation of joints b. Signs and symptoms include pain and swelling 2. Bursitis, an inflammation of the fluid filled sac (bursa) between muscle attachments and bone 3. Gout a. A form of arthritis b. Caused by faulty uric acid metabolism 4. Osteomyelitis a. An inflammation of the bone, especially the bone marrow b. Caused by bacterial infection 5. Osteoporosis, a disorder that involves a loss of bone density. B. Muscular system 1. Atrophy, a decrease in size (wasting) of a muscle, usually due to inactivity such as bed rest. 2. Muscular dystrophy a. Genetic disease b. Muscle atrophy 3. Myalgia, a painful muscle 4. Tendinitis a. An inflammation of muscle tendons b. Usually due to overexertion C. Reproductive system 1. Female a. Cervical cancer b. Infertility c. Uterine cancer d. Ovarian cyst e. Ovarian cancer f. Sexually transmitted diseases i. Syphilis ii. Gonorrhea iii. Genital herpes 2. Male a. Benign prostatic hypertrophy b. Prostate cancer c. Testicular cancer	Lecture Discussion

Objectives & Content	Recommended Teaching Strategies & Evaluation
D. Digestive system 1. Gastritis, inflammation of the lining of the stomach. 2. Ulcer a. An open sore or lesion b. Can be found anywhere in the digestive system, most commonly found in the: i. Stomach ii. Duodenum 3. Gastroenteritis, an inflammation of the stomach and intestinal tract. 4. Cholecystitis, an inflammation of the gall bladder 5. Hepatitis, an inflammation of the liver 6. Pancreatitis, an inflammation of the pancreas 7. Colitis, an inflammation of the colon 8. Peritonitis, an inflammation of the abdominal cavity lining E. Endocrine system 1. Pituitary gland a. Acromegaly i. An overgrowth of the bones of the hands, feet, and face ii. Caused by excessive growth hormone in adulthood b. Diabetes insipidus i. Increased thirst and urine production ii. Caused by inadequate secretion of antidiuretic hormone (ADH) c. Dwarfism d. Gigantism 2. Thyroid gland a. Cretinism, an untreated congenital hypothyroidism b. Hypothyroidism, characterized by: i. Weight gain ii. Lethargy c. Hyperthyroidism, characterized by: i. Weight loss ii. Nervousness iii. Protruding eyeballs d. Goiter, an enlargement of the thyroid gland 3. Parathyroid glands a. Hyposecretion can cause muscle spasms and convulsions b. Hypersecretion can cause kidney stones and bone destruction 4. Adrenal glands	

Objectives & Content	Recommended Teaching Strategies & Evaluation
a. Hyposecretion, known as Addison's disease, can cause: i. Weight loss ii. Dehydration iii. Hypotension b. Hypersecretion, known as Cushing's disease, can cause: i. A "moon face" ii. Hypertension iii. Edema 5. Pancreas a. Diabetes mellitus, type 1, in which the body is unable to produce insulin. b. Diabetes mellitus, type 2, in which the body is able to produce insulin but may not: i. Produce enough insulin ii. Be able to correctly use the insulin. F. Nervous system 1. Encephalitis, an inflammation of the brain 2. Meningitis, an inflammation of the membranes that cover the brain and spinal cord 3. Epilepsy, a recurrent pattern of seizures 4. Hydrocephalus, an accumulation of fluid in the brain 5. Amyotrophic lateral sclerosis, a degeneration of portions of the brain and spinal cord, causing: a. Muscle weakness b. Atrophy of muscles 6. Multiple sclerosis, destruction of the myelin sheath that covers the nerves of the brain, causing complex neurological problems. 7. Parkinson's disease, a chronic disease that is characterized by: a. Fine muscle tremors b. Muscle weakness c. Muscle rigidity 8. Shingles, an acute eruption of herpes blisters along the course of a peripheral nerve. 9. Injuries to nerves related to procedures performed by the phlebotomist. a. Radial nerve injury can result from: i. Improperly administered intra muscular injections into the deltoid muscle ii. A too tight cast applied around mid-humerus b. A weak wrist indicates radial nerve	

Objectives & Content	Recommended Teaching Strategies & Evaluation
injury. c. Median nerve injury is indicated by: i. Numbness, tingling, and pain in the palm and fingers ii. The inability to turn the forearm palm-down and flex the proximal joints of the fingers iii. The inability to flex the distal joints of the second and third fingers iv. Weak wrist flexion, adduction and thumb movements. d. Ulnar nerve injury is indicated by: i. Inability to abduct or adduct the fingers. ii. Atrophy of the interosseus muscles of the hand. iii. Hyperextension of the wrist joints. iv. Flexion of the finger joints, called clawhand v. Loss of sensation over the little finger. G. Urinary system 1. Renal failure, a sudden and severe impairment of renal function 2. Nephritis, an inflammation of the kidneys 3. Uremia, the build up of waste products in the blood 4. Kidney stones, the development of uric acid, calcium phosphate, or oxalate stones in the kidneys, ureter, or bladder 5. Cystitis, an inflammation of the bladder 6. Urinary tract infection (UTI), a term that implies an infection of the organs and/or ducts of the urinary system. H. Integumentary system 1. Acne, an inflammatory disease of the sebaceous glands and hair follicles 2. Cancer of the skin includes: e. Basal cell f. Squamous cell g. Melanoma 3. Dermatitis, an inflammation of the skin 4. Fungal infection, includes tinea and ringworm 5. Herpes infection, seen as a cold sore or shingles 6. Impetigo, an infection of the skin caused by staphylococcus or streptococcus organisms 7. Keloid, an overgrowth of skin tissue at scar areas	

Objectives & Content	Recommended Teaching Strategies & Evaluation
8. Pediculosis, an infestation with lice, usually found in areas of the skin covered with hair such as the scalp 9. Pruritis, itching of the skin that can be from a variety of sources, including: a. Infection b. Bites (e.g. mosquito, flea) c. Dryness d. Chemicals (e.g. elevated levels of bilirubin with jaundice) e. Response to irritation (e.g. soaps, perfumes, fabrics) 10. Psoriasis, a chronic disease of unknown origin that has clearly defined red patches of scaly skin I. Respiratory system 1. Upper respiratory infection (URI), an infection of the nose, throat, larynx, or upper trachea, that may be caused by a cold virus 2. Rhinitis, an inflammation of the nasal mucous membranes 3. Tonsillitis, an inflammation or infection of the tonsils 4. Asthma a. Difficulty in breathing that has accompanying wheezing b. Caused by spasm or swelling of the bronchial tubes. 5. Bronchitis, an inflammation of the mucous membranes of the bronchial tubes, may be acute or chronic 6. Emphysema, a chronic obstructive pulmonary disease (COPD) that: a. Involves rigidity of the alveoli of the lungs b. Will result in air trapping in the lungs and a barrel chest 7. Cystic fibrosis, a genetic disease that causes an excess production of mucous that obstructs the bronchi 8. Pneumonia, an inflammation of the lungs 9. Pulmonary edema, the build-up of fluid in the lungs 10. Tuberculosis, a bacterial infection of the lungs 11. Respiratory syncytial virus (RSV), a viral infection that causes respiratory distress in infants and children.	
2. State the common diagnostic tests associated with each body	Lecture

Objectives & Content	Recommended Teaching Strategies & Evaluation
system. A. Skeletal system 1. Alkaline phosphatase (ALP) 2. Calcium (Ca) 3. Complete blood count (CBC) 4. Erythrocyte sedimentation rate (ESR) 5. Phosphorus (P) 6. Synovial fluid analysis 7. Uric acid 8. Vitamin D B. Muscular system 1. Autoimmune antibodies 2. Creatinine phosphokinase (CPK/CK) 3. CPK/CK isoenzymes 4. Lactic acid 5. Lactic acid dehydrogenase (LD/LDH) 6. Myoglobin 7. Troponin 8. Beta Naturetic Polypeptid (BNP) C. Reproductive system 1. Acid phosphatase 2. Estrogen 3. Follicle stimulating hormone (FSH) 4. Human chorionic gonadotropin (HCG) 5. Luteinizing hormone (LH) 6. Microbiological cultures 7. Pap smear 8. Prostate-specific antigen (PSA) 9. Rapid plasmin regain (RPR) 10. Testosterone 11. Viral tissue studies D. Digestive system 1. Amylase 2. Bilirubin 3. Carcinoembryonic antigen (CEA) 4. Carotene 5. Cholesterol 6. Complete blood count 7. Glucose 8. Glucose tolerance test (GTT) 9. Lipase 10. Liver function tests a. Alanine transaminase (ALT) b. Aspartate transaminase (AST) c. Alkaline phosphatase (ALP) d. Albumin e. Globulin f. Prothrombin time (PT) 11. Occult blood	

Objectives & Content	Recommended Teaching Strategies & Evaluation
12. Ova and parasite (O&P) 13. Triglycerides E. Endocrine system 1. Adrenocorticotropic hormone (ACTH) 2. Aldosterone 3. Antidurietic hormine (ADH) 4. Cortisol 5. Erythropoietin 6. Glucagon 7. Glucose tolerance test (GTT) 8. Growth hormone (GH) 9. Insulin level 10. Renin 11. Thyroid function studies (T_3, T_4, TSH) 12. Hemoglobin ($HGBA_1c$) 13. Glycocilated Hemoglobin F. Nervous system 1. Acetylcholine receptor antibody 2. Cerebrospinal fluid (CSF) analysis: a. Cell count b. Glucose c. Protein d. Culture 3. Cholinesterase 4. Drug levels 5. Serotonin G. Urinary system 1. Albumin 2. Ammonia 3. Blood urea nitrogen (BUN) 4. Creatinine clearance 5. Electrolytes a. Sodium (Na) b. Chloride (Cl) c. Potassium (K) d. Calcium (Ca) 6. Osmolality 7. Urinalysis (UA) 8. Urine culture and sensitivity (C&S) H. Integumentary system 1. Microbiological cultures 2. Skin scrapings for fungal cultures 3. Tissue cultures I. Respiratory system 1. Alkaline phosphatase (ALP) 2. Arterial blood gases (ABG) 3. Capillary blood gases (CBG) 4. Complete blood count 5. Drug levels	

Objectives & Content	Recommended Teaching Strategies & Evaluation
6. Electrolytes 7. Microbiological cultures 8. Pleural fluid (from pleuracentesis) 9. Skin tests (e.g. tuberculosis, allergies)	

Component I: **CORE**

Module 3: **Medical Terminology/Basic Anatomy and Physiology**

Topic 4: **Circulatory System**

Purpose: **To prepare the learner with a basic understanding of the circulatory system.**

Suggested Time Frame: **2.5 hours**

Objectives: **Upon the completion of this module, the learner will be able to:**

1. Spell and define key terms.
2. Explain the purpose of the circulatory system.
3. Describe the structures of the heart.
4. Describe the structures and functions of the body's blood vessels.
5. Locate the major vessels used in phlebotomy.

Vocabulary:

Atria	Artioventricular	Aortic
Artery	Antcubital fossa	Anterior tibial vein
Arterial blood gases (ABG)	Brachial	Benour
Basilic vein	Capillary	Cephalic vein
Deoxygenated blood	Epicardium	Endocardium
Femoral vein	Femoral artery	Median cubital vein
Myocardium	Oxygenated blood	Palpate
Popliteal vein	Posterior tibial vein	Pulmonic
Pulmonary circulation	Radial	Semilunar
Systemic circulation	Ventricle	

* Definitions are within the module only

References:

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Spell and define the key terms. A. Review the terms listed in the vocabulary section. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in the proper context.	Lecture
2. Explain the purpose of the circulatory system. A. Pulmonary circulation 1. Carries blood from the heart to the lungs to remove carbon dioxide and pick up oxygen. 2. Returns oxygenated blood to the heart to be pumped throughout the body. B. Systemic circulation 1. Carries oxygenated blood from the heart, along with nutrients from the digestive system, to all the cells of the body 2. Returns carbon dioxide to the lungs and other waste products of metabolism to the liver and kidneys for disposal	Lecture Circulatory Routes - Appendix 3.15
3. Describe the structures of the heart A. The "pump" that circulates blood throughout the body B. Structure 1. 4 chambered, hollow, muscular organ 2. Slightly larger than an man's closed fist C. Layers of the heart 1. Epicardium, the thin outer layer 2. Myocardium, the middle, muscular layer 3. Endocardium, the thin membrane lining the heart D. Chambers of the heart 1. Atria, the upper chambers a. The "receiving chambers". b. The right atrium receives unoxygenated blood from the venous system (superior and inferior vena cavae). c. The left atrium receives oxygenated blood from the lungs via the pulmonary veins. 2. Ventricles, the lower chambers a. The "pumping or delivering chambers". b. The right ventricle sends blood to the lungs via the pulmonary artery. c. The left ventricle sends blood to the aorta and the whole body. E. Heart valves 1. Atrioventricular a. Tricuspid, between the right atrium and	Lecture The Heart - Appendix 3.16

Objectives & Content	Recommended Teaching Strategies & Evaluation
right ventricle b. Bicuspid or mitral, between the left atrium and left ventricle 2. Semilunar a. Pulmonic, between the right ventricle and the pulmonary artery b. Aortic, between the left ventricle and the aorta F. Coronary arteries 2. The heart's blood supply 3. Open just off the aortic semilunar valve	
4. Describe the structures and functions of the body's blood vessels A. General description of blood vessels 1. Tube-like structures 2. Capable of expanding and contracting B. Arteries 1. Carry blood away from the heart. 2. Have thick walls because the blood in them is under pressure from contraction of the heart. 3. The pressure creates a pulse that can be felt; one way of distinguishing an artery from a vein. 4. The blood is oxygenated with the exception of the pulmonary artery, which carries blood from the right ventricle to the lungs. 5. Arterioles are the smallest branches of arteries and connect to capillaries. C. Veins 1. Return blood to the heart 2. Have thinner walls than arteries because the blood is under less pressure 3. Can collapse more easily than arteries 4. Blood is kept moving through veins via: a. Skeletal muscle movement b. Valves to prevent backflow because venous blood moves against the pull of gravity 5. Blood is low in oxygen (deoxygenated) except for the pulmonary vein, which carries blood from the lungs to the left atrium. 6. Venules are the smallest veins, which connect to capillaries. D. Capillaries 1. Microscopic, one-cell thick vessels 2. Connect arterioles and venules. 3. The blood is mixture of venous and arterial blood. 4. The thin walls allow for the exchange of: a. Oxygen for carbon dioxide.	Lecture Comparative Structure of Blood Vessels - Appendix 3.17

Objectives & Content	Recommended Teaching Strategies & Evaluation
b. Nutrients for wastes between the cells and the blood.	
5. Locate the major vessels used in phlebotomy. A. Major veins are located in antecubital fossa. 1. Area of arm that is anterior to and below the bend of the elbow. 2. Antecubital veins lie close to the surface of the skin, making them easier to locate and penetrate with a needle B. Antecubital veins subject to venipuncture 1. Median cubital vein a. First choice vein for venipuncture. b. Large and well anchored c. Easiest and least painful to puncture. d. Least likely to bruise. 2. Cephalic vein a. Second choice vein for venipuncture. b. Harder to palpate but is fairly well anchored c. Often is the only vein that can be palpated in obese patients. 3. Basilic vein a. Third choice vein for venipuncture b. Easy to palpate but is not anchored. c. Therefore it will roll and bruise more easily d. Venipuncture tends to be more painful to patient e. Possibility of accidental puncture of the median nerve or brachial artery. C. Other arm and hand veins subject to venipuncture 1. Used when antecubital veins are unsuitable or unavailable 2. Veins of forearm a. Antibrachial veins b. Accesory cephalic vein 3. Veins of wrist 4. Dorsal metacarpal veins of the back of the hand. D. Leg, ankle and foot veins subject to venipuncture 1. Should only be used when no other sites are available 2. Must have the permission of the patient's physician. 3. Veins a. Femoral - performed only by physician or specially trained personnel. b. Popliteal veins c. Posterior tibial veins	Lecture Major Arteries & Veins - Appendix 3.18 Veins of the Right Upper Limb - Appendix 3.19 Veins of the Right Lower Limb - Appendix 3.20 Veins of the Right Hand - Appendix 3.21 Arteries of the Right Upper Limb - Appendix 3.22 Arteries of the Right Lower Limb - Appendix 3.23

Objectives & Content	Recommended Teaching Strategies & Evaluation
d. Anterior tibial veins e. Dorsal metatarsal veins (foot) E. Arteries subject to puncture 1. Requires special training to perform 2. Is more painful and hazardous to the patient 3. Generally limited to the collection of arterial blood gases (ABGs) 4. Arteries of the arm a. Radial arteries b. Brachial arteries 5. Artery of the leg - femoral artery a. Emergency situations only b. Performed by physicians and specially trained personnel.	

Component I: **CORE**

Module 3: **Medical Terminology/Basic Anatomy and Physiology**

Topic 5: **Blood**

Purpose: **To prepare the learner with a basic understanding of blood.**

Suggested Time Frame: **1 hour**

Objectives: **Upon the completion of this module, the learner will be able to:**

1. Spell and define key terms.
2. Describe the components of whole blood.
3. Differentiate between plasma and serum.
4. Describe the coagulation process.
5. Differentiate among the different types of blood groups.

Vocabulary:

Alkaline	Acidic	Albumin
Antibodies	Anuclear	Agranuocyte
Antigen	Biconcave	Basophil
Carbohydrate	Coagulation	
Coagulation cascade		
Crossmatch	Detoxify	Erythrocyte
Extravascular	Eosinophils	Extrinsic pathway
Fibronolysis	Fibrinogen	Formed elements
Fibrin clot	Granulocytes	Histamine
Heparin	Hemostasis	Intrinsic pathway
Leukocyte	Lipid	Lymphocyte
Mineral	Monocyte	Neutrophil
Plasma	Platelet	Platelet plug
Pathogen	Phagocytise	Parasitic infections
pH	Protein	Serum
Throbocyte	Vasoconstriction	Waste product

* Definitions are within the module only

References:

McCall, Ruth E. & Tankersley, Cathee M. (1998). Phlebotomy Essentials. Philadelphia, Pennsylvania: Lippincott, Williams, & Wilkins.

Module 3: Medical Terminology/ Basic Anatomy & Physiology **Topic 5: Blood**

Objectives & Content	Recommended Teaching Strategies & Evaluation
1. Spell and define the key terms. A. Review the terms listed in the vocabulary section. B. Spell the listed terms accurately. C. Pronounce the terms correctly. D. Use the terms in their proper context.	Lecture
2. Describe the components of whole blood. A. Characteristics 1. A mixture of fluid and cells 2. About 5 times thicker than water 3. Slightly alkaline pH of 7.4 B. Plasma 1. 55% of blood 2. Normal plasma is clear, pale yellow fluid 3. Nearly 90% water 4. Composition a. Proteins i. Albumin • Manufactured by the liver • Helps regulate the tendency of blood to attract water. ii. Antibodies - combat infection iii. Fibrinogen • Manufactured by the liver • Functions in clotting process b. Nutrients - supply energy i. Carbohydrates (i.e. glucose) ii. Lipids (fats) c. Minerals - Examples: i. Sodium (Na) • Helps maintain fluid balance, pH, and calcium & potassium balance necessary for normal heart action. ii. Potassium (K) • Normal muscle activity • Conduction of nerve impulses. iii. Calcium (Ca) • Proper bone and teeth formation	Lecture Components of Blood - Appendix 3.24 Types of Blood Cells - Appendix 3.25

Objectives & Content	Recommended Teaching Strategies & Evaluation
• Nerve conduction • Muscle contraction • Blood clotting iv. Magnesium (Mg) d. Gases i. Oxygen (O_2) ii. Carbon dioxide (CO_2) iii. Nitrogen (N) e. Other substances i. Vitamins ii. Hormones iii. Waste products of metabolism • Urea (BUN) • Creatinine • Uric acid C. Formed elements 1. Erythrocytes a. Known as red blood cells (RBCs) b. Are the most numerous cells in the blood c. Produced in the bone marrow d. Functions i. To carry oxygen from the lungs to the cells. ii. Carry CO_2 from the cells back to the lungs to be exhaled. e. Description i. Anuclear (no nucleus) in mature cells only ii. Biconcave disks - indented from both sides f. Life span of 120 days g. Hemoglobin i. After O_2 crosses respiratory membranes into the blood, about 97% of O_2 combines with iron-containing heme portion of hemoglobin. Remainder 3% dissolves in plasma. ii. Hemoglobin carries O_2 in the red blood cells from lungs to blood vessel capillaries. iii. O_2 and CO_2 rapidly combine with hemoglobin to form oxyhemoglobin and carbminohemoglobin. 2. Leukocytes a. Also called white blood cells (WBCs) b. Contain a nucleus	

Objectives & Content	Recommended Teaching Strategies & Evaluation
c. Formed in the bone marrow and lymphatic tissue d. Able to leave the blood stream and do a job in the tissues. (extravascular) e. Function to destroy pathogens i. Can produce antibodies that destroy pathogens directly. ii. Phagocytize by surrounding and engulfing the pathogen. f. Types identified by: i. Size ii. Shape of nucleus iii. Granules present in cytoplasm when stained for a microscope. g. Life span varies with type 3. Granulocytes a. Can tell the type apart by the color of their granules when stained. b. Neutrophils i. Most numerous of WBCs ii. Granules are fine in texture and stain lavender. iii. Nucleus has several lobes iv. Increased numbers are associated with bacterial infections. v. Life span is 6 hours to a few days. c. Eosinophils ii. Granules are bead-like and stain bright orange-red. iii. Nucleus has two lobes iv. Ingest and detoxify foreign protein and help turn off immune reactions v. Increased numbers associated with allergies and parasitic infestations. vi. Life span is 8-12 days. d. Basophils iv. Least numerous of WBCs. v. Granules are large and stain dark blue. vi. Nucleus often in shape of "S". vii. Release histamine and heparin, which enhance the inflammatory response. viii. Life span is several days. 4. Agranulocytes a. Monocytes	

Objectives & Content	Recommended Teaching Strategies & Evaluation
ii. Largest of WBCs. iii. Have a fine gray-blue cytoplasm and large, dark stained nucleus. iv. Destroy pathogens by phagocytosis. v. Life span is several months. b. Lymphocytes i. Second most numerous WBCs ii. Large, round, dark purple nucleus surrounded by thin rim of pale blue cytoplasm. iii. T-lymphocytes - directly attack infected cells. iv. B-lymphocyte • Give rise to plasma cells. • Plasma cells produce antibodies, which are released into blood stream. • Antibodies circulate and attack foreign cells. v. Life span varies from a few hors to a number of years. 5. Thrombocytes a. Known also as platelets b. Smallest of formed elements c. Essential to coagulation and are first on the scene when injury occurs. d. Life span is around 10 days.	
3. Differentiate between plasma and serum. A. Plasma 1. Fluid separated from the red blood cells and buffy coat. c. Clear, pale yellow fluid d. Contains fibrinogens. 2. With the addition of an anticoagulant to the blood specimen, it will centrifuge into three layers; one of which is plasma. 3. The use of an anticoagulant preserves the fibrinogens in the plasma, so it may be used in a coagulation test. B. Serum 1. The fluid portion of a blood clot. a. Clear, pale yellow fluid b. Does not contain fibrinogen 2. Separated from the blood cells by centrifugation. 3. Coagulation tests cannot be performed because the coagulation factors (fibrinogen) have been	Lecture Anticoagulated vs. Non-Anticoagulated Blood - Appendix 3.26

Objectives & Content	Recommended Teaching Strategies & Evaluation
used in the process of clot formation.	
4. Describe the coagulation process A. Hemostasis 1. The process by which the body stops the leakage of blood from the vascular system after injury 2. This process is also called coagulation and proceeds in four stages: a. Stages 1 and 2 are called "primary" b. Stages 3 and 4 are called "secondary" B. Primary hemostasis 1. Stage 1: vasoconstriction in which the damaged vessel narrows to decrease the flow of blood to the injured area 2. Stage 2: platelet plug formation a. Injury to the blood vessel exposes protein material b. Contact with the protein material causes platelets to stick to one another (aggregation) and the injured area C. Secondary hemostasis 1. Stage 3: Fibrin clot formation a. Involves the complex interaction of a series of coagulation factors, designated by Roman numerals in the order of discovery b. Called a "coagulation cascade" c. 2 separate pathways eventually join to form the clot i. Intrinsic pathway ii. Extrinsic pathway 2. Stage 4: Fibrinolysis a. Involves the ultimate removal of the fibrin clot once healing has occurred. b. The fibrin clot is broken into small fragments and is removed by the phagocyte cells.	Lecture Clotting Response - Appendix 3.27
5. Differentiate among the different types of blood groups. A. The ABO blood group system recognizes four blood types: 1. A with A antigen 2. B with B antigen 3. AB with both A and B antigens; least common type of blood 4. O no antigens; most common type of blood B. Antibodies are in the blood that will cause blood to clot. 1. Type A blood has an antibody for type B blood 2. Type B blood has an antibody for type A blood	Lecture

Objectives & Content	Recommended Teaching Strategies & Evaluation
3. Type AB blood has neither antibody for types A or B 4. Type O blood has antibodies for both A and B blood C. Rh blood group system 1. Based upon the presence or absence of an antigen called the "D" also known as Rh factor 2. Antibodies to the Rh factor are not preformed in the blood of Rh negative individuals a. A person can become sensitized and when given Rh positive blood can destroy the cells of the Rh positive blood b. This becomes a problem when a Rh negative mother is exposed to a Rh positive fetus she can produce antibodies that will harm a subsequent fetus D. Compatibility testing/crossmatch 1. Other factors in an individual's blood can cause reactions during a blood transfusion even with the correct ABO and Rh type blood. 2. Compatibility test or crossmatch is performed.	

Medical Terminology Appendix 3.1

-A-			
a-	away from, negative, no, not without	*adren/o ,adrenal/o*	adrenal glands
ab-	away from	*-aemia*	blood
abdomin/o	abdomen	*aer/o*	air, gas
-able	capable of, able to	*aesthe-, -aesthesia, aestget/o*	sensation, sense of perception
abort/o	premature expulsion of a nonviable fetus	*af-*	toward, to
abrad/o, abras/o	rub or scrape off	*affect/o*	exert influence on
abrupt/o	broken away from	*ag-*	toward, to
abs-	away from	*agglutin/o*	clumping, stick together
abscess/o	going away, collection of pus	*aggress/o*	attack, step forward
absorpt/o	suck up, suck in	*-ago*	attack, diseased state for condition
ac-	toward, to	*agor/a*	marketplace
-ac	pertaining to	*-agra*	excessive pain, seizure, attack of severe pain
acanth/o	spiny, thorny	*-aise*	comfort, ease
ascetabul/o	acetabulum (hip socket)	*al-*	like, similar
-acious	characterized by	*-al*	pertaining to
acne/o	point or peak	*alb/albi alb/o ablin/o*	White
acou/o acous/o	hearing, sense of hearing	*albumin/o*	albumin, protein
acquir/o	get, obtain	*alg/e, alg/o*	pain
-acusia, -acusis, acust/o	hearing, sense of hearing	*algesi/o, -algesia*	suffering pain, the sense of pain, sensitivity to pain
acr/o	extremities, top, point	*-algesic*	painful
acromi/o	acromion, point of shoulder blade	*algi-, algia*	suffering, pain
acu/o	sharp, severe, sudden	*align/o*	bring into line or correct position
acuit/o, acut/o	sharp, sharpness	*aliment/o*	to nourish
ad-, -ad	toward, to, in direction of	*all/o, all-*	other, different
aden/o	gland	*allucin/o*	wander in the mind

adenoid/o	adenoids		*alopec/o*	mangy, baldness
adhes/to	stick to, cling to		*alveoli/o*	alveolus, air sacs, small sac
adip/o	fat		*amb-, ambi-*	both, on both sides
adnex/o	bound to		*ambly/o*	dim, dull

-*A*-continued				
ambul/o, ambulat/o	to walk		*aqu/aqui, aqu/o, aque/o*	water
ametr/o	out of proportion		*-ar*	pertaining to
-amine	nitrogen compound		*arc/o*	bow, arc or arch
amni/o	amnion, fetal membrane		*-arche*	beginning
amph-	around, on both sides, doubly		*arachn/o*	spider web, spider
amput/o,amputate/o	cut away, cut off a part of the body		*areat/o*	occurring in patches or circumscribed areas
amyl/o	starch		*areol/o*	little open space
an-	no, not, without		*arrect/o*	upright, lifted up raised
an-, ana-	up, apart, backward, excessive		*arteri/o*	artery
andr/o	male		*arthr/o, articul/o*	joint
aneurysm/o	aneurysm		*-ary*	pertaining to
angi/o, angi ,angio	relating to blood or lymph vessels		*as-*	toward, to
angin/o	choking, strangling		*-ase*	enzyme
anis/o	unequal		*asphyxia/o*	absence of a pulse
an/o	anus, ring		*aspir/o, aspirat/o*	to breathe in
ankyl/o	crooked, bent stiff, looped		*asthen-, -asthenia*	weakness, lack of strength
anomal/o	irregularity		*-asthmat/o*	a gasping, choking
ante-	before, forward		*at-*	toward, to
anter/o	front		*atel/o*	incomplete
anthrac/o	coal dust		*atherl/o*	plaque, fatty substance
anti-	against, counter		*athet/o*	uncontrolled
anxi/o, anxiety/o	uneasy, anxious, distressed		*-atonic*	lack of tone
aort/o	aorta		*atop/o*	strange, out of place
ap-	toward, to		*atres/atresi*	without an opening
-apheresis	removal		*atri/o*	atrium
aphth/o	a small ulcer or eruption		*attenuate/o*	diluted, weakened
apic/o	apex		*aud-, audi/o,audit/o*	ear, hearing, the sense of hearing
aplast/o	defective development, lack of development		*aur/auri, aur/o*	ear, hearing
apo-	from, opposed, detached		*auscult/o*	listen

aponeur/o	aponeurosis		*aut/o*	self
apoplect/o	a stroke		*ax/o*	axis, main stem
append/o, appendic/o	appendix		*azot/o*	urea, nitrogen
-B-				
bacill/o	little stick or rod		*borboygm/o*	rumbling sound
balan/o	glans penis		*brachi/o*	arm
bar/o	pressure, weight		*brachy-*	short
bas/o	base, opposite of acid		*brady-*	slow
bi-, bin, bis-	twice, double, two		*brev/I, brev/o*	short
bi/o, bio	pertaining to life		*bronch/i, bronch/o*	bronchial tube, windpipe, bronchus
bifid/o	split, cleft into two parts		*bronchi/o*	bronchial tube
bifid/o	divide or fork into two branches		*bronchiol/o*	bronchiole, bronchiolus
bil/bili	bile, gall		*brux/o*	grind
bilirubin/o	bilirubin		*bucc/o, bucca*	cheek
-blast	embryonic, immature		*burs/o*	bursa, sac of fluid near joint
blephar/o	eyelid			
-C-				
cac-, cac/o, caca-	evil, bad, diseased, weak		*chalaz/o*	a hailstone
cadaver/o	dead body, corpse		*cheil/o*	lip
calc/o	calcium		*cheir/o, cheir-*	hand
calcane/o	calcaneus, heel bone		*chem./chemi chem./o, chemic/o*	drug, chemical
calcul/o	stone, little stone		*chir/o, chiro-*	hand
cali/o	cup, calyx		*chlorhydr/o*	hydrochloric acid
call/calli, callos/o	hard, hardened and thickened		*chol/e*	bile, gall
calor/calori	heat		*cholangi/o*	bile, duct
canalicul/o	little canal or duct		*cholecyst/o*	gall bladder
canth/o	corner of the eye		*choledoch/o*	common bile duct
capill/o	hair		*cholesterol/o*	cholesterol
capit/o	head		*chondr/o, chondri/o*	cartilage
capn/o, -capnia	smoke, carbon dioxide		*chord/o*	cord, the spinal cord
capsul/o	little box		*chori/o*	chorion, membrane
carb/o	carbon		*choroid/o*	choroids layer of eye
carbuncul/o	carbunculus		*chrom/o, chromat/o*	color
carcin/o	cancerous		*chym/o*	to pour, juice
cardi/o	heart		*cib/o*	meal
cari/o	rottenness, decay		*cicatric/o*	scar
carot/o	stupor, sleep		*-cidal*	pertaining to death
carp/o	carpus,. wrist bone		*-cide*	causing death
cartilage/o, cartilagin/o	gristle, cartilage		*cili/o*	microscopic hair-like projections, eyelashes
caruncul/o	bit of flesh		*cine/o*	movement

cat-, cata-, cath-	down, lower, under, downward		*cir/circi*	ring or circle
catabol/o	a breaking down		*circulat/o*	go around in a circle
cathart/o	cleansing, purging		*circum-*	around, about
cathet/o	send down, insert		*circumcise/o*	cutting around
caud/o	tail, lower part of body		*circumscribe/o*	confined, limited in space
caus/o, caust/o	burn, burning		*cirrh/o*	tawny, orange-yellow
cauter/o, caut/o	heat, burn		*cis/o*	cut
cav/cavi, cav/o	hollow, cave		*-clasis,-clast*	break
cavern/o	containing hollow spaces		*claudicate/o*	limping
cec/o	cecum, blind gut		*claustr/o*	barrier
-cele	tumor, cyst, hernia		*clav/clavi*	key
celi/o	belly, abdomen		*clavicul/o, cleid/o*	clavicle, collar bone
cement/o	a rough stone, cementum		*climacter/o*	crisis, rung of a ladder
cent-	hundred		*clitor/o, clitorid/o*	clitoris, a small hill
-centesis	surgical puncture to remove fluid		*clon/o*	violent action
cephal/o, cephal, -ceps	relating to a head, head		*clus/o*	shut or close
cera-	wax		*-clysis*	irrigation, washing
cerebell/o	cerebellum		*co-*	together, with
cerebr/o	brain, cerebrum		*coagul/o,coagulat/o*	congeal, curdle, fix together
cerumin/o	cerumen		*coarct/o, coarctat/o*	press together, narrow
cervic/o	neck, cervix		*cocc/cocci, cocc/o, -coccus*	berry-shaped bacterium, spherical bacterium
chalas/o,-chalasis	relaxation, loosening		*coccyg/o*	coccyx, tailbone
***-C-* continued**				
cochle/o	snail, snail shell, spiral		*copi/o*	plentiful, abundant
coher/o, cohes/o	cling or stick together		*copulat/o*	joining together, linking
coit/o	a coming together		*cor/o*	pupil
col/o	colon, large intestine		*cord/o*	cord, spinal cord
coll/a	glue		*cordi/o*	heart
coll/colli	neck		*core/o*	pupil
colon	colon, large intestine		*cori/o*	skin, leather
colp/o	vagina		*corne/o*	cornea
column/o	pillar		*coron/o*	crown, coronary
com-	together, with		*corp/u, corpor/o*	body
comat/o	deep sleep		*corpuscul/o*	little body
comminute/o	break into pieces		*cort-*	covering
communic/o	share, to make common		*cost/o*	rib
compatibil/o	sympathize with		*cox/o*	hip, hip joint
con-	together, with		*crani/o*	skull
concave/o	hollow		*-crasis*	a mixture or blending
concentr/o	condense, intensify, remove excess water		*crepit/o, crepitate/o*	crackling, rattling
concept/o	receive or take to oneself,		*crin/o, -crine*	secrete, separate

	become pregnant			
conch/o	shell		*cris/o, critic/o*	turning point
concuss/o	shaken together, violently agitated		*-crit*	separate
condyl/o	knuckle, knob		*cry/o*	cold
confus/o	disorder, confusion		*crypt/o*	hidden
conjunctiv/o	conjuctiva, joined together, connected		*cubit/o*	elbow
consci/o	aware, awareness		*cuboid/o*	cube-like
consoled/o, consolidate/o	become firm or solid		*culd/o*	cul-de-sac, blind pouch
constipat/o	pressed together, crowded together		*cult/o*	cultivate, plow, till
constrict/o	draw tightly together		*-cusis*	hearing
contact/o	touched, infected		*cusp/cuspi*	point, pointed flap
contagi/o	touching of something, unclean, infection		*cut-, cutane/o*	skin
contaminat/o	pollute, render unclean by contact		*cyan/o*	blue
contine/o, continent/o	keep in, contain, hold back, restrain		*cycl/o*	ciliary body of eye, cycle
contra-	against, counter, opposite		*cyes/cyesi, cyes/o -cyesis*	pregnancy
contracept/o	prevention of conception		*cyst-, cyst*	bag, bladder
contus/o	bruise		*cyst/o*	urinary bladder, cyst, sac of fluid
convalesce/o	become strong, recover		*cyt/o, -cyte*	cell
convex/o	arched, vaulted		*-cytic*	pertaining to a cell
convolute/o	coiled, twisted		*-cytosis*	condition of cells
convuls/o	pull together			
-D-				
dacry/o, dacry-	tear, tear duct, lacrimal duct		*debrid/e*	open a wound
dactyl/o, dactyl-	fingers, toes		*deca-, deci-*	ten, tenth
dart/o	skinned, flayed		*decidul/o*	falling off, shedding
de-	from, not, down, lack of		*decubit/o*	lying down
-D- continued				
defec/o, defecat/o	clear, free from waste		*diffuse/o*	pour out, spread apart
defer/o	carrying down or out		*digest/o*	divide, distribute
degenerate/o	gradual impairment, breakdown, diminished function		*digit/o*	finger or toe
deglutit/o	swallow		*dilat/o, dilatat/o*	spread out, expand
dehisc/o	burst open, split		*dilut/o*	dissolve, separate
deliri/o	wandering in the mind, silly, crazy		*diphther/o*	membrane
delt/o	greek letter delta or d,		*dipl/o, dipla-*	double

	triangular shape			
delus/o	mock, cheat, delude		*dips/o, -dipsia*	thirst
-dema	swelling (fluid)		*dis-*	negative, apart, absence of
demi	half		*dislocat/o*	displacement
dem/o	people, population		*dissect/o*	cutting apart
dendr/o	tree, resembling a tree, branching		*disseminat/o*	widely scattered
dent-, dent/denti, dent/o	tooth, relating to the teeth		*dist/o*	far
depilate/o	hair removal		*distend/o, distent/o*	stretch apart, expand
depress/o	press down lower, pressed or sunk down		*diur/o, diuret/o*	tending to increase urine output
derm/o, dermat/o, derma	skin		*divert/diverti*	turning aside, bypath
-desis	bind, tie together, surgical fixation of bone or joint		*domin/o*	controlling, ruling
deterioat/o	worsening or gradual impairment		*don/o*	give
dextr/o	right side		*dors/dorsi, dors/o*	back of body
di-	double, apart from, two		*drom/o, -drome*	run, running, to run
dia-	through, between, apart, complete		*duct/o*	to lead, carry
diaphor/o	sweat		*-duct*	opening
diaphragmat/o	diaphragm, wall across		*duoden, duodeni, duoden/o*	duodenum
diastole/o	standing apart, expansion		*dur/o*	dura mater
didym/o	testes, twins, double		*-dynia*	pain
			dys-	difficult, painful, bad
-E-				
e-	out of, from		*effect/o*	bring about a response, activate
-eal	pertaining to		*effuse/o*	pouring out
ec-	out, outside		*ejaculat/o*	throw or hurl out
ecchym/o	pouring out of juice		*elasm/o*	plate
ech/o	sound		*eliminate/o*	expel from the body
-ectasia, -ectasis	stretching, dilation, enlargement		*em-*	in
ecto-	out, outside		*emaciate/o*	lean, wasted by disease
-ectomy	surgical removal, cutting out, excision		*embol/o*	something inserted or thrown in
eczemat/o	boil over, eruption		*embras/o*	a sloped or beveled opening
edem-, edemat/o	swelling, fluid, tumor		*embry/o*	fertilized ovum, embryo
edentul/o	toothless		*-emesis*	vomiting

ef-	out		*emet/o*	vomit
-E- continued				
-emia	blood, blood condition		*esophag/o*	esophagus
emmetr/o	in proper measure		*-esthesia, esthesi/o*	sensation, feeling
emolli/o	make soft, soften		*esthete/o*	feeling, nervous sensation, sense of perception
en-	in, into, within		*estr/o*	female
encephal/o	brain		*ethm/o*	sieve
end/o, endo-	within, in, inside		*eti/o*	cause
endocrine/o	secrete within		*eu-*	well, good
enem/o	end in, inject		*evacu/o,evacuat/o*	empty out
enter/o	small intestine		*eviscer/o, eviscerate/o*	disembowelment, protrusion of viscera
ento-	within		*ex-*	out of, outside, away from
enzyme/o	leaven		*exacerbate/o*	irritate, aggravate
eosin/o	red, rosy, dawn-colored		*excis/o*	cutting out
epi-	upon, above, on, upper		*excori/o, excoriate/o*	abrade or scratch
epidemic/o	among the people, an epidemic		*excret/o*	separate, discharge
epididym/o	epididymis		*excruciate/o*	intense pain, agony
epiglot/o	epiglottis		*exhal/o, exhalat/o*	breathe out
episi/o	vulva		*-exia, -exis*	condition
epithel, epitheli, epitheli/o	epithelium		*exo-*	out of, outside, away from
equin/o	pertaining to a horse		*exocrine/o*	secrete out of
erect/o	upright		*expector/o,expectorat/o*	cough up, drive out of the chest
erg/o	work		*expir/o,expirat/o*	breathe out
erot/o	sexual love		*exstroph/o*	turned or twisted out
eruct/o, eructat/o	belch forth		*extern/o*	outside, outer
erupt/o	break out, burst forth		*extra-*	on the outside, beyond, outside
erythem/o, erythemat/o	flushed, redness		*extreme/o, extremit/o*	outermost, extremity
erythr/o	red		*extrins/o*	from the outside, contained outside
es-	out of, outside, away from		*exud/o, exudat/o*	to sweat out
-esis	state or condition, abnormal condition		*extern/o*	outside, outer
eso-	inward			
-F-				
faci-	facies, face		*fet/feti, fet/o*	the fetus, the unborn child in the womb
faci/o	the face, form		*fibr/o*	fiber
-facient	making, producing		*fibril/o*	muscular twitching
fasci/o	fascia, fibrous band		*fibrin/o*	fibrin, fibers, threads of a clot

fascicul/o	little bundle		*fibros/o*	fibrous connective tissue
fatal/o	pertaining to fate, death		*fibul/o*	fibula
fauc/fauci	narrow pass, throat		*-fic, fic/o*	making, producing, forming
febr/febri	fever		*filtr/o, filtrat/o*	to strain through
fec/feci, fec/o	dregs, sediment		*fimbri/o*	fringe
femor/o	femur, thigh bone		*fiss/o, fissur/o*	crack, split, cleft
fenestr/o	window		*fistul/o*	tube or pipe
fer/o	bear, carry		*flame/o*	flame colored
-ferent	carrying		*flat/o*	breaking wind, rectal gas
-ferous	bearing, carrying, producing		*flex/o*	bend
fertile/o	fruitful, productive		*flu/o*	flow
-F- continued				
fluor/o	luminous		*fract/o*	break, broken
foc/o	point, focus		*fren/o*	bridle, any device that limits movement
foll/folli	bag, sac		*frigid/o*	cold
follicul/o	follicle, small sac		*front/o*	forehead, brow
formain/o	opening		*-fuge*	to drive away
fore-	before, in front of		*funct/o, function/o*	perform, function
-form, form/o	form, figure, shape		*fund/o*	bottom, base, ground
formic/o	arch, vault, brothel		*fung/fungi*	fungus
foss/o	ditch, shallow depression		*furc/o*	forking, branching
fove/o	pit		*furuncul/o*	furunculus, a boil, an infection
			-fusion	pour
-G-				
galact/o	milk		*glott/glotti, glott/o*	back of the tongue
gamet/o	wife or husband, sperm or egg		*gluc/o*	glucose, sugar
gangli/o, ganglion/o	ganglion		*glute/o*	buttocks
gangren/o	eating sore, grangrene		*glyc/o*	glucose, sugar
gastr/o	stomach, belly		*glycer/o*	sweet
gastrocnemi/o	gastrocnemius, calf muscle		*glycogen/o*	glycogen, animal starch
gemin/o	twin, double		*gnath/o*	jaw
gen/o, genit/o	producing, produced by, birth, origin, race		*-gog, -gogue*	make flow
-gene	production , origin, formation		*goitr/o*	goiter, enlargement of the thyroid gland
-genesis, -genic	producing, forming		*gon/e, gon/o*	seed
genit/o	related to birth or the reproductive organs		*gonad/o*	sex glands
-genous	producing		*goni/o*	angle
ger/geri	old age		*gracil/o*	slender
germin/o	bud, sprout, germ		*grad/gradi*	move, go, step, walk
geront/o	old age		*-grade*	go

gest/o, gestat/o	bear, carry young or offspring		*-gram*	tracing, picture, record
gigant/o	giant, very large		*granul/o*	granule(s)
gingiv/o	gum		*-graph*	instrument of recording, picture
glauc/o	gray		*-graphy*	process of recording a picture or record
glen/o	socket or pit		*grav/gravi*	heavy, severe
gli/o	glue		*gravid/o*	pregnancy
-globin, -globulin	protein		*-gravida*	pregnant woman
globul/o	little ball		*gynec/o*	woman, female
glomerul/o	glomerulus		*gyr/o*	turning, folding
gloss/o, glosso-	tongue, relating to the tongue			
-H-				
hal/o, halit/o	breath		*heap-, hepar-, hepat/o*	liver
halluc/o	great or large toe		*hered/o, heredit/o*	inherited, inheritance
hallucin/o	to wander in the mind		*herni/o*	hernia
hem-	relating to the blood		*herpet/o*	creeping
hem/e	deep red iron-containing pigment		*heter/o, hetero-*	other, different
hem/o, hemat/o	blood, relating to the blood		*hiat/o*	opening
hemangi/o	blood vessel		*hidr/o*	sweat
hemi-	half			
hil/o	hilum or hilus, notch or opening from a body part		*hydr/o, hydra-*	relating to water
hirsute/o	hairy, rough		*hygien/o*	healthful
hist/o, histi/o	tissue		*hymen/o*	hymen, a membrane
holo-	all		*hyper-*	over, above, increased, excessive, beyond
hom/o	same, like, alike		*hyph-*	under
home/o	sameness, unchanging		*hypn/o*	sleep
horde/o	barley, corn		*hyp/o, hypo-*	under, decreased, deficient, below
hormone/o	excite, rouse, urge on		*hyster/o*	uterus, womb
humer/o	humerus			
-I-				
-iac	pertaining to		*inject/o*	to forced or throw in
-iasis	condition, pathological state, abnormal condition		*innominat/o*	unnamed, nameless
-ible	able to be, capable of being		*inocul/o*	implant, ingraft, introduce
-ic	pertaining to		*insipid/o*	tasteless
ichthy/o	dry, scaly		*inspire/o, inspirit/o*	breathe in
icter/o, ictero-	jaundice		*insul/o*	island
idio-, idi/o	peculiar to the individual or organ, one, distinct		*intact/o*	untouched, whole
-iferous	bearing, carrying,		*inter-*	between, among

	producing			
-ific	making, producing		*intermit/o*	not continuous
ile/o	ileum, small intestine		*intern/o*	within, inner
ili/o	ilium, hip bone		*interstiti/o*	the space between things
illusi/o	deception		*intestine/o*	intestine
immune/o	immune, protected, safe		*intim/o*	innermost
impact/o	pushed against, wedged against, packed		*intoxic/o*	put poison in
impress/o	pressing into		*intra-*	within, into, inside
impuls/o	pressure or pushing force, drive, urging on		*intrins/o*	contained within
in-	in, into, not, without		*intro-*	within, into, inside
incis/o	cutting into		*introit/o*	entrance or passage
incubat/o	incubation, hatching		*intussuscept/o*	take up or receive within
indurat/o	hardened		*involut/o*	rolled up, curled inward
infarct/o	filled in, stuffed		*ion/o*	ion, wander
infect/o	tainted, infected		*ir/iri, ir/o, irid/o, irit/o*	rainbow, iris of eye
infer/o	below, beneath		*is/o*	same, equal
infest/o	attack, assail, molest		*isch/o*	hold back
inflammat/o	flame within, set on fire		*ischi/o*	ischium
infra-	beneath, below, inferior to		*-ism*	state of
infundibul/o	funnel		*iso-*	equal
ingest/o	carry or pour in		*istis, -it is*	inflammation
inguin/o	groin		*-ium*	structure, tissue
inhal/o, inhalat/o	breathe in			
-J-				
jejun/o	jejunum		*juxta-*	near, nearby
jugul/o	throat			
-K-				
kal/kali	potassium		*kel/o*	growth, tumor
kary/o, karyo-	nucleus, nut		*kera-*	horn, hardness
kata-, kath-	down		*kert/o*	horny, hard, cornea
-K- continued				
ket/o, keton/o	ketones		*klept/o*	to steal
kinesi/o	movement		*kraur/o*	dry
-kinesis	motion		*kyph/o*	bent, lump
-L-				
labi/o	lip		*ligament/o*	ligament
labyrinth/o	maze, labyrinth, the inner ear		*ligat/o*	a binding or tying off
lacer/o, lacerat/o	torn, mangled		*lingu/o*	tongue
lacrim/o	tear, tear duct, lacrimal duct		*lip/o*	fat, lipid
lact/lacti, lact/o	milk		*-lite, lith/o, -lith*	stone, calculus
lactate/o	secrete milk		*-lithiasis*	presence of stones
lamin/o	lamina		*lob/lobi, lob/o*	lobe, fairly well-defined part of an organ
lapar/o	loin, flank, abdomen		*loc/o*	place
laps/o	slip, fall, slide, gradual		*loch/lochi*	childbirth, confinement

	movement, especially downward			
laryng/o	larynx, voice box		*longev/o*	long-lived, long life
lt/lati, lat/o	broad		*lord/o*	bent backward
later/o	side		*lumb/o*	lower back, loin
lav/o, lavat/o	wash, bathe		*lumen/o*	light
lax/o, laxat/o	loosen, relax		*lun/o*	the moon
leiomy/o	smooth muscle		*lunat/o*	of the moon
lemm/o	husk, peel, bark		*lunul/o*	crescent
lent/lenti	the lens of the eye		*lup/lupi, lup/o*	wolf
lenticul/o	shaped like a lens, pertaining to a lens		*lute/o*	yellow
-lepsy	seizure		*lymph/o*	lymph, lymphatic tissue
lept/o	thin, slender		*lymphaden/o*	lymph gland
lepto-	small, soft		*lymphangi/o*	lymph vessel
letharg/o	drowsiness, oblivion		*-lysis*	setting free, break down, separation, destruction
leuco-, leuk/o	white		*-lyst*	agent that causes lysis or loosening
lev/o, levat/o	raise, lift up		*-lytic*	reduce, destroy
libid/o, libidin/o	sexual drive, desire, passion			
-M-				
marc/o	large, abnormal size or length, long		*manipul/o*	handful, use of hands
macul/o	spot		*manubri/o*	handle
magn/o	great, large		*masset/o*	chew
marjor/o	larger		*mast/o*	breast, nipple
mal-	bad, poor, evil		*mastic/o, masticat/o*	chew
malac/o, -malacia	abnormal softening		*mastoid/o*	mastoid process
malign/o	bad, evil		*matern/o*	maternal, of a mother
malle/o	hammer		*matur/o*	ripe, ripened
malleol/o	malleolus, little hammer		*maxilla/o*	maxilla, upper jaw
mamm/o	breast		*maxim/o*	largest, greatest
man/mani	rage, madness		*meat/o*	meatus, a passage
man/mani, man/o	the hand		*med-, medi/o*	middle
mandibul/o	mandible, lower jaw		*mediastin/o*	middle, in the middle
-mania	obsessive preoccupation		*medic/o*	medicine, physician, healing
-M- continued				
medicat/o	medication, healing		*minor/o*	smaller
medull/o	medulla, inner section, middle, soft, marrow		*mio-*	less, smaller
mega-, megal/o	large, great		*miring/o*	tympanic membrane, eardrum

-megalia, -megaly	large, great, extreme, enlargement		*mit/o*	a thread
mei/o	less, meiosis		*mitr/o*	a miter having two pts on top
melan/o	black, dark		*mobil/o*	capable of moving
mellit/o	honey, honeyed		*mon/o, mono-*	one, single
membrane/o	membrane, thin skin		*monil/monili*	string of beads, genus of parasitic mold or fungi
men/o	menses, menstruation, month, moon		*morbid/o*	disease, sickness
mening/o, meningi/o	membranes, meninges		*moribund/o*	dying
menisci/o	crescent		*morph/o*	shape, form
mens-, mens/o	menses, menstruate, menstruation, monthly		*mort/morti, nort/o, mort/u*	death, dead
menstru/o, menstruat/o	taking place monthly		*mortal/mortali*	pertaining to death, subject to death
ment/o	mind		*mot/o, motil/o*	motion, movement
mes-, meso-	middle		*mu/o*	close, shut
mesenter/o	mesentery, middle intestine		*muc/o, mucos/o*	mucus
mesi/o	middle, median plane		*multi-*	many, much
meta-	beyond, over, between, change, transposition		*muscul/o*	muscle
metabol/o	a change		*mut/a*	genetic change
metacarp/o	metacarpals, hand bones		*mut/o*	unable to speak, dumb, inarticulate
metatars/o	bones of the foot between the tarsus and toes		*my/o*	muscle
-meter	measure		*myc/e, myc/o*	fungus
meta-, metr/metri, metr/o, metri/o	the uterus, womb		*mydri/o*	wide
mi/o	smaller, less		*mydria, mydriasi*	dilation of the pupil
micr/o, micro-	small		*myel/o*	spinal cord, bone marrow
mictur/o, micturit/o	urinate		*myocardi/o*	myocardium, heart muscle
midsagitt/o	from front to back, at the middle		*myom/o*	muscle tumor
-mimetic	mimic, copy		*myos/o*	muscle
mineral/o	mineral		*myx/o, myxa-*	mucus, slime

minim/o	smallest, least			

-N-				
nar/nari	nostril		*noct/nocti*	night
narc/o	numbness, stupor		*nod/o*	knot, swelling
nas/nasi, *nas/o*	the nose		*nodul/o*	little knot
nat/nati	birth		*nom/o*	law, control
natr/o	sodium		*non-*	no
nausea/o	nausea, seasickness		*nor-*	chemical compound
ne/o, *neo-*	new, strange		*norm/o*	rule, order
necr/o	death		*nuch/o*	the nape
-necrosis	death of tissue		*nucle/o*	nucleus
nect/o	bind, tie, connect		*nucleol/o*	little nucleus, nucleolus
nerv/o	nerve, nerve tissue		*nulli-*	none
neu-, *neur/neuri,* *neur/o*	pertaining to the nerves, nerve, nervous tissue		*numer/o*	number, count
neurtr/o	neither, neutral		*nunci/o*	messenger
nev/o	birthmark, mole		*nutri/o* *nutrit/o*	nourishment, food, nourish, feed
niter-, *nitro-*	nitrogen		*nyct/o,* *nyctat/o*	night
-O-				
o-	egg, ovum			
ob-	against		*oment/o*	omentum, fat
obes/o	extremely fat		*omphal/o*	the navel
oblique/o	slanted, sideways		*onc/o*	tumor
oblongat/o	oblong, elongated		*onych/o*	fingernail or toenail
obstetr, *obstetric,* *obstetr/o*	midwife, one who stands to receive		*oo/o*	egg
occipit/o	back of the skull, occiput		*oophor/o,* *oophoron-*	ovary
occlude/o, *occlus/o*	shut, close up		*opac/o,* *opacity/o*	shaded, dark, impenetrable to light
occult/o	hidden, concealed		*oper/o,* *operat/o*	perform, operate, work
ocul/o, *ocul-*	eye		*opercul/o*	cover or lid
odont/o	tooth		*opthalm/o*	eye, vision
olecran/o	olecranon, elbow		*-opia*	vision
olfact/o	smell, sense of smell		*opish/o*	backward
olig/o	scanty, few		*-osia, -opsis,* *-opsy*	vision, view of
-olisthesis	slipping, dislocation		*opt/opti,* *opt/o,* *optic/o*	eye, vision

-ology	the science or study of		*or/o*	the mouth
-oma	tumor, neoplasm		*orbit/o*	circle, orbit, bony cavity or socket
om/o, *omo-*	shoulder		*orch/o,* *orchid/o,* *orchid/o*	testis, testes

-O- continued				
orect/orecti, *orex/orexi*	appetite		*-ostomosis,* *-ostomy*	surgically creating a mouth or opening
organ/o	organ		*ot/o*	ear, hearing
orgasm/o	swell, be excited		*-otomy*	cutting, surgical incision
orth/o, *ortho-*	straight, normal, correct		*-ous*	pertaining to
os-	mouth, bone		*ov/ovi, ov/o*	egg, ovum
-osis	an abnormal condition		*ovar/o*	ovary
osm/o, *-osmia*	smell, odor		*ox/oxi,* *ox/o,* *ox/y*	oxygen
osm/o	pushing, thrusting		*oxido/o*	containing oxygen
oss/e, *oss/ossi,* *oste/o*	bone		*oxy-*	sharp, acid, quick, oxygen
-P-				
pachy-	thick		*parotid/o*	parotid gland
palat/o	palate, roof of mouth		*-parous*	having borne one or more children
pall/o, *pallid/o*	pale, lacking or drained of color		*paroxysm/o*	sudden attack
palliate/o	cloaked, hidden		*part/o,* *-partum*	birth, labor
palm/o	the palm		*parturit/o*	childbirth, labor
palpate/o	touch, feel, stroke		*patell/a,* *patell/o*	patella, kneecap
palpebr/o	eyelid		*path/o,* *pathia,* *-pathy*	disease, suffering, feeling, emotion
palpit/o	throbbing, quivering		*-pathic*	pertaining to, affected by disease
pan-	all, entire, every		*paus/o*	cessation, stopping
pancreat/o	pancreas		*pector/o*	chest
papil, */papilli,* *papill/o*	nipple-like		*pedi/a*	child
papul/o	pimple		*ped/o*	child, foot
par/o, *para-*	apart from, beside, near, abnormal		*pedicul/o*	a louse
par/o	labor, act of bearing		*pelv/pelvi,* *pelv/o*	pelvic bone, pelvic cavity, hip

-para	to bear, bring forth		*pen/peni*	penis
paralys/o, paralyt/o	disable		*-penia*	lack, deficiency, too few
parasit/o	near food, parasite		*peps/pepsi,pept/o*	digest, digestion
parathyroid/o	parathyroid glands		*per-*	excessive, through
pare, paresi	to disable		*percept/o*	perceive, become aware
-paresis	slight paralysis		*percuss/o*	strike, tap, beat
paret/o	to disable		*peri-*	around, surrounding
pareuni/o	coitus		*perine/o*	perineum
pariet/o	wall		*peristals/o, peristalt/o*	constrict around
-P- continued				
peritone/o	peritoneum		*pineal/o*	pineal gland
perme/o	to pass or go through		*pinn, pinni*	external ear, auricle
pernici/o	destructive, harmful		*pituit/o*	pituitary
perone/o	fibular		*pituitary/o*	mucous secretion
perspire/o	perspiration		*plac/o*	flat plate or patch
pertuss, pertussi	intensive cough		*placent/o*	round flat cake, placenta
petechi/o	skin spot		*-plakia, plak/o*	plate, thin flat layer or scale
-pexy	surgical fixation, to put in place		*plan/o*	flat
phac/o	lens of eye		*plant, planti, plant/o*	sole or bottom of foot
phag/o	eating, swallowing		*plas/plasi, plas/o*	growth, development, formation, mold
-phage	one that eats, a cell that destroys		*-plasia*	formation, development, growth
-phagia	eating, swallowing		*-plasm*	to mold, formation
phak/o	lens of eye		*plasm/o*	something molded or formed
phalang/o	phalanges, finger and toe		*plast/o*	growth, development, mold
phall/o	penis		*-plasty*	surgical repair
pharmacy/o	drug		*-plegia*	stroke, paralysis, palsy
pharyng/o	throat, pharynx		*-plegic*	paralysis, one affected with paralysis
phas/o	speech		*pleur/o*	pleura, side of the body
-phasia	speak		*plex/o*	plexus, network
phe/o	dusky		*plic/o*	fold or ridge
pher/o	to bear or carry		*-pnea*	breathing
-pheresis	removal		*-pneic*	pertaining to breathing
phil/o	to like, to love, attraction to		*pneu-*	relating to the air or lungs
-philia	attraction for, love of, increase in numbers		*penum/o, pnuemon/o*	lung, air
phim/o	muzzling, stopping up,		*-pod/o*	foot

	constriction of an orifice			
phleb/o	vein		*-poiesis*	formation
phlegm/o	thick mucus		*poikil/o*	varied, irregular
phob/o	fear		*poli/o, polio-*	gray mater of brain and spinal cord
phon/o, -phonia	sound, voice		*pollic/o*	thumb
phor/o	carry, bear, movement		*poly-*	many
-phoresis	carrying, transmission		*polyp/o*	polyp, small growth
-phoria	to bear, carry, feeling, mental state		*pont/o*	pons, a part of the brain
phot/o	light		*poplit/o*	back of the knee
phren/o	diaphragm, mind		*por/o*	pore, small opening
-phylactic	protective, preventive		*-porosis*	passage, porous condition
-phylaxis	protection		*port, porti*	gate, door
physic/o, physic/o	nature		*post-*	after, behind
-physis	to grow		*poster/o*	back of body, behind
-phyte	plant		*potent/o*	powerful
pigment/o	paint, color, pigment		*pract, practi, practice/o*	practice, pursue an occupation
pil/pili, pil/o	hair			

-P- continued				
prandi/o, -prandial	meal, late breakfast, dinner		*prurit/o*	itch
-praxia	action, condition concerning the performance of movements		*pseud/o*	false
-praxis	therapeutic treatment involving a specified method		*psor, psori, psor/o*	itch
pre-	before, in front of		*psych/o*	mind
precoc, precoci	early, premature		*ptomat/o*	a fall
pregn/o	pregnant, full of		*-ptosis*	drooping, sagging, prolapse, dropping down
premature/o	too early, untimely		*-ptyal/o*	spittle, spit, saliva
preputi/o	foreskin, prepuce		*-ptysis*	spitting
presby/o	old age		*pub/o*	pubis, part of hip bone
press/o	press, draw		*puberty/o*	ripe age, adult
priap/o	penis		*pudend/o*	pudendum, shameful
primi-	first		*puerper, puerperi*	childbearing, labor
pro-	before, in behalf of		*pulm/o, pulmon/o*	lung
process/o	going forth		*pulpos/o*	fleshy, pulpy
procident/o	fall down or forward		*puls/o*	beat, beating, striking

procreat/o	beget, reproduce		*punct/o*	sting, prick, puncture, little hole
proct/o	anus and rectum		*pupil/o*	pupil
prodrom/o	running ahead, precursor		*pur/o*	pus
product/o	lead forward, yield, produce		*purpur/o*	purple
prolaps/o	fall downward, slide forward		*pustule/o*	infected pimple, blister
prolifer/o	bear offspring, reproduce		*py/o*	pus
pron/o, pronat/o	bent forward		*pyel/o*	renal pelvis, bowl of kidney
prostate/o	prostate gland		*pylor/o*	pylorus, gate keeper
prosth/o, prosthet/o	addition, appendage		*pyr/o, pyret/o*	fever, fire
prot/o, prote/o	first, original, protein		*pyramid/o*	pyramid shaped
proxim/o	near			
-Q-				
quadr, quadric, quadr/o	four			
-R-				
rabi/o	rage, madness		*-raphy*	suturing, stitching
rachi/o	spinal column, vertebrae		*re-*	back, again
radi/o	radius, lateral lower arm bone		*recept/o*	receive, receiver
radiat/o	giving or passing off rays or radiant energy		*recipe/o*	receive, take to oneself
radicul/o	root, nerve root		*recticul/o*	network
raph/o	seam, suture		*rect/o*	rectum, straight

***-R-* continued**				
recuperate/o	recover, regain health		*-rhexis*	rupture
reduct/o	bring back together		*rheum/o, rheumat/o*	a watery flow, subject to flow
refract/o	bend back, turn aside		*rhin/o*	nose
regurgit/o, regurgitate/o	flood or gush back		*rhiz/o*	root
remiss/o	let go, relax, give up		*rhonc/o*	snore, snoring
ren/o	kidney		*rhythm/o*	rhythm
restor/o	rebuild, put back, restore		*rhytid/o*	wrinkle
resuscit/o, resuscitat/o	revive		*rigid/o*	stiff
retent/o	hold back		*ris/o*	laugh
retin/o	retina, net		*roentgen/o*	x-ray
retract/o	draw back or in		*rotat/o*	rotate, revolve

retr/o, retro-	behind, backward back of		*-rrhage, -rrhagia*	bursting forth
rhabdomy/o	striated muscle		*-rrhaphy*	suture
-rhage, -rhagia	bursting forth		*-rrhea*	flow, discharge
-rhaphy	suture		*-rrhexis*	rupture
-rhea	flow, discharge		*rug/o*	wrinkle, fold
-S-				
sacc, sacci, sacc/o	sac		*scoli/o*	crooked, curved
sacchar/o	sugar		*-scope*	instrument for visual examination
sacr/o	sacrum		*-scopic*	pertaining to visual examination
saliv/o	spittle, spit		*-scopy*	see, visual examination
salping/o	uterine (fallopian) tube, auditory (eustachian) tube		*scot/o*	darkness
-salpinx	uterine (fallopian) tube		*scrib/o, script/o*	write
san/o	sound, healthy, sane		*scrot/o*	bag or pouch
sangu, sangui, sanguine/o	blood		*seb/o*	sebum, wax, suet
sanit/o	soundness, health		*secret/o*	produce and separate out
saphen/o	clear, apparent, manifest		*sect/o*	cutting
sapr/o	dead or decaying		*secti/o*	to cut
sarc/o, sarcomat/o	flesh (connective tissue), cancer of connective tissue		*segment/o*	in pieces
sarco-	flesh		*sell/o*	saddle
-sarcoma	tumor, cancer		*semi-*	half
scalp/o	carve, scrape		*semin, semini*	seed, sperm; semen
scapula/o	scapula, shoulder blade		*sen, seni*	old
-schisis, schiz/o	split, cleft, divided		*senesc/o*	grow old
scirrh/o	hard		*senile/o*	old age
sclera/o	sclera, white of eye, hard		*sens, sensi*	feeling, sensation
-sclerosis	abnormal dryness, hardness, hardening		*sensitive/o*	sensitive (to), affected (by)

-S- continued				
seps/o	infection		*spontane/o*	unexplained, of one's own accord
sept/o	infection, partition		*spor/o*	seed, spore
ser/o	serum		*sput/o*	spittle, spit
seros/o	serous		*squam/o*	scale
sial/o	saliva, salivary glands		*-stalsis*	contraction
sialaden/o	salivary gland		*straped/o, stapedi/o*	the stapes, stirrup, middle ear bone
sider/o	iron		*staphyl/o*	cluster, bunch of grapes
sigm/o	sigma, the greek letter "s"		*stas/stasi, -stasis,*	stopping, controlling,

			stat/stati, -static	slowing
sigmoid/o	sigmoid colon		*-statis*	stopping, controlling
sin/o, sin/u	hollow, sinus, tube-like passage		*steat/o*	fat, lipid, sebum
sinister/o	left, left side		*sten/o*	narrowing, contracted
sinus/o	sinus		*-stenosis*	tightening, stricture
sit/u	place		*ster/o*	solid structure
skelet/o	skeleton		*stere/o*	solid, three-dimensional
soci/o	companion, fellow being		*steril, sterili*	barren, sterile
solute/o, solv/o	loosened, dissolved		*stern/o*	sternum, the breastbone
soma-, somat/o	body		*stert/o*	snore, snoring
somn/somni, somn/o, -somnia	sleep		*steth/o*	chest
son/o	sound		*sthen/o, -sthenia*	strength
spoor/o	sleep		*steth/o*	chest
spad/o	draw off, draw		*stigmat/o*	point, spot
spasm/o, -spasm, spasmod/o	sudden involuntary, contraction, tightening or cramping		*stimul/o*	goad, prick, incite
spec, speci	look at, a kind of sort		*stol/o*	send or place
specul/o	mirror		*stomat/o*	mouth
sperm/o, spermat/o	spermatozoa, sperm cells, seed		*-stomosis, -stomy*	furnish with a mouth or outlet, new opening
sphen/o	wedge, sphenoid bone		*strab, strabi*	squint, squint-eyed
sphere/o	round, sphere, ball		*strat, strati*	layer
sphincter/o	tight binder or band		*strept/o*	twisted chain
sphygm/o, -sphyxia	pulse		*striat/o*	stripe, furrow, groove
spin/o	spine, backbone		*stric-*	narrowing
spir/o	breathe		*strict/o*	draw tightly together, bind or tie
spirill/o	little coil		*strid/o*	harsh sound
spirochete/o	coiled microorganism		*stup/e*	benumbed, stunned
spleen/o	spleen		*styl/o*	pen, pointed instrument
spondyl/o	vertebra, vertebral column		*sub-*	under, less, below

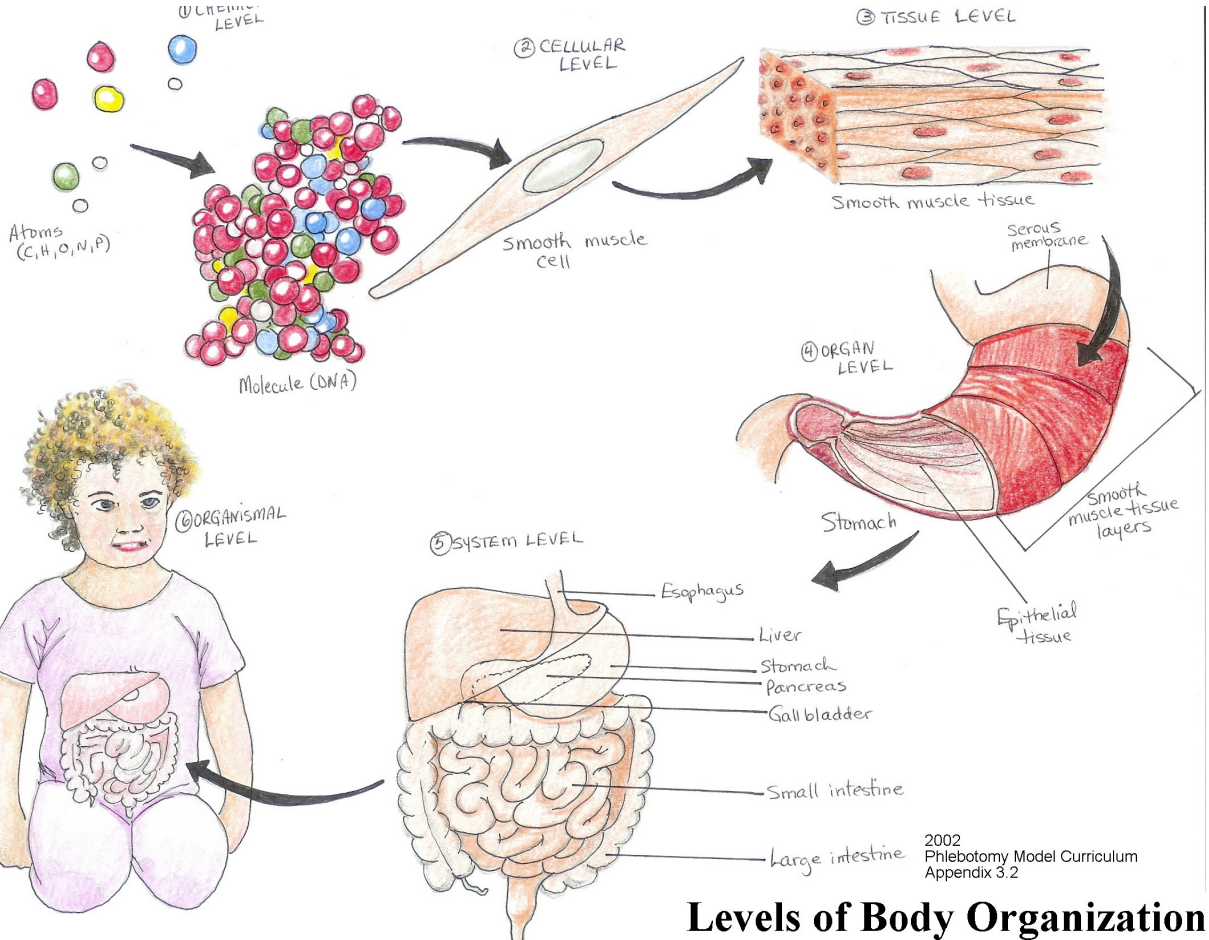
-S- continued				
subluxat/o	partial dislocation		*sym-*	with, together
sucr/o	sugar		*symptomat/o*	falling together, symptom
sudor/sudori	sweat		*syn-*	with, together
suffoc/o, suffocate/o	choke, strangle		*synaps/o, synapt/o*	point of contact

sulc/o	furrow, groove		*syncope/o*	cut short, cut off
super-, super/o	above, excessive, higher than		*-syndesis*	surgical fixation of vertebrae
superflu/o	overflowing, excessive		*syndesm/o*	ligament
supin/o	lying on the back		*syndrome/o*	running together
supinat/o	bend backward, place on the back		*synovi/o*	synovia, synovial membrane, lubricating fluid
suppress/o	press down		*syphil, syphilis, syphil/o*	syphilis
suppur/o, suppurat/o	to form pus		*syring/o*	tube
supra-	above, excessive		*system/o, systemat/o*	body system
supraren/o	above or on the kidney, suprarenal gland		*systol/o*	contraction
suture/o	stitch, seam			
-T-				
tachy-	fast, rapid		*the/o*	put, place
tact, tacti	touch		*thec/o*	sheath
talip/o	foot and ankle deformity		*thel/o*	nipple
tars/o	ankle, instep, edge of the eyelid		*therapl/o, therapeut/o*	treatment
tax/o	order, coordination		*therm/o*	heat
techn/o, techni/o	skill		*thio-*	sulfur
tectori/o	covering, roof-like		*thorac/o*	chest
tele/o	distant, far		*-thorax*	pleural cavity, chest
tempor/o	the temple		*thromb/o*	clot
tenac/tenaci	holding fast, sticky		*thym/o*	thymus gland
ten/o, tend/o	tendon, stretch out, extend, strain		*thyr/o, thyroid/o*	shield, thyroid gland
tendin/o	tendon		*tibi/o*	tibia, shin bone
tens/o	stretch out, extend, strain		*-tic*	pertaining to
terat/o	monster, malformed fetus		*tine/o*	gnawing, worn, ringworm
termin/o	the end, limit		*tinnit/o*	ringing, buzzing, tinkling
test, testi, test/o	witness, testis, testicle		*toc/o*	birth, childbirth
testicul/o	testicle		*-tocia, -tocin*	labor, delivery, birth
tetan/o	rigid, tense		*tom/o*	cut
tetra-	four		*-tome*	instrument to cut
thalam/o	thalamus, inner room		*-tomy*	cutting, incision
thalass/o	sea		*ton/o*	tone, tension, stretching
thanas/o, thanat/o	death		*tone/o*	stretch

***-T-* continued**				
tonsil/o	tonsil, throat		*-tresia*	opening
top/o	place, position, location		*tri-*	three
tors/o	twist, rotate		*trich/o*	hair
tort, *torti*	twisted		*trigon/o*	trigone
tox/o, *toxic/o*	poison, poisonous		*-tripsy*	crushing stone
trabecul/o	little beam marked with cross bars or beams		*-trite*	instrument for crushing
trache, *trachei,* *trachel/o*	trachea, windpipe		*trochle/o*	pulley
trachel-	neck		*trop/o*	turn, change
tract/o	draw, pull, path, bundle of nerve fibers		*troph/o,* *-trophic,* *-trophy*	relating to nutrition, nourishment, development, growth
tranquil/o	quiet, calm, tranquil		*-tropia*	turn
trans-	across, through		*-tropic,* *-tropin*	pertaining to a pituitary hormone
transfus/o	pour across, transfer		*tub,* *tubi,* *tub/o*	tube, pipe
transit/o	changing		*tubercul/o*	little know, swelling
transvers/o	across, crosswise		*tunic/o*	covering, cloak, sheath
traumat/o	injury		*turbinat/o*	coiled, spiral-shaped
trem/o	shaking, trembling		*tuss,* *tussi*	cough
tremul/o	fine tremor or shaking		*tympan/o*	tympanic membrane, eardrum
treponem/o	coiled, turning microbe			
-U-				
ulcer/o	sore, ulcer		*urethra/o*	urethra
uln/o	ulna		*urg/o*	press, push
ultra-	beyond, excess		*-uria*	urination, urine
umbilic/o	navel		*urin/o*	urine or urinary organs
un-	not		*urtic/o*	nettle, rash, hives
ungu/o	nail		*-us*	thing
uni-	one		*uter,* *uteri,* *uter/o*	uterus, womb
ur/o	urine, urinary tract		*uve/o*	vascular layer of eye, iris, choroids, ciliary body
-uresis	urination		*uvul/o*	uvula, little grape
ureter/o	ureter			

-V-				
vaccin/vaccine, vaccin/o	vaccine		*valg/o*	bent or twisted outward
vacu/o	empty		*valv/o, valvul/o*	valve
vag/o	wandering		*var/o*	bent or twisted inward
vagin/o	vagina, sheath		*varic/o*	swollen or dilated vein

-V- contiued				
vas/o	vessel, duct, vas deferens		*vertigo/o, vertigin/o*	whirling round, turning around, revolution
vascul/o	little vessel		*vesic/o*	urinary bladder
vaso-	vessel		*vesicul/o*	seminal vesicle, blister, little bladder
vast/o	vast, great, extensive		*vestibule/o*	entrance, vestibule
vulv/o	vulva, covering		*vi/o*	force
vect/o	carry, convey		*vill/villi*	shaggy hair, tuft of hair
ven/o	vein		*vir/o*	poison, virus
vener/o	coitus, sexual intercourse		*viril/o*	masculine, manly
venter-	abdomen		*vis/o*	seeing, sight
ventilat/o	expose to air, fan		*visc/o*	sticky
ventr/o	in front, belly side of body		*viscer/o*	viscera, internal organ
ventricul/o	ventricle of brain or heart, small chamber		*viscosl/o*	sticky
venul/o	venule, small vein		*vit/a, vit/o*	life
verg/o	twist, incline		*viti/o*	blemish, defect
verm,vermin	worm		*vitre/o*	glassy, made of glass
verrucl/o	wart		*voc/voci*	the voice
-version	to turn		*vol/o*	the palm or sole
vers/o,vert/o	turn		*volv/o*	roll, turn
vertebr/o	vertebra, backbone		*vulgar,vulgari*	common
-X-				
xanth/o	yellow		*xer/o*	dry
xen/o	strange, foreign		*xiph/xiphi, xiph/o*	sword
-Z-				
zygomat/o	yoke, cheekbone			
zygot/o	joined or yoked together			



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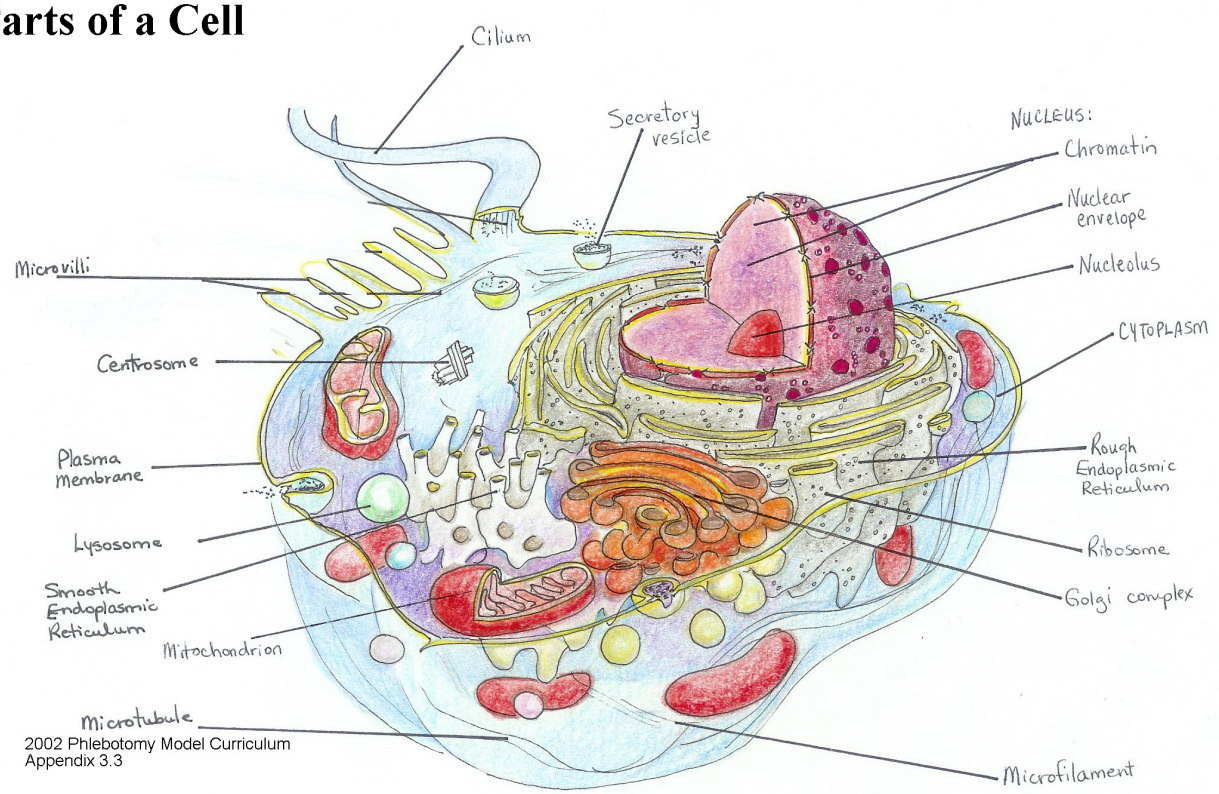
Appendix 3.2

Levels of Body Organization

Parts of a Cell



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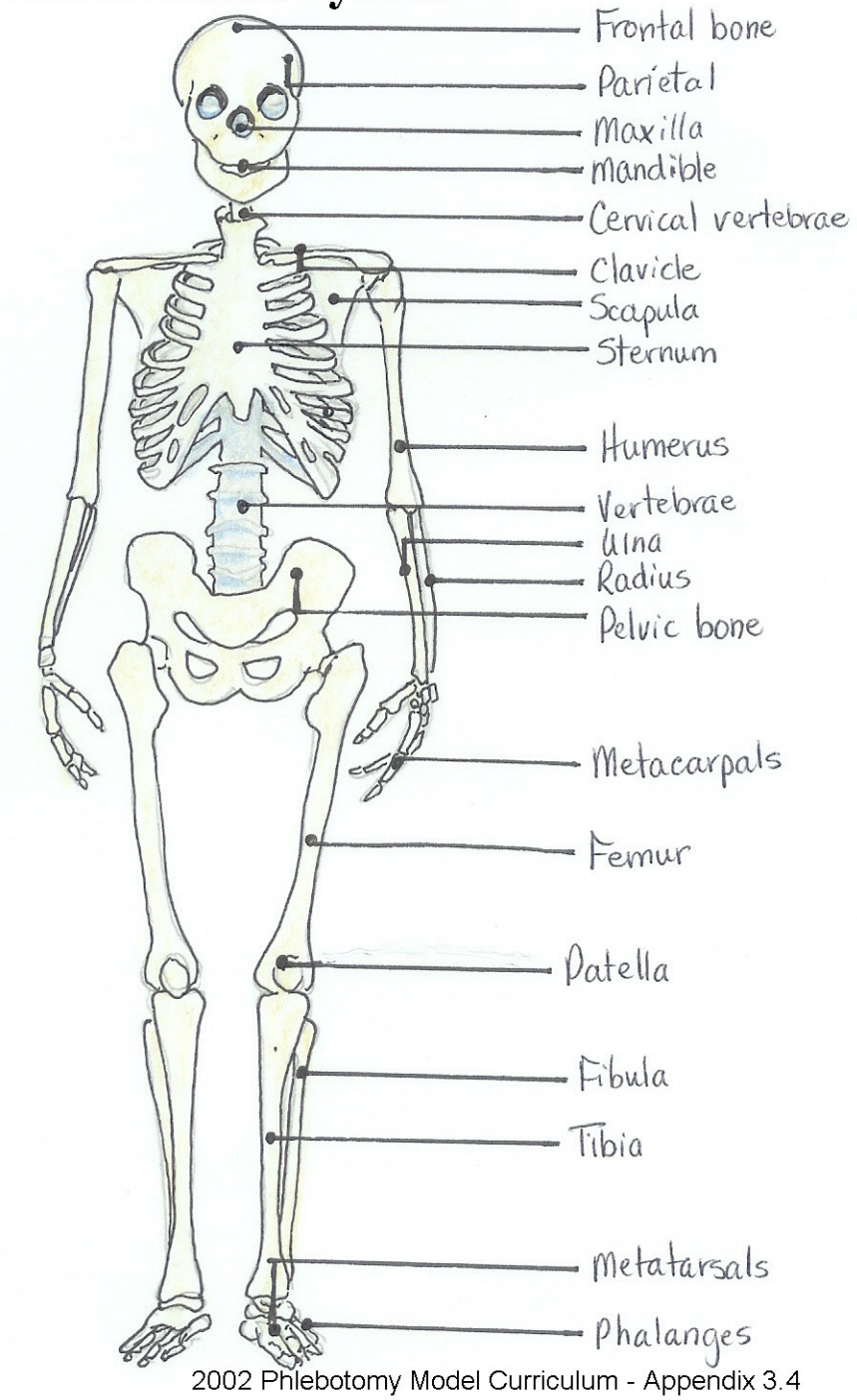
Appendix 3.3

The Skeletal System



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Muscular System

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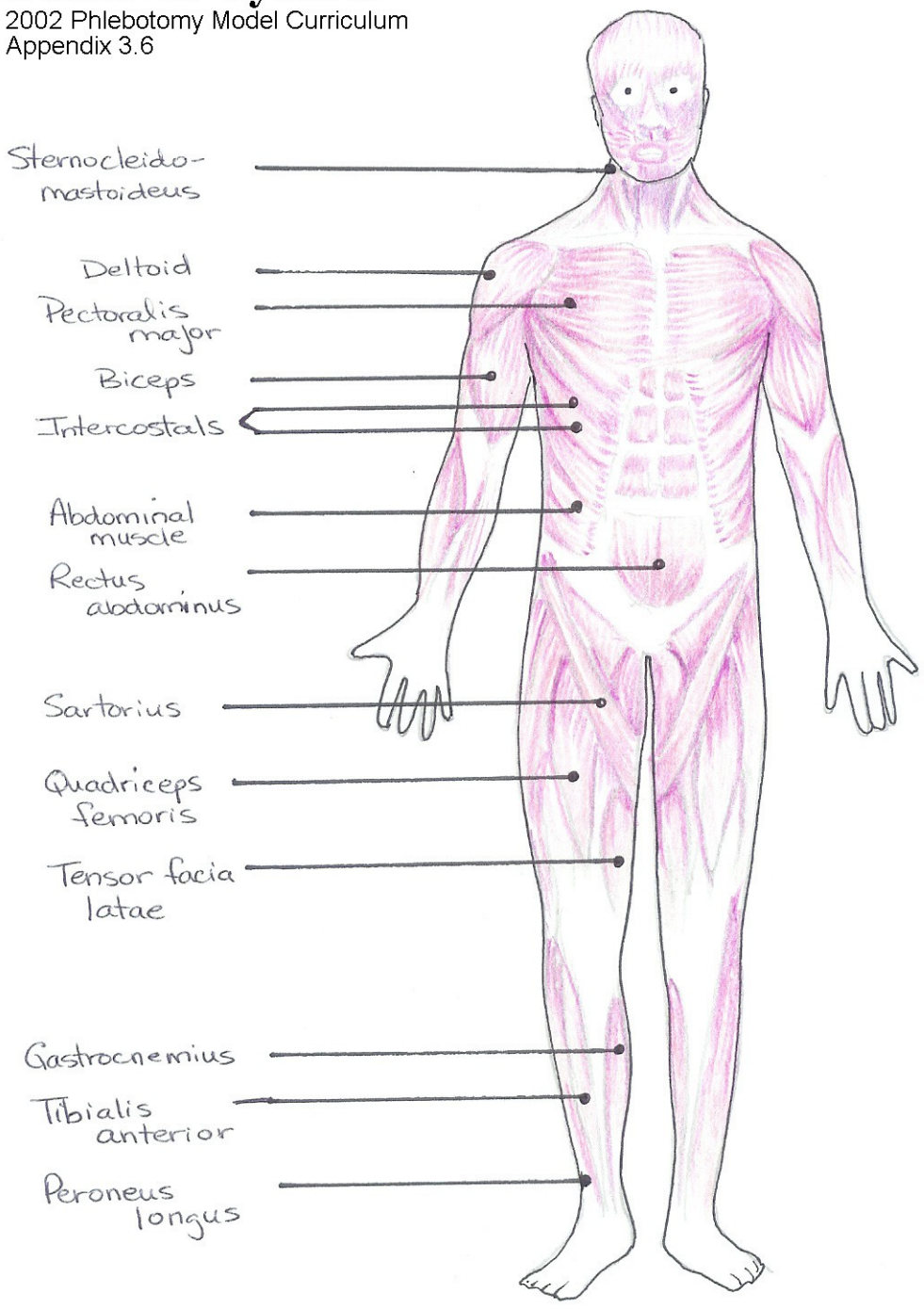
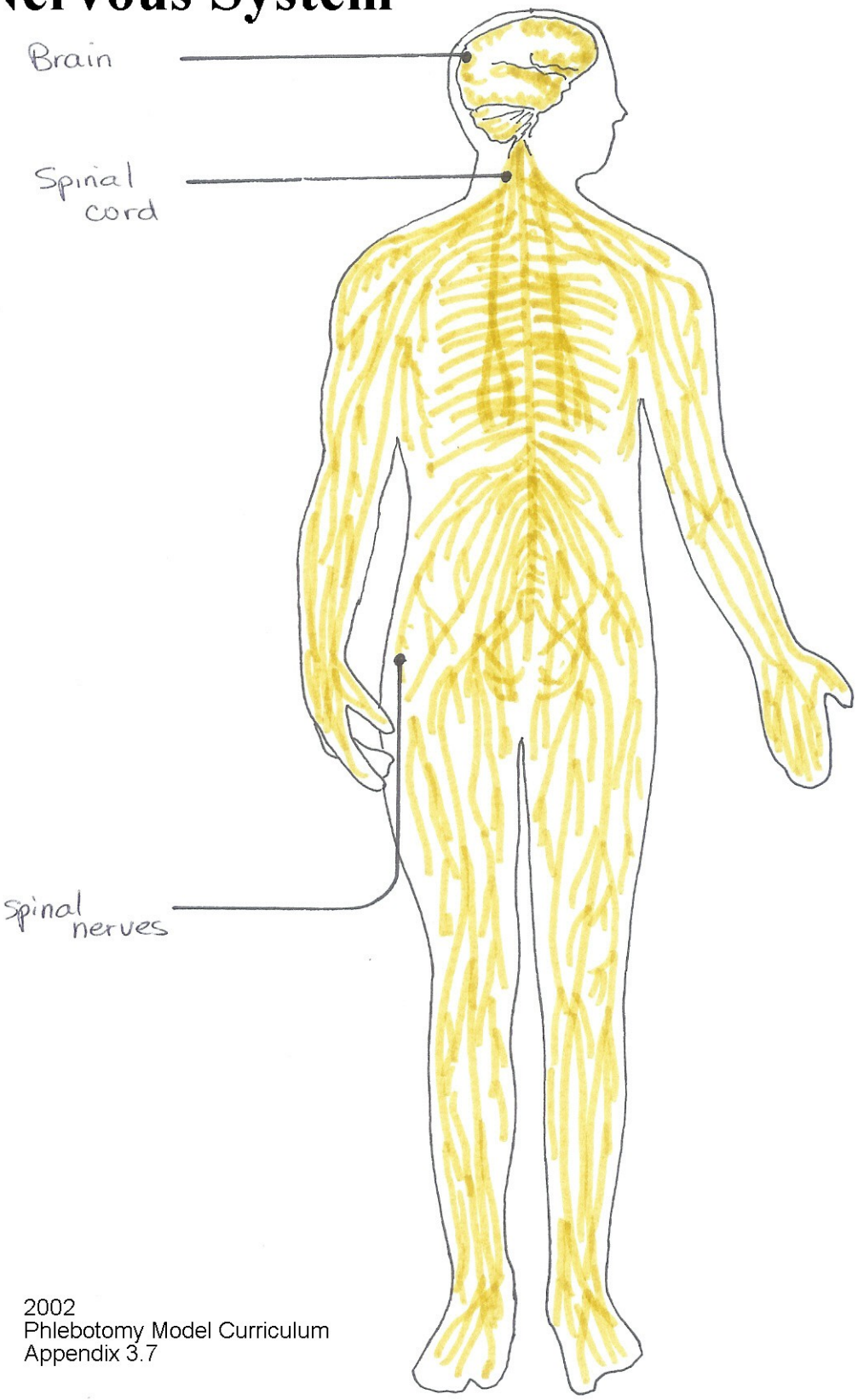
Appendix 3.6



Nervous System



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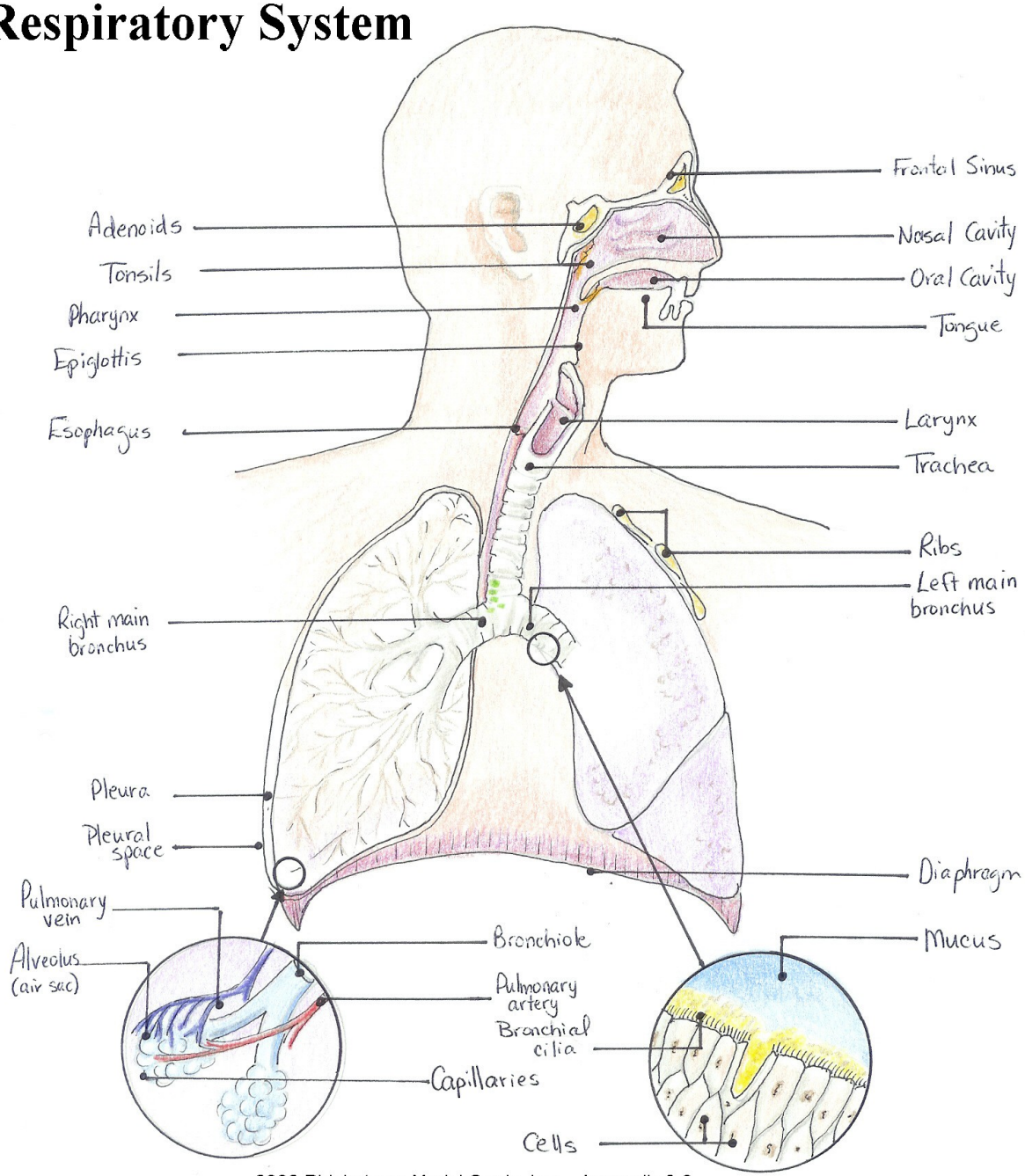
Respiratory System



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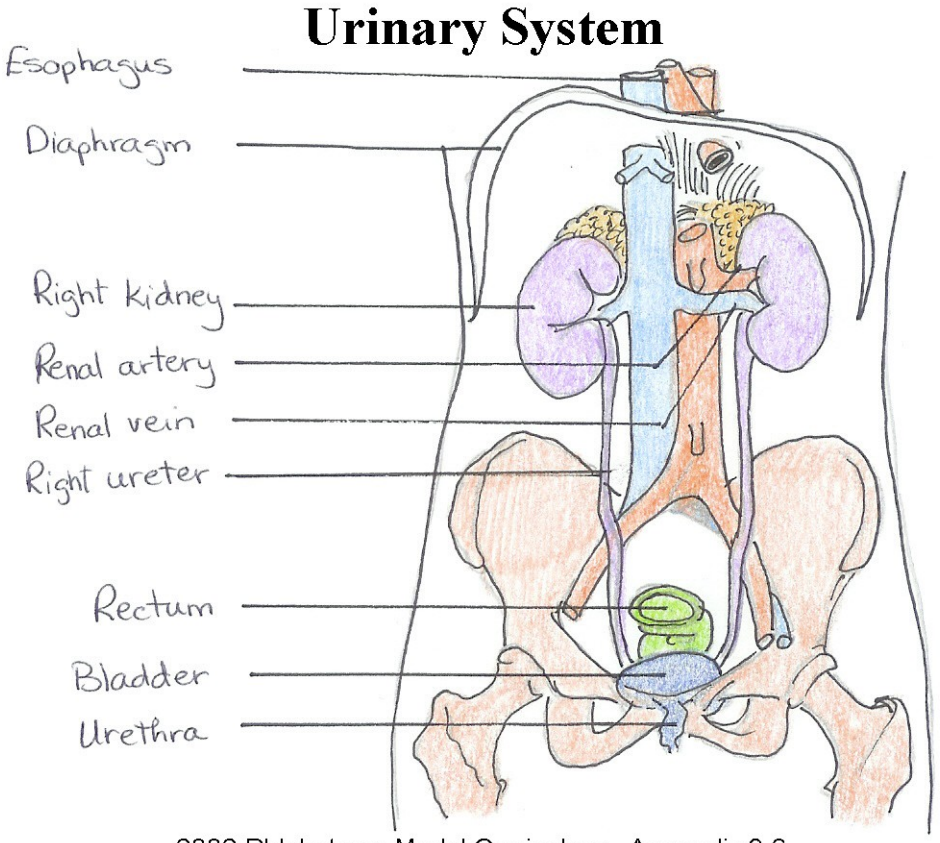

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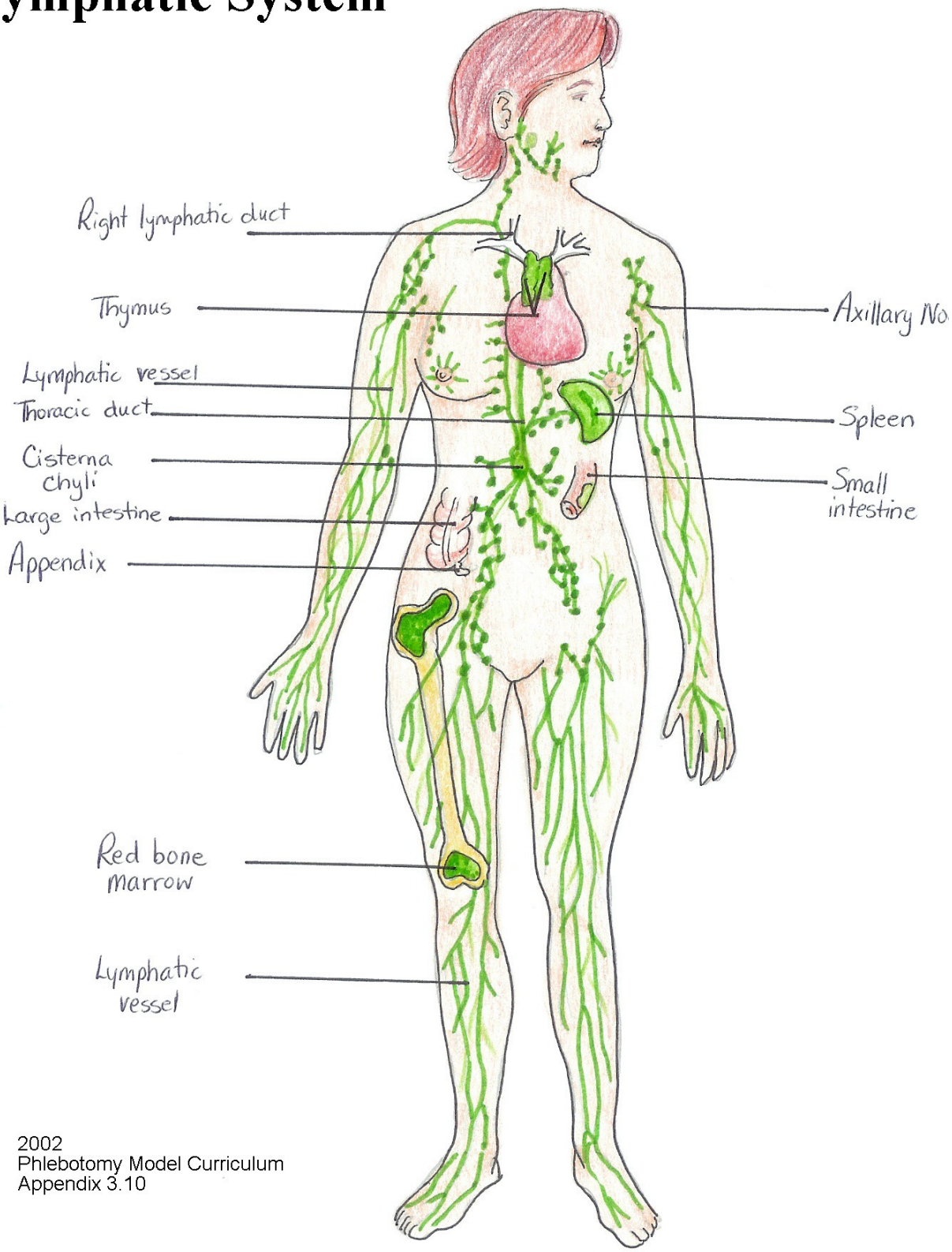
Lymphatic System



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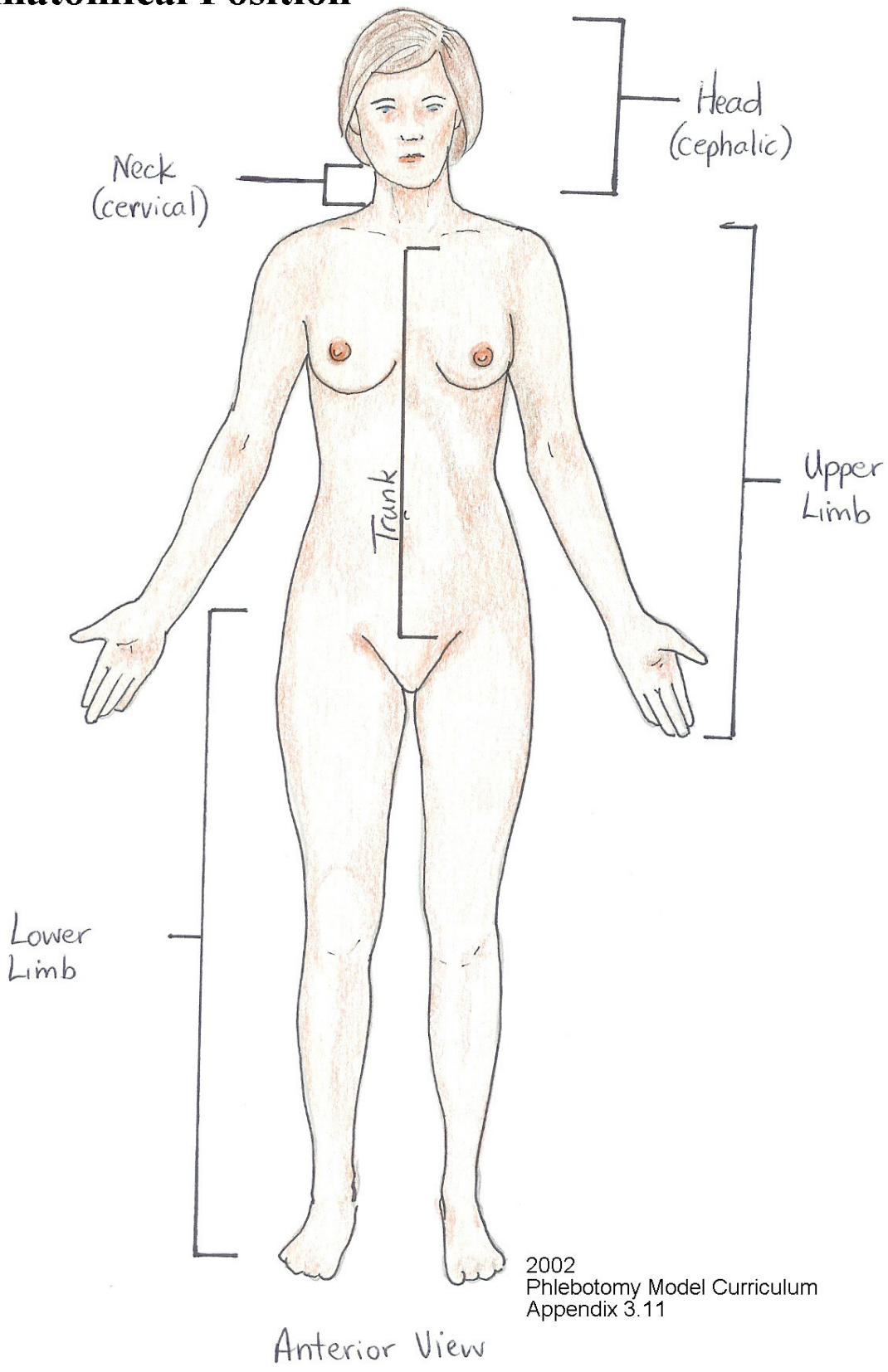
Anatomical Position



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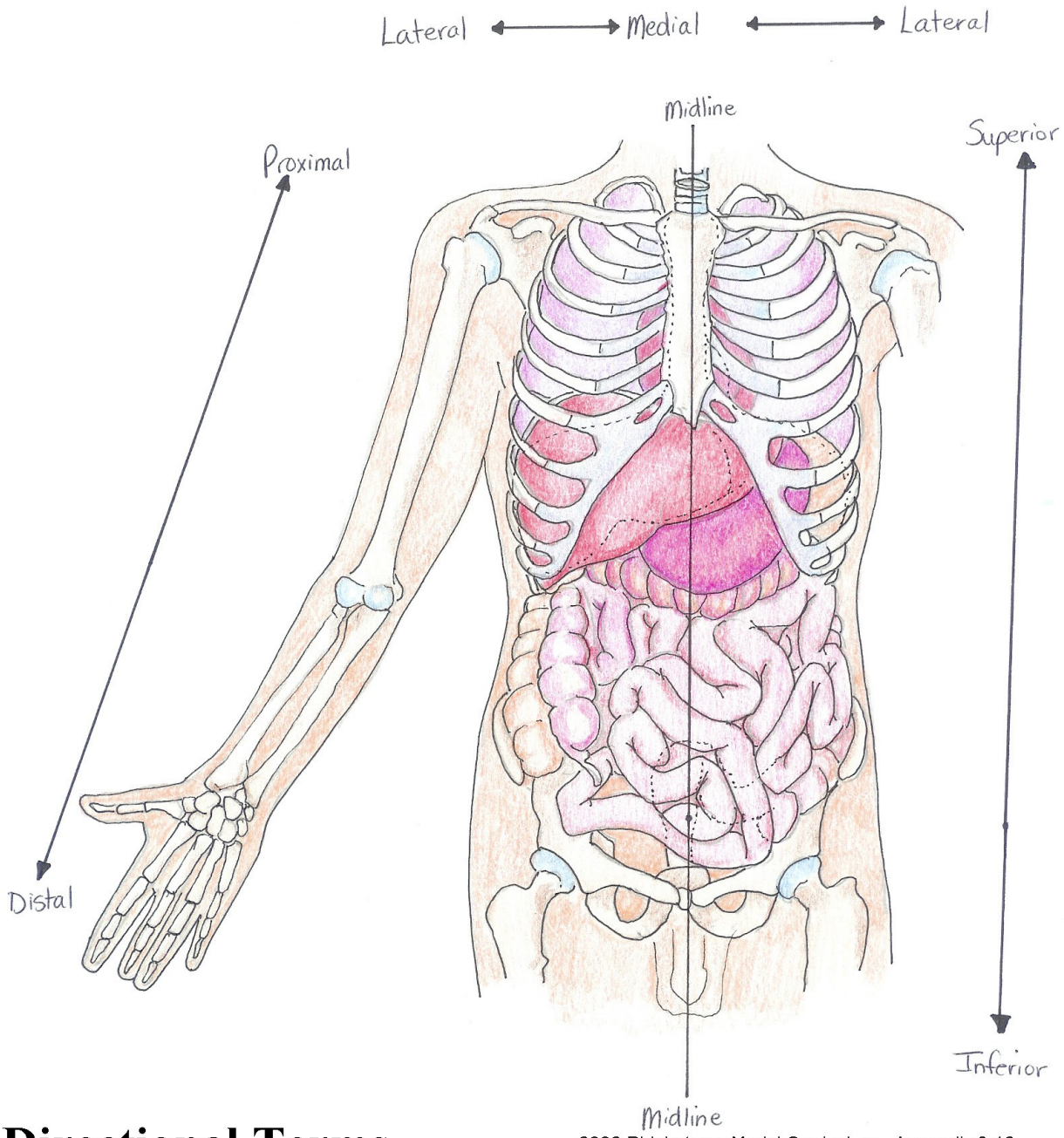

Directional Terms

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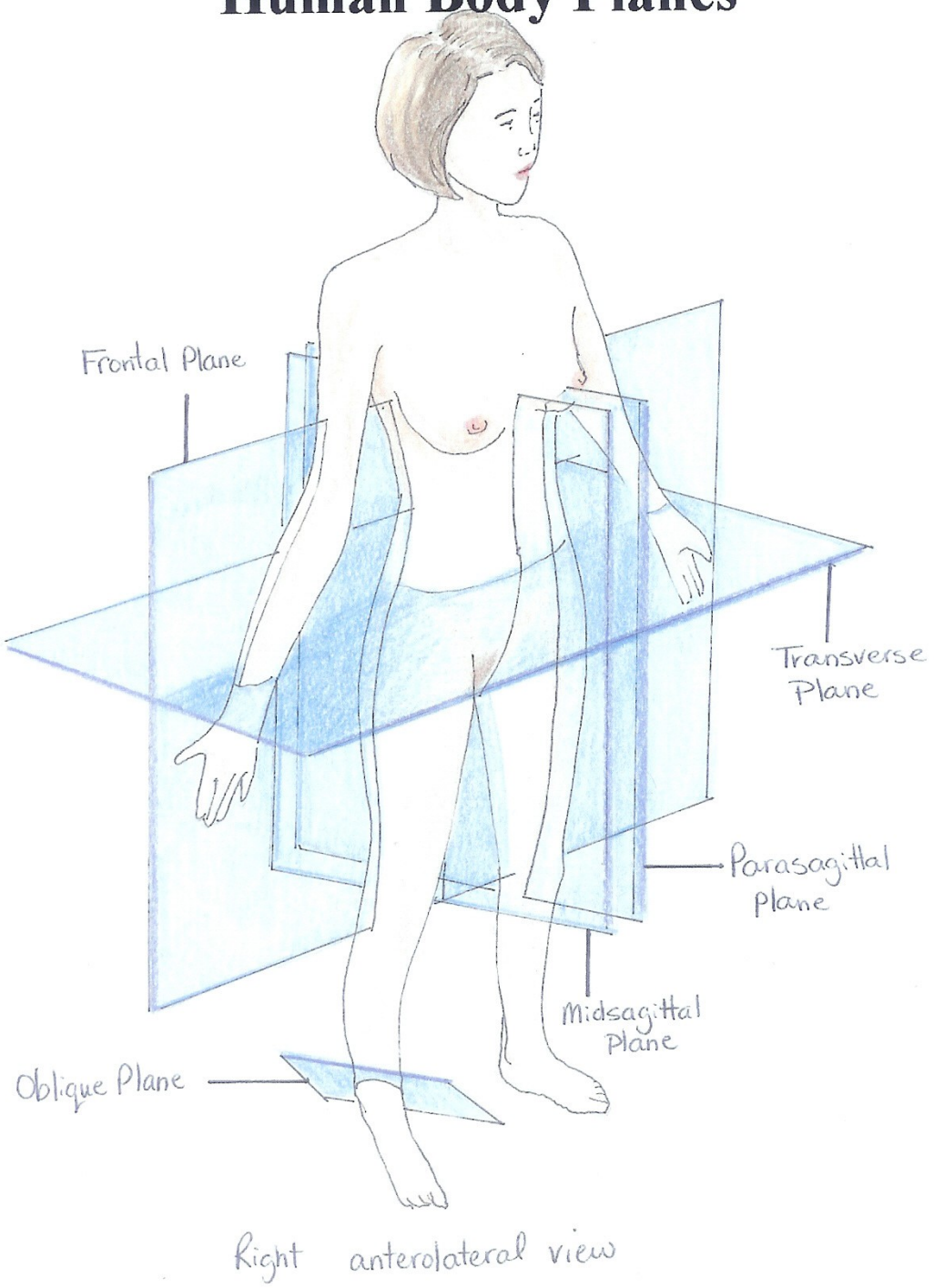
Human Body Planes



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Appendix 3.13

Anatomical Atlas

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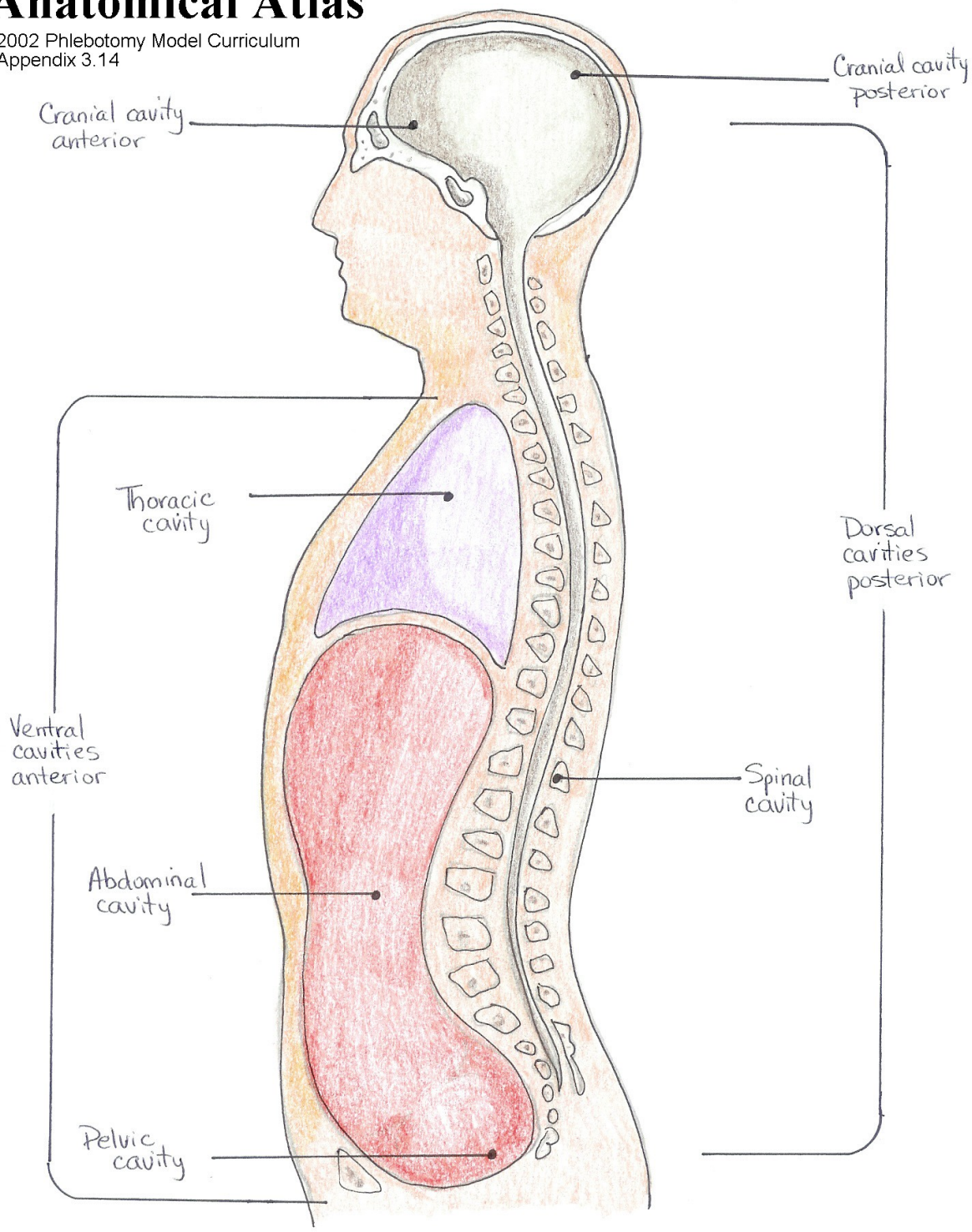
Appendix 3.14



Circulatory Routes

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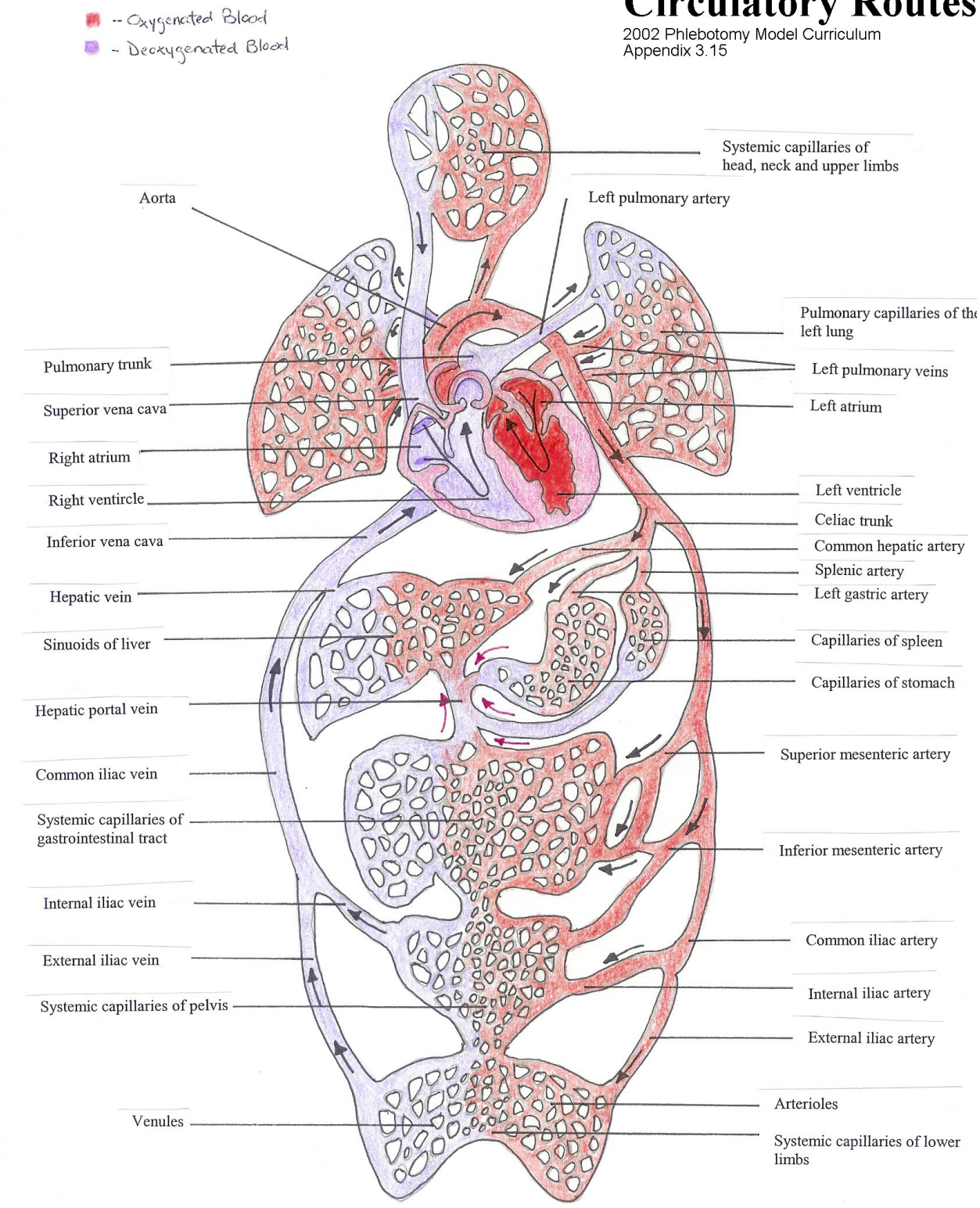
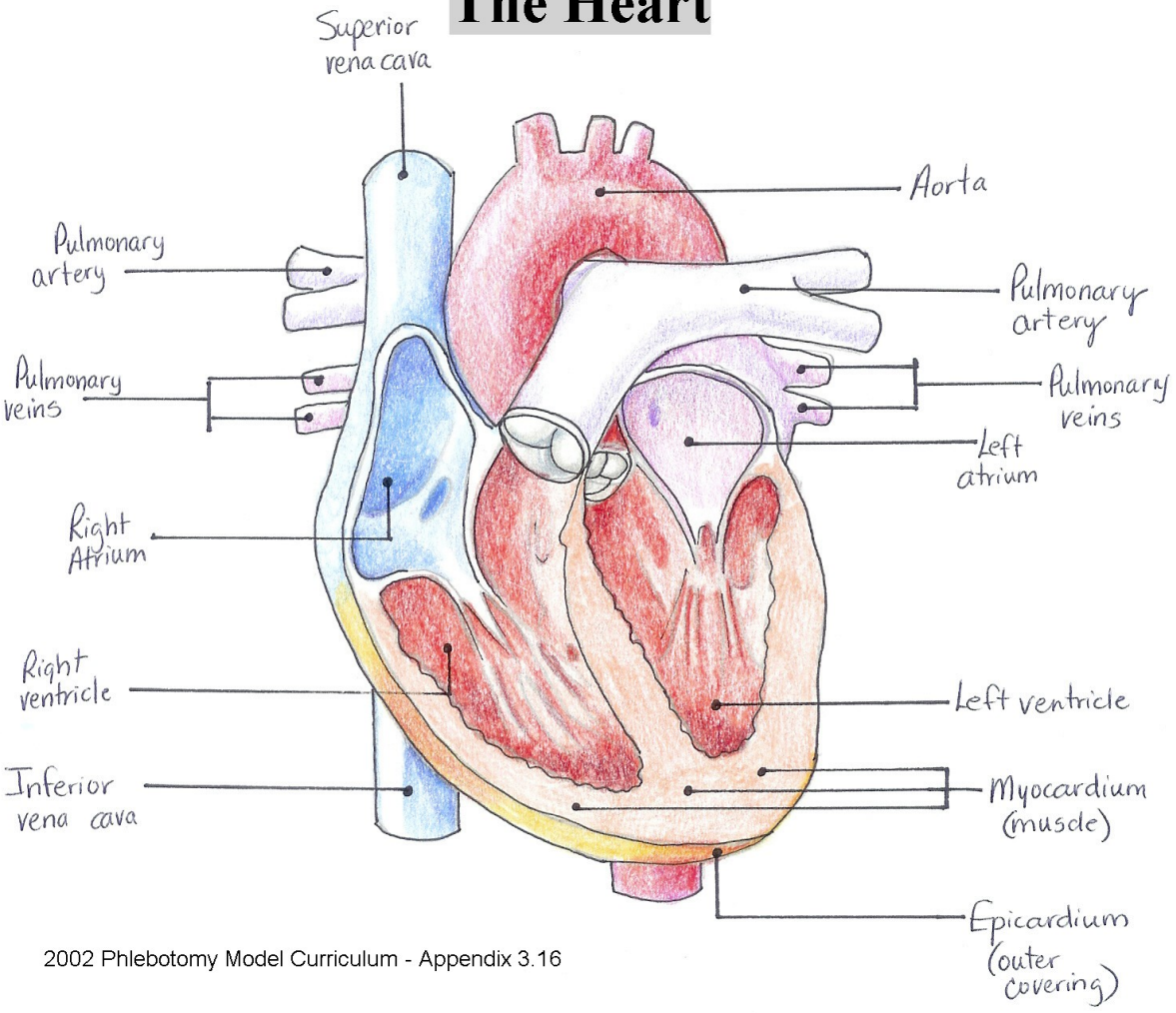


The Heart



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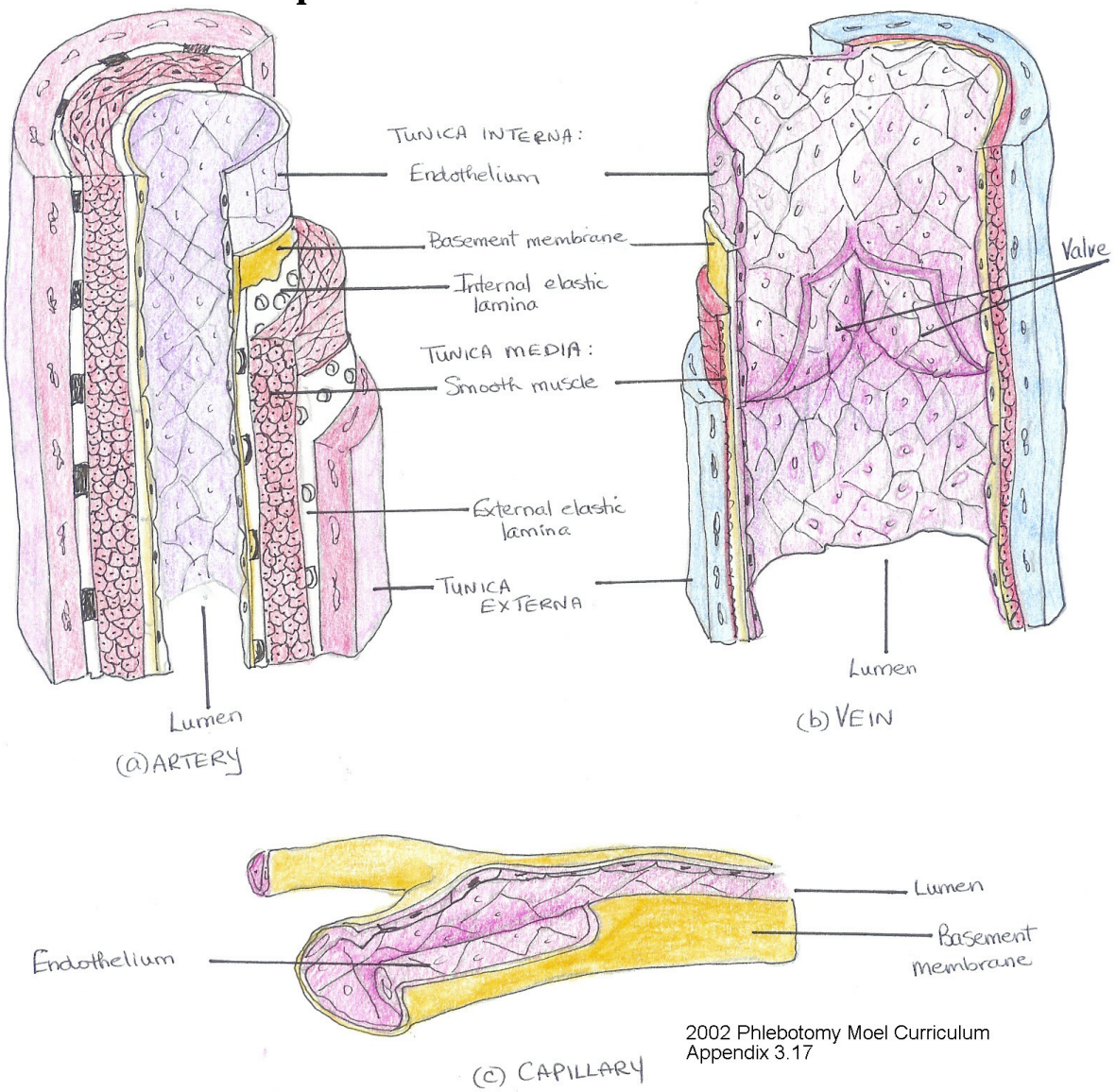
Comparative Structure of Blood Vessels



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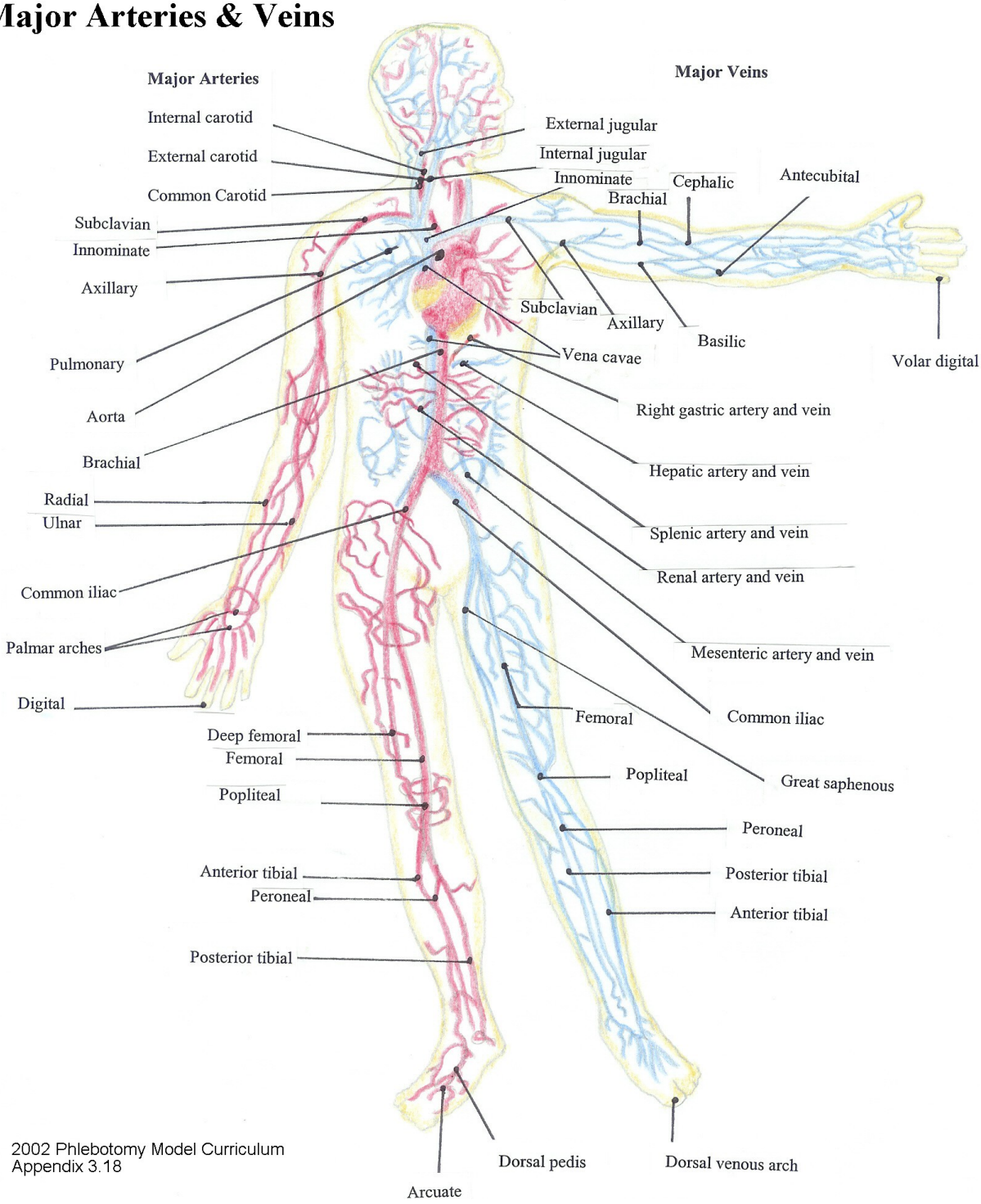
Major Arteries & Veins



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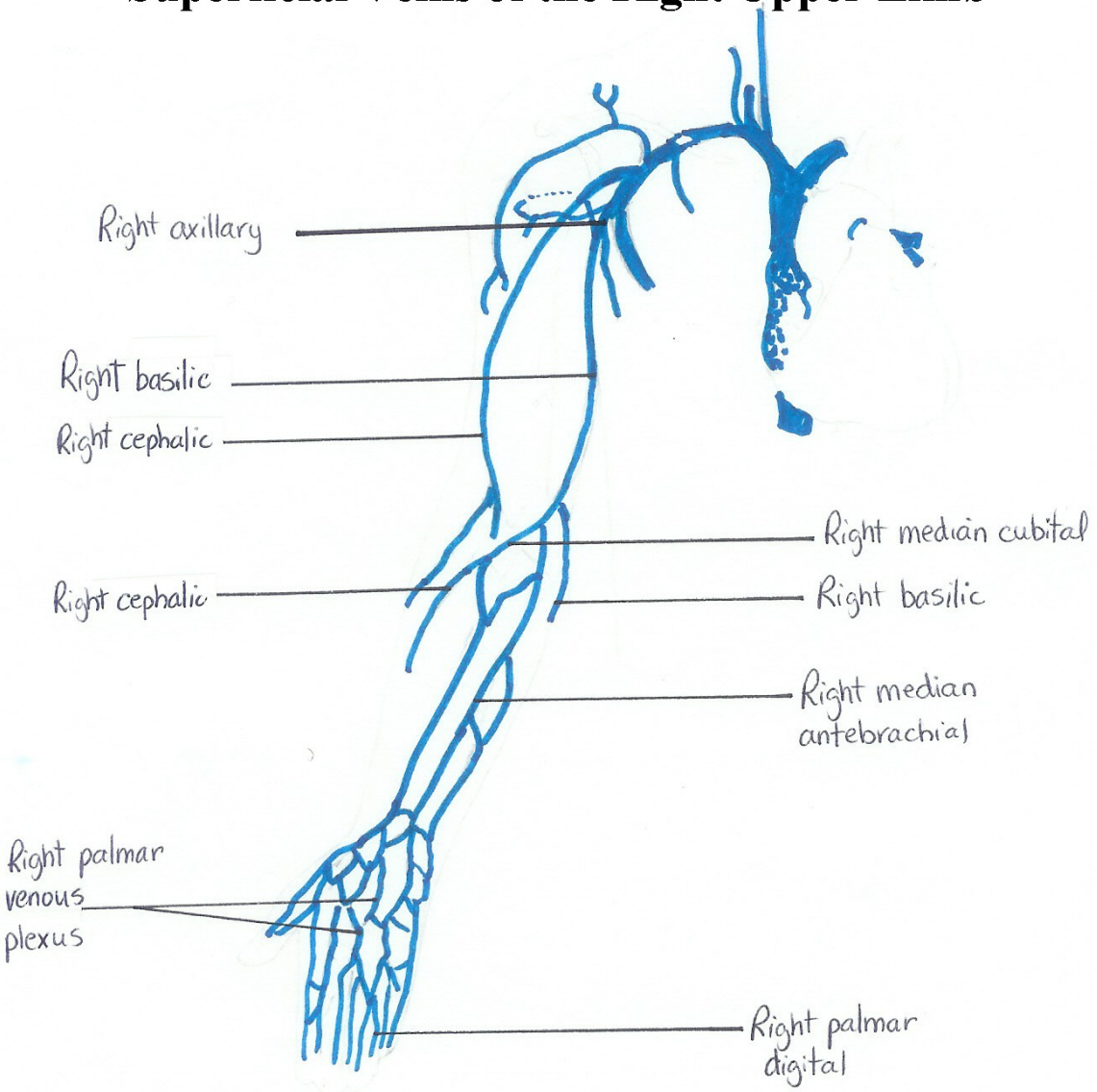
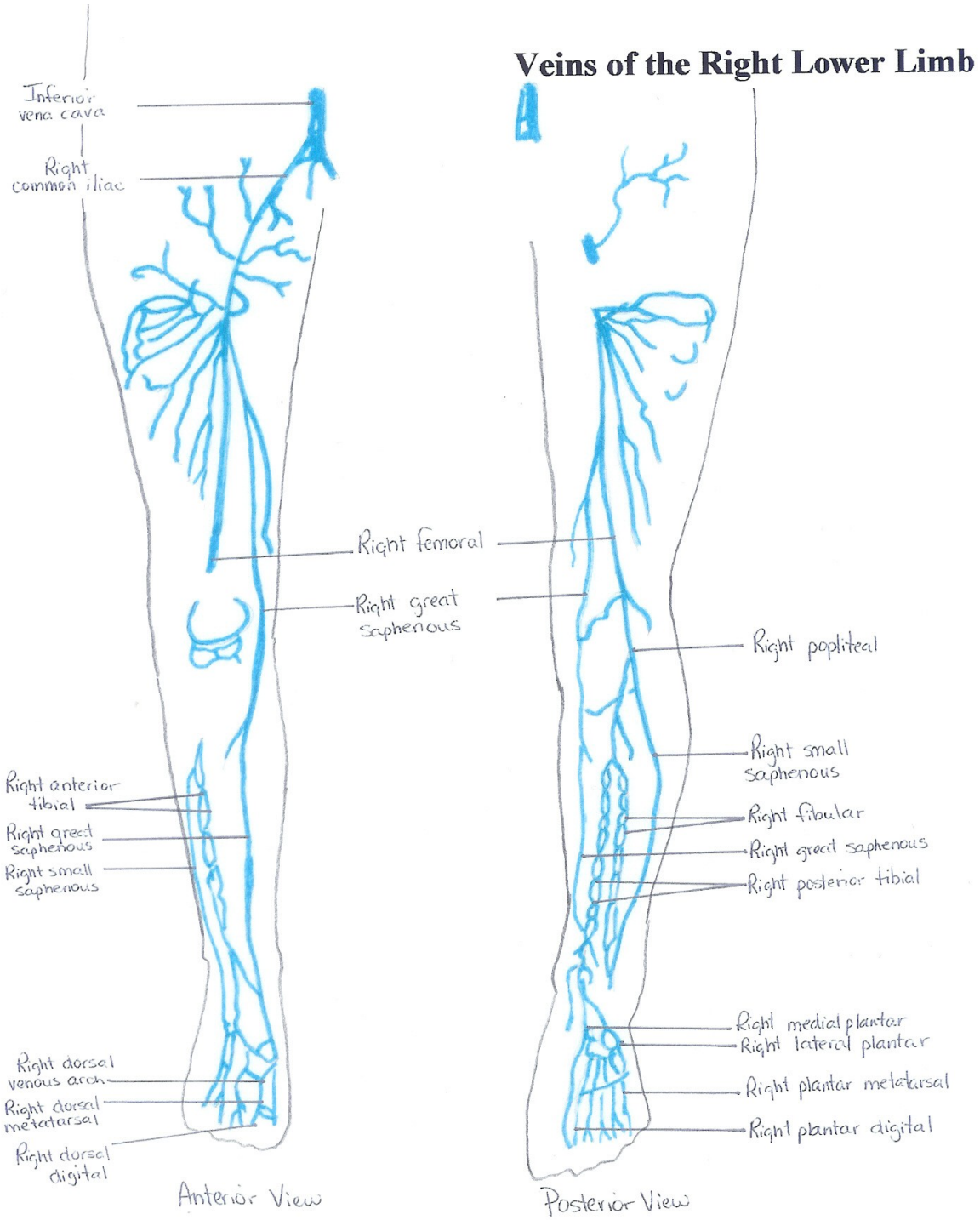
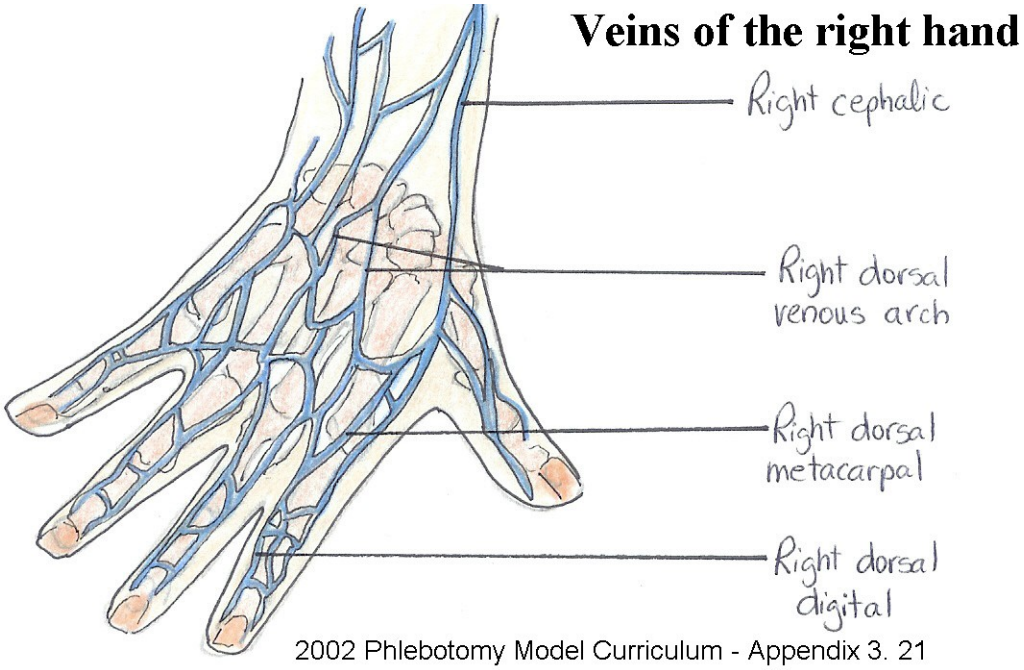
Appendix 3.18

Superficial Veins of the Right Upper Limb

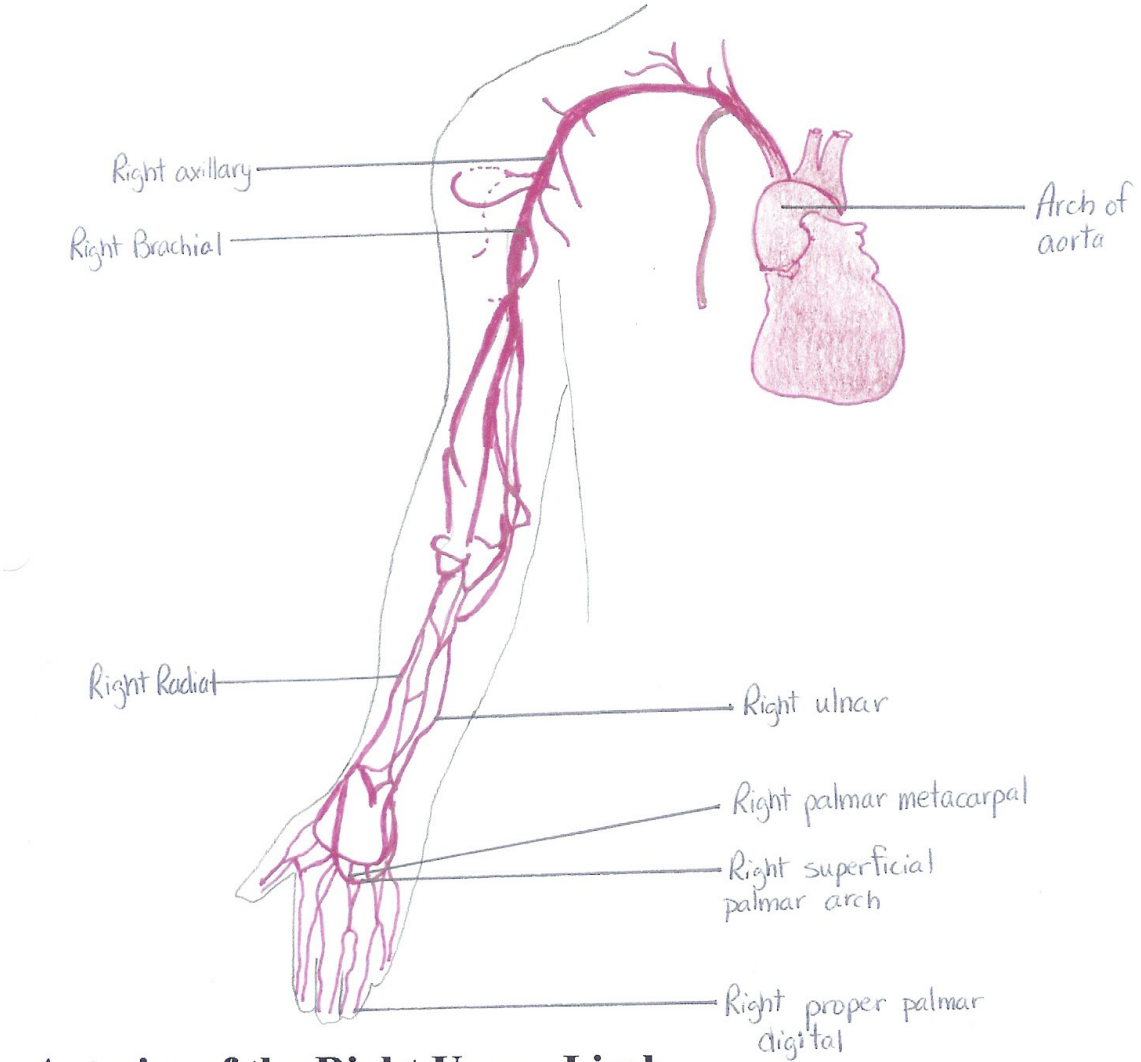




2002 Phlebotomy Model Curriculum - Appendix 3.20



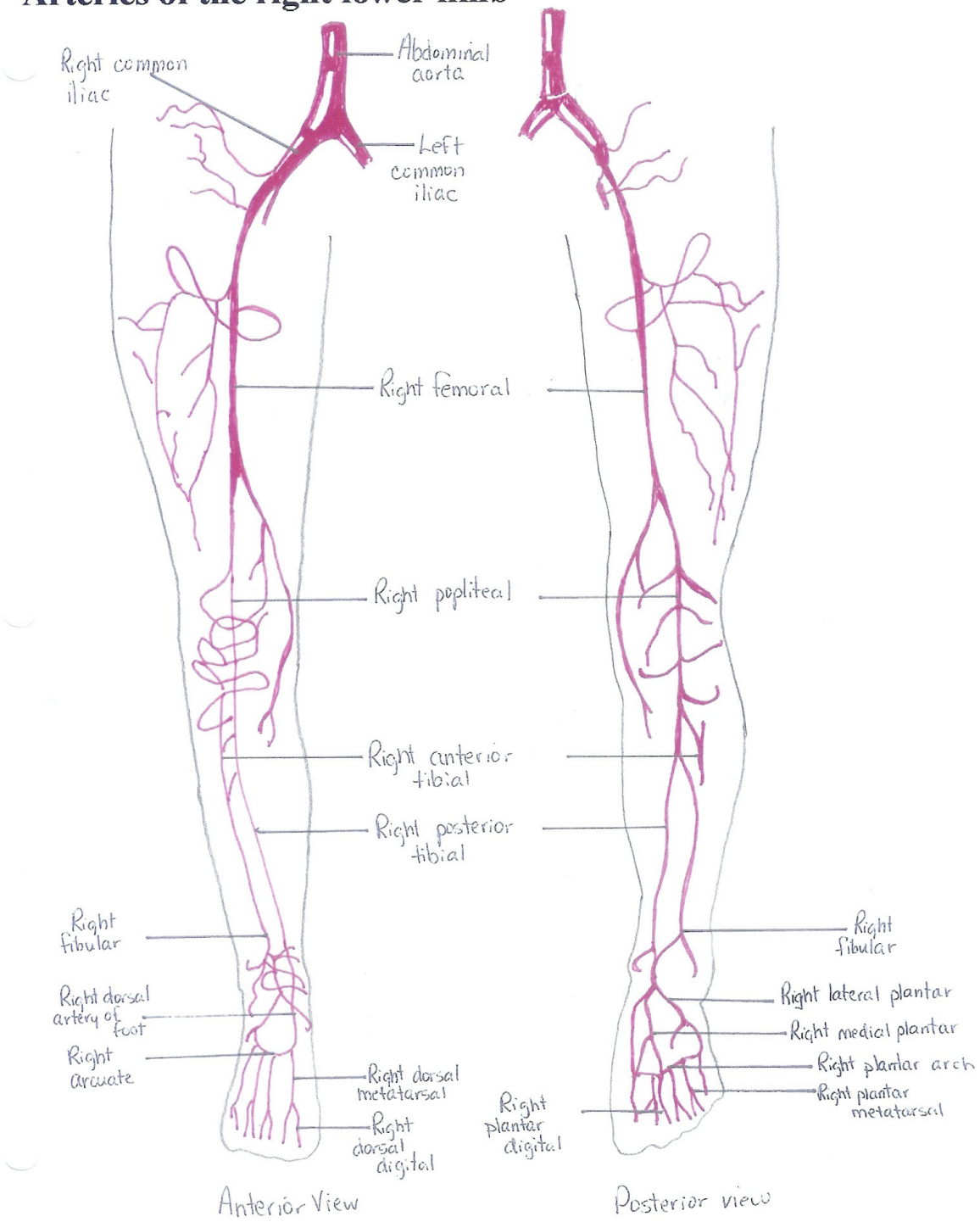
2002 Phlebotomy Model Curriculum - Appendix 3. 21



Arteries of the Right Upper Limb

2002 Phlebotomy Model Curriculum - Appendix 3.22

Arteries of the right lower limb



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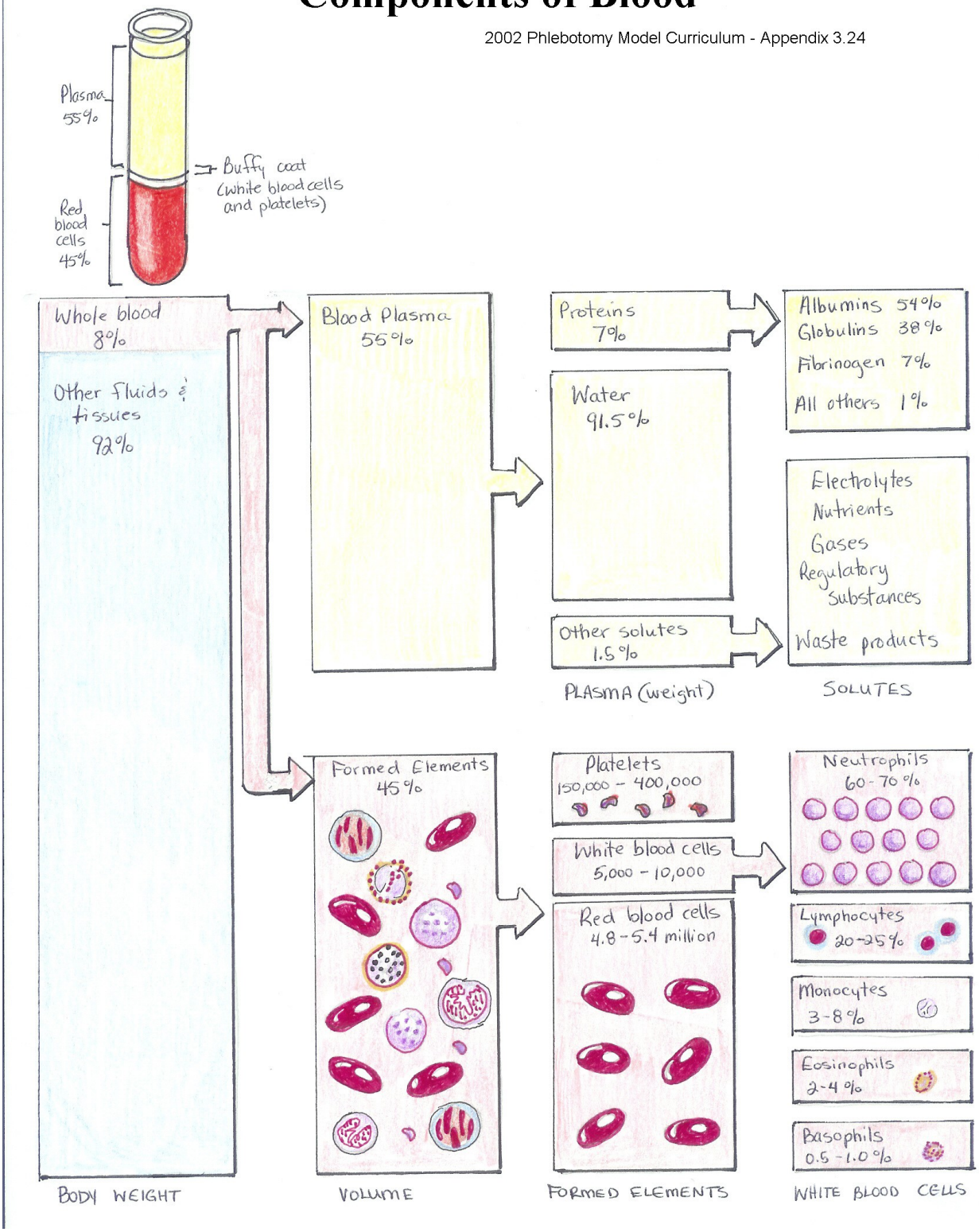
Components of Blood

2002 Phlebotomy Model Curriculum - Appendix 3.24



Types of blood cells

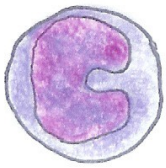
Red Blood Cell
(erythrocyte)

Platelets
(thrombocytes)

Eosinophil

Basophil

Neutrophil



Monocyte

T lymphocyte
(Tcell)

B lymphocyte
(Bcell)

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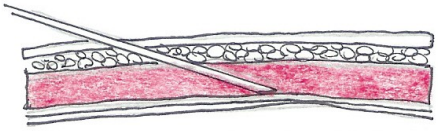
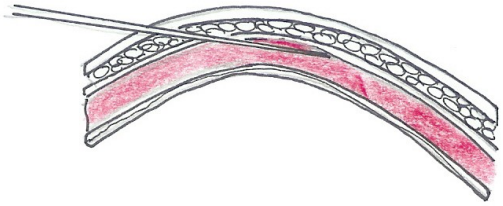
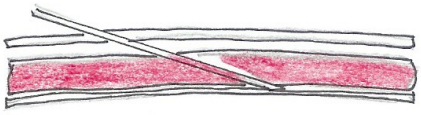
Proper & Improper Needle Positioning



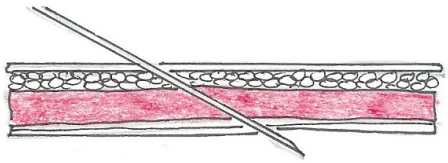
A. Correct insertion technique; blood flows freely into the needle.



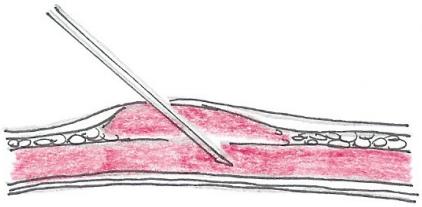
B. Bevel on vein upper wall does not allow blood to flow.



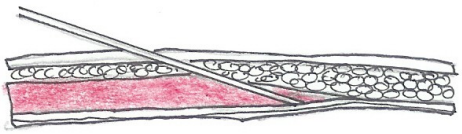
C. Bevel on vein lower wall does not allow blood to flow.



D. Needle inserted too far.

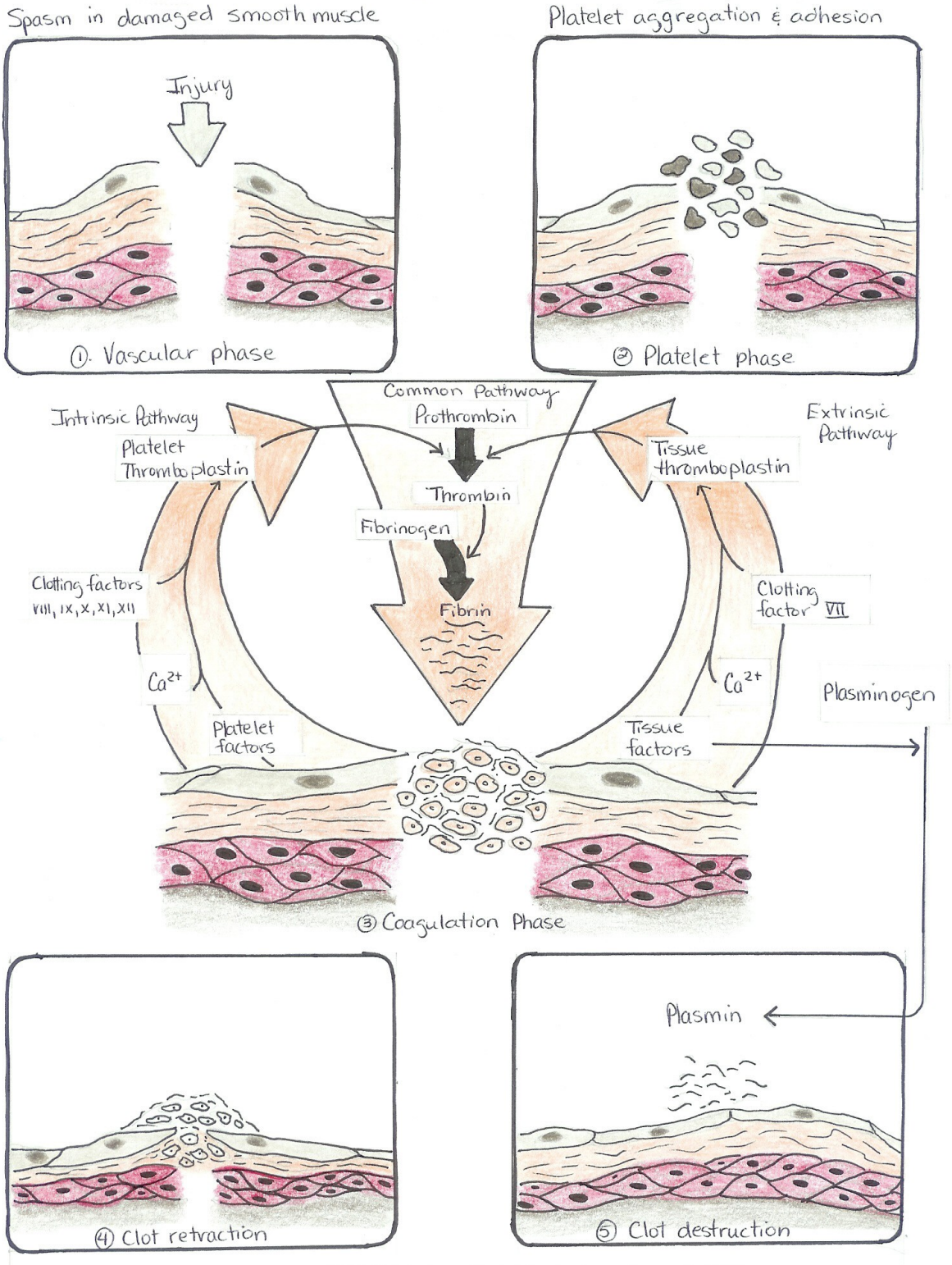


E. Needle partially collapsed and causes blood leakage into tissue



F. Collapsed vein.

Clotting Response



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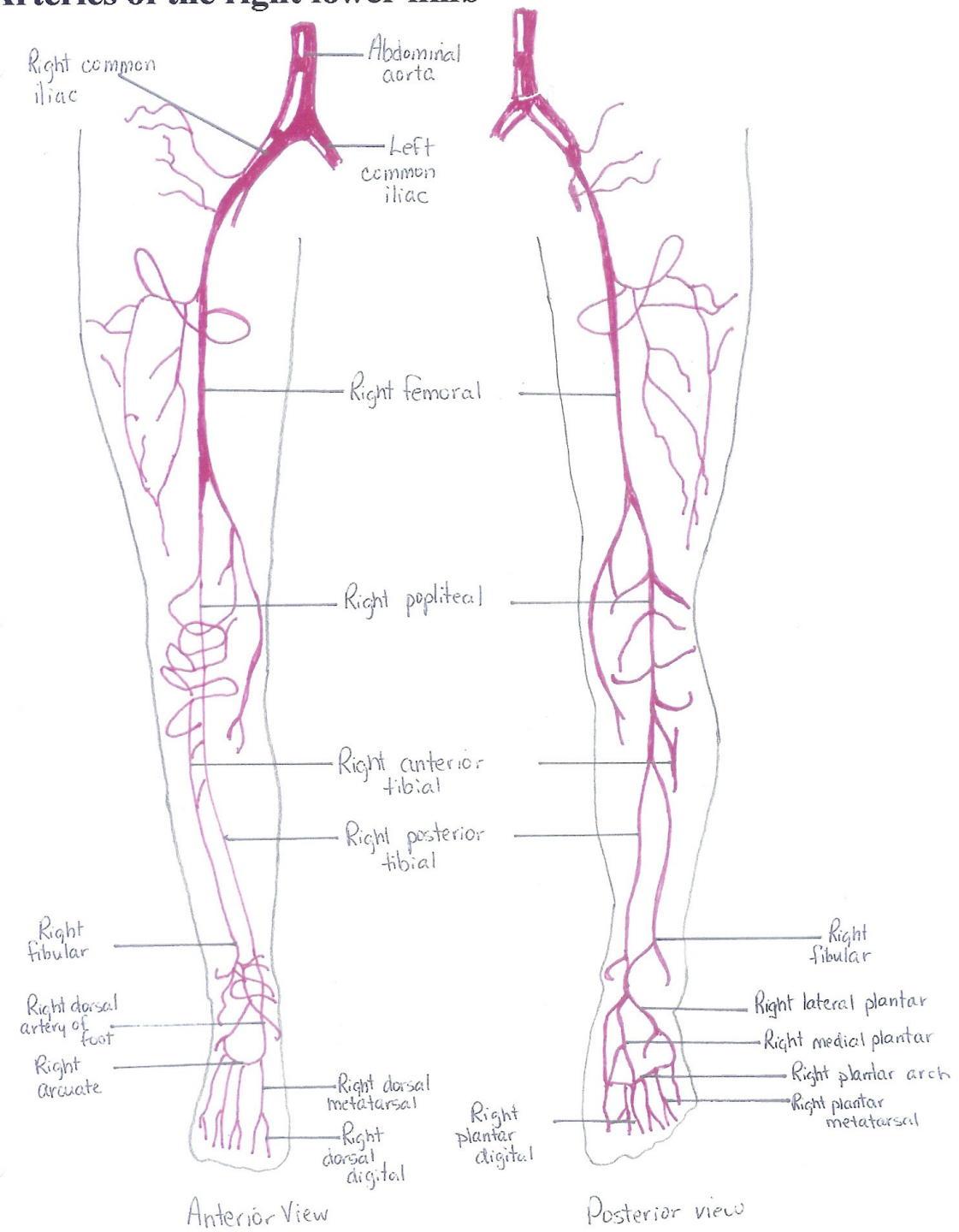
Arteries of the right lower limb



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