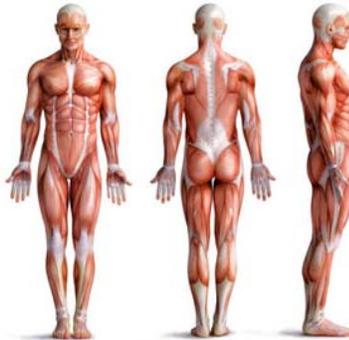


MEDICAL TERMINOLOGY AND ABBREVIATIONS

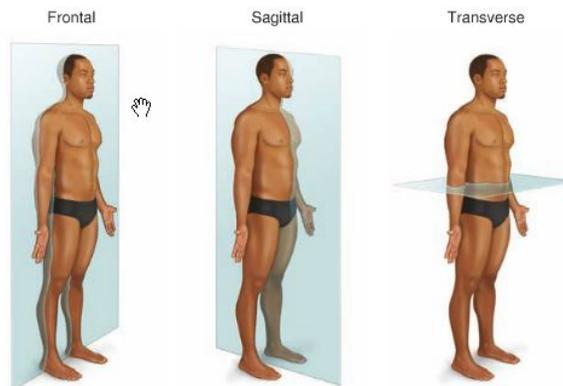
Standard Anatomical Position and Anatomical Planes: Before we cover medical terminology and abbreviations, it will be helpful to understand the standard anatomical position and the anatomical planes of the body. All anatomical location and movement terms are with respect to the standard anatomical position which refers to a body in the standing position with the arms and palms facing forward (thumbs out).



Frontal Plane: Divides the body into front and back portions (or posterior and anterior as described below).

Sagittal Plane: Divides the body into left and right portions

Transverse Plane: Divides the body into upper and lower halves (or superior and inferior as described below).



Location Terms:

Superior and Inferior: Superior refers to something “above” while Inferior refers to something “below”. In the anatomical position, the head is the most superior part of the body while the feet are the most inferior. Examples: The hips are superior to the legs but inferior to the chest.

Anterior and Posterior: Anterior refers to the front and posterior refers to the back. As an example, in the anatomical position a person’s heart is posterior to their sternum as the heart lies behind the sternum. Alternatively, the sternum is anterior to the heart since it lies in front of the heart.

Medial and Lateral: Imagine a line splitting the human body into right and left halves in the anatomical position (facing forward). Medial means towards that center line (midline) while means away from the midline. Examples: The nose is medial to the ears. The shoulders are lateral to the sternum.

Proximal and Distal: These terms are used to describe a structure's distance from the torso with proximal being closest to the torso and distal being furthest away. Examples: The hand is distal to the elbow. The knee is proximal to the ankle.

Movement Terms:

Flexion and Extension: These motions occur in the sagittal plane and refer to increasing or decreasing the angle between two body parts.

- **Flexion** refers to a decrease in the angle between two body parts.
- **Extension** refers to an increase in that angle. For example, flexion at the elbow decreases the angle between the wrist and the shoulder, as seen when doing a bicep curl. Extension of the elbow increases that angle as seen when you straighten your arm.

Abduction and Adduction: These terms refer to movement towards or away from the body in the frontal plane.

- **Abduction** is a movement away from the midline of the body.
- **Adduction** is a movement towards the midline. For example, abduction of the shoulder joint moves the arm further away from the body while adduction returns the arm closer to the side of the body. Abduction of the hip joint spreads the legs apart while adduction of the hip joints brings the legs together (remember those hip abduction and adduction machines in the gym? Now you know where they get their names from!)

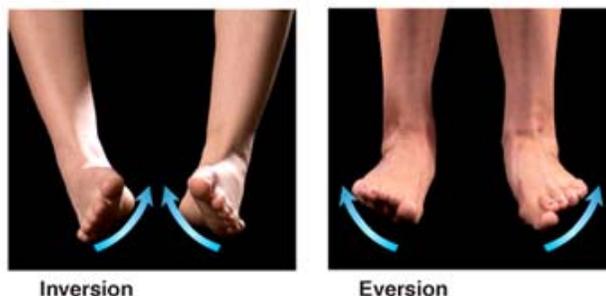
Internal (medial) and External (lateral) Rotation: These terms refer to movement of the limbs around their long axis.

- **Internal rotation** is a movement towards the midline of the body.
- **External rotation** is a movement away from the midline. To understand these terms, take a moment and, with a straight leg, rotate it to point your toes inward. You have just internally rotated your hip joint. Now bend your elbow to a 90-degree angle, imagining that you are carrying an object in front of you. Now rotate your arm outward as if you are going to hand that object to someone standing beside you. You have just externally rotated your shoulder joint.

Pronation and Supination: Pronation refers to “facing down” while supination refers to “facing up”. When laying on your back, you are laying in a supine position. When laying on your stomach, you are in a prone position. With your forearm resting on your desk, keep your shoulder still and turn your hand so that your palm is facing up. This is supination. Now flip your palm so that it is facing down. This is pronation.

Dorsiflexion and Plantarflexion: These terms describe movement of the ankle. Dorsiflexion refers to flexion of the ankle so that the toes are pointed up. Plantarflexion refers to extension of the ankle so that the toes point down. Imagine a woman wearing high heeled shoes. The shoes are placing her ankle into constant plantarflexion.

Eversion and Inversion: These terms are typically used when describing movement of the foot and ankle away from (eversion) or towards (inversion) the midline of the body.



Prefixes, Suffixes and Root Words: To list all prefixes, suffixes and root words in medical terminology is beyond the scope of this course; so, we are providing you with the most common that you should know when reviewing medical reports in a claims environment.

- **Prefixes:** A prefix is located at the beginning of a word. It modifies a word and its meaning.

A-, an-	Lack of, without, not
Ante-	Before, in front of, or forward
Anti-	Opposing or against
Bi-, Di-	Double, two, twice or both
Co-, con-, com-	Together or with
De-	Down, or from
Dys-	Difficult, labored, painful; abnormal
Ecto-	Outside, outer
Endo-	Within
Extra-, extro-	Beyond, outside of, or outward
Hemi-, semi-	Half, half of
Hyper-	Above, excessive, beyond
Hyp-, hypo-	Below, beneath, deficient
Infra-	Below or beneath
Inter-	Between
Intra-	Within, inside
Macro-	Large
Mal-	Bad
Micro-, micr-	Tiny, small
Post-	After, following, behind
Pre-, pro-	In front of, before, proceeding
Retro-	Behind, backwards
Sub-	Under, below
Super-	Over; above
Tachy-	Fast; rapid
Trans-	Through or across
Tri-	Three
Ultra-	Excessive, beyond

- **Suffixes:** Suffixes are located at the end of a word, indicating a procedure, condition or disease.

-ac, ary, -ic, -al, -ous, -tic	Related to, or pertaining to
-ate, -ize	Subject to, use
-ectomy	Excision, surgical removal
-emia	Condition of the blood
-ent, -er, -ist	Person, agent
-genic	Produced by, originatin
-gram	A written record
-graph	Instrument used to record data
-graphy	Process of recording data
-ia	Condition of abnormal state
-ism	Condition, state of
-itis	Inflammation
-odynia	Pain
-oid	Resembling
-ologist	One who studies, specialist
-ology	The study of, process of study
-oma	Tumor, swelling
-opsy	To view
-orrhoea	Flow, excessive discharge
-osis	Abnormal condition
-otomy	Cut into, incision
-pathy	Disease, disease process
-phobia	Fear of, intolerance
-phoria	Feeling
-plasia	Formation, development
-plasm	Growth, substance, formation
-plegia	Paralysis
-sarcoma	Malignant tumor
-sclerosis	Hardening
-sepsis	Infection
-scope	Instrument used to visually examine
-scopy	Process of visual examination

- **Root Words** Below are some common root words for various parts of the body or conditions. These words, combined with the prefixes and suffixes above can give a clear definition of a condition, procedure, etc. For example: **Hyper-** = Above, excess, beyond / **glyc** = sugar / **-emia** = blood. **Hyperglycemia** = High or Elevated Blood Sugar

abdomen	Abdomen
adrenal	Adrenal gland
algesi	Pain
arthr	Joint
carcin	Cancer
cardi	Heart

cephal	Head
cerebr	Brain
cyst	Bladder, sac
dent	Tooth
derm	Skin
disc	Intervertebral Disk
dors	Back (of the body)
enter	Intestine
esthesi	Sensation, sensitivity, feeling
faci	Face
gastr	Stomach
paell	Patella (kneecap)
ped	Child, foot
fibul	Fibula (lower leg)
glyc	Sugar
hem	Blood
hepat	Liver
hist	Tissue
iatr	Medicine, physician
isch	Deficiency, blockage
kinesi	Movement, motion
myelon	Bone marrow
stern	Sternum
tarsals	Ankle bones
therm	Heat
thromb	Clot
radicul	Nerve root
rhin	Nose
sarc	Flesh, connective tissue
tibi	Tibia (lower leg bone)
ven	Vein
vertebr	Vertebra

Abbreviations Used in Medical Reports: Medical reports can be quite difficult for the untrained person to understand as medical professionals routinely use a variety of abbreviations and acronyms to rapidly record information and give instructions. Some common ones that you may see are below.

ac	Before meals	GP	General practitioner
ACL	Anterior cruciate ligament	HR	Heart Rate
ADL	Activities of daily living	hs	At bedtime
ad lib	As desired	Hx	History
Afib	Arterial fibrillation	ICU	Intensive care unit
AP	Anteroposterior	inf	Inferior
A&P	Anterior and posterior	inj	Inject
AQ	Water	IMP	Impression
bid	Twice a day	IU	International unit
BLS	Basic life support	IV	Intravenous

BMR	Basal metabolic rate	JT	Joint
BP	Blood pressure	LBP	Lower back pain
bpm	Beats per minute	MD	Medical doctor
c*	With	MRI	Magnetic resonance imaging
C/O	Complaint of	MS	Multiple Sclerosis
D/C or DC	Discontinue or discharge	NPO	Nothing by mouth
DO	Doctor of osteopathy	pc	After meals
Dx	Diagnosis	po	By mouth
ECG	Electrocardiogram	prn	As needed
EEG	Electroencephalogram	PT	Physical Therapy
EMG	Electromyogram	qd	Every day
ENT	Ear, nose and throat	qid	Four times per day
exc	Excision	RN	Registered nurse
FX	Fracture	ROM	Range of motion
GI	Gastrointestinal	Rx	Prescription
CAD	Coronary artery disease	s*	Without
caps	Capsules	S&S	Signs and symptoms
CBC	Complete blood count	stat	Immediately
CC	Chief complaint	sx	Symptoms
CNS	Central Nervous System	Tabs	Tablets
COPD	Chronic obstructive pulmonary disease	tid	Three times per day
CPR	Cardiopulmonary resuscitation	UA	Urinalysis
diff	Differential blood count	Vfib	Ventricular fibrillation
		VS	Vital Signs

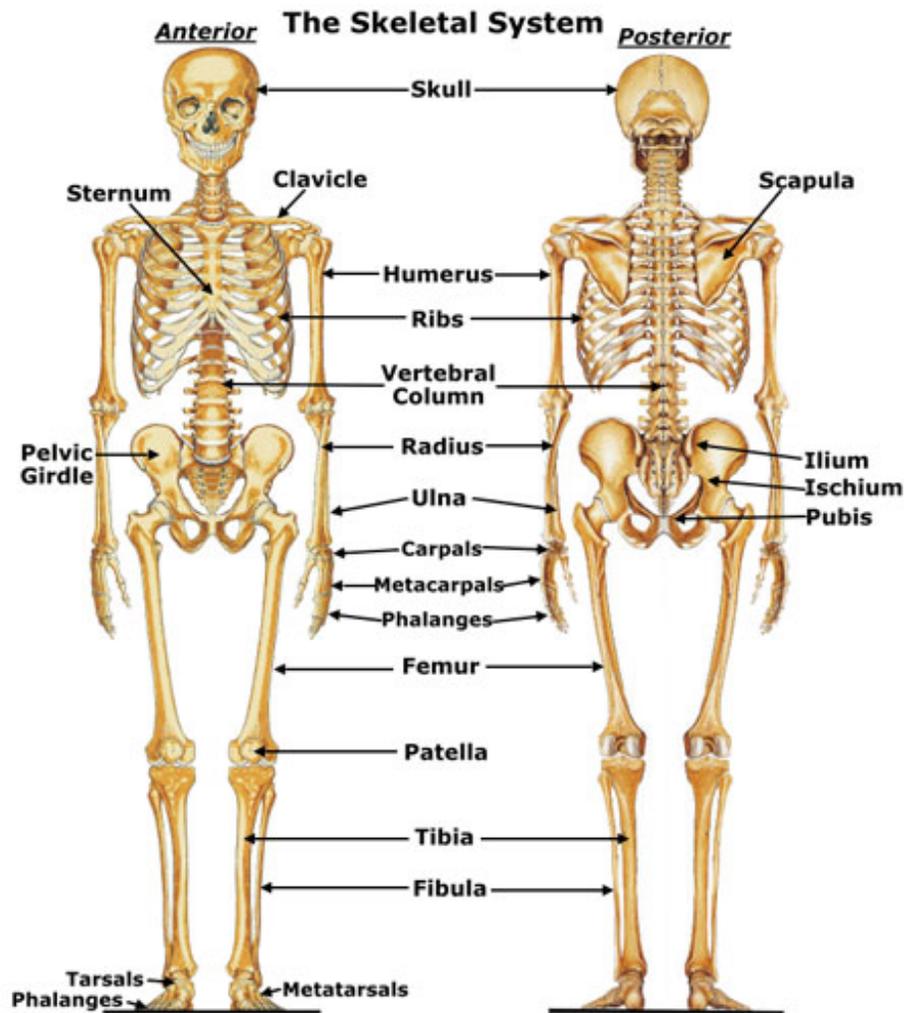
Medical Specialties: Casualty adjusters see many conditions and injuries over the course of their career. A claimant will often require a practitioner trained in a specific field of medicine to receive appropriate care. This is where medical specialties come in. To discuss all specialties is far beyond the scope of this course. Therefore, we will focus on medical specialties that adjusters are most likely to encounter.

- **Anesthesiologist:** administers anesthesia, monitors a patient during surgery; treats chronic pain
- **Cardiologist:** treats heart conditions
- **Internal Medicine Physician:** treats diseases and disorders of internal structures of the body
- **Neurologist:** treats diseases and disorders of the nervous system
- **Neurosurgeon:** conducts surgery of the nervous system
- **Occupational Medicine Physician:** treats work-related disease or injury
- **Oral and Maxillofacial Surgeon:** treats diseases and injuries of the face, mouth and jaw
- **Orthopedic Surgeon:** treats conditions or injuries related to the musculoskeletal system
- **Pediatrician:** treats infants, toddlers, children and teenagers
- **Podiatrist:** provides medical and surgical treatment of the foot
- **Psychiatrist:** treats patients with mental and emotional disorders
- **Pulmonary Medicine Physician:** diagnoses and treats lung disorders
- **Rheumatologist:** treats conditions characterized by inflammation, soreness and stiffness of muscles, and pain in joints and associated structures

BASIC HUMAN ANATOMY

- **Musculoskeletal System:** The musculoskeletal system encompasses the skeletal system and the muscular system which allows movement. The skeletal system and muscular system are connected by tendons, ligaments, joints and other connective tissues. Together, this system provides form, support, stability and movement to the body and protects vital organs.
- **Ligaments:** They connect the bones to each other and stabilize joints. Cartilage is a connective tissue that prevents the bones from rubbing against each other.
- **Tendons:** They connect attach muscle to the bone.

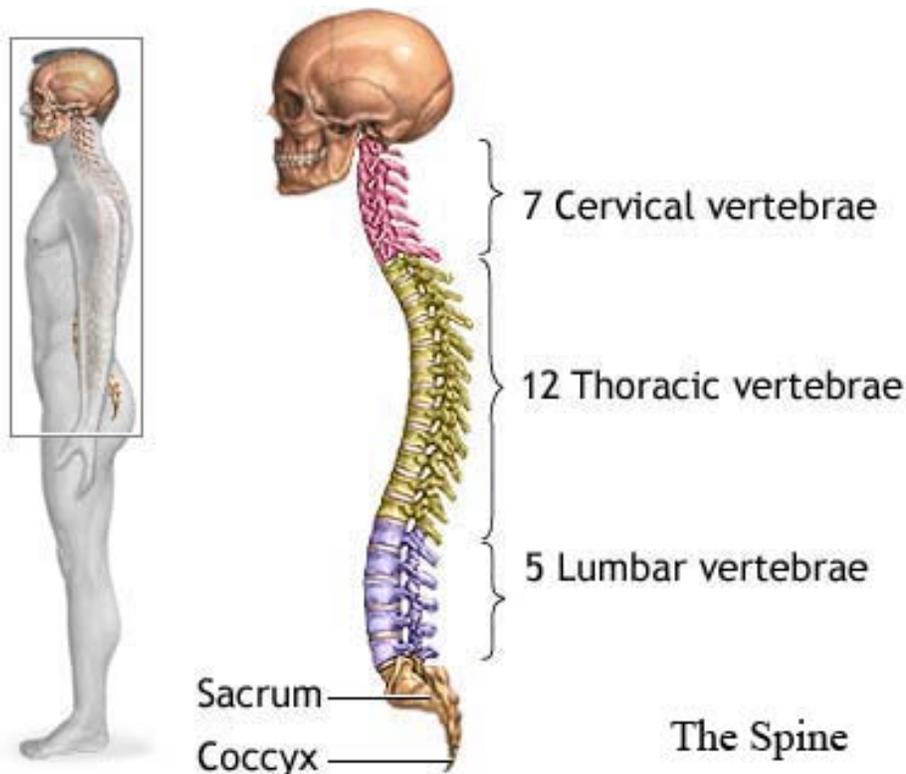
Here is the general diagram of the skeletal system:



The Spine: Because of the number of injuries related to the spine that an adjuster will see throughout his or her career, we will provide a short overview of the makeup of the spine.

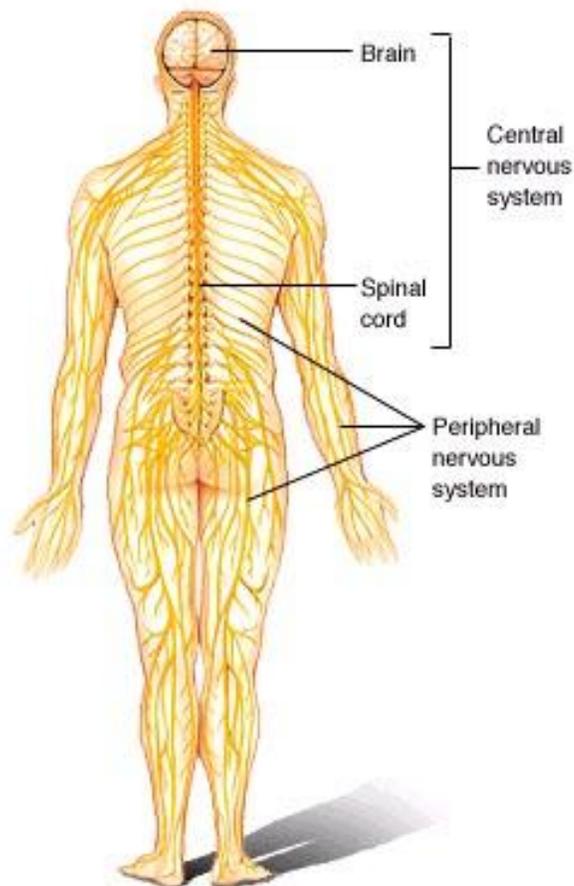
The **spine** is made up of 33 bones called vertebrae that are stacked one on top of the other. Each vertebra is separated and cushioned by an intervertebral disk which keeps the bones from rubbing together. The vertebrae are numbered and divided into 5 regions:

- **Cervical (neck):** The main function of the cervical spine is to support the weight of the head. There are 7 cervical vertebrae numbered C1-C7 with C1 located at the top of the spine connecting to the skull and C7 located at the bottom of the neck.
- **Thoracic (mid back):** The main function of the thoracic spine is to hold the ribcage and protect the heart and lungs. There are 12 thoracic vertebrae numbered (from top to bottom) T1-T12.
- **Lumbar (low back):** The main function of the lumbar spine is to bear the weight of the body. There are 5 lumbar vertebrae numbered (from top to bottom) L1-L5.
- **Sacrum:** The sacrum connects the spine to the hip bones. There are 5 sacral bones that are fused together.
- **Coccyx:** The coccyx is also known as the tailbone and is comprised of 4 bones that are fused together.

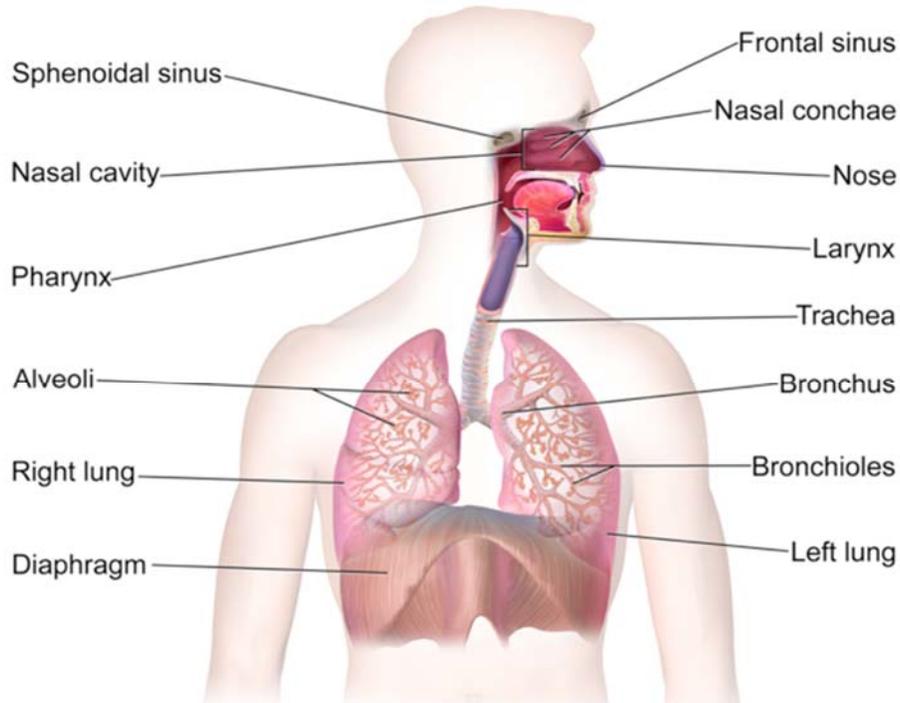


The Nervous System: The nervous system is a complex network that acts as the communication and control center of the body. It is comprised of the brain, spinal cord, sensory organs, and the nerves and tissues connecting these organs to the rest of the body. Together, the brain and spinal cord create the body's control center:

- The **Central Nervous System (CNS):** Sensory nerves and organs throughout the body create the Peripheral Nervous System (PNS);
- The **Peripheral Nervous System (PNS)** monitors conditions inside and outside of the body and sends this information to the CNS.
- Communication between the CNS and PNS is carried out by a variety of nerves:
 - **Efferent Nerves** carry messages from the brain to the organs of the body.
 - **Afferent Nerves** carry messages from the body back to the brain.



Respiratory System: The respiratory system is responsible for taking in oxygen for cellular respiration and expelling carbon dioxide, a poisonous waste product of the respiratory process. The primary organs of the respiratory system are the lungs. When we take a breath (i.e. inspiration or inhalation), oxygen enters the body through the nose and mouth. The trachea, or windpipe, filters the air and branches into the bronchi and smaller bronchioles which are tubes that carry the air into each lung. Inside each lung are lobes (3 in the right lung and 2 in the left lung). These lobes are filled with small sacs called alveoli. This is where the exchange of oxygen and carbon dioxide occurs. The alveoli absorb oxygen from the air into the blood and remove carbon dioxide from the blood, which is then exhaled (i.e. "expiration").



The Respiratory System

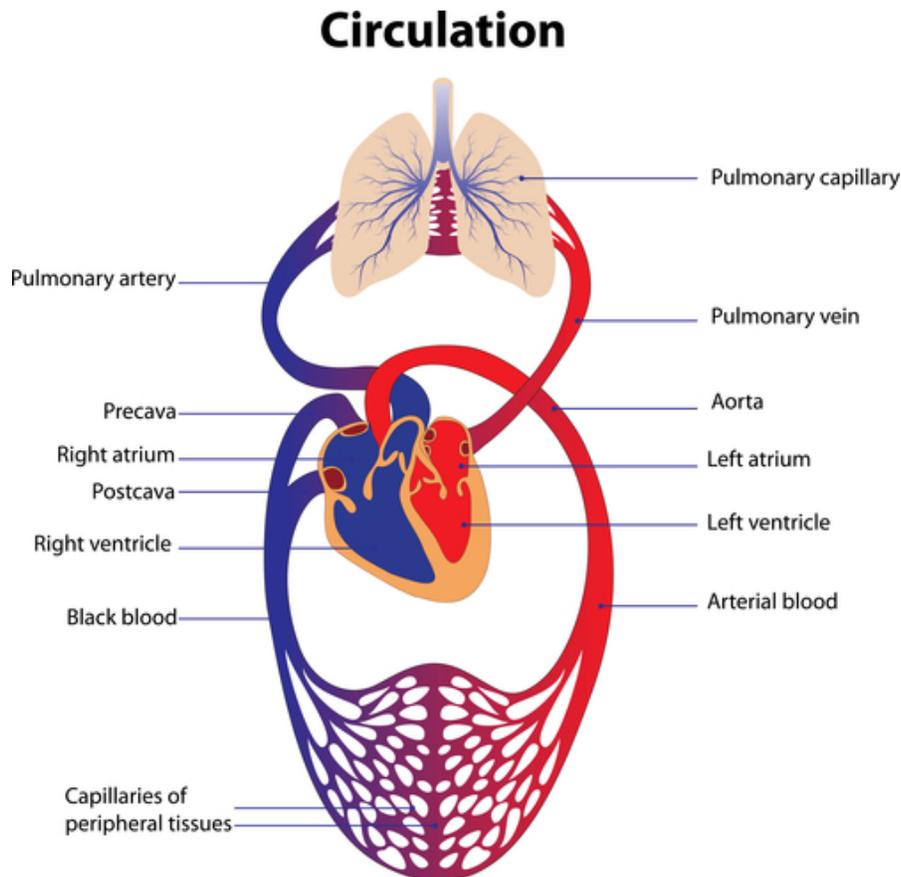
Cardiovascular System: The cardiovascular system (also referred to as the circulatory system) is responsible for transporting oxygen, nutrients, hormones and blood cells throughout the body via the circulation of the blood.

The cardiovascular system is powered by the heart which pumps blood through a network of blood vessels (the arteries, veins and capillaries).

- **Arteries** are the vessels that transport blood away from the heart.
- **Veins** are the vessels that return the heart.
- **Capillaries** are very small vessels that lie between the arteries and the veins and are where oxygen and nutrient exchange take place.

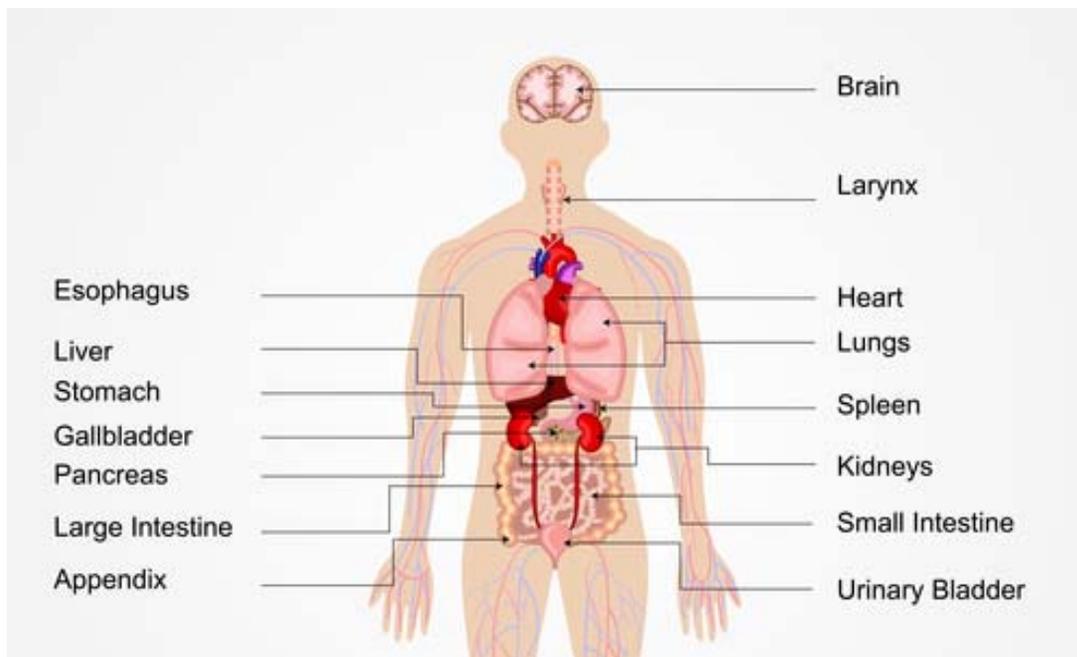
There are 3 types of circulation that occur within the cardiovascular system.

- **Pulmonary Circulation** takes oxygen depleted blood to the lungs, where the cardiovascular system meets the respiratory system and the exchange of oxygen and carbon dioxide takes place. The now oxygen-rich blood is returned back to the heart.
- **Systemic Circulation** transports the oxygen-rich blood to the tissues and organs of the body.
- **Coronary Circulation** is the circulation of blood through the heart itself.



Abdominal Organs: The abdominal cavity is where the majority of the digestive process occurs. The main abdominal organs are:

- **Liver:** The body's largest organ. The liver performs a variety of functions. Among the most important are ridding the body of toxins, production of bile which aids in digestion and absorption of fats and fat-soluble vitamins.
- **Gallbladder:** A small sac beneath the liver that stores extra bile made by the liver until it is needed and pumped into the small intestine.
- **Stomach:** The stomach is located directly below the liver and stores food while preparing it for digestion. In the stomach, food mixes digestive juices and enzymes to break it down further before passing to the small intestine.
- **Pancreas:** The pancreas is a gland that produces digestive enzymes. It is also responsible for the production hormones including insulin, which regulates the distribution of glucose (sugar).
- **Small Intestine:** A 21-foot long tube which is where most of the digestion occurs. The small intestine occupies the majority of the abdominal cavity. The small intestine breaks down and absorbs nutrients from food into the blood stream. It is comprised from top to bottom of the duodenum, jejunum and ileum.
- **Large Intestine:** The large intestine is actually shorter in length than the Small Intestine but is wider in girth. This organ is responsible for the absorption of water from the indigestible remainder of food. The large intestine is comprised of the cecum, the colon, and the rectum.
- **Kidneys:** Located behind the intestines, the kidneys are responsible a wide range of functions including the removal of waste and water from the blood in the form of urine, balancing chemicals in the body, releasing hormones and producing Vitamin D.
- **Adrenal Glands:** Directly on top of the kidneys are the adrenal glands which are a part of the endocrine (hormonal) system. The adrenal system is responsible for the production of a plethora of hormones including cortisol, adrenaline, norepinephrine, dopamine, estrogen and progesterone.



Common Injuries and Diseases in Casualty Claims Handling

- **Strains & Sprains:** A **strain** is the stretching or tearing of a muscle or tendon. As covered previously, tendons connect the muscle to the bone. Low back and hamstring strains are common. A **sprain** is the stretching or tearing of the ligaments which connect two bones together. The most common sprain is in the ankle. The initial treatment for both injuries is rest, ice, compression and elevation... easily remembered as RICE. Most can be treated at home but more severe tears may require surgical repair.
- **Dislocations:** A dislocation is an injury at the joint where there is an abnormal separation where two bones meet. Dislocations are usually caused by sudden trauma to the joint such as a fall. They are most commonly seen in shoulders and fingers.
- **Fractures:** A fracture is the medical term for a broken bone. There are many types of fractures, but the main categories are displaced, non-displaced, open, and closed. A **closed fracture** is when the bone breaks but there is no puncture or open wound in the skin. An **open fracture** is one in which the bone breaks through the skin; it may then recede back into the wound and not be visible through the skin. This is an important difference from a closed fracture because with an open fracture there is a risk of a deep bone infection. Displaced and non-displaced fractures refer to the way the bone breaks. In a **displaced** fracture, the bone snaps into two or more parts and moves so that the two ends are not lined up straight. If the bone is in many pieces, it is called a comminuted fracture. In a **non-displaced** fracture, the bone cracks either part or all the way through, but does not move and maintains its proper alignment. For a more detailed description and images of the various types of fractures, please refer to the online Medical Anatomy lesson.
- **Soft Tissue Injuries:** Injuries such as a contusion (bruise) or a sprained or strained back, neck, knee or ankle are referred to as soft tissue injuries because they involve muscles, ligaments, tendons and other soft connective tissue throughout the body. Soft tissue injuries are subjective in nature, require limited treatment, resolve themselves quickly with rest, ice, elevation, and/or over the counter or prescribed medication.
- **Brain Injuries:** Brain injuries or "Traumatic head injuries" are among the most serious of casualties. The results of traumatic brain injury range from mild concussions (resulting in a brief period of unconsciousness, dizziness, or disorientation) to comas and lasting cognitive problems.
- **Burn Classifications:** Burns are usually thought of to be caused by contact with extreme heat but can also be caused by chemicals, electricity or radiation. Burns are classified by severity and penetration through the layers of the skin.
 - **First-Degree Burn:** Also called a superficial burn. Only the outer layer of skin or epidermis is affected. The skin is red and painful and may swell slightly but does not blister and heals quickly.
 - **Second-Degree Burn:** Damages the top layer of skin as well as a portion of the second layer of skin called the dermis. Symptoms are similar to a first degree burn but will often include blistering.
 - **Third-Degree Burn:** These burns go through both the first and second layers of skin to the layer of fat below. These burns can destroy nerves, leaving the area numb. A third-degree burn is considered severe and should receive immediate medical attention.
 - **Fourth-Degree Burn:** The most severe type of burn. These burns go through all the layers of skin and tissue to affect the muscles and bones. The skin may be blackened or charred or completely burned away. Due to the severe nerve damage, patients may feel no pain.
- **Cumulative Trauma & Repetitive Motion Injuries:** Cumulative Trauma Disorder (CTD) and Repetitive Stress Injuries are characterized as excessive wear and tear on the muscles, tendons and nerve tissues caused over time due to repetitive motion. These conditions are commonly caused by improper body mechanics, poor posture and the repetitive motions such as typing. Some common conditions include

carpal tunnel syndrome, cubital tunnel syndrome, tendonitis, bursitis, tennis elbow, and thoracic outlet syndrome.

Lung Disease: Lung diseases are some of the most common medical conditions and often a concern in certain work environments due to exposure to various dusts or chemicals (ex. coal, asbestos, silica, mold, etc.). Some common lung diseases are lung cancer, asthma, tuberculosis, emphysema, COPD (chronic obstructive pulmonary disease) and cystic fibrosis.

Diabetes Mellitus: A disease resulting in the body's inability to produce or respond to insulin, resulting in elevated levels of glucose in the blood (high blood sugar). Type 1 Diabetes is sometimes referred to as "juvenile diabetes" and is the result of the pancreas's inability to produce sufficient insulin. The cause of Type 1 Diabetes is unknown. Type 2 Diabetes is usually a result of lifestyle factors such as poor diet and lack of exercise and is the most common type of diabetes. It is characterized by the cells' resistance to insulin which may eventually lead to a reduced production of insulin.

Glaucoma: A condition caused by a buildup of pressure inside the eye which causes damage to the optic nerve and can lead to decreased vision or, in extreme cases, total blindness. Glaucoma is often inherited but can also be caused by trauma or infection.

Hypertension: Persistently high blood pressure in the arteries. A normal blood pressure is defined at 120/80. The first number is called the systolic pressure and is the amount of pressure within the arteries when the heart beats, pumping the blood. The second number is called diastolic pressure and is the pressure within the arteries when the heart is at rest. A blood pressure reading of 140/90 or higher is considered to be hypertension.

Arthritis: Arthritis is a general term referring to joint pain or joint disease. There are over 100 types of arthritis and related conditions. Symptoms often include pain, swelling, stiffness, and decreased range of motion. The most common type of arthritis is **osteoarthritis** which generally occurs with age. Over time the cartilage in the joints can wear away, allowing bone to rub against bone, causing pain, swelling and stiffness. Another common form of arthritis is inflammatory which includes rheumatoid and psoriatic arthritis. These are autoimmune conditions in which the immune system

Osteomyelitis: Infection and inflammation of the bone, often caused by staph infection.

Stroke: A condition caused when the blood supply to the brain is interrupted or reduced, depriving the brain of oxygen. Signs and symptoms can include weakness, sudden loss of speech or paralysis of one side of the body. A stroke is a serious condition that can lead to lasting brain damage, long term disability or even death and requires immediate emergency care.

Tachycardia: An excessively high heart rate. In adults, a heart rate above 100 beats per minute is considered tachycardia.

Atherosclerosis: The hardening and narrowing of the arteries. It is the most common cause of cardiovascular disease which includes heart attacks and strokes.

Coronary Thrombosis: A blood clot in the coronary artery which blocks the flow of blood to the heart

Mental Wellness: Mental Wellness is defined by the World Health Organization as "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community. Mental health can be affected by numerous internal and external factors including but not limited to relationships, finances, work issues and physical health.

Medical Tests

- **Laboratory Tests:** Tests performed in a laboratory using samples of blood, urine or body tissues
- **Radiography (X-Ray):** A common imaging test which uses electromagnetic waves to create images of internal structures of the body. X-rays are most commonly used to check for broken bones.
- **Magnetic Resonance Imaging (MRI):** A test that provides images of organs and internal structures using a magnetic field and pulses of radio wave energy. An MRI can provide information and identify problems that cannot be obtained via other imaging methods. MRI's are commonly done to diagnose problems such as tumors, injury, bleeding, infection, and more. A contrast material may be used during the test to show abnormal tissue more clearly.
- **Computerized Tomography (CT or CAT):** A CT scan uses a computer to combine a series of X-ray images taken from various angles into two-dimensional, cross-sectional images of bones, soft tissues and blood vessels. A CT Scan provides more information than a traditional X-ray and can be used to visualize nearly all parts of the body.
- **Electromyography (EMG):** A test used to assess the health of muscles and their respective nerve cells. The results of an EMG can identify nerve dysfunction, muscle dysfunction or problems with signal communication between the nerves and the muscle.
- **Nerve Conduction Studies:** This is another component of the EMG which uses electrodes attached to the skin to measure the speed and strength of the signal traveling between nerves. The nerve conduction study can identify nerve damage and destruction.
- **Myelography:** A test that uses X-rays or CT scans with a contrast dye injected into the spinal canal in order to identify problems in the spinal canal including the spinal cord, nerve roots and surrounding tissue. It has been used to diagnose conditions such as degenerative disk disease and spinal stenosis. Due to the invasive nature of myelography, MRI and CT scans have largely taken its place.
- **Arthroscopy:** A minimally invasive procedure in which a thin fiber optic scope is inserted into a joint space through a small incision. The operating surgeon can view the area on a monitor in order to diagnose and in some cases repair torn joint tissue.
- **Electrocardiogram (EKG or ECG):** A test that records the electrical activity of the heart as a line of spikes and dips (referred to as waves) on a strip of paper. It is used to identify abnormal heart rhythms and investigate the cause of chest pains.
- **Electroencephalography (EEG):** A test that detects electrical activity in the brain. It is most commonly used to show the type and location of activity in the brain during a seizure and has also been used to evaluate brain activity in patients suffering from impaired brain function due to problems including coma, tumors, long-term cognitive or memory problems and stroke.