Section Ten: Anatomy & Physiology

Estimated Contact Time:
120 -160 minutes

This module covers:

…the components, functions and the terminology associated with the study of the human body. It also describes illnesses that can affect the body and equipment that is used in treatment. This module is an overview, intended to help you become familiar with the human body so that you can better understand the supplies and equipment that are used in its care.

Following instruction, you should be able to perform the following:

- ☑ List ten major body systems and identify their role and function within the body.
- ☑ Identify terms associated with human anatomy and physiology. Locate (identify anatomical positions of) main components of each bodily system.
  - Identify articulation types
  - Diagram blood flow
  - Detail the digestive process
  - Detail the human reproductive process
- ☑ Identify the basic structure and function of a human cell.

Understanding the Human Body

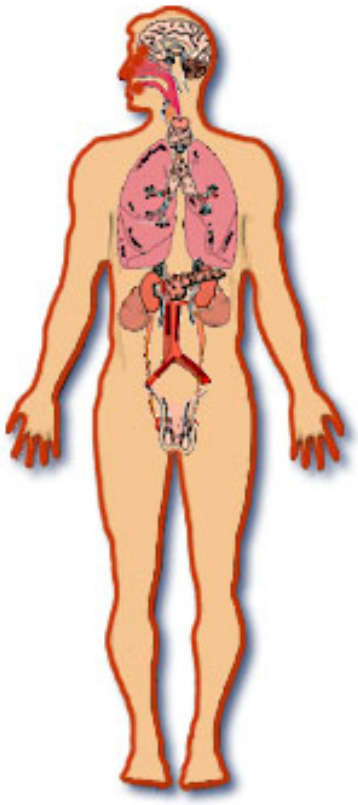
Your body is an incredibly sophisticated organism made up of billions of individual living cells. Cells combine into tissues, tissues combine into organs and organs combine to form systems. The systems allow you to walk, talk, breathe, think, and be you.

Anatomy is the study of the structure of the human body – its components and how they are put together. Even more amazing than the structures themselves, is how they work together to do what they do. ***Physiology*** is the study of how the body functions.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Medical supply technicians need a basic knowledge of human anatomy, physiology, and ***cytology*** in order to understand the reasons for policies and procedures regulating the processing, storing, and distribution of supplies and equipment used for patient care.

For convenience and to help understand how different components relate to one another, the study of the human body is often organized into systems.



- Skeletal
- Muscular
- Nervous
- Vascular
- Digestive
- Respiratory
- Urinary
- Reproductive
- Endocrine
- Sensory

A system is defined as a group of components that work together to perform a specific function. Each of the above systems has a specific job to do. The following sections describe each system.

Skeletal System

The skeletal system provides the framework for the other body systems and is composed of 206 bones. Bones have several important functions. They provide structure and support for the soft tissues, form protective cages around vital organs, allow movement by providing anchor points for muscles and manufacture red and white blood cells.

Bones are classified by their shape and composition. They can be long, short, flat or irregular and each shape can be cancellous

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

(spongy) or cortical (dense). They are made of calcium, phosphorus and bone marrow, making them both strong and light. The study of bones is called osetology.

Bones are made of connective tissue that is strong as steel but light as aluminum. The marrow is the center of the bone, where red blood cells are produced. The strong, flexible tissues that connect bones together are called ligaments. The point where two bones meet is called a joint. Joints allow the body to bend and move. Synovial fluid and membranes act as cushioning and lubricants in the joints, preventing the bones from rubbing together and causing damage. Bones are not completely rigid and can grow and regenerate after injuries.

Components

- **Long bones** – Include the bones of the arms and legs – the humerus, radius, fibula, and femur, the largest bone in the body. The ends of the long bones contain the soft tissue, which produces blood cells.
- **Short bones** – includes the bones of the fingers and toes – carpals, metacarpals, tarsals, metatarsals, and phalanges.
- **Flat** – Exist to protect vital organs. They include the ribs and scapula (shoulder blades).
- **Irregular bones** are found in the skull and pelvis. They include the illium, the bones of the skull and the smallest bones, the ossicles of the middle ear.
- **Cartilage** – Most bones start out as cartilage and ossify or harden as they mature. The ends of the long bones are covered with cartilage. It forms into columns that push older cells toward the middle of the bone shaft – causing the bone to lengthen or grow. Most bones stop growing between the ages of 17 and 25.
- **Ligaments** – strong bands of connective tissue which help to hold the bones in place and provide stability to joints (bone-to-bone).
- **Tendons** – strong connective tissue that connects muscle to the bone.
- **Bone marrow** – Bone marrow produces red blood cells.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

- **Spinal column** - The spinal column holds the body upright, supports the skull and protects the spinal cord.

Terms and Procedures

There are a number of conditions that affect the skeleton. A broken bone is called a fracture. Osteolitis is the inflammation of a bone. Osteoporosis is a decrease in the bone density causing the bone to become thinner and more porous. It can lead to fractures and curvature of the spine. Disk prolapse is when the pad of cartilage between spinal vertebrae ruptures. A microdiskectomy is an operation to repair this damage. A craniotomy is any operation on the cranium (skull), and the instrument that would be used to cut the cranium is a craniotome.

Terminology

- **cephal** - head
- **crano** - skull
- **osteo** - bone
- **sacro** - sacrum *(tailbone)*
- **thoraco** - chest
- **ischi -** hip
- **calc** - foot *(calcaneous bone)*
- **costa** - rib
- **oss** – bone

Joints

A joint is formed where two bones meet. The study of joints is called arthrology. Joints are classified by the way they move and there are three distinct types in the human body.

- *Fibrous or fixed joints* (synarthrosis) allow limited movement, generally for growth. As the body matures, the joints harden and movement ceases. Fibrous joints are held together by ligaments. Ligaments are tough, collagenous bundles of tissue that allow very little movement. The connections between the bony plates of the skull and the attachment of the teeth to the jawbone are examples of this type of joint.
- *Cartilagenous joints* (amphiarthrosis) are held together by cartilage and are partially moveable. The spinal column is an example of a cartilagenous joint. A thick disk of cartilage connects the individual vertebrae and allows the column of bone to twist and bend. It also absorbs most of the impact from the force of walking.
- *Synovial joints* (diarthrosis) move in many directions. The ends of the bone are connected by ligaments and cartilage, but separated by a cavity filled with synovial fluid. Synovial fluid is

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

a clear, sticky liquid that helps lubricate and protect the joint as it moves. The shoulder, elbow, knee, wrist, and ankles are examples of this type of joint.

Terms used to describe joints:

- **synovial membrane** – thin delicate layer of connective tissue which secretes thick, viscuous synovial fluid, there are three types which occur in joints; bursal, articular, and vaginal.
- **cartilage** – Slick, elastic tissue that thinly covers bones, helping to prevent friction when bones touch, found in joints.
- **fibrous membrane** – The strong, lining or coating around membranes.
- An **arthrotome** is an instrument used to cut into a joint.
- An **arthroscope** is an endoscope which is used to view the interior of a joint.
- A **chondrectomy** would be the surgical removal of a cartilage.

Terminology

- **artho** - joint
- **chondro** - cartilage
- **articul** - joint
- **fibro** - connective tissue
- **synovi** - synovial fluid

Muscular System

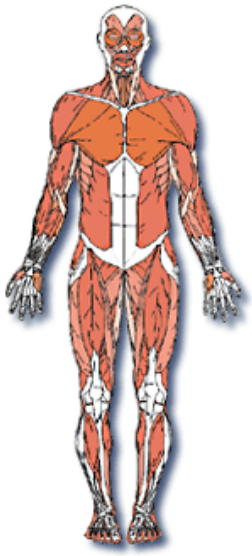
All the body's movements are powered by muscles. Different types of muscles enable motion, generate heat to maintain body temperature, move food through the digestive tract and contract the heart. There are more than 600 muscles in the human body. They can be divided into several types:

- **voluntary** (or skeletal),
- **involuntary** (or visceral), and a subcategory of involuntary,
- **cardiac** (heart).

Voluntary

The voluntary or skeletal muscles are the ones that are attached to bones and allow you to move about. They are also called striated muscles because under a microscope they appear striped.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.



Voluntary muscles are made up of bundles of muscle fibers and are attached to bones by tendons, which are tough, white, cords of inelastic muscle tissue. Movement occurs when these bundles contract and extend. Many of these muscles are arranged in pairs across a joint; one contracts and pulls the bone, then relaxes while it's partner contracts and pulls it back.

Involuntary

Involuntary muscles (visceral) provide for the movement of blood throughout the vascular system. They also aid in the digestion of food. *Peristalisis* is the wavelike motion of the muscles of the large and small intestine which pushes food through. Involuntary muscles are under the control of the autonomic nervous system and are not consciously controlled. These muscles are also found in the various glands of the human body, blood vessels, and the uterus. These types of muscles are made up of much smaller muscle fibers and do not appear striped under the microscope. They appear smoother and are often referred to as smooth muscles.

Cardiac

The cardiac muscle is unique in that the muscle fibers interlace with one another and have very small amounts of connective tissue at their joining. No other muscle in the human body has this distinction. This type of muscle contracts and relaxes in a slow rhythmic action. The sounds created by the movement of this muscle can determine normal or abnormal functioning of the heart.

Did you know?

The cardiac muscle wins the endurance award. From the moment it begins beating until the moment it stops, the human heart beats nonstop. In an average lifetime, the heart beats more than two and a half billion times, without ever pausing to rest.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Terms and Procedures

- **Myology** is the study of muscles.
- **Myopathy** is disease of a muscle.
- **Tendonitis** is the inflammation of a tendon.
- A **myotome** is a surgical instrument used to cut a muscle.

Terminology
my - muscle
ten - tendon

Due to the current focus on personal training and fitness, the names of many muscles are familiar to most people.
How many do you recognize?

Mastoid	Aductor longus	Gluteus maximus
Trapezius	Occipitofrontalis	Soleus
Deltoid	Mastoid	Vastus lateralis
Pectoral	Trapezius	Latissimus dorsi
Biceps	Deltoid	
Gluteus medius	Triceps	
Soleus	Biceps	

Did you know?
The word muscle is from the French “mus”, meaning “a mouse”.

Nervous System

Nerves help to control and coordinate the whole body, allowing it to receive stimuli from the environment and react to it. The nervous system has two divisions; the central system made up of the brain and spinal cord, and the peripheral system which consists of the nerve fibers, ganglia.

Components

The *central nervous system* has two components; the brain and the spinal cord. The spinal cord weighs about 35-40 grams and is about 43 cm long in adult women and 45 cm long in adult men. The vertebral column, the collection of bones (back bone) that houses the spinal cord, is about 70 cm long. Therefore, the spinal cord is much shorter than the vertebral column.

The contents of this manual are the sole property of the Department of Veteran’s Affairs and may not be used or reproduced without permission.

- **Brain** – The brain is the command center for the central nervous system; without its interaction the human body is considered clinically dead. The medulla oblongata, which is located at the base of the brain, controls our heartbeat, respiration, and body temperature.
- The **cerebellum**, which is located at the back of the brain behind the medulla oblongata, controls equilibrium, body balance, and muscle coordination.
- The **cerebrum**, which is located above the cerebellum in the back of the brain, is the largest part and controls our memory and thought processes, our voluntary impulses (decisions and movements), and interpretation of all sensory nerve impulses (information). In the average adult human, the brain weighs about 3 pounds and contains about 100 billion nerve cells (neurons) and trillions of "support cells" called glia.
- **Spinal cord** - The spinal cord is the main pathway for information connecting the brain and peripheral nervous system. It consists of a large bundle of neurons, which branch off into ganglia, which in turn are the beginning of the peripheral nervous system.
- The *peripheral nervous system* extends out to all other parts of the body where it picks up stimuli and returns it to the spinal cord and brain for interpretation and response messages.

Terms and procedures

- **Nerve fibers** - Nerve cells or ***neurons*** connect all parts of the human body in order to receive, process, and send messages. The nerve cell has three parts: the body, which is the nerve cell; the dendrite, which is responsible for receiving incoming messages and

Terminology

- **encephalo** - brain
- **myel** - spine
- **mening** - membrane
- **neuro** - nerve
- **spina** - spinal cord

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

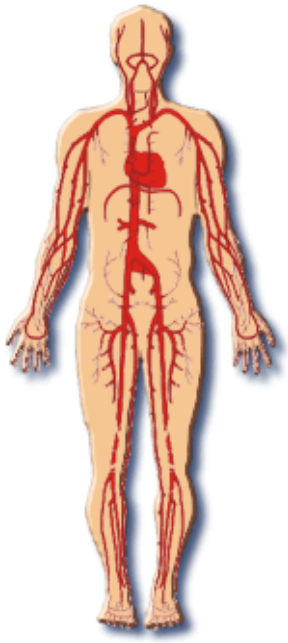
resembles tree branches and, and the axon, which is generally a single extension that transmits messages to the next neuron.

Nerve cells do not reproduce themselves.
Once they are destroyed or damaged they will not be replaced.

-
- ***Ganglia*** are connections between the spinal cord and the peripheral nervous system.
- ***Spinal meningitis*** is an inflammation of the membranes covering the spinal cord.
- ***Neuritis*** is the inflammation of a neuron/nerve.
- When an ***EEG*** is ordered for a patient, a test using an electroencephalograph records the electrical activity of the brain.
- A ***myelogram tray*** contains instruments and supplies used for a diagnostic photograph of the spinal cord by introducing a radiopaque dye.

Vascular System

The vascular or circulatory system has two components, the lymphatic system and the blood vascular system**.**



Blood Vascular

The blood vascular system consists of the heart, arteries, arterioles, capillaries, venules, veins, and blood. It is responsible for transporting oxygen, nutrients, minerals, chemicals, disease fighting cells, and hormones to all parts of the body and removing waste products and carbon dioxide. The circulatory system allows us to regulate body temperature and *electrolyte* balance.

Components

The **heart** is a four-chambered muscular pump which facilitates the circulation of blood. The right atrium receives blood from the body and pumps it into the right ventricle. From

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

there it travels to the lungs where it picks up oxygen, and then back to the the left atrium and the left ventricle. These chambers contract in pairs, first the atriums and then the ventricles.

The **right atrium** receives blood from the upper part of the body through the superior vena cava and from the lower part of the body through the inferior vena cava**.** It is then pumped into the right ventricle. The **right ventricle** pumps blood through the pulmonary arteries into the lungs where it receives oxygen. The **left atrium** then receives the blood from the lungs via the pulmonary veins. The pulmonary arteries and veins are unique in that the pulmonary arteries are the only arteries in the body that carry unoxygenated blood and the pulmonary veins are the only veins in the body that carry oxygenated blood. From the left atrium the blood flows into the **left ventricle**, which pumps it out through the aorta, the largest artery in the body.

Did you know?

The heartbeat sound is caused by the valves between the atriums and the ventricles opening and closing.

Arteries (except for the pulmonary arteries) carry oxygenated blood away from the heart to the tissues of the body. Arteries branch off into **arterioles**, which further branch off into **capillaries. Capillaries** are where nutrients, oxygen, and other products are absorbed for use by the body's tissues.

Veins (except for the pulmonary veins) carry deoxygenated blood back to the heart from the tissues. The venous system relies on daily activities to push blood back to the heart. The simple act of walking causes muscles in the legs to contract and extend which squeezes and pushes blood along the veins. Waste products are removed from the tissues by **venules**, which are branches of the veins.

Blood is the fluid that is circulated through the heart, arteries, capillaries, and veins. Blood carries nutrients and oxygen to the body's cells and removes wastes. It consists of:

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

- **plasma** - a pale yellow liquid which gives the blood it's volume,
- **erythrocytes** - red blood cells that are saturated with *hemoglobin* **(**Oxygen attaches to the hemoglobin and is carried to the cells),
- **leukocytes** - white blood cells which vary in size and are focused on destroying pathogenic organisms. White blood cells seek out and attack unknown substances and pathogens. If a white blood cell is alerted to the presence of unwanted bacteria in the blood, it will find the bacteria and surround it. After a type of white blood cell (a T cell) has the bacteria trapped, it releases a deadly toxin that destroys the bacteria by breaking its outer membrane.
- **thrombocytes** - platelets which aid in the clotting of blood.

Terminology

- **angio** - vessel
- **arterio** - artery
- **cardio** - heart
- **erythr** - red
- **hemo** - blood
- **leuko** - white
- **phleb** - vein
- **vas** - vessel

Did you know?

There are approximately 5 quarts of blood, recycled through the heart once every minute, in the average adult body. In 24 hours, 7,200 quarts of blood pass through the heart.

Terms and Procedures

With the prevalence of heart disease, many of the terms associated with the vascular system are becoming household words. ***Angina*** is the term for chest pains that come on with exertion, signaling that the heart muscle is not getting enough oxygen. ***Atherosclerosis*** is the build up of fatty deposits in arteries, is usually the cause of coronary heart disease. Buildup in critical areas can require a surgical procedure called balloon angioplasty, where a balloon catheter is inserted to clear out a blocked artery. A swelling in a weak section of an artery wall is called an ***aneurysm.***

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Blood clots can lead to ***thrombophlebitis*** (inflammation of a vein). If a blood clot (***thrombosis***) becomes mobile and occludes (completely blocks) a vessel in the heart, it can cause a heart attack. Thigh-length and knee-length compression devices are used on bed-ridden patients to prevent venous stasis (pooling of blood in the extremities).

A ***defibrillator*** is a device that is designed to deliver an electric shock to the heart muscle to regulate or restart contractions. If someone's heart requires constant stimulation, a battery operated pacemaker may be installed in the chest wall to regulate heart contractions by electrical impulse. ***Hemostats*** are clamps that are used to prevent bleeding from blood vessels during surgery.

Problem	Description	Treatment
Arrhythmia	Irregular heartbeat	Pacemaker
Atherosclerosis	Build up of fatty deposits in artery	Balloon angioplasty
Hypertension	Persistently elevated arterial blood pressure	Lifestyle changes and drug therapy
Pericarditis	Inflamation of the membrane surrounding the heart	Anti-inflammatory drugs and sometimes surgery
Myocardial infarction	Heart attack	Coronary artery bypass

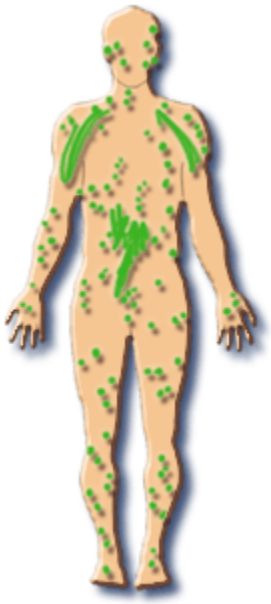
Lymphatic System

The lymph system has two main functions:

- draining excess fluid and removing dead white blood cells, then transporting them away from tissues and;
- helping the body fight infection by manufacturing and distributing white blood cells.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

The lymphatic system consists of thin walled capillaries, larger lymphatic vessels, and lymph nodes. Lymph is constantly moving around the body. Unlike the heart-driven circulatory system, the lymphatic system has no pump but circulates by means of the movement of the body's muscles. Exercise and exertion helps push fluid from the body tissues through the lymphatic system.



Components

- **Lymph vessels** – The lymph system contains a network of vessels that assists in circulating body fluids. These vessels carry *lymph* - a clear, watery fluid containing lymphocytes, and their main function is to act as "drains" to collect excess fluid, transport it away from interstitial spaces in body tissue and return it to the bloodstream. Lymph vessels are found throughout the body and can be superficial, lying just beneath the skin, or deep, dispersed throughout the tissue of the cranial, thoracic, and abdominal cavities.
- **Lymph nodes** – Filter out destroyed microorganisms and are largely responsible for our disease fighting processes. Cells that eat up disease producing cells, called lymphocytes are concentrated in the lymph nodes and, as the lymph fluid passes through the nodes, it is filtered, recycled and directed back to the vascular system for recirculation throughout the body. The lymph nodes are located throughout the body along the lymph vessels. They are imbedded deeply in connective tissue so they are rarely seen. They are found in larger clusters in the axillary (arm pit area), inguinal (pubic/groin region), and cervical regions of the body.
- **Tonsils** – A pair of masses of lymphoid tissue located on either side of the throat.

Terminology

- **lymph** - water *(lymphatic)*

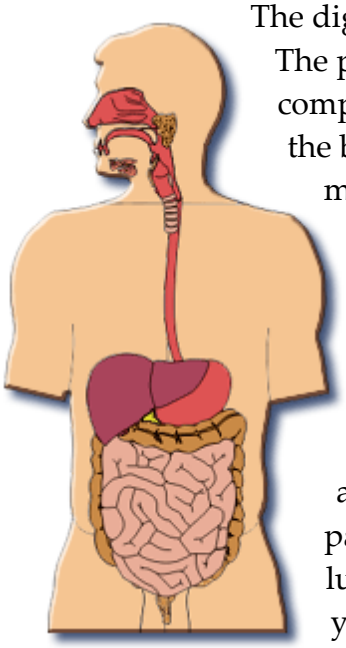
Terms and Procedures

- **Tonsillitis** is a bacterial or viral infection of the lymphoid tissue of tonsils. **Tonsillectomy** is the removal of the tonsils.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

- **Lymphangitis** is a bacterial infection that has spread from its initial site (skin cut, etc.) to nearby lymph glands.
- **Lymphomas** – is the medical term for cancer. The specific cause is unknown, but it is thought to be associated with the complex chemical processes associated with the body's immune defenses. Treatment often involves chemotherapy, radiation, or removal of the affected area.

Digestive System



The digestive system is responsible for the digestion of food. The process involves the breaking down of large, complex compounds into simple ones that are easily absorbed into the blood stream and transported to the body's cells. The main functions of the digestive system are to take in nutrients and eliminate waste. The digestive system is basically a 30-foot long tube, (**alimentary canal**) that runs from the mouth to the anus, and acts as a conduit for the digestive process. Digestion starts before you ever take a bite, when the sight and smell of food causes the central nervous system to alert the accessory organs. These organs; the salivary glands, pancreas, and stomach, secrete a watery solution that lubricates the alimentary canal and make it easier for your body to break down the food. The solution contains enzymes that help prepare the food to be absorbed into your bloodstream. The movement of food is helped along by peristalsis, the wave like motion caused by the involuntary muscles of the alimentary canal.

Almost all the organs that make up the digestive system can be bypassed or removed, and life can still be maintained, using feeding tubes which deliver nutrients either through the nose/mouth or directly into the stomach or small intestine. Administration of insulin and synthetic pancreatic enzymes can replace the loss of function of the pancreas. The liver's function cannot be replaced.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Components

- ***Mouth*** – In the mouth, food is mixed with saliva (which is secreted by the salivary glands) chewed, and swallowed.
- ***Esophagus*** – The muscular tube through which food passes from the mouth to the stomach.
- ***Stomach*** – The stomach is a large muscular organ, which mixes the food with the secretions from the gastric glands and converts the contents into a semi-liquid called ***chyme***.
- ***Small intestine*** – Most of the absorption of nutrients and water takes place in the small intestine which is divided into three parts: the duodenum, jejunum, and the ileum. The small intestine is the longest segment of the alimentary canal, averaging about 23 feet in length. In the small intestine, chyme is mixed with secretions from the liver, biliary tract and the pancreas, breaking it into compounds that can be readily absorbed into the bloodstream.
- ***Large intestine*** – Material that is not absorbed in the small intestine flows into the large intestine where more water is absorbed into the bloodstream. The large intestine consists of five sections:
    - the ascending colon,
    - transverse colon,
    - descending colon,
    - sigmoid colon,
    - rectum, and
    - anus.
- ***Rectum*** – Collection site for solid waste matter.
- ***Anus*** – Strong circular muscle through which fecal matter (solid waste) is excreted from the body.
- ***Biliary tract*** – The biliary tract secretes and transports bile for use in digestion. It includes the hepatic duct which drains from the liver, the cystic duct which drains from the gall bladder and the common bile duct which leads to the small intestine.
- ***Salivary glands*** – Located in the mouth, the salivary glands are responsible for production and secretion of saliva (spit).

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

- ***Pancreas*** – a large gland that secretes digestive enzymes that help break down proteins, carbohydrates and fats. It secretes insulin into the digestive system via the pancreatic duct.
- ***Liver*** – The liver secretes bile for use in digestion. It is also responsible for purifying blood by removing and breaking down chemicals that could be harmful to the body. Without the liver, life cannot be sustained.
- ***Gall bladder*** – The gall bladder stores bile until it is needed for digestion. Bile is required for the breakdown of fats into simpler compounds.
- ***Spleen*** – acts as a reservoir for red blood cells, and supplies additional ones as needed for digestion

Terms and Procedures

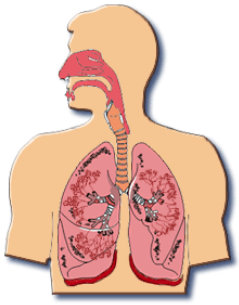
A ***cholecystectomy*** is the surgical removal of the gall bladder. A ***colonoscopy*** is the visual inspection of the colon using a flexible endoscope. A proctoscope allows examination of the rectum and anus. A gastroscope is used to view the stomach.

Stomatitis is the inflammation of an opening, while ***ileostomy*** means the surgical creation of a stoma (mouth) in the ileum, through the abdominal wall, for the removal of fecal wastes.

Terminology

- **chol** - bile
- **col** - colon
- **gastro** - stomach
- **gloss** - tongue
- **hepat** - liver
- **ileum** - small intestines
- **insul** - insulin
- **oral** - mouth
- **proct** - anus
- **sial** - saliva
- **stomata** – mouth*(opening)*

Respiratory System



The primary function of the respiratory system is to supply oxygen and remove carbon dioxide through ventilation or breathing. Oxygen enters the mouth and the nose, and passes through the ***larynx*** and the ***trachea***. The trachea splits into two smaller tubes called the ***bronchi***, which then divide into ***bronchial tubes***. The bronchial tubes lead directly into the lungs where they subdivide many times, ending in tiny sacs called ***alveoli***.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Oxygen passes into the blood stream from the aveoli through ***capillaries***. Carbon dioxide from the blood enters the alveoli and travels back up the same path on the return breath. This exchange of oxygen and carbon dioxide at the cellular level is called respiration.

The main components of the respiratory system are often referred to as the respiratory tree because they resemble an upside down tree with the trachea as the trunk and the bronchioles and alveoli as stems and leaves. Infections of the respiratory tree are very common and are often caused by viruses or bacteria that flourish in the warm moist air.

Components

- ***Nostrils*** (nose) – Opening for drawing in and exhaling air. When air first enters, it is warmed, moistened, and filtered by mucous and tiny hairs called cilia.
- ***Pharynx*** – The part of the alimentary canal situated between the mouth cavity and the esophagus that communicates through the Eustachian tubes to the ears.
- ***Larynx*** (voice box) - The larynx contains the vocal cords which vibrate as air from the lungs flows past them, creating sound.
- ***Trachea*** (windpipe) – The main airway to the lungs. The trachea splits to form the bronchi.
- ***Bronchi*** – Air passages into the lungs through the bronchi which branch off into progressively smaller passageways.
- ***Lungs*** – Each lung contains a tree of branching tubes that end in tiny air sacs called alveoli.
- ***Alveoli*** – Very small air sacs at the tips of the respiratory branches. This is where oxygen and carbon dioxide are exchanged into the bloodstream.
- ***Diaphragm*** – The diaphragm is a sheet of muscles that lies across the bottom of the chest cavity separating the thoracic and abdominal cavities. Its job is to help expand and contract the lungs, pulling air in and then pushing it out.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Did you know?

The diaphragm is the main respiratory muscle. It expands and contracts about 12 to 17 times a minute, drawing in and pushing out about a pint of air with each breath. The rate and volume of air increase automatically if the body requires a greater oxygen supply.

Terms and Procedures

Respiratory infections are very common. They range from colds and bronchitis to emphysema and pneumonia (inflammation of the lungs). A ***pneumothorax*** is a collapsed lung.

Breathing is ***autonomic*** – the body does it without conscious thought. A respiratory center in the brain responds to levels of carbon dioxide in the blood and regulates the expansion and contraction of the lungs. When a patient is not getting enough oxygen they are said to be ***cyanotic*** (blue). A ***thoracotomy*** tray contains instruments used in making a surgical incision into the chest cavity.

Terminology

- **aer** - air
- **bronchi** - windpipe
- **cyan** - blue
- **nas** - nose
- **thorac** – chest
- **pleura** – lining of the lungs
- **pne** - breathing
- **pneum** - breath, air
- **pneumo** - lung
- **rhin** - nose
- **sin** - sinus (fold, hollow)
- **trache** - windpipe (trachea)
- **spir** - breathing

Urinary System

The urinary or renal system is responsible for filtering the blood and removing waste. This results in the formation and elimination of urine. The human body excretes about one and one-half quarts of urine daily.

Components

- ***Kidneys*** – Two bean-shaped organs located in the back upper left and right quadrants of the abdominal cavity. Tiny filtering units in the kidneys, called nephrons, form urine by removing waste liquids and excess water, salts, sugar, and protein from

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

the blood. When you hear the word *nephro* it is referring to the kidneys.

Terminology

- **uro** - urine
- **neph** - kidney
- **cysto** - bladder

- ***Ureters*** – The ureters are thick walled tubes, up to 15 inches long, that connect each kidney to the urinary bladder. If they become blocked by a kidney stone or from renal diseases, the kidneys will continue to produce urine and eventually be destroyed.
- ***Bladder*** – A muscular sac where liquid wastes form the ureters are collected. The bladder stores the urine until it is eliminated outside of the body through the urethra. The bladder normally rests in the pelvic cavity but, as it fills with urine, it can rise up into the abdominal cavity.
- ***Urethra*** – The channel through which urine passes from the bladder, out of the body. In males, the ***prostrate gland*** encircles the urethra at the bladder's base.

Terms and Procedures

Hemodialysis is the process of removing waste products by artificial means. Blood is filtered through a dialysis machine which filters wastes from the blood. This must be done up to 3 days a week and takes about 4 hours.

Substances in the urine can concentrate and harden to form ***kidney stones***. If they do not pass out of the urethra on their own surgery may be required to remove them.

Incontinence is the involuntary leakage of urine and is more prevalent in women than in men.

Did you know?

The kidneys can filter one quart of blood per minute or 360 gallons per day.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Reproductive System

The reproductive system is responsible for reproduction and producing hormones which influence the development of feminine and masculine characteristics.

The purpose of the reproductive system is creation of a new human being. The main organs of the male reproductive system are the testicles, the vans deferens, the prostate and the penis. The main organs of the female reproductive system are the mammary glands, ovaries, fallopian tubes and the uterus. The uterus provides the nest where a fertilized egg grows and develops into a baby.

Components

The reproductive system in the female is comprised of the ovaries, fallopian tubes, uterus, vagina (birth canal), and mammary glands.

- **Ovary** –The ovaries are almond-shaped organs that produce ova (eggs) that contain the female genes. They also produce the female hormones estrogen and progesterone, which regulate the menstrual cycle and produce the development of secondary feminine characteristics. At puberty, the folicles in the ovary begin to release ova or eggs, one or more mature every month and make their way down the fallopian tube into the uterus.
- **Fallopian tube** – There are two fallopian tubes, one on each side, which connect the ovaries to the uterus. They have funnel shaped ends with fringelike projections that surround the ovary and receive any ovum that are released.
- **Uterus** – If the egg is fertilized it implants itself in the endometrium – the lining – of the uterus, where it stays to be grown and nourished for 40 weeks. If no egg is fertilized, part of the lining sloughs off every month as part of the menstrual flow.
- **Cervix** – The lower, narrow opening at the bottom of the uterus. During the birth process it must widen or dialate to more than 10 times it's normal size.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

- **Vagina** – A muscular passageway between the uterus and the outside world, the vagina is lined with a mucous membrane which provides lubrication and creates an acidic environment that serves as a barrier to germs.
- **Clitoris** – The female equivalent of the penis, this organ contains spongy erectile tissue and nerve endings.
- The **mammary glands** (breasts), under hormonal control, fill with milk after child birth. Breast milk is nutritious, easily digested, and contains the mother's antibodies which will nourish and protect the child from diseases.

Terminology

- **lact** - milk
- **mamm** - breast
- **mast** - breast
- **colpo** – vagina
- **ooph** - ovary
- **orchi** - testicle
- **gyn** - women
- **ova** - egg
- **hyster** - womb
- **salping** – tube
- **sperm** - seed
- **test** - testicle

The male reproductive system consists of the testes (testicles), penis, the vans deferens and prostate gland.

- **Penis** – The external appendage used for urination and sexual intercourse. Enclosing the lower section of the urethra, the penis is composed of columns of spongy erectile tissue. When these fill with blood, the penis becomes erect.
- **Prostrate gland** – a donut shaped organ, wrapped around the base of the bladder, the prostate gland produces a milky white alkaline secretion that becomes part of the seminal fluid. This fluid allows for the mobility of the sperm and protects it from the acidic conditions of the female vagina.
- **Vas deferens** – the tube that leads form the testicle to the prostrate gland
- **Epididymis** – A long coiled tube leading form the testes where sperm mature and are stored until ejaculated or reabsorbed into the body.
- **Testes** – A pair of rounded glands that lie in the scrotum. The testes produce spermatazoa which carry the male genes and the male sex hormone testosterone which is responsible for secondary male characteristics such as body hair.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

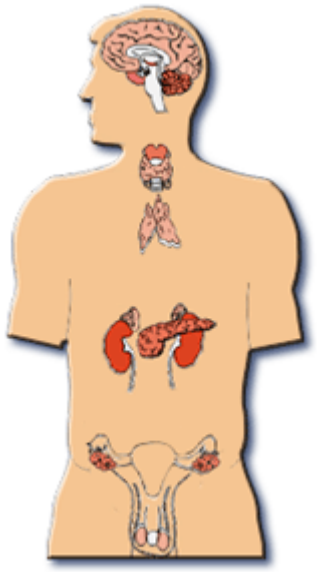
- **Seminal vesicle** – Produces a sugary fluid that provides the energy necessary for the sperm to swim.

Terms and procedures

- A ***hysterectomy*** is the surgical removal of the uterus.
- An ***orchiectomy*** is the surgical removal of a testicle.
- A ***mammogram*** is an x-ray of the breasts to detect the presence of cancer.
- A ***prostatectomy*** is the surgical removal of the prostate gland.
- A ***gynecologist*** is a physician who specializes in the reproductive system and the diseases associated with women.

Endocrine System

The endocrine system is unique in that its components are not physically connected. The glands that comprise this system are located throughout the human body. The term endocrine means "to secrete from within." The glands do not have ducts and are sometimes referred to as the "ductless glands." The endocrine glands deliver their secretions directly into the bloodstream where they are directed throughout the body. The glands secrete substances called hormones. Hormones are chemical substances which tell other tissues of the body to perform a task. Some hormones even direct other endocrine glands.



Components

The endocrine glands, though physically unconnected, are responsible for directing other parts of the body through the secretion of hormones. They are directly responsible for growth and development, the movement of chemicals in the body, blood pressure, labor and lactation, metabolism, stress responses, and other body functions.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

- **Pituitary gland** – Also called hypophysis, the pituitary is known as the master gland because it controls the functions of the other endocrine glands, helping to regulate skeletal growth, reproductive activities, muscle, and blood functions. In humans this gland is roughly the size of a garbanzo bean.

- **Thyroid gland** – Regulates metabolism and requires the compound iodine for normal function.
- **Parathyroid glands –** Control the amount of calcium in the blood. Usually there are four of these.
- **Adrenal glands** – Adrenal glands are responsible for how we respond to stressful situations. During emergency situations, the *suprarenals* secrete adrenalin which acts on smooth muscles, and increases the amount of glucose available for use by body tissues. This provides the energy necessary for the body to fight for its life or run away from the situation and is known as the "fight or flight" syndrome.

Terminology

- **adren** - adrenal gland *(suprarenal)*
- **insul** - insulin
- **thyr** - thyroid

- **Pancreatic islands** – Also called the islands of langerhans, these glands secrete insulin. Insulin regulates the sugar content of the body.
- **Ovaries** secrete hormones that control secondary female sex characteristics. These are covered more thoroughly in the reproductive section.
- **Testes** secrete hormones that control secondary male sex characteristics. These are covered more thoroughly in the reproductive section.
- **Thymus** – Regulates growth and *atrophies* with the completion of adolescence.

Terms and Procedures

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

An **insulin pump** is a device, implanted under the skin, which delivers synthetic insulin in order to allow the body to metabolize sugar.

Thyropenia is a condition where the thyroid gland does not produce enough thyroid hormones. **Hyperthryroidism** (Grave's disease) is associated with enlargement of the thyroid. Surgery may be required to relieve pressure on the trachea or esophagus. A **thyroidectomy** is the surgical removal of the thyroid gland.

Sensory System

The body takes in information from the environment through the sensory system. The eyes, ears, nose, tongue and skin all contain receptors which help the body see, hear, smell, taste, and feel stimuli. These sensations are then passed to the brain via nerves.

Sensory organs

Sensory organs are designed to receive and interpret messages from the sensory nerves providing the capability of sight, sound, smell, and taste.

- The **eyes** are globular organs of vision (sight). There are three layers;
  - **Sclera** - the white, dense, inelastic membrane that helps the eye maintain its globular shape and provides protection,
  - **Choroid** - the thin, dark brown middle layer
  - **Retina** – The rods and cones within the retina receive the light impressions which enter the eye through the pupil. The pupil, which is surrounded by a colored ring called the iris, dilates and constricts (by involuntary muscles) to control the amount of light which is reflected onto the retina by the lens. The rods and cones transmit the impressions to the brain by way of the optic nerves where they are interpreted.

- The **ear** is the sensory organ of hearing and equilibrium. It is divided into three parts:

The contents of this manual are the sole property of the Department of Veteran's Affairs an
used or reproduced without permission.

- outer ear,
- middle ear, and
- inner ear.

The outer ear protrudes from the sides of the head and collects sound waves which it directs to the ear drum. The ear drum then conducts the sound waves to the middle ear. Within the middle ear are three tiny, connected bones called the hammer, the anvil, and the *stirrup*. After receiving the sound waves, these tiny bones conduct (by vibrating) the sound waves into the inner ear. The inner ear contains the sensory nerves and as sound waves enter, they are converted into nerve impulses and are conducted to the brain for interpretation by the auditory nerves. The eustachian tube, which is located in the middle ear, connects the middle ear to the pharynx. This tube helps to equalize pressure on both sides of the ear drum.

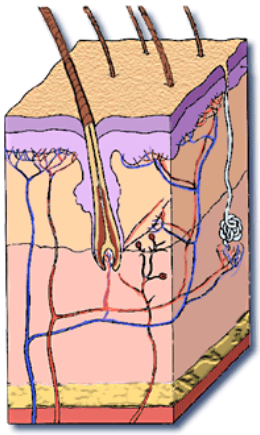
- The organ of smell is the **nose**. The sensory nerve cells for smell are located in the mucous membrane that lines the upper portion of the nasal cavity. As smells pass through the nasal cavity, they are transmitted to the brain by the olfactory sensory nerve.

- The **tongue** is the sensory organ of taste. Tiny buds cover the surface of the tongue and they are capable of distinguishing four kinds of taste: sweet, sour, bitter, and salty. The taste receptors (buds) are constantly being replaced by new cells.

- The **skin** or *integument* is often overlooked as a system, but it is one of the body's most important organs. Nerve cells in the skin help the body communicate with its environment by allowing it to perceive pressure, pain, heat, cold and touch. The skin also helps regulate temperature and moisture in the body and prevents harmful substances from entering. It plays an important role in maintaining homeostasis.
    - The primary function of skin is to provide protection from the environment. It creates a barrier against infection and helps contain body fluids to keep deep

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

tissues moist and viable. Keeping the skin intact decreases our susceptibility to disease. Large areas of skin loss, as in burns, can be fatal due to loss of body fluids and infection.



Components

- **Epidermis** – The thin layer of epithelial tissue that forms the outer layer of skin. Its outer surface is made up of dead skin cells which are constantly being sloughed off and replaced by new ones from the layer underneath. The epidermis contains only a few nerve cells and no blood vessels. There are many delicate creases in the outer surface which help give skin its elasticity. On the palms of the hands and the soles of the feet, there are ridges and grooves that form intricate patterns, which we call fingerprints and footprints. These textures allow us to grip things.
- **Dermis** – Lying beneath the epidermis, the dermis is a thick layer containing a dense network of blood vessels and nerve cells. The blood vessels, called capillaries, provide nutrients to the skin tissue and help to regulate body temperature by expanding and contracting to control the amount of blood that is circulated near the surface. The nerve cells act as receptors to the nervous system, allowing the body to perceive pressure, pain, heat, cold, and touch.
- **Cutaneous glands** – There are two types: sweat (sudoriferous) and oily (sebaceous). Sweat glands help regulate body temperature by producing sweat which is excreted to the skin surface where it evaporates, carrying excess heat with it. Oily glands are located around hair follicles and secrete sebum which coats and protects hair follicles. Most pimples are caused by infection or blockage of the area around these glands.
- **Hair follicle** – Hair and nails are appendages of the skin. They are composed of dead skin cells which are hardened by a natural substance called keratin. Hair follicles are surrounded by nerve cells which increase our sense of touch. They are also surrounded by tiny bundles of smooth muscles which contract in order to cause the sebaceous glands to secrete sebum. These

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

tiny clusters of smooth muscles are also responsible for giving rise to "goose bumps" when they contract as a group.

Did you know?

The patterns in a person's skin are unique. No two individuals have the same fingerprints or footprints, which is why they can be used to identify people.

Terms and Procedures

- A ***dermatologist*** is a physician who is concerned with the diagnosis and treatment of skin disorders. ***Dermatitis*** is an inflammation of the skin.
- Some skin cells release a pigment called melanin. Melanin determines skin color. Concentrations of melanin can produce freckles or moles. If a mole changes size, shape or color it may form a tumor or ***melanoma***. Melanoma may be malignant and should be removed.
- **Ophthalmoscopes** and **otoscopes** are instruments used to view the eyes, ears, and nose.
- A **rhinoplasty** tray contains surgical instruments used in nasal surgery.

Terminology

- **derm** - skin
- **hidr** - sweat
- **onych** - nail
- **sarc** - flesh
- **tact** – touch
- **gloss** - tongue
- **naso** - nose
- **sens** - sensory
- **ophthalm** - eye
- **ot** - ear
- **rhin** - nose

Cytology

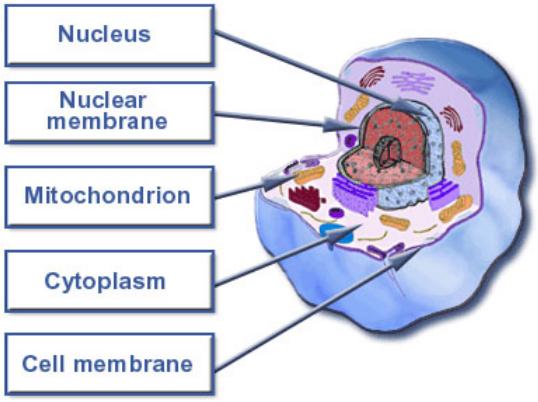
Cytology is the study of the structure and function of cells. Cells are the basic building blocks of all living things. Cells are microscopic in size and each specializes in a particular function. Your body is composed of over 100 trillion cells, but they are too small to be seen with the naked eye. It would take at least 100 of them to cover the surface of this period.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Although cells differ functionally, they all have common physical features and multiply by the same basic process. Cytology is necessary for the medical supply technician in order to understand how diseases are transmitted and how to control the spread of diseases through infection control mechanisms.

Components

- **Nucleus** – The nucleus of the cell contains DNA, a substance which carries information that determines the genetic or hereditary makeup of each individual. DNA (Deoxyribonucleic Acid) molecules are arranged as a double helix or double spiral chains which are connected together by amino acids. These connections are arranged specifically to generate individuals traits. During cell multiplication, DNA thins out into threads which become chromosomes. Each cell in the human body contains 46 chromosomes.
- **Nuclear membrane** – A nuclear membrane surrounds the nucleus. It is permeable – substances can pass through it.
- **Cytoplasm** – Cytoplasm is the jelly-like, filled area outside of the nuclear membrane. This area is the work area of the cell and contains numerous structures (intracellular bodies and organelles) that produce energy for the cells functions. Cellular functions include protein synthesis and cellular metabolism (growth, maintenance, and repair).
- **Cell membrane** - The cell membrane surrounds the cytoplasm.
- **Organelles** - Organelles are chemical structures that allow the cell to live and grow.
- **Mitochondria** – Mitochondria are little organs in the cytoplasm. They produce energy for the cell's use.



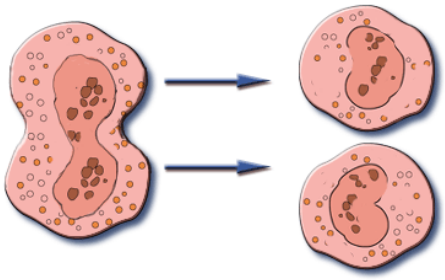
The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

There are about 200 different kinds of specialized cells in the human body. New cells are needed on a continuous basis and the requirements change as we age. From infancy to adolescence, the human body requires numerous new cells for growth and development. As we age, new cells are required to replace those that die.

The skeletal systems cells are replaced every 7 years. Taste buds in the mouth are replaced every 30 hours. Blood cells are in constant demand by the body. There are some types of cells that are not replaced as they age and die. The muscle and nerve cells are examples of cells that are not replaced.

Mitosis – Cell Reproduction

Cells multiply by a process called mitosis. When the process is completed, two identical cells emerge.



1. The process begins when the 46 chromosomes thicken, contract, and form 23 pairs.
2. The pairs make 23 exact copies of themselves through a process called replication.
3. When replication is completed, the 23 pairs line up along the center of the cell and the new chromosomes split and go to the opposite ends.
4. A new cell membrane forms across the middle of the cell, and the cell divides,
5. The chromosomes begin to lengthen, and two identical cells are formed.

Cancer is usually caused by cellular genes that have been abnormally activated or mutated. These cells are usually those that control cell growth and mitosis. These abnormal cells are called ***oncogenes***. We are still learning about what causes oncogenes and how they function. ***Oncology*** is the study of tumors.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Summary

In order to effectively perform the duties of an SPD technician, you must have a working knowledge of the main body systems, the problems that affect them and the procedures that are use din their treatment. This Module has provided an overview of the ten major systems and the terminology associated with each.

Skeletal

Bones are made of connective tissue that is strong as steel but light as aluminum. The marrow is the center of the bone, where red blood cells are produced. The strong, flexible tissues that connect bones together are called ligaments. The point where two bones meet is called a joint. Joints allow the body to bend and move. Synovial fluid and membranes act as cushioning and lubricants in the joints, preventing the bones from rubbing together and causing damage. Bones are not completely rigid and can grow and regenerate after injuries.

A joint is formed where two bones meet. Joints are classified by the way they move and there are three distinct types in the human body; fibrous or fixed, cartilaginous or partially movable, and synovial which are free moving and lined with a lubricant called synovial fluid. The study of joints is called arthrology.

Muscular

The muscular system covers most of the human body. Skeletal muscles expand and contract to move bones and allow us to walk, talk, and chew gum. We don't have to think about involuntary or smooth muscles. They work to maintain body functions like breathing and digestion. Cardiac muscles allow the chambers of the heart to expand and contract, circulating blood throughout the body.

Nervous

The nervous system allows your body to pick up information from the outside world and react to it. The brain is the control center for the whole body. It processes the messages from the peripheral nerves, decides how to react, and sends messages back to the motor nerves which tell the muscles and organs what to do. The

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

peripheral nervous system handles both conscious and unconscious or autonomic functions.

Vascular

The vascular system circulates blood, transporting oxygen, nutrients, minerals, chemicals, disease fighting cells, and hormones to all parts of the body. It is also responsible for removing waste products and carbon dioxide. The blood circulation part of this system allows us to regulate body temperature and electrolyte balance, while the lymphatic part removes excess fluid and helps the body fight infection.

Digestive

Digestion, the process of taking in food and breaking it into compounds that can be absorbed into the bloodstream, takes place in the digestive system. It includes the mouth, esophagus, stomach, small intestine, large intestine, rectum, anus, biliary tract, pancreas, salivary glands, and the liver.

Respiratory

The respiratory system supplies oxygen and removes carbon dioxide. It is composed of a series of branching components, often referred to as the respiratory tree; nostrils, pharynx, larynx, trachea, bronchi, alveoli, lungs and the diaphragm. Respiratory infections are very common. They range from colds and bronchitis to *emphysema* and pneumonia (inflammation of the lungs).

Urinary

The urinary system regulates the volume and composition of fluids in the body and removes waste products. This process enables the body to maintain homeostasis by controlling the acid-base balance of the blood and maintaining adequate levels of water, salts, proteins, and electrolytes (such as potassium). The urinary tract is susceptible to infection and to chronic disorders.

Reproductive

The reproductive system is responsible for reproduction and producing hormones which influence the development of feminine and masculine characteristics. The reproductive system in the

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

female is comprised of the ovaries, fallopian tubes, uterus, vagina (birth canal), and mammary glands.
The male reproductive system consists of the testes (testicles), penis, and prostate gland.

Endocrine

The term endocrine means "to secrete from within." The endocrine glands, though physically unconnected, are responsible for producing hormones which direct other parts of the body They are directly responsible for growth and development, the movement of chemicals in the body, blood pressure, labor and lactation, metabolism, stress responses, and other body functions.

Sensory

The eyes, ears, nose, tongue and skin all contain receptors which help the body see, hear, smell, taste, and feel stimuli. These sensations are then passed to the brain via nerves. The skin is one of the body's most important organs. It helps regulate temperature and moisture in the body and prevents harmful substances from entering. Keeping the skin intact decreases our susceptibility to disease. Nerve cells in the skin help the body communicate with its environment by allowing it to perceive pressure, pain, heat, cold and touch.

Cytology

Cytology is the study of cells. There are about 200 different kinds of specialized cells in the human body. Cell reproduction is called mitosis.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

✓ Check What You Know

1. Match each term to its description.

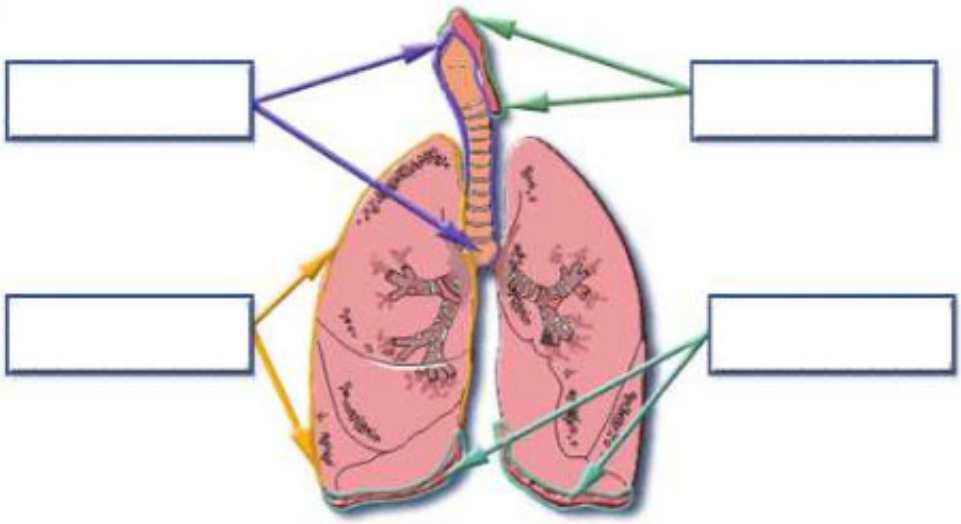
colonoscopy	a device used to view the stomach
proctoscope	the visual inspection of the colon by means of a flexible endoscope
gastroscope	device used to view the rectum and anal areas
stomatitis	surgical removal of the gall bladder
cholecystectomy	opening or mouth for the removal of fecal matter
ileostomy	surgical creation of an opening through the abdominal wall to the small intestine
stoma	inflammation of the mouth

2. Match the term to its meaning.

sebaceous	beneath the skin
dermis	flesh
sarc	sweat
hidr	skin
onych	nail
dermititis	oily
subcutaneous	skin infection

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

3. Label each component.



4. Match each respiratory term to its description.

_____ Allergic reaction which causes the smaller bronchi to constrict and become blocked with mucus

_____ Disease often brought on by long term smoking which causes the alveoli to rupture and burst

_____ Surgical procedure for removing a small portion of the lung, usually due to lung cancer

_____ Thin layered sac that encloses each lung

_____ Dome shaped muscle that separates the lungs from the abdominal cavity

a. Asthma
b. emphysema
c. lobectomy
d. bronchioscopy
e. pleural membranes
f. diaphragm

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

5. Match each urinary system component to its description.

_____ Has a muscular wall, the detrusor muscle, which expands or contracts to accommodate changing volume

_____ Main function is to regulate the acidity and concentration of water in the body

_____ Tube from bladder for draining urine

_____ The inability to control urine flow

_____ Liquid wastes removed from the blood stream

_____ Urine making unit of the kidney

_____ Concretions of minerals, mostly calcium, which form in the kidneys

a. Incontinence
b. Urethra
c. Bladder
d. Kidney
e. Calculi
f. Urine
g. Nephron

6. Match each term to the related phrase.

Vas deferens	non-cancerous uterine tumor
Scrotum	sperm passageway
Pelvic cavity	woman's wider than man's
Puberty	most common male cancer
Fibroid	temperature regulation
Endometriosis	cysts form female organs
Prostate	pap smear

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Cervical onset of sexual maturity

7. Which of these are important for maintaining a healthy lymphatic system?
   a. Drink adequate amounts of good quality water
   b. Eat nutritionally balanced meals
   c. Exercise regularly
   d. Avoid exposure to the causes of disease and infection
   e. Avoid pollutants, toxic substances and unhealthy environments
   f. Manage stress

8. Match each description to the proper term.

   ____ Delivers synthetic insulin to allow metabolism of sugar

   ____ Removal of the thyroid gland

   ____ Inadequate production of thyroid hormones

   ____ Adrenal gland

   ____ Regulates body's sugar content

   ____ Insulin secretion

   a. insulin pump
   b. thyroidectomy
   c. thyropenia
   d. suprarenal
   e. insulin
   f. islands of langerhans

9. _____ is the study of muscles.

10. The three types of muscles are:

_____, involuntary, and _____.

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

11. The nervous system has two divisions; the _____ which includes the brain and spinal cord, and the peripheral which consists of nerve fibers and ganglia.

12. _____ nerves control reflexive functions such as the working of the heart, stomach, lungs and intestines.

13. There are approximately _____ bones in the adult human body.

14. Bones are primarily composed of bone marrow, _____ and phosphorus.

15. What is the approximate amount of blood in the human body?

    a. 1 liter
    b. 26 pints
    c. gallons
    d. quarts

16. Match each term:

    ____ The study of the structure and function of cells

    ____ The study of growths formed by mutating cells

    ____ Cell reproduction

    ____ Threads of DNA formed in pairs

    ____ The jelly-like substance where cell metabolism occurs

    a. Cytology
    b. Oncology
    c. Mitosis
    d. Chromosomes
    e. Cytoplasm

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

Terminology

The following terms were used in this module.

arterioles	small terminal twigs of an artery that end in capillaries
arthrology	the study of joints
atrophies	decreases in size or wastes away
autonomic nervous system	away the portion that controls unconscious actions such as heartbeat and breathing
capillaries	the smallest of blood vessels which connect arterioles with venules
cartilage	a tough fibrous connective tissue (also known as gristle)
collagenous	composed of the insoluble, fibrous protein – collagen – which makes up the organic matter in bones and connective tissue
cyanotic	a bluish or purplish discoloration of the skin due to insufficient oxygen in the blood
dermis	the sensitive, vascular, inner layer of the skin
electrolyte	a nonmetallic electrical conductor in which current is carried by movement of ions
emphysema	a local or generalized condition of the lung, characterized by distension and loss of elasticity
endocrine	producing hormonal secretions that are distributed throughout the body via the bloodstream
epidermis	the outer layer of the skin
epithelial	membranous cellular tissue that covers a free body surface or lines a tube or cavity
hemoglobin	an iron containing pigment in red blood cells that helps to transport oxygen
hemostasis	stoppage or sluggishness of blood flow
homeostasis	resistance to change, the efforts of an organism to maintain

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.

	its equilibrium
hormones	chemical messenger, produced by a cell that effects changes in other cells
Inferior vena cava	the largest vein in the body, which returns blood to the right atrium of the heart from the lower body
lactation	the secretion and yielding of milk by the mammary gland
ligaments	a tough fibrous band of tissue that supports bones, particularly in and around joints
lymph nodes	a small oval gland, attached to lymph vessels and packed with white blood cells that act as a barrier to infection
Lymphatic system	an extensive network of transparent vessels, responsible for removing excess fluid form cells
lymphocytes	small white blood cell, part of the immune system, protects against viral infections and cancer
metabolism	chemical changes in living cells during which new material is taken in and energy is provided for vital processes
pathogenic	disease causing
peristalsis	a coordinated series of muscular contractions and relaxations in a tubular muscle wall (such as the stomach). It's purpose is to move contents along
secretion	the process of forming and releasing a material for a specific function (as in the salivary glands secrete saliva)
Superior vena cava	the second largest vein in the body, which returns blood to the right atrium of the heart from the upper body
tendons	a strong band of collagen fibers that join muscle to bone, and transmit the pull that is a muscle contraction
venous stasis	a slowing of the current of the blood in the veins

The contents of this manual are the sole property of the Department of Veteran's Affairs and may not be used or reproduced without permission.