

4N051, Module 5, Human Anatomy, Physiology, and Development



Lesson 1- Human Anatomy and Physiology

Lesson 2- Human Development

Lesson 1- Human Anatomy and Physiology

After completing this lesson, the student will be able to identify human anatomy and physiology principles in accordance with prescribed guidance and publications.

Descriptive Terms and Topographic Anatomy

Topographic Anatomy – The focus on descriptive terminology is used to define body areas and movements. The use of topographic terminology is very important in the medical profession. Proper use of these terms will ensure that accurate information about patient assessment and care procedures is communicated appropriately.

Anatomical Anatomy – Specific terms are used to describe anatomical relationships based on a reference point. For anatomical anatomy the professional world of medicine uses the anatomical position as the reference point which is a diagram of a human body standing upright, arms at the sides and palms facing forward. These terms are used to describe the location of one body part or marking in relationship to another part or marking. The table below lists each of the common terms used in the medical profession to describe body structure and area locations.

Term	Definition	Examples
Anterior (ventral)	Located at or toward the front of the body or body part.	Stomach is anterior to the kidneys. The nose is on the anterior surface of the head.
Posterior (dorsal)	Located at or toward the back of the body or body part.	Spine is posterior to the sternum. The kidneys are posterior to the stomach.
Medial	Located at or near the midline of the body or body part.	Sternum is medial to the ribs. The septum of the heart is medial to the left ventricle.
Lateral	Located away from the midline of the	Ribs are lateral to the sternum. The left

Term	Definition	Examples
	body or body part and toward the side of the body or body part.	ventricle of the heart is lateral to the septum.
Superior	Located toward the head or area of the body that is closer to the head.	Stomach is superior to the cecum. Eyes are superior to the mouth.
Inferior	Located toward the feet or area of the body that is closer to the feet.	Cecum is inferior to the liver.
Proximal	Located toward or closer to a given point or origin. Usually in relation to the trunk or midline of the body.	Pelvis is proximal to leg.
Distal	Located farther from a given point of origin. Usually used in relation to the trunk or midline of the body.	Hand is distal to the elbow. Foot is distal to the knee.

CONTINUE

Body Movement Terminology

These are various terms used to describe the movements of body parts. This section contains a list of the terminology used to describe the movement of various body parts in relation to the action that occurs. The tables below refers to common terms used to describe body structure and area locations when referring to the normal anatomical position of the human body, which is standing upright, arms at the sides, palms facing forward. Just as anatomical relationships, there are specific various terms used to describe the general and specific movement of the human body.

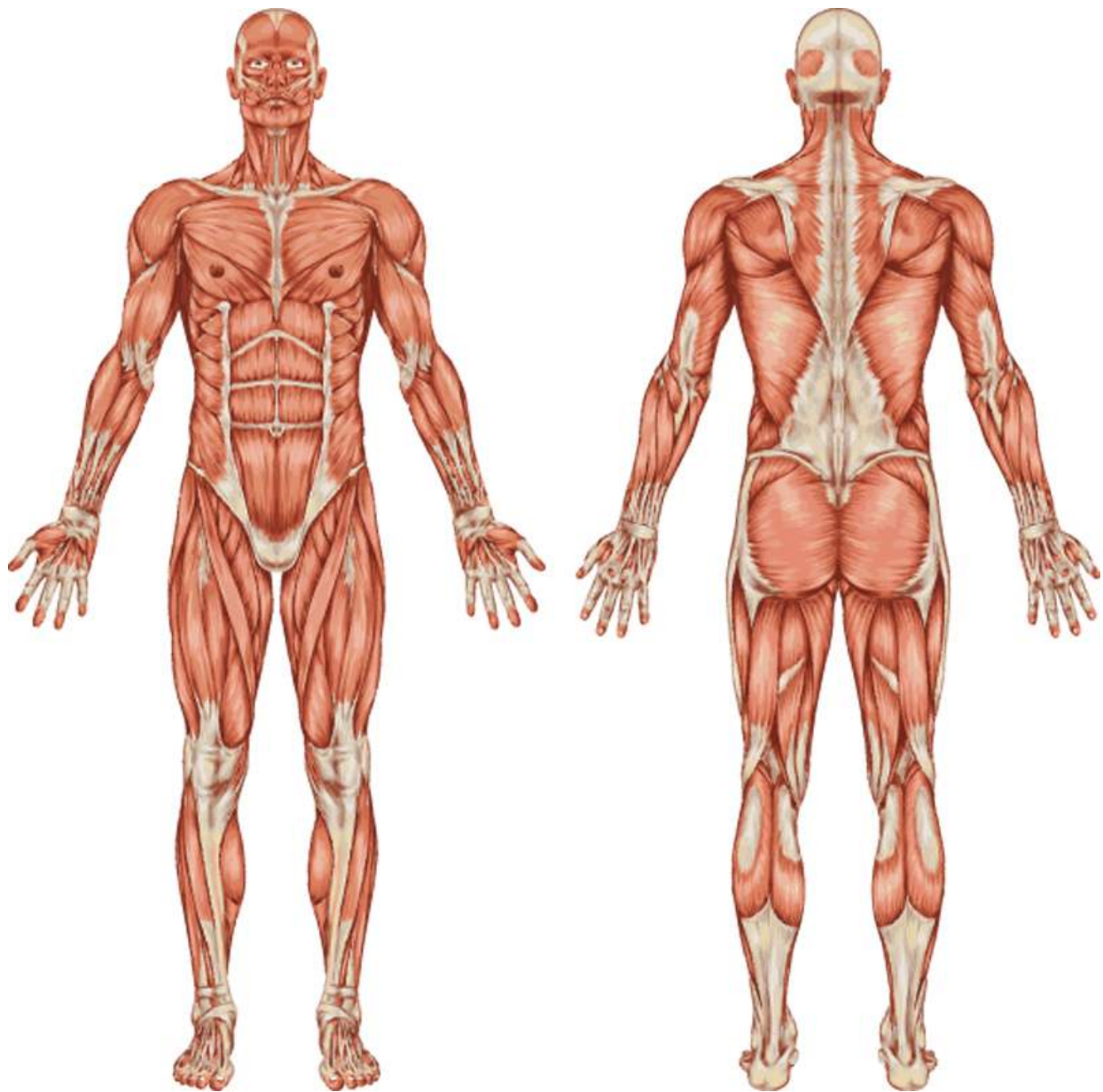
Term	Definition
Range of motion	The range, measured in degrees of a circle, through which a body part can be rotated, extended or flexed at a joint.
Longitudinal axis	An imaginary line that passes lengthwise through a portion of the body or a bone. This line divides the part equally and symmetrically.
Axis of joint rotation	A line projecting at right angles to the plane of motion. The axis of rotation for most joints' changes with the motion of the joint due to the joint's structure and the variety of angles in which it can be moved.

Specific Body Movements

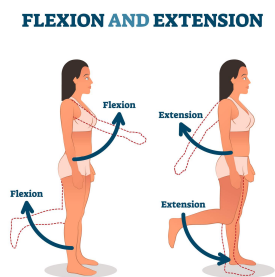
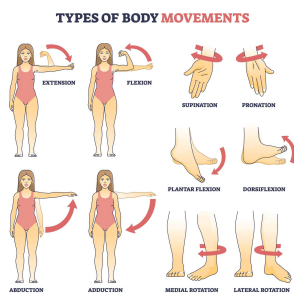
Term	Definition	Example
Rotation	A joint motion whereby a part moves or turns about its longitudinal axis.	Turning the head from side to side.
Circumduction	A movement whereby the distal end of a part makes a circle while the proximal portion of the part remains relatively stationary.	Making circles with the entire arm while it is stretched out.
Supination	The movement that rotates the forearm outward so that the palm of the hand faces forward.	Rotating the palms forward while the arms are hanging loosely at the side.
Pronation	The movement that rotates the forearm inward, causing the back of the hand to face forward.	Rotating the palms toward the back of the body while the arms are hanging loosely at the side.
Flexion	A motion described when adjacent body parts approach each other, thereby decreasing the angle between them. More simply stated, flexion is the act of folding, bending or withdrawing a body part.	Moving the forearm toward the head by bending the elbow (as in doing a “curl” with a weight).
Dorsiflexion	A special type of flexion used to	Pointing the toes toward the face.

Term	Definition	Example
	describe ankle and foot movement where the top (dorsal) surface of the foot moves closer to the leg, causing the angle between the anterior surface of the leg and the foot to decrease.	
Plantar flexion	Another type of flexion used to describe ankle/foot movement. The bottom (plantar) surface of the foot moves away from the leg, causing the angle between the anterior surface of the leg and the foot to increase.	Pointing the toes away from the face.
Extension	A movement, which increases the angle between two adjacent, body parts. Refers to a movement that causes the parts of an extremity to line up in a straight manner.	Standing with the arms facing outward or forward, then bringing them straight to the side (the position of attention).
Hyperextension	A type of extension where a body part is extended or stretched beyond its normal anatomical position.	Standing in the normal anatomical position, then moving the head backward (as if looking up in the sky).

Term	Definition	Example
Abduction	Movement of a body part away from the midline or medial plane of the body.	Raising an arm from the side to shoulder level.
Adduction	Movement of a body part toward the midline or medial plane of the body.	Bringing the arm from shoulder level back to the side.
Inversion	A special term used to describe the movement that turns the bottom of the foot inward.	Turning the soles of the feet toward each other.
Eversion	A special term used to describe the movement that turns the bottom of the foot outward.	Turning the soles of the feet away from each other.



Anatomical Position



CONTINUE

Fluids, Electrolytes, and Acid-Base Balance

Fluid and Electrolyte Balance – The **two** main constituents that compose human body fluid are water and electrolytes. Water aides in the transportation of substances through cellular membranes but also throughout the body. Water also aides in regulating body temperatures and balancing hydrogen molecules in the body. During the digestive process, water acts as a medium in support of enzymes breaking down particles. Because of these actions, the human body is about 60% water.



Water



Electrolytes

Fluid Imbalances - Fluids that **leave** the body do so through respiration, perspiration, urination, and elimination. When there is an **imbalance**, the patient exhibits signs and symptoms associated with the deficiency or excess. There are

two types of fluid imbalances—fluid volume **deficit** and fluid volume **excess**.

Fluid Volume Deficit

Fluid volume deficit (FVD) is also referred to as hypovolemia. Hypovolemia can be caused from not taking in enough fluids, or a loss of fluids from sweating, vomiting, and diarrhea. Other causes are severe burns, bowel obstructions, excessive gastrointestinal suctioning, and severe bleeding. Signs and symptoms you'll notice include poor skin turgor, concentrated urine, which will result in a high specific gravity, oliguria (diminished urine output), dry mucous membranes, weak and rapid pulse, orthostatic hypotension, and a low central venous pressure (below four cm of water).

In severe cases of hypovolemia, confusion and restlessness may be observed. The treatment for hypovolemia is to encourage fluid intake, if the patient is conscious, and in severe cases, the administration of intravenous (IV) therapy may be necessary. In cases of severe bleeding, maintain the patient's body temperature and give oxygen.

Fluid Volume Excess

Fluid volume excess (FVE) is also referred to as hypervolemia. There are a number of disease processes that cause hypervolemia (e.g., congestive heart failure, renal failure, cirrhosis, and Cushing's syndrome). Other causes of FVE include excessive intake of parenteral fluids, excessive intake of salt, and decreased renal function along with an excess or normal fluid intake.

Signs and symptoms to look for are edema, ascites (abdominal swelling), and pulmonary edema. The patient will show a weight gain and distended neck veins. The central venous pressure will be high (over 11 cm of water) with a full bounding pulse. If the hypervolemia is due to decreased renal function, the patient will exhibit polyuria and diluted urine.

Multiple Response

What are the two types of fluid imbalances?

- ☐ hypovolemia
- ☐ hypervolemia
- ☐ hypertension
- ☐ hypotension

SUBMIT



Complete the content above before moving on.

The Importance of Electrolytes, Sodium, Potassium, and Calcium

Click on the flip cards below to learn more about electrolytes and the affect of sodium on the human body.



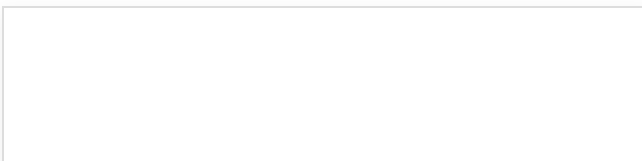
Electrolytes - To refresh your memory, an electrolyte is a chemical substance (ion), capable of carrying an electrical charge when it is in water. Electrolytes are found in the body's extracellular and intracellular spaces. There must be a unique balance between the intracellular and extracellular

1 of 3

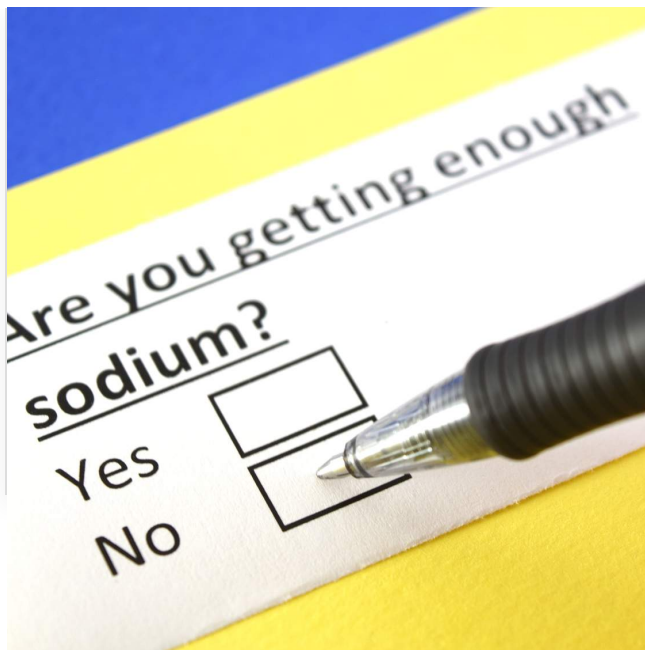


Sodium - The sodium (Na) cation (positively charged ion) is the main electrolyte found in extracellular fluid. The importance of this electrolyte cannot be overlooked. It is essential for normal nerve and muscle activity and the regulation of fluid balance. Normal sodium concentration in

2 of 3



Sodium Deficit - A sodium



3 of 3

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deficit is referred to as hyponatremia. Hyponatremia can occur from profuse sweating (diaphoresis), vomiting, loss of gastric secretions from suctioning, and the administration of nonelectrolyte intravenous fluids. Symptoms to look for include confusion.

If you work with cardiac patients, you may monitor serum potassium levels.

Potassium Deficit - A potassium deficit is referred to as hypokalemia. Hypokalemia can occur with the use of certain diuretics (Lasix), a loss of fluid due to vomiting and diarrhea, and gastric suctioning. Signs and symptoms include fatigue, weakness, anorexia, nausea, vomiting, and dysrhythmias (abnormal heart rate or rhythm). In more severe cases of hypokalemia, hypotension and death caused by cardiac or respiratory arrest can result. Treatment of hypokalemia includes dietary supplements of potassium rich foods (fruits), to administering oral potassium salt. The physician may also order intravenous administration of potassium in severe cases of hypokalemia.

Potassium Excess - A potassium excess is referred to as hyperkalemia. Hyperkalemia can result from severe renal failure, severe burns, overuse of potassium supplements, and the over-administration of parenteral potassium. Symptoms associated with hyperkalemia are diarrhea, nausea, muscle weakness, and dysrhythmias. Death can occur from cardiac or respiratory arrest due to severe cases of hyperkalemia. The treatment of hyperkalemia ranges from removing potassium from the diet to special medications that help to lower serum potassium levels.



Calcium

Calcium (Ca) is found mostly in the bones and teeth. Regulated by the parathyroid glands; serum levels of calcium account for only one percent of the body's calcium level. Calcium is necessary for nerve impulse transmission, blood clotting, and muscle contraction. Normal serum calcium levels range from 8.4 to 10.6 milligrams per decilitre (mg/dL).

Calcium Deficit - Referred to as hypocalcemia, calcium deficits can result from an insufficient dietary intake of calcium. Since vitamin D is necessary for the absorption of calcium, a vitamin D deficiency will directly affect calcium levels. Other causes of hypocalcemia may be from metastatic cancer attacking bone. Damage to the parathyroid glands or removal during a thyroidectomy may cause a hormone deficiency that could cause hypocalcemia as a side effect.

Calcium Excess - Hypercalcemia is the medical term for calcium excess. Large amounts of calcium in the blood can result from tumors on the parathyroid glands, multiple fractures, excessive doses of vitamin D, prolonged immobilization, and some drugs used

to fight cancer (antineoplastics). Symptoms associated with hypercalcemia are deep bone pain, constipation, anorexia, nausea, vomiting, polyuria, polydipsia, fractures, and mental changes. To treat hypercalcemia, the physician would first determine the cause, and then treat it. In mild cases, limiting calcium intake and forcing fluids would be used. In more acute cases of hypercalcemia, the use of intravenous fluids that would increase calcium excretion would be administered.



Multiple Choice

Which mineral is necessary for nerve impulse transmission, blood clotting, and muscle contraction?

- ☐ Potassium
- ☐ Iron
- ☐ Calcium
- ☐ Electrolytes

SUBMIT



Complete the content above before moving on.

Acid and Base Imbalances

Simply speaking, the body's acid-base balance is essential for life. Have you ever been involved in providing cardiopulmonary resuscitation due to respiratory or cardiac arrest? If you have, you may remember the physician calling out orders for blood gases to be performed. Once the results are obtained, the physician may then give an order for sodium bicarbonate to be given stat. After reading the following lessons regarding acid-base balance, you will understand why the physician ordered the sodium bicarbonate.



The symbol pH refers to the percentage of hydrogen ions (atoms) present in a solution. The more hydrogen ions in a solution, the more alkaline it is. The less number of hydrogen ions, the more acidic the solution will be. When a physician requests blood gases to be performed, one of the tests performed on the blood is pH. A normal plasma pH is 7.34 to 7.45, or a slightly alkaline state. With results below 7.34, the patient is considered acidic; with results above 7.45, the patient's serum is considered alkaline.

**We will discuss the four types of acid-base imbalance:
Metabolic Acidosis, Metabolic Alkalosis, Respiratory Acidosis,**

Respiratory Alkalosis.



Metabolic Acidosis

This is a deficit of bicarbonate (base) or a gain in an acid in the body fluid. In most cases, metabolic acidosis results from an imbalance in the metabolism of foods or fluids (e.g., usually diabetes). Some causes of metabolic acidosis include starvation, insulin deficiency resulting in diabetic acidosis, diarrhea, and renal failure. The patient's serum pH is below 7.34. The treatment for metabolic acidosis is to eliminate the cause and replace the lost fluids and electrolytes. Bicarbonate may also be administered.

Metabolic Alkalosis

This is an excess of bicarbonate (base) in the body fluids. Metabolic alkalosis can be the result of problems with the gastrointestinal tract (e.g., chronic or excessive vomiting) or the ingestion of too many alkalies (i.e., medications used for acid indigestion, antacids). Excessive gastric suctioning can remove too much hydrochloric acid, resulting in metabolic alkalosis. The treatment for metabolic alkalosis is to eliminate the cause.

Respiratory Acidosis

This is the result from an excess of carbonic acid in the body fluids. The cause of respiratory acidosis can be any deficiency in respiratory ventilation (e.g., pneumonia, emphysema, asthma, and respiratory obstruction). Treatment depends on the cause of respiratory acidosis, and it is very individualized. Patients who are having difficulty breathing may be given medications (e.g., bronchodilators) to improve respiratory sufficiency.

Respiratory Alkalosis

This is the result of a deficiency of carbonic acid. In most cases this is due to hyperventilation, the “blowing off” of excessive amounts of carbon dioxide (CO_2). Patients hyperventilate because of anxiety, high fevers, and hysteria. Treatment for respiratory alkalosis is to correct the hyperventilation. Rebreathing expired air from a paper bag is one method taught in most emergency medical technician courses.

Multiple Choice

What is the normal plasma pH?

☐ 7.10-7.20

☐ 7.34-7.45

☐ 7.47-7.85

☐ 8.23-8.41

SUBMIT



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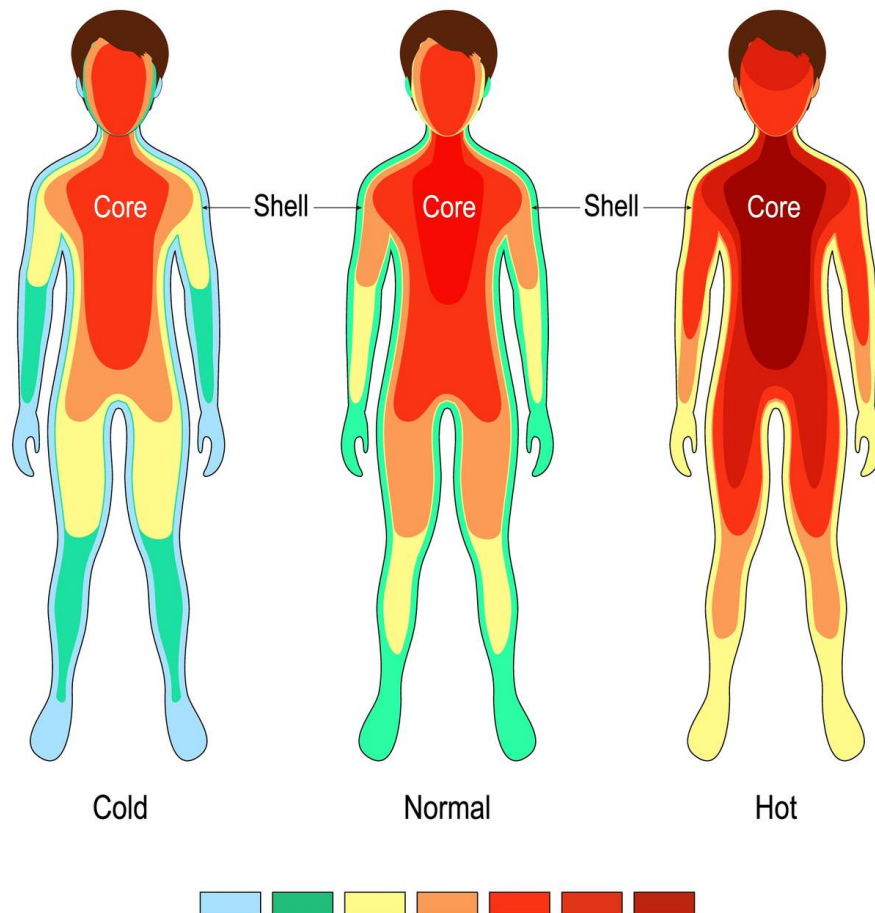
Thermal Regulation

Thermal regulation of body cells - Body temperature regulation is vital to homeostasis. Even the slightest shift in body temperature can disrupt the rate of the metabolic reactions in the cells functions. Normal body temperature is 98.6 degrees Fahrenheit (F). For the body to maintain this constant temperature it must balance the amount of heat produced through cellular metabolism and the amount of heat lost that is largely regulated through the skin.

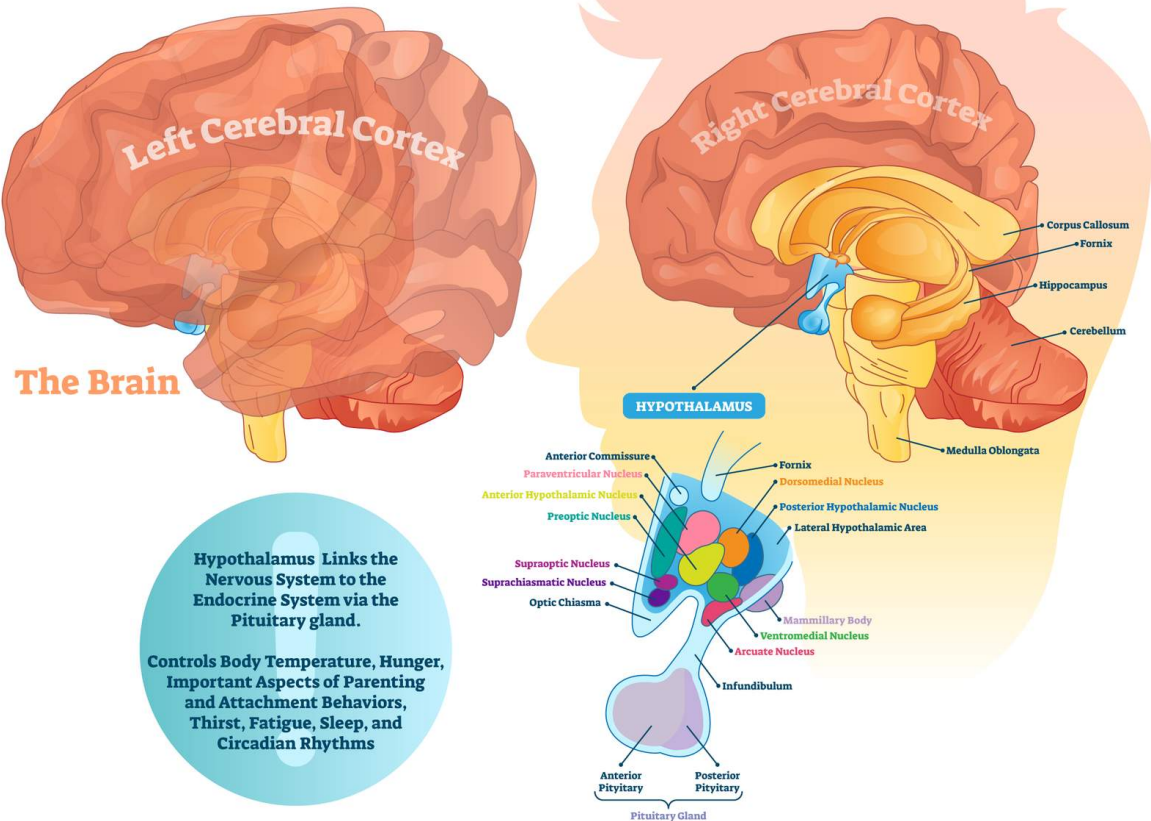
The cellular metabolic heat produced during physical exercise is released from the muscles to the blood where it is carried away from the muscles to the hypothalamus. In

turn the hypothalamus will signal the dermal blood vessel walls of the muscle to relax. As the vessels dilate, more blood enters the vessels and the heat in the blood escapes to the outside. This works at the dermal layer of the skin over the muscles being worked. At the same time, the deeper blood vessels of the active muscle vasoconstrict, diverting the blood to the surface of the skin over the muscle producing redness. This will stimulate the heart to beat faster, moving the blood out of the deeper tissue faster.

Body temperature



HYPOTHALAMUS



Hypothalamus

The hypothalamus controls the functions to regulate the body temperature; normal regulation of heat loss begins with the blood vessels. As the muscles of the dermal blood vessels contract, this decreases the flow of heat-carrying blood through the skin. The result is a reduction of heat loss by radiation, conduction and convection; it is evidenced by a loss of color to the skin. The body will also signal the sweat glands to remain inactive to reduce the heat loss through evaporation.

If the constriction of the blood vessels and inactivating the sweat glands is not enough to stop the heat loss, and the body temperature continues to fall, the nervous system may stimulate muscle fibers to contract slightly. This action will increase the rate of cellular respiration to produce heat

at the cellular level. If this response still does not raise the body temperature, then small muscle groups will begin to rhythmically contract to cause a person to shiver, generating more heat.

Radiation

The primary means of heat loss of the body is radiation. Infrared heat rays escape from warmer surface to cooler surroundings. These rays will release the heat in all directions, much like the bulb from a heat lamp. Conduction and convection also allow the body to release heat, but in lesser amounts.

Conduction

During conduction, the heat moves from the body directly into the molecules of cooler objects you are in contact with. Example: when you sit on a cold metal bench in the winter. The heat from your body is lost by conduction into the metal seat.

Convection

Convection is when there is a continuous circulation of cooler air that is warmed over a surface. As the cooler air becomes heated, it moves away from the body carrying the heat along with it. This air is then replaced with cooler air moving toward the body to be warmed. This continuous cycle of air circulated is heat loss through convection.



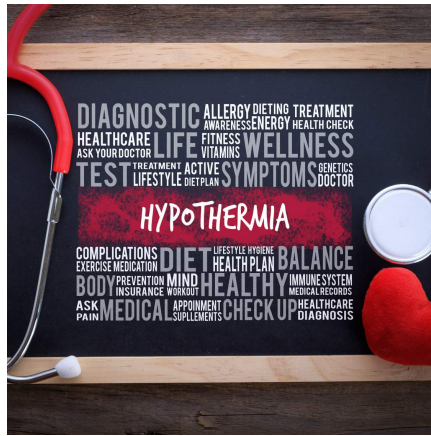
Evaporation

There is still one more way the body will lose heat. When the body temperature rises above normal the nervous system stimulates the sweat glands to release sweat onto the skin's surface. When the sweat evaporates, it carries the heat away from the surface to cool the skin. This process is what is called evaporation.

Hypothermia

Unfortunately, the mechanisms do not always function properly. When the body function fails, the consequences can be dangerous. Hypothermia, an excessively lowered body temperature, can result from prolonged exposure to cold or even as part of an illness. Hypothermia begins with the last normal response to cold—shivering.

Hypothermia effects continue with the feeling of coldness, and the progression to mental confusion, lethargy, loss of reflexes and consciousness, and eventually the shutting down of major organs. If the temperature of the body core drops even just a few degrees, respiratory failure or heart arrhythmias may occur.



With any disease process, certain people are at higher risk for developing hypothermia. This includes very young, very old, extremely thin individuals and the homeless. The best way to prevent hypothermia is to dress appropriately with layers and stay active in the cold. Any individual being treated, or even just a particular body part, for hypothermia must be warmed gradually. This allows the respiratory, cardiovascular, and circulatory functions to remain stable.

Hypothermia is one extreme when the body is unable to regulate the body's temperature and hyperthermia is the other.

Hyperthermia

Being able to cool the body temperature is done largely through the dilation of the blood vessels and the secretion of sweat. In extremely humid environments, the body has a difficult time reducing the body temperature. Air can only hold a limited amount of water vapor, so on the hot humid day; the air becomes nearly saturated with water. During this time, the sweat glands may be activated, but the sweat is unable to evaporate quickly so the skin becomes wet, but the individual remains hot and uncomfortable. In high humidity, the body is unable to release the necessary heat through evaporation due to the humidity level. This can also be compounded with a high ambient air temperature.

When the air temperature is higher than the body temperature, the body will continue to gain heat from the surroundings causing the core temperature to rise even higher. A high core temperature can result in circulatory system collapse.



Fever

Hyperthermia is not always to this extreme and not always a life threatening situation. A fever is the body's attempt to fight an infection by self-inducing a hyperthermic response. In a fever, molecules on the surface of the infectious agent stimulate phagocytes to release a substance called endogenous pyrogen, meaning "fire starters." The bloodstream carries the endogenous pyrogen to the hypothalamus, where the set point controlling temperature is raised.

The body responds by signaling the skeletal muscles to increase the heat production, decrease the blood flow to the skin, and decrease the production of sweat gland secretion. This results in the body temperature rising to the new set point, and the person then has a fever.

This increase in the body temperature helps the immune system to kill the pathogens, also making the individual uncomfortable. The immune system is the primary defense the body has to fight disease processes. For the system to work effectively, specific body functions must be working together for the immune system to perform.

CONTINUE

Cellular Metabolism

There are **two** pathways of cell metabolic reactions, anabolism and catabolism.

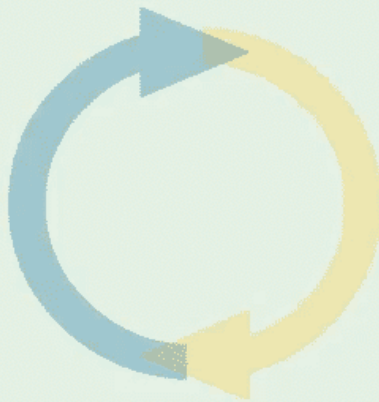
Anabolism is when larger molecules are constructed from smaller ones, requiring input of energy. In catabolism, larger molecules are broken down into smaller ones, releasing energy.

Before a cell can perform its function, it must have the energy necessary for the job. Heat is one form of energy (a catalyst) used to increase the rate of chemical reactions in a laboratory. A catalyst is a particular molecule that can change the rate of a reaction without itself being consumed. Heat energy increases the rate at which molecules move and the frequency of the molecular collisions. The temperature of a body cell is usually too mild to promote the reactions of life; the body uses enzymes to make these reactions possible. Enzymes promote specific chemical reactions within cells by lowering the activation energy needed to start these reactions.

When the body recognizes a deficiency, the body begins production of the enzyme to produce the necessary molecule product. Enzyme molecule names are often derived from the type of reaction that is catalyzed and has the suffix –ase added. Example, a lipid-splitting enzyme is called lipase, a protein-splitting enzyme is protease, and a starch-splitting enzyme is called amylase. Similarly, there are also sugar sucrose-splitting enzymes that result in sucrase, sugar lactose-splitting enzymes produce lactase, and sugar maltose-splitting enzymes are called maltase.

Watch the video below to learn more about these processes.

metabolism





Metabolism - Anabolism and Catabolism Video Transcript.pdf

131.6 KB



Multiple Choice

Amino acids are made during which phase of metabolism?

☐

Anabolism

☐

Catabolism

SUBMIT



Complete the content above before moving on.

Oxygenation and Circulation

Basic physical needs are essential to maintaining life. The most important of these basic physiological needs is oxygenation. The body must have adequate oxygenation for proper cardiovascular function to supply the tissues with oxygen. Respirations are the source for

oxygenation. Everything begins at the cellular level and oxygenation and the circulation of this oxygen is no exception.

A patient's physiological need for oxygenation can be affected by many things, such as altitude and disease processes. Diseases such as emphysema and chronic obstructed pulmonary disease (COPD) are two examples where the physiological need for oxygen could be compromised. In both disease processes the alveoli lose their shape and become floppy. Less air gets in and less air goes out because:

- 1 The alveoli lose their elasticity (like an old rubber band).
- 2 The walls between many of the alveoli are destroyed.
- 3 The walls of the airways become thick and inflamed (swollen).
- 4 Cells in the airways make more mucus (sputum) than usual, which tends to clog the airways.

Signs and symptoms can be monitored through the patient's use of accessory muscles, monitor tracings, and through bloodwork results. Bloodwork results offer significant clues to a health care provider about the patient's ability to oxygenate and what treatment to implement for the patient's recovery. Without circulation, the body can inhale and exhale air all day long, but it will not sustain life. The blood is what transports the oxygen and carbon dioxide between the lungs and the body cells. As these gasses enter the blood, they dissolve in the plasma or combine chemically with other atoms or molecules. The alveoli provide the capillary network necessary for this exchange of gasses.

The partial pressure of oxygen (PaO_2) is a sensitive and non-specific indicator of the lungs' ability to exchange gases with the atmosphere. The **PaO_2** determines the amount of partial pressure of oxygen that combines with hemoglobin. The greater the PaO_2 , the more oxygen that can combine with the hemoglobin for circulation. Almost all oxygen in the body (98 percent) is carried in the blood, where it bonds to the protein hemoglobin

in the red blood cells. The remaining two percent is dissolved in the blood plasma. For the circulatory system to carry oxygen to the body tissues, we must be able to produce enough red blood cells (RBC). Good nutrition of an individual greatly increases the body's ability to produce the RBCs we need to carry the vital oxygen throughout the body.

Follow the link below to learn more about PaO₂.



Understanding the Partial Pressure of Oxygen (PaO₂) Test

A PaO₂ test measures partial pressure of oxygen, or PaO₂—the oxygen pressure in arterial blood. The PaO₂ reflects how well oxygen is able to move from the lungs to the blood. It is often altered by severe illnesses, with the PaO₂ test results used to guide treatment.

READ MORE VERYWELL HEALTH >

CONTINUE

Nutrition and Elimination

Following closely behind oxygenation and circulation is nutrition and elimination. Good nutrition enables proper body functions and the end result is to help ease recovery time for the patient. Nutrition covers a broad spectrum of vitamins, minerals, chemical reactions with cells, and of course, the ability to eliminate the excess waste the body does not need. Many diseases affect the physiology of the body's cells and their function. As discussed previously, all things begin at the cellular level.

Nutrition is the basis for most cells, acquiring the necessary molecules they need for proper function. The body relies on RBCs to produce hemoglobin for oxygen to bond to. The hemoglobin then is transported to the body tissues and cells in need of the oxygen. The availability of two B-complex vitamins significantly influences RBC production.



Vitamin B12 and folic acid are the B-complex vitamins necessary for the production of RBCs. These vitamins are also required for DNA synthesis, thus being needed for the growth and reproduction of all cells. Cellular reproduction occurs at such a high rate in hematopoietic tissues that tissue is extremely vulnerable to the deficiency of either of these vitamins. The lack of B12 is usually due to a disorder or disease process that prevents the stomach lining from absorbing the B12 rather than a dietary deficiency.

Along with B-complex vitamins, iron is necessary for hemoglobin synthesis. Iron is absorbed slowly from food in the small intestine. Just a small portion is absorbed even when the food contains an abundance of iron. The rate of absorption is directly related to the amount of iron the body currently has in it. If the body is low on iron, the absorption rate will increase. When a patient is anemic, this reduces the oxygen-carrying capacity of the blood, giving the person a pale appearance and a lack of energy.

Nutrients in the plasma portion of the blood are also very important. Plasma nutrients include amino acids, simple sugars, nucleotides, and lipids absorbed through the digestive tract. Blood plasma transports glucose from the small intestine to the liver

where it may be stored as glycogen or altered to form fat cells. Amino acids are also carried to the liver where the amino acids are synthesized into proteins to be used as an energy source.

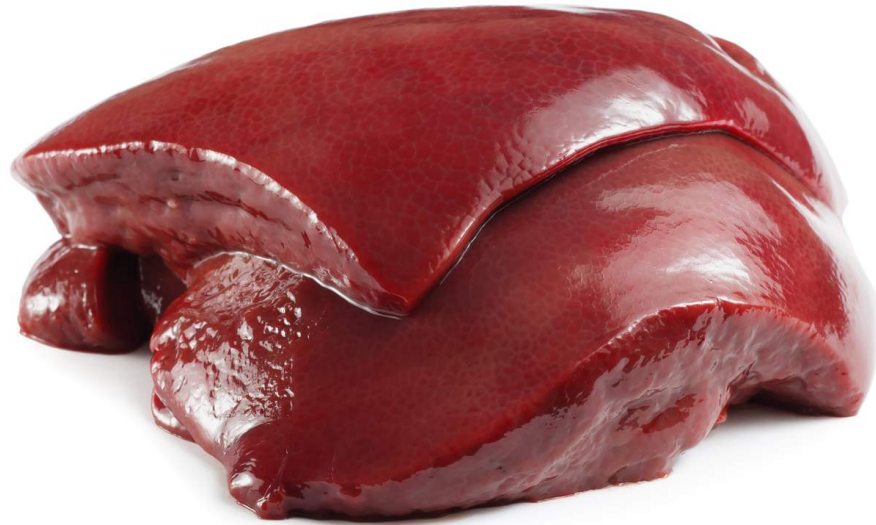
Plasma lipids include triglycerides, phospholipids, and cholesterol. Because lipids are not water soluble, the lipids combine with proteins in lipoprotein complexes. Lipoproteins are classified into four groups based on their density, which reflects their composition. Chylomicron consists mainly of triglycerides absorbed from the small intestine.

Very low-density lipoproteins (VLDL) consist of a relatively high concentration of triglycerides. Low-density lipoproteins (LDL) consist of a relatively high concentration of cholesterol and are the major cholesterol-carrying lipoprotein. High-density lipoproteins (HDL) consist of a high concentration of protein and a lower concentration of lipids. The following table reviews the characteristics and functions of each of these lipoproteins.

Lipoprotein	Characteristics	Functions
Chylomicron	High concentration of triglycerides.	Transports dietary fats to muscle and adipose cells.
VLDL	Relatively high concentrations of triglycerides; produced in the liver.	Transports triglycerides synthesized in the liver from carbohydrates to adipose cells.
LDL	Relatively high concentrations of cholesterol; formed from remnants of VLDL molecules that	Delivers cholesterol to various cells, including liver cells.

Lipoprotein	Characteristics	Functions
	have given up their triglycerides.	
HDL	Relatively high concentrations of protein and low concentrations of lipids.	Transports remnants of chylomicrons that have given up their triglycerides to the liver.

The **chylomicrons** transport dietary fats to both muscle and adipose tissues. The chylomicrons are then used as energy or stored as fat. In a similar manner, VLDL transport triglycerides that have been synthesized from excess dietary carbohydrates to adipose cells; the remnants are converted to LDL. Because most of the triglycerides have been removed, the LDL molecules have the higher cholesterol content. Cholesterol content is one of the contributing factors to many coronary disease processes.



Human Liver

The HDL molecules formed in the liver and small intestine transport the chylomicron remnants back to the liver. The liver disposes of most of the cholesterol by secreting it into the bile. These bile secretions are later reabsorbed largely by the small intestine and back to the liver. The secretion-reabsorption cycle of the cholesterol and bile secretions are constantly repeated. During each cycle some of the by-products of bile salts and cholesterol reach the large intestine and are eliminated with the feces.

Matching

Match the lipoprotein to the correct function.

≡ 1	HDL	Transports remnants of Chylomicrons that have given up their triglycerides to the liver.	▼
≡ 2	Chylomicron	Transports dietary fats to muscle and adipose cells.	▼
≡ 3	LDL	Delivers cholesterol to various cells, including liver cells.	▼
≡ 4	VLDL	Transports triglycerides synthesized in the liver from carbohydrates to adipose cells.	▼

SUBMIT



Complete the content above before moving on.

Activity and Rest



Rest

Rest is something that everyone must do. It is a need that helps the body save energy but also refreshes the individual. Also, when someone is resting their vital signs (blood pressure, pulse, respirations, and temperature) will be much more improved than when they would be awake. During this time the body is also healing and repairing tissue. Overall, after someone awakens, they will feel much better.

Factors Impacting Sleep

1

Age – The amount of sleep needed decreases with age.

2

Illness – The need for sleep increases when someone is ill. However, sleep will be interrupted when someone is dealing with pain, vomiting, headaches, chills, difficulty breathing, diarrhea or

increased voiding. Sleep will also be impacted when positioned in uncomfortable positions due to medical equipment.

3

Nutrition – Foods with caffeine will decrease the amount of sleep one person gets. Caffeine is a stimulant, preventing any ability to sleep. Foods with tryptophan help aid sleep.

4

Exercise – Exercise stimulates the body and gets your blood circulating. Any exercise should be avoided 2 hours prior to bed.

5

Environment – People get used to the daily room that they sleep in, such as their beds, pillows, any noises or lighting, or even their sleeping partner. Any changes in any of these examples, change the person's environment and affect their sleep.

6

Drugs – Some drugs are naturally depressants that will help aid someone with resting. However, some drugs have a side effect that may cause drowsiness that will also help with sleep. Then there are some drugs that are stimulants that speed up the body internally and decrease any sleep for the person.

7

Emotional concerns – Some people struggle with anxiety, depression, fear or worrying. People can be impacted by either staying awake or sleeping too often.

8

Sleep disorders–

- **Insomnia** – When an individual cannot sleep or has trouble falling asleep. Insomnia can also be referred to as someone who wakes up early but can no longer fall asleep.
- **Sleep Deprivation** – Described as sleep is interrupted and the quality and amount of sleep is decreased.
- **Sleep walking** – When someone leaves their bed and is walking around. The person has no

recollection of the event, and these events could last up to 4 minutes or longer. The person's risk of falls is greatly increased as well.

CONTINUE

Human Growth and Development and the Aging Process

The terms growth and development are both dynamic processes. Growth refers to the physical changes that can be measured and occur in a steady and orderly manner. Height and weight are two examples. Development relates to changes in psychological and social functioning. Different age groups generally act appropriately for their age. Certain developmental tasks should also be accomplished during each stage. Each stage lays the foundation for the next.



Growth and development occur from the moment of fertilization until death. The processes proceed from simple to complex. There is a sequence, order, and pattern to growth and development. This lesson explains nine age groups and the growth and

development stages that usually occur in each stage. Though some people may either be slightly ahead of or behind these general expectations, an average view of each group is covered in this lesson. Understanding these expected characteristics is important for those involved in patient care. Knowing appropriate growth characteristics can help to identify abnormalities. Awareness of expected developmental characteristics serves to anticipate behavior for patients of various ages. Lets begin taking a look at each of these developmental stages.



Infant Growth and Development (Birth to One Year)

Rapid physical, psychological, and social development characterize this period. The developmental tasks that have been identified for this period are developing stable sleep patterns, beginning to

have emotional relationships with parents and siblings, beginning to talk and communicate with others, learning to eat solid foods, and learning to walk. Average newborns weigh seven to seven and one-half pounds and are 20–21 inches long.

Their birth weight usually doubles by the fifth or sixth month, and by the end of the first year, their weight triples and they should also grow 10–12 inches in the first year. The newborn’s central nervous system is not well developed. Movements are uncoordinated and generally without purpose. As the nervous and muscular systems develop, the infant develops specific voluntary and coordinated movements. Certain reflexes and involuntary movements normally are present and disappear as the central nervous system develops.

Infants can see at birth, but their vision is not clear. They respond to bright objects. They can also hear well and are startled by loud noises and soothed by soft sounds. At birth, they respond to touch and their senses of smell and taste are developed. During the first six months of life, the infant’s diet usually consists of breast milk or formula. Solid foods, such as strained fruits and vegetables, are gradually added to the diet about the sixth month. Around the eighth month, the infant normally advances to junior foods, still remaining on breast milk or formula until one year of age. Table food usually is introduced at the end of the infant stage.

Months	Infant Development
1	Can hold their head up while lying on their stomach.
2	Can smile and follow objects with their eyes.
3	Can raise their head and shoulders while lying on their stomachs, sit for a short time, and hold an object in their hand.
4	Can roll over, sit-up when supported, and may sleep all night.

Months	Infant Development
	The Moro and rooting reflexes have disappeared by this time. The infant can hold objects with both hands, puts objects in the mouth, and babbles when spoken to.
5	Can grasp objects and play with their toes. Teeth begin to erupt at this point.
6	Usually have two lower front teeth and begin to chew finger food. They are able to hold a bottle for feeding and can sit alone for short periods of time. By this time, the infant can manipulate small objects and can vocalize one-syllable sounds.
7	Upper teeth begin to erupt. Infants can respond to their name and begin to show a fear of strangers. They can transfer objects from one hand to another. They also begin to imitate simple acts and sounds.
8	Can usually stand while holding onto something, they respond to the word "no" and cry when scolded. They can feed themselves finger foods and reach with open arms to be picked up. At this point, the infant is usually bashful and nervous with strangers.
9	Crawls and can pull to a standing position. They comply with simple verbal commands and can communicate with hand gestures such as waving. They also show a

Months	Infant Development
	fear of being left alone which may be evident when going to bed.
10	Can walk while holding onto objects, will look under objects for a toy and can pull themselves to a sitting position, infants are also aware of their own names by this age.
11	Can stand momentarily and can play interactive games using body language. They also communicate disapproval by shaking their head "no".
12	Begins to walk with help and can hold a cup for drinking. Demonstrates emotions such as anger and affection, and clings to parents in unfamiliar situations.

Toddler Growth and Development (One to Three Years)

Physical growth is not as rapid during the second year of life as it is during the first year; however, the rate of development increases dramatically. At one year, visual acuity is fairly well established. Between the ages of one and two years, toddlers grow approximately four to five inches. Fine muscle coordination and gross motor skills improve during the toddler years. At about 18 months, they can walk up stairs with assistance and pick up small objects and place them in a receptacle. Several other things also occur with toddlers at the two-year point:

- Can be expected to weigh four times the birth weight.

- Lose most of their “baby look;” they are usually chubby, with relatively short legs and a large head.
- They have a protruding abdomen, which flattens as the child grows and the abdominal muscles develop.
- Can use a spoon correctly, are able to run, balance on one foot, and ride a tricycle.



Toilet training is a major developmental task for the toddler. Bowel and bladder control is directly related to the development of the central nervous system. By three years, most children are toilet trained, although they may still have accidents while playing or during the night. Speech and language skills begin to increase by age three. Speech becomes clearer, and the vocabulary increases as words are learned by imitating others.

Toddlers understand more words than they use and are capable of constructing two- to three-word sentences. They begin to play alongside other children but not with them. They are very possessive and do not agree with the concept of sharing. The word “mine” is used frequently. Temper tantrums are the way toddlers deal with frustration. They

often respond to discipline by kicking and screaming. At three years, the integration of visual and neuromuscular mechanisms is fairly well developed. This allows a child to look away from an object prior to reaching out and picking it up. Also, the senses of hearing, taste, smell, and touch become more developed and associated with each other. Hearing in the three year old is at adult levels. Touch is extremely important to toddlers; they are often soothed by tactile sensations.



Preschool Growth and Development (Three to Six Years)

The preschool stage is characterized by less physical growth than the toddler stage. Both gross and fine motor skills are fairly well developed. In this stage, the child shows increased independence and intellectual development. Preschoolers are less quarrelsome than the toddler; they are developing a sense of right and wrong, and they usually try to comply with the rules. Growth is steady but slow at this stage. Height usually increases by two to three inches per year and weight increases about five pounds per year.

At three years old, play is very important. They usually play in a group of two or three children and are able to share toys. They play simple games and can follow simple rules. They may create imaginary playmates if there is no one to play with. They may also begin to imitate adults by playing "house" and "dress-up." Three-year-olds also begin to understand time and begin to speak in the past, present, and future tenses. They become less fearful of strangers and can tolerate separation from their primary caregiver for short periods of time. At age four, children can hop, skip, jump, and catch a ball. They can lace their shoes, draw faces, and try to print letters. Four-year-olds can bathe with supervision and take care of toileting needs with some help. Their vocabulary increases to about 1,500 words. They ask numerous questions and exaggerate when telling stories. They can sing simple songs, count to (at least) three, and name a few colors. At four years, children tend to verbally attack others by teasing or tattling on them. They may also physically attack others. They are proud of their accomplishments but can be very moody. They have a strong preference for the primary caregiver of the opposite sex, and rivalries exist between siblings.

At five years, coordination continues to develop. These children can jump rope, skate, dress, and bathe. They can print a few letters, numbers, and their first name. The ability to communicate also increases. Vocabulary consists of about 2,100 words. Sentences now consist of six to eight words, and more meaningful questions are asked. They may request definitions for unfamiliar terms and try to participate in conversations. Five-year-olds can name the days of the week, the months, and four or more colors. They are more responsible, truthful, and quarrel less. They strive to do things the right way and begin to develop manners. These children also enjoy simple games. They enjoy adults during play and have a greater interest in watching television. They also enjoy spending time with their parents as well as activities such as housecleaning, shopping, yard work, and sports. They are more tolerant of younger siblings and are usually protective of them. Although they have fewer fears, they may experience occasional nightmares.



Middle Childhood Growth and Development (Six to Eight Years)

Physical growth during this stage is rapid. School is the greatest event that takes place during this stage. The child is exposed to a whole new world with new values, ideas, and challenges. Height increases at a rate of one to two inches per year, and weight increases at a rate of three to six pounds per year.

Body proportions continue to change and become more adult-like. Body fat decreases and muscle and bone mass increase. Primary teeth are replaced by permanent teeth. At six years, children have a vocabulary of about 2,500 words. They know all the letters of the alphabet and can usually read and spell. They play well with others but prefer playing with children of the same sex. Their play interest includes collections, cards, paints, games, and so forth.

At seven years, excellent eye-hand coordination is evident. Children learn to write in cursive rather than print. They enjoy quiet time alone and are more serious and

concerned about being liked by other children. They are very sensitive and do not like being teased or criticized; they enjoy school and learning, especially reading; and their play activities include swimming, biking, working puzzles, and playing ball. At eight years, children continue to be physically active. Movements become faster and more graceful.

The process of learning continues to develop as they become curious about science, history, geography, and so forth. Social opportunities with peers are enjoyed. This age group has interests in fads, opinions, and activities involving peer groups. Eight-year-olds develop manners, relate well to adults, and participate in adult conversations. They are also friendly and affectionate.



Late Childhood Growth and Development (Nine to Twelve Years)

Late childhood is also known as preadolescence. During this stage, males grow at a rate of one inch per year and gain about three to four pounds per year. Females grow at a rate of about two inches per year and gain between four to five pounds per year. Body movements are more graceful

and coordinated, and there is an increase in physical skill. The developmental tasks are similar to middle childhood; however, the preadolescent is expected to be more mannerly and refined.

By age 12, the child uses about 7,000 words and can understand about 50,000 when reading. Interest in science, history, and geography continues and the use of reference books, such as the encyclopedia and dictionary, increases. The preadolescent begins to question the authority of adults and often rebels against authority. The peer group is the center of the preadolescent's activities. The group influences the attitudes and behaviors of the child. They still prefer companions of the same sex; however, the association between girls is stronger than that of boys.



Adolescent Growth and Development (12 to 20 years)

Adolescence is the stage of life between school age and adulthood. The adolescent is neither a child nor an adult, yet has characteristics of each. It is a period of growth, change, and emotional crisis. This is usually the period of separation from the parents and the establishment of lifetime goals. Adolescence is the last period of significant physical growth during the lifetime of a person. You grow in height and weight and mature sexually. Usually, females have entered into puberty by

age 12, but boys usually enter puberty around age 13. Body changes begin to occur due to the onset of puberty. Girls begin to develop breasts, the pelvis broadens, and fat appears on the hips and chest. Boys show fewer signs of maturing sexually at this time.

Some females may experience the onset of puberty as early as 10 years of age; most begin at age 12. This period is marked by menarche, the beginning of menstruation. Secondary sex characteristics appear, including increase in breast size, the appearance of pubic hair, and a slight deepening of the voice. During this stage, girls grow an average total of two to eight inches and gain anywhere from 15–50 pounds. They usually stop growing around age 18, but some will continue to grow until 21 years of age. Puberty in males is signaled by nocturnal emissions, which occurs during sleep when the penis becomes erect and semen is released. Other secondary sex characteristics begin to develop, such as the appearance of facial hair, axillary hair, hair on the arms, chest, legs, and deepening of the voice. During this stage the male will grow an average total of four to twelve inches and gain about 15–60 pounds. The male will usually stop growing around age 21, but some may continue to grow until age 23.

The adolescent is often awkward and clumsy. This is due to the uneven growth of muscles and bones. As the muscles and bones develop, so do more graceful and coordinated movements. Emotions vary in the adolescent from high to low. They can be happy one minute and sad the next. Teenagers begin to control their emotions as they progress toward adulthood. Adolescents need to become independent of adults, especially parents. Many work towards adulthood by having a part-time job, baby-sitting, and dating. Adolescents usually begin dating at this time and become more concerned with personal appearance. They spend a lot of time talking to friends on the phone, listening to music, and reading popular magazines. They still need guidance, discipline, and support from parents, although arguments and disagreements are common at this stage of development. Teenagers often would rather be with their peers than with their parents.

Adolescents begin to think about careers and college. Their interests and skills influence the choice of further education or seeking employment. Many social factors influence adolescents, such as parents, friends, television, culture, and school. Normally, at the end of this stage, adolescents have developed into young, self-sufficient adults. They usually are totally emancipated from parents and have established goals and individual lifestyles.



Young Adult Growth and Development (20–40 Years)

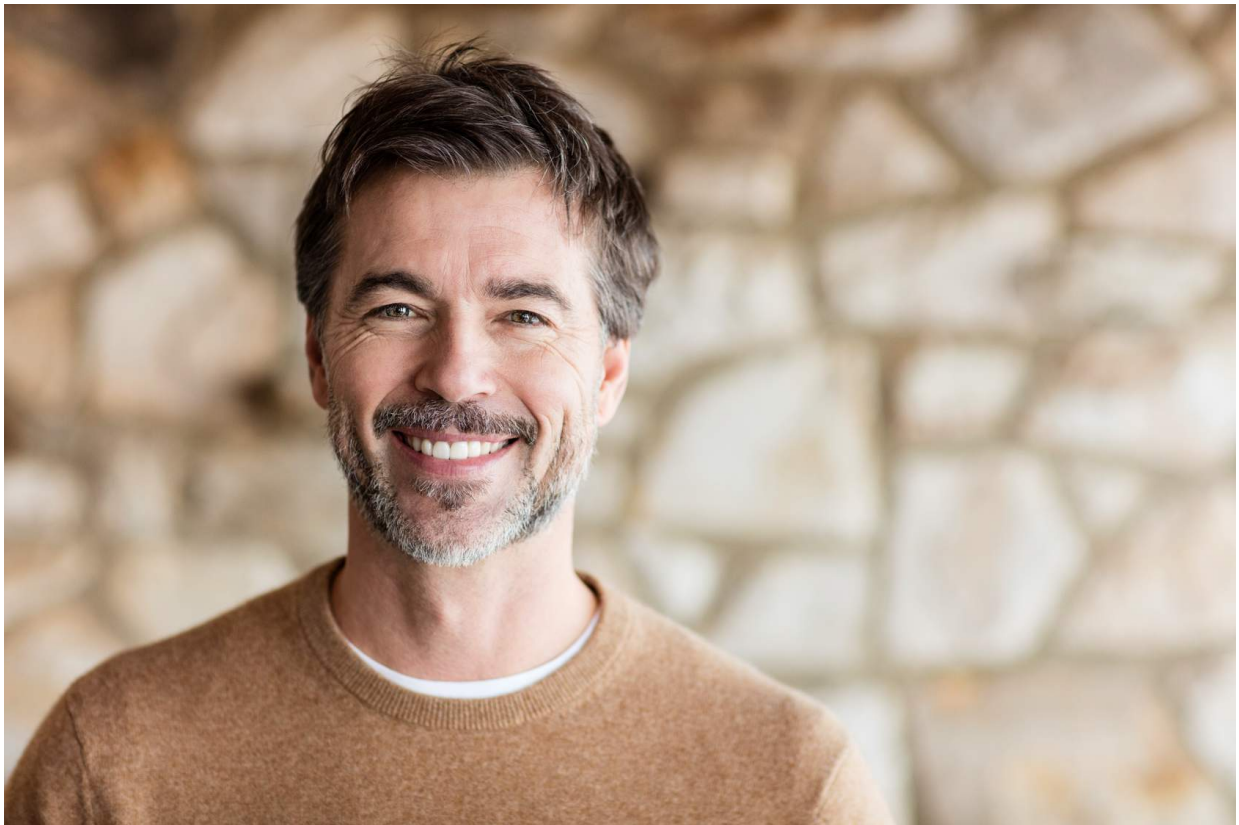
During this stage, the young adult continues to mature physically and emotionally. One of the main goals in young adulthood is choosing a career or occupation. Many career choices involve extensive education. The young adult may still be in school when he or she reaches this stage. Education enhances employment opportunities and helps to ensure economic stability. Entering a career usually means starting at the bottom and working upward. The young adult is faced with proving his or her abilities to older adults.

Another goal for the young adult is choosing a partner. Most young adults need to feel a sense of love and belonging that comes from having a long-term relationship. Many factors influence the selection of a partner, such as age, interest, religion, and love.

During young adulthood many changes occur, both mentally and physically. After age 30, some physical deterioration will start, but it is usually gradual and not very noticeable. At the end of this period, young adults are close to accomplishing the goals of youth. They have made their place in society and are ready to move toward the next stage of life.

Middle Adult Growth and Development (40–60 Years)

Middle adulthood is usually a time when people look back at the goals that have been accomplished so far. The adult is now mature mentally and physically. He or she has usually met most of his or her goals and now must guide others in doing the same. During this time, many physical changes begin to occur. The hair begins to turn gray. Metabolism slows, resulting in a potential weight problem. Women experience menopause, which is the cessation of menstruation. Calcium loss is common among women in this age group. Men experience a decrease in hormones, which can lead to a decrease in sex drive as well as thinning of the hair.



Adults have more time for themselves during this stage. Their children are growing up or have already grown up. Another factor middle adults may have to contend with is caring for elderly parents. This may result in the parents either moving in with them or possibly being relocated to a nursing care center.

Late Adult Growth and Development (65+ Years)

An increase in life expectancy has led to the creation of gerontology, which is the scientific study of the problems of aging. This science includes biological, psychological, and sociological aspects. A change in the appearance and the texture of the skin is a normal process of growth. The skin of the elderly person is usually thin and delicate and extremely sensitive to trauma. Proper skin care for the elderly is very important. As the aging process occurs, there is a normal loss of subcutaneous (SC) fat near the skin surface. The loss of fat and the hardening of small arterioles cause the skin to become

wrinkled. Decreases in blood supply and a gradual atrophy of the sweat glands and excretory functions result in the skin becoming dry and more susceptible to infection.



Another physical change is the decline in stamina. With age, all body cells change and undergo progressive deterioration. Body tissues gradually become less active. Unused muscles begin to atrophy and contribute to the decline of physical stamina. There are also changes in the blood vessels. A loss of elasticity and/or the buildup of fatty deposits will limit the amount of oxygen that can get to the cells. The veins lose their strength, and valves weaken and often become distended. The loss of muscle tone and reduced physical activity will also affect the efficiency of the vessels. It is unknown if the changes that occur are due to simple aging or some other pathological cause. Some contributing factors may include trauma, obesity, malnutrition, and stress. Psychologically, the aging adult needs respect, security, and self-esteem. The elderly need to feel appreciated and valued by others. There may be many emotional adjustments that the elderly have to deal

with, such as the death of a spouse, children, or friends. Socioeconomic losses and the loss of health are also major psychological adjustments the elderly have to make.

Multiple Choice

At what age is play very important?

- ☐ 4-6 months
- ☐ 3 years
- ☐ 7 years
- ☐ All of the above

SUBMIT

True or False: One of the main goals in young adulthood is choosing a career or occupation.

☐ True

☐ False

SUBMIT

Multiple Choice

At what age does the normal loss of subcutaneous (SC) fat near the skin's surface occur?

☐ 50

☐ 55

☐ 60

☐ 65+

SUBMIT

END OF LESSON

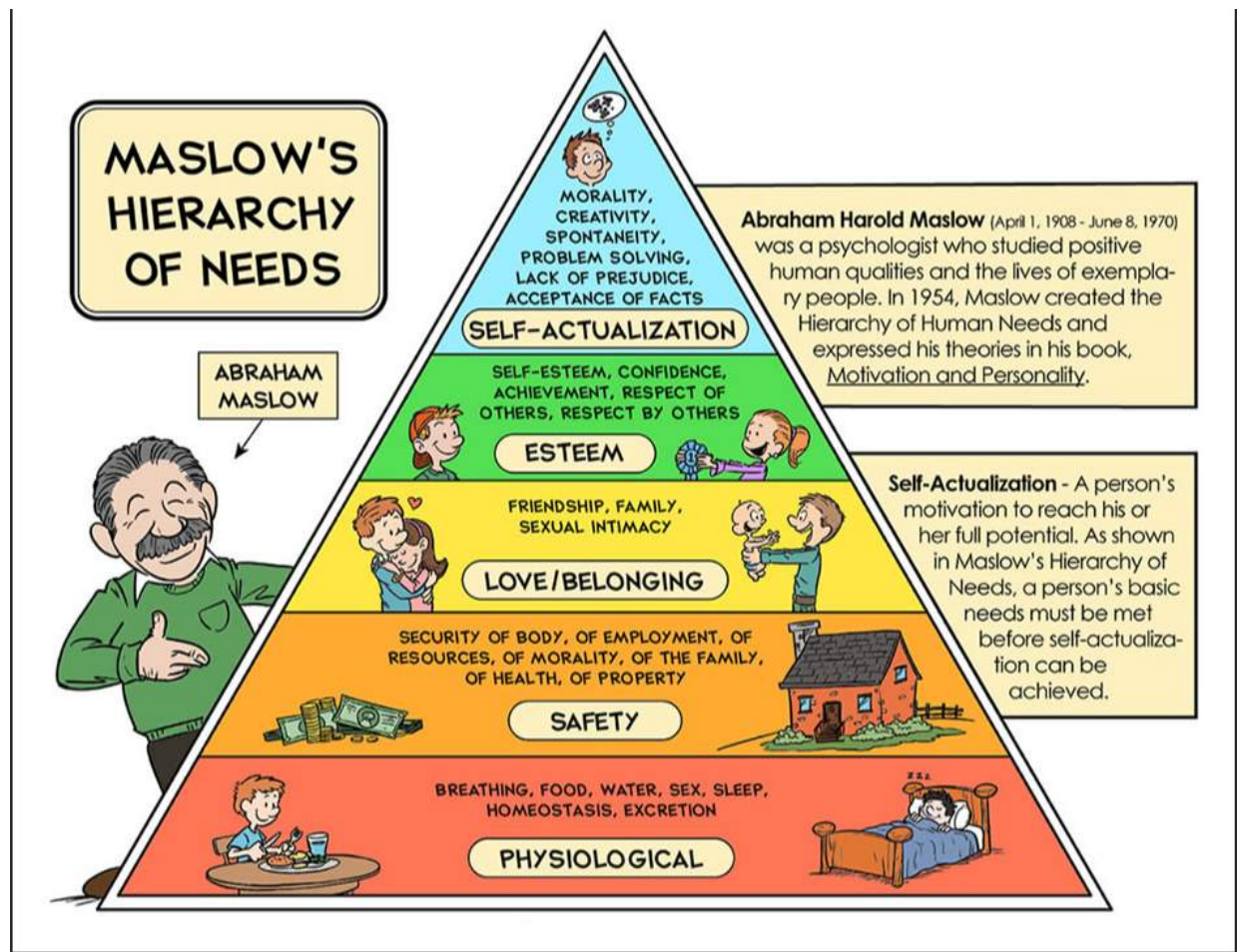
Lesson 2- Human Development

After completing this lesson, the student will be able to identify human development principles in accordance with prescribed guidance and publications.

Basic Human Needs

Basic Human Needs Theory

All humans have basic needs to **live and survive**. We must have food, water, air and shelter and if any one of these basics are **not** met, then humans cannot survive. The extent their basic human needs are met determine their **level** of health. Everyone's needs are different and some may have to be met before other needs can be obtained.



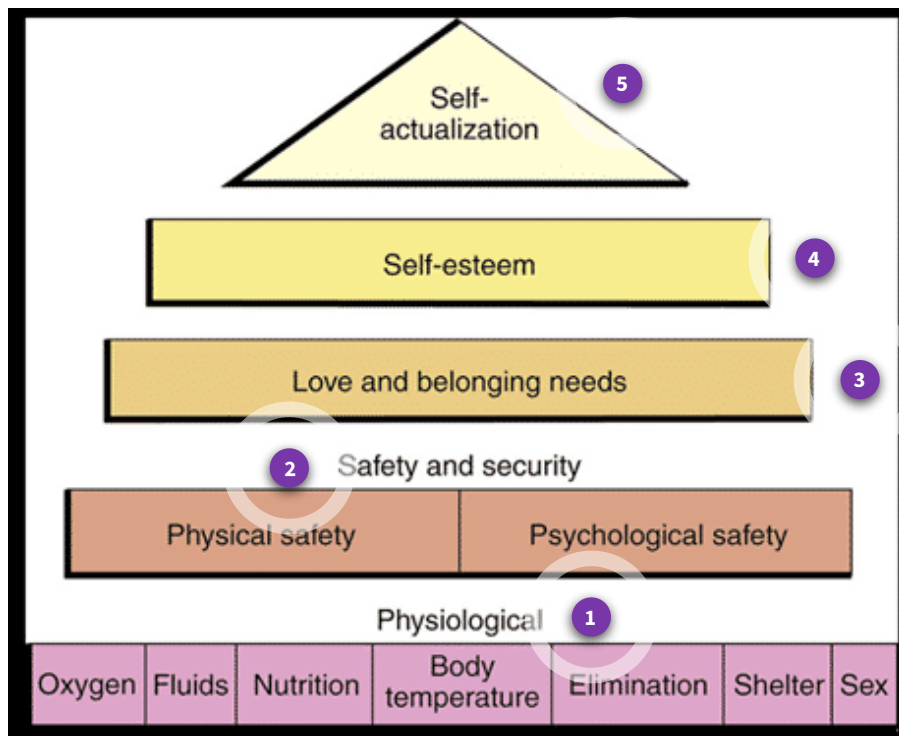
Maslow's hierarchy of needs

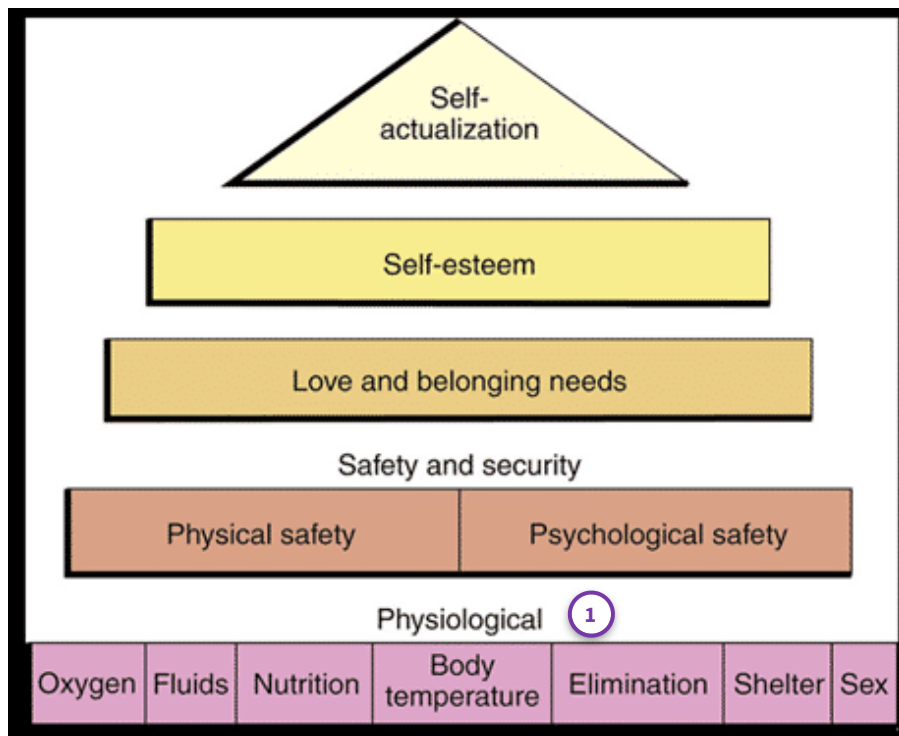


Self-actualization is the highest expression of one's individual full potential and allows for continual self-discovery. A person's basic needs must be met before this can be achieved.

Maslow's hierarchy provides a basis for medical personnel to care for all patient's needs depending on their unique individual experiences and priorities, rather than on a strict adherence to the hierarchy. You must apply Maslow's hierarchy to each patient individually. In all instances, an emergent physiological need takes precedence over all other needs

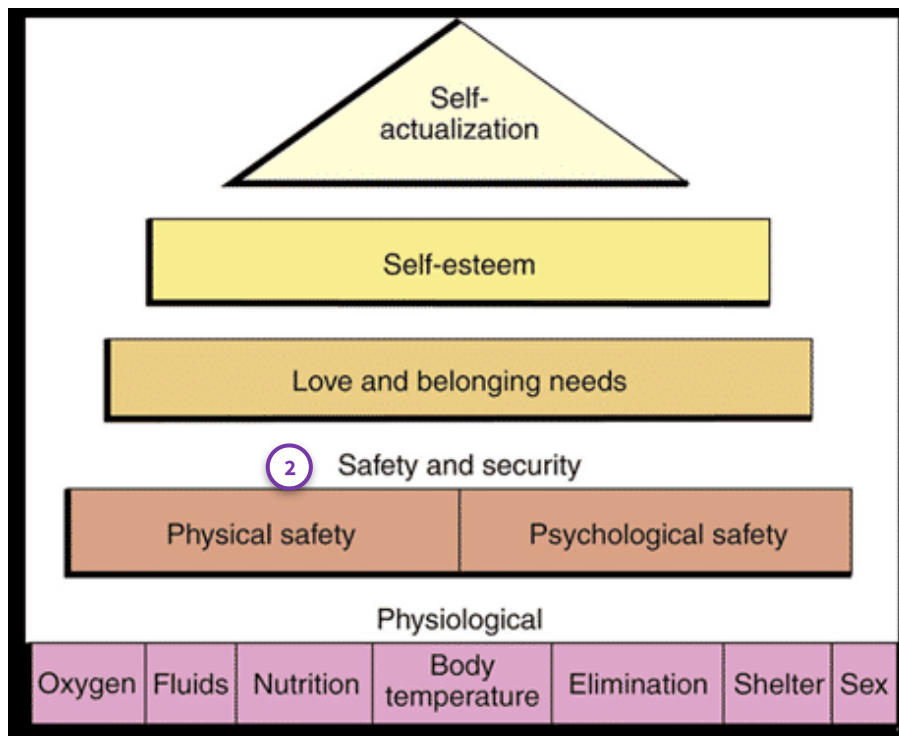
In other situations, a psychological or physical need takes priority. Click on the hotspots below to read what need is in each block.





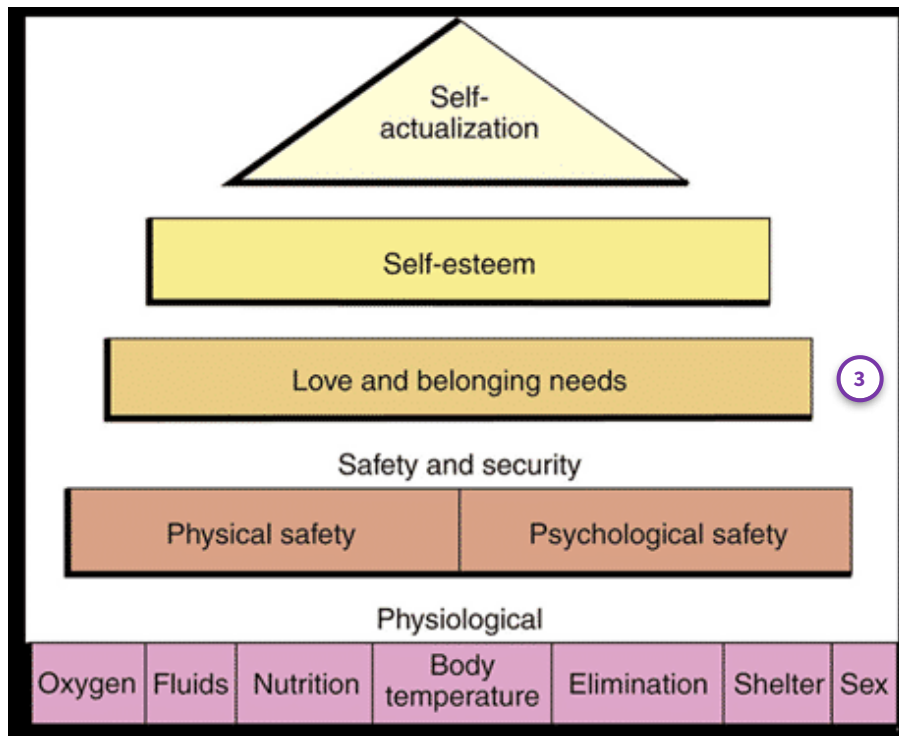
Physiological

Oxygen, fluids, nutrition, body temperature, elimination, shelter, and sex and at the bottom of the pyramid and must be full-filled before anything else can be full-filled in the pyramid.



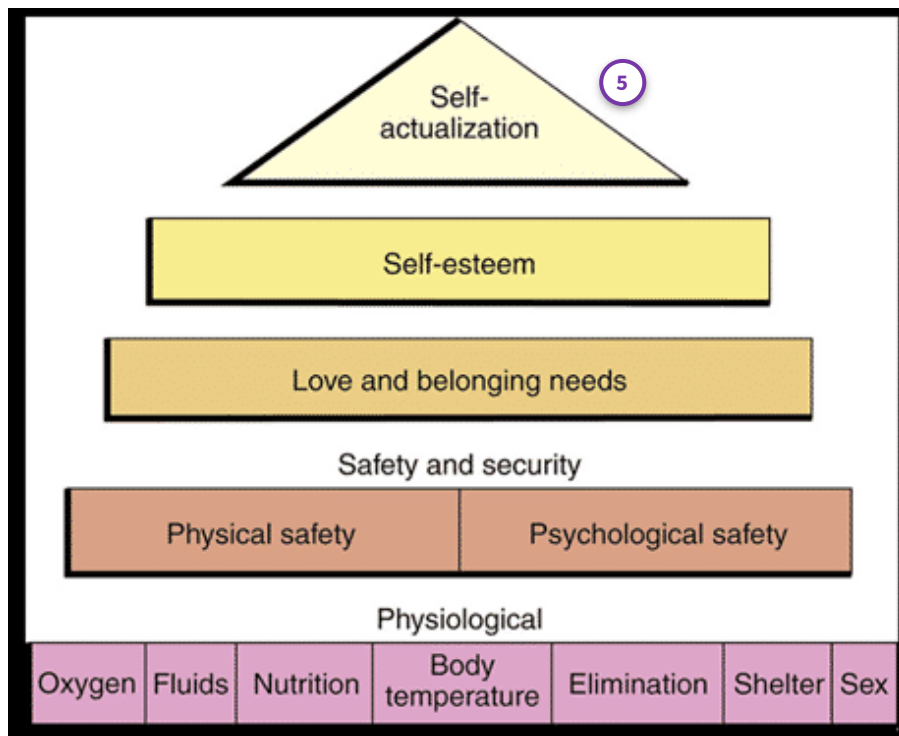
Safety and Security

Safety and Security is our physical and psychological safety that we have through-out our daily lives.



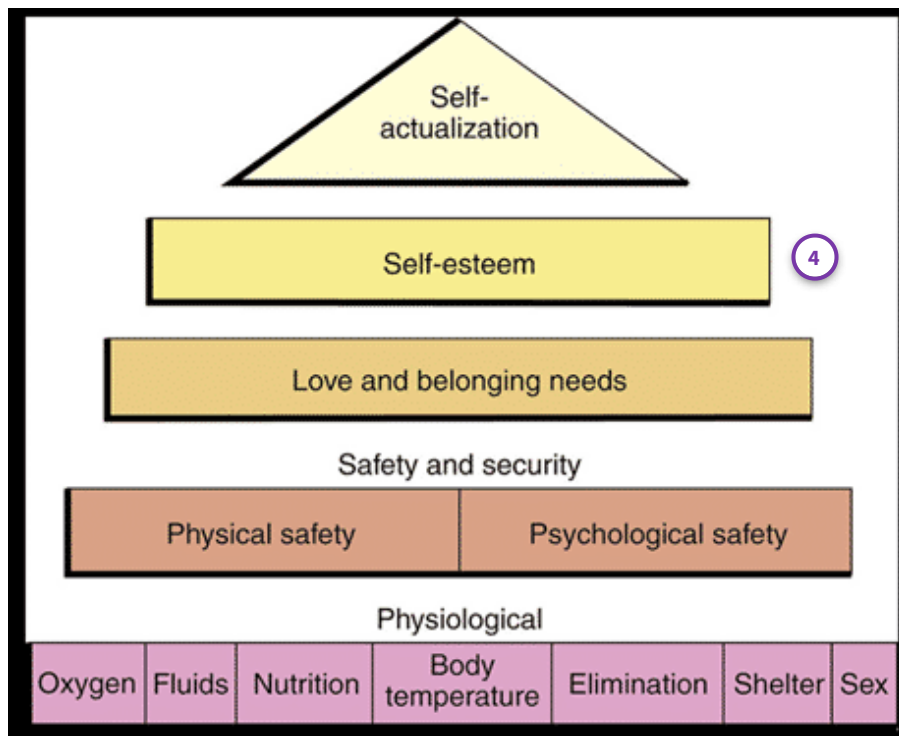
Love and Belonging

Love and Belonging: Friendship, Family, Intimacy.



Self-Actualization

Self-Actualization: Morality, Creativity, Spontaneity, Problem Solving, Lack of Prejudice, Acceptance of Facts.



Self Esteem

Self-Esteem: Confidence, achievement, respect for others, respect by others.

Multiple Choice

What is the highest expression of one's individual full potential and allows for continual self-discovery?

- ☐ Safety and Security
- ☐ Physiological
- ☐ Self-actualization



Self-esteem

SUBMIT



Complete the content above before moving on.

Environmental and Community Health

Health is more than a concept. Humans are concerned continually with their own health and the health of family and friends. The health of patients, as it relates to both the environment and community health, includes areas where health care personnel can be very involved. Many programs currently in place are designed to help ensure a healthy patient care environment. Additionally, programs designed to improve the health of a community are relied on as important preventive programs.

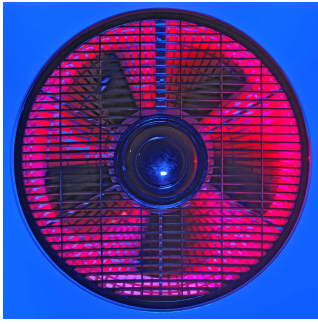


Environmental health is the sum of elements and factors that surround a patient, which influences their care.



The purpose of understanding these factors is to help prepare healthcare workers in providing a safe and comfortable environment for their patients. Florence Nightingale established a theory linking health with various environmental factors. This theory links the health of patients to the following controllable factors:

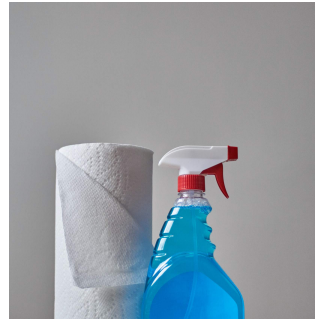
- **Ventilation** – Keep windows closed; allow hospital ventilation system to filter air. Promptly report ventilation system problems to the proper personnel. Perform routine cleaning to eliminate unfavorable odors. Maintain a room temperature between 68 degrees F and 74 degrees F.
- **Efficient Drainage** – Remove waste from patient rooms/care areas frequently. Remove food trays promptly after use. Promptly report mechanical problems in the restroom to proper personnel. Change drinking water in pitchers frequently.
- **Cleanliness** – Ensure patient hygiene standards are strictly adhered to. Ensure healthcare workers and patient visitors are in observance of proper hygiene. Ensure appropriate aseptic techniques and infection control guidelines are followed.
- **Light** – Open curtains to patient rooms during daytime when practical. Ensure adequate and proper functioning of artificial lighting in patient rooms/care areas.



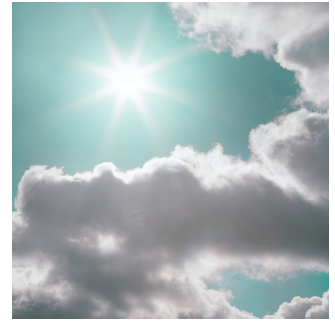
Ventilation



Efficient Drainage



Cleanliness



Light

CONTINUE

Community Health

Various programs have been established that are designed to enhance the health of a community as a whole. When a community is healthy, the chances of a widespread health problem diminish greatly. Community health focuses on educating the community about overall primary health and promotes care outside the traditional institution such as a hospital.

The primary goal for community health is to increase life expectancy and quality of life and promote preventative healthcare through improved health care services.



1

The first component is assessment of needs, which entails evaluating systematic data based on individuals, families and the community. Assessment of needs also includes data, monitoring the health of the community and any extra available information like incident rates.

2

Incident rate examples – Reporting/identifying infections or diseases, motor vehicle accidents caused by adolescents, and underage pregnancy.

3

Comprehensive community assessments focus on the efforts and programs determined by the information obtained, such as sex education, infection control or teen driving.

- The second component in improving community health care is developing policies. Healthcare staff and professionals provided guidance when developing policies supporting

the health of the community. Evidence-based practices help determine which policies will better manage chronic illness of the community addressed by healthcare professionals and their patients.

- The final component is patient access to care. To ensure that community-wide healthcare is available and accessible, access to care addresses insurance coverage, developing relationships with providers and geographic location. Focusing on access to care, community health programs can promote prenatal care programs, disease prevention and overall health prevention. Community healthcare utilizes a concept of five-level health services to deliver care within an established health service.

CONTINUE

Nutrition and Exercise

Nutrition is the result of consuming nutrients and breaking them down through bodily functions that can be used to build strong bodies and promote a healthy lifestyle.

Nutrients are substances provided primarily by food. Nutrients function to provide heat or energy (as we have seen), build and repair tissue, and regulate life processes. Failure to include even one of these nutrients in the diet can result, over a period, in severe health problems that may eventually lead to disease and/or death. In this section, we discuss carbohydrates, proteins, fats, vitamins, minerals, water, and fiber. We will also review the recommended allowances and identify sources for obtaining these nutrients.





What is a calorie?

A calorie is a unit for measuring energy. We use kilocalorie (1,000 calories) when food is involved because the amount of energy is much larger; therefore, the energy requirement of the body is expressed as the caloric requirement. The calorie is the name of a standard unit for measuring heat. Since the body produces heat in energy expenditure, the calorie can serve as a measure of energy metabolism. In addition, each food has a specific caloric value: a given amount of a specific food will yield a certain amount of heat when metabolized (burned).

This amount of heat is expressed as the number of calories. Of all the nutrients, proteins, fats, and carbohydrates are the only ones that the body can use as fuel sources; however, other nutrients must be present to release the energy. The caloric yield of a food depends on how much of these four nutrients it contains. The following values have been established:

- One gram of protein yields four calories
- One gram of carbohydrates yields four calories
- One gram of fat yields nine calories
- One gram of alcohol yields seven calories

Dietary Guidelines

The United States Department of Agriculture (USDA) developed a new food guidance system titled MyPlate. MyPlate was designed to be consumer friendly as explained how all five food groups are correlated on your typical plate. This is to help promote a healthy diet and explain the use of each group. MyPlate visually orchestrates that about half of an individual's plate should consist of fruits and vegetables. Personalizing your nutrition is important.

Depending on a person's age, sex and activity will dictate the food intake amount to maintain body weight. Servings should consist of three main meals with two snacks. The USDA publishes guidance every 5 years, and the current guidelines are as follows:

- Follow a healthy diet plan
- Focus on nutrient dense, food amounts and variety
- Limit caloric intake from saturated fats and added sugars, and minimize sodium intake

- Make healthy food and drink decisions

Click each **factor** below to learn how they **affect** nutrition.

Illness —

- Though desire (appetite) to eat decreases during illness, nutritional needs also increase.
- Special diets are often required.
- Various methods of feeding are often implemented to provide nutritional needs.



Appetite —

- Hunger may result in over consumption of foods.
- Anorexia (loss of appetite) can have adverse effects on the body.



Personal Preference —

- Most likes/dislikes established during childhood.
- Some foods may be avoided if associated with illnesses (such as history of abdominal pain associated with a food, allergic reactions, and so forth).



Culture —

- Types of foods regularly consumed are often influenced by an individual's ethnic background.
- Food preparation habits often vary between different ethnic groups.



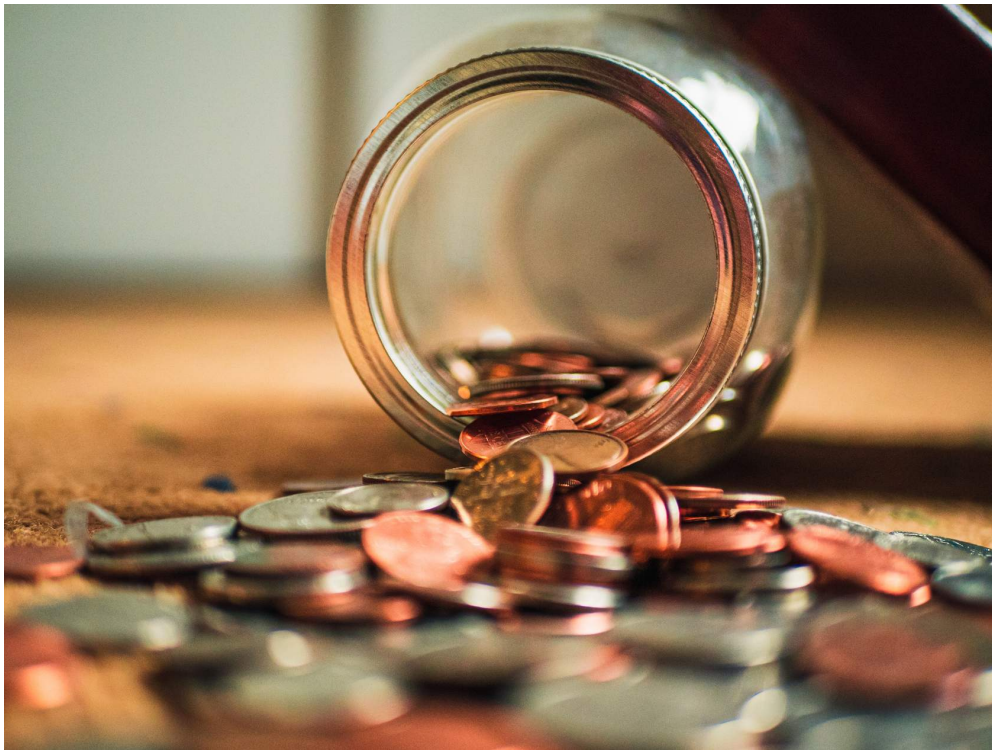
Religion —

- Some religious beliefs observe complete or occasional avoidance of certain foods.
- Method of food preparation is sometimes a necessary consideration.



Financial Status

- Lower incomes often result in an over consumption of less expensive foods containing carbohydrates and an under consumption of foods containing proteins, vitamins, and minerals.



Protein —

- All cells contain protein.
- Essential for tissue growth and repair.
- Sources include dairy products, meat, fish, poultry, eggs, cereals, some vegetables, and nuts.



Carbohydrates —

- Essential for energy.
- Provide fiber for bowel elimination.
- Sources include fruits, vegetables, cereals, breads, and sugar.



Fats —

- Provide energy.
- Assist in maintaining body temperature.
- Help the body to metabolize some vitamins.
- Sources include dairy products, eggs, meat, oils, and nuts.



Vitamins —

- Various vitamins are needed to assist in body metabolism.
- Each vitamin is necessary for specific body functions.
- Vitamins A, D, E, and K can be stored by the body when ingested.
- Vitamins B and C cannot be stored by the body and must be ingested daily.
- Sources vary depending on the vitamin.



Minerals —

- Necessary to support various body functions.
- Especially essential for bone and tooth formation, muscle function, nerve function, and fluid balance.
- Examples include calcium, iron, sodium, potassium, phosphorus, magnesium, chloride, and zinc.
- Sources vary depending on the mineral.



Multiple Choice

How often does the USDA publish guidance regarding dietary guidelines?

- ☐ every three years
- ☐ every four years
- ☐ every five years



every six years

SUBMIT



Complete the content above before moving on.

Physiology of Nutrition

There are many factors that affect the natural reactions of the body. The functions of the cells are the primary factors that affect the body's processes. A proper diet is one of the building blocks for the body's ability to perform properly. Our ability to ingest, digest, use, and eliminate all the nutrients we need are vital.

There are two major components of nutrients we will discuss: vitamins and minerals. Both are vital to the body's ability to process the chemicals needed for cellular functioning, healing, fighting disease processes, and interacting with medications. Vitamins are organic

compounds that must be present in order for the normal metabolic process to occur in the body. It is essential to obtain these nutrients through a well-balanced diet because the body cannot synthesize adequate amounts for normal metabolic process. Our focus will be to understand how these nutrients interact with the cells, functions and the disease/injury processes.

CONTINUE



Water-soluble vitamins

Water-Soluble Vitamins

These vitamins help to oxidize carbohydrates, lipids and proteins. Since the B vitamins often occur together in foods, they are usually referred to as the vitamin B-complex. Previously you learned that B-complex vitamins such as B12 and folic acid are important to the circulation of oxygen through the body, but how does the body obtain these vital nutrients?

B12

Vitamin B12, (also called cobalamin and cyanocobalamin) is found in meats (especially found in organ meats), poultry, eggs, fish, shellfish and some dairy (milk and cheese). B12 is normally absorbed through the stomach, but it is dependent on a particular substance (intrinsic factor) secreted by the gastric mucosa. Without the intrinsic factor for the B12 to bond, the body would be unable to produce RBCs and synthesize DNA. The recommended daily allowance (RDA) of B12 is 2 µg.

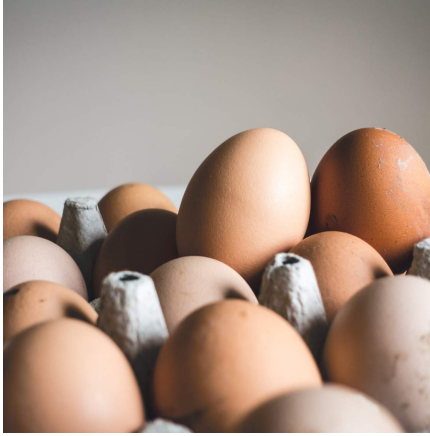
Deficiencies can be associated with patients who have had intestinal resections, gastrectomy, or other malabsorption syndromes. Vegetarians must also be aware of their B12 intake, and supplement their diet depending on the degree of their vegetarian diet. As previously stated, most B12 deficiencies are generally due to the lack of absorption because of the body's inability to produce the intrinsic factor, not from a lack of diet.

Patients without a confirmed deficiency should avoid taking large doses of vitamin B12. Taking mega doses may mask symptoms of folic acid deficiency or cause complications in patients with cardiac or gout conditions.

Clinical signs of B12 deficiency are noted at first by pernicious (L-destructive) anemia and weakness. Progressing deficiency can proceed to include poor muscle coordination, numbness of hands and feet, mental confusion and irritability.

The treatment for pernicious anemia consists of monthly injections of vitamin B12 ordered by the health care provider. With any medication order there are side effects and interactions to consider. Side effects of B12 treatment include transient diarrhea along with itching and urticaria. Interactions may occur with anticonvulsants, slow-release

potassium and colchicine (gout medication), and aminoglycoside antibiotics (gentamicin).



Eggs



Cheese



Fish



Folic Acid

Folic acid or folacin is a vitamin included in the B-complex group and is found in leafy and green vegetables, avocado, orange juice and kidney beans. One problem with many of these sources is the loss of the folic acid vitamin when they are cooked or reheated. The RDA is 400 µg per day.

Folic acid is used for the production of RBCs and DNA synthesis. During pregnancy, a deficiency of folic acid can result in neural tube defects, such as spina bifida in newborns. Some of the reasons an individual may be deficient are due to improper diet or disease processes that affect the liver: cirrhosis from chronic alcoholism, or renal dialysis. Malabsorption syndromes, malnutrition, or an intestinal obstruction may also cause a deficiency of folic acid.

Some of the signs of a folic acid deficiency may include sore mouth, diarrhea, and anorexia resulting in weight loss, irritability, and possible behavior disorders. Many disease processes have these same signs, so individuals are advised not to take folic acid supplements in doses larger than 0.4 mg (400 µg) found in most over the counter (OTC) vitamin supplements. When taking high dose supplements without the diagnosis of a folic acid deficiency, there is the potential of masking other disease processes as pernicious anemia.

Individuals diagnosed with a folic acid deficiency may be treated with a 1 mg dose prescription. Taking more than the recommended amount of folic acid without proper diagnosis, could interfere with the action of other medications as Phenytoin (Dilantin), estrogen, as found in oral contraceptives, or barbiturates.

B6

B6 or pyridoxine is a coenzyme used in the metabolism of carbohydrates, fats, protein, and amino acids. It is found in meats, legumes, peanuts, whole-grain cereals, and bananas. When calculating daily doses of B6 you must account for foods that are frozen, as there is a significant loss of B6 through this process. The RDA is 1.6–2 mg/day.

Deficiencies of B6, as with folic acid deficiencies, are from improper diet or disease process affecting the liver. Additionally, some drug interactions cause a deficiency of B6.

Individuals taking isoniazid (INH) therapy (used to treat tuberculosis) or even oral contraceptives may incur B6 deficiencies. B6 supplements should not be taken without proper diagnosis of a true deficiency. Patients under treatment for Parkinson's disease who are taking the medication levodopa (L-dopa) must be cautioned not to take B6 supplements. The B6 vitamin will antagonize the action of the L-dopa producing more problems with the disease.

Signs of deficiencies can include peripheral neuropathy, oral sores, and depression in adults. For infants, the deficiency may cause seizure activity. An overdose of B6 in pregnant women may result in seizures among newborns with a developed need for greater than normal amounts of pyridoxine.



Peanuts



Bananas



Legumes

Vitamin C

Vitamin C or ascorbic acid is found in fresh fruits and vegetables, especially citrus fruits, tomatoes, and broccoli. It is unstable when exposed to

For adults with no other disease processes, a dose of 100–250 mg twice a day (BID) may be ordered.

A hemodialysis patient may follow 100–200 mg daily. For an infant, beginning at two to four weeks of age, the dosage would be 20–50 mg per day. Many adults use vitamin C as a preventative supplement or treatment of a common cold with

heat or air or combined with alkaline compounds such as antacids. Adding baking soda to vegetables for color retention also destroys the vitamin C. The RDA for vitamin C is 60 mg/day.

Vitamin C is necessary for cellular metabolism and intercellular substances (collagen), and normal growth of teeth, gums and bones. Without this vitamin, iron is unable to be absorbed by the body properly. Vitamin C also promotes the healing of wounds and bone fractures.

Deficiencies are associated with pregnancy and lactation, gastrointestinal (GI) track diseases, smoking and, of course, a lack of fresh fruits and vegetables in an individual's diet. Other contributing factors to a deficiency are alcoholism, infections, and even stress.

Signs of a vitamin C deficiency (scurvy) can include muscle weakness and cramping, lethargy, sore and bleeding mouth and gums, or degenerative changes in bone and connective tissue. As with

a dose of 1–2 mg per day. Since ascorbic acid is a water-soluble vitamin, more than 50 percent of the dose is excreted in the urine for individuals without any kidney disease processes. Excretion of less than 20 percent of the dose over a 24-hour period may also suggest a vitamin C deficiency. Doses larger than that recommended are to be avoided because of the potential side effects.

Side effects of large doses of vitamin C, more than the RDA, can include increased urinary calcium; (precipitating kidney stone formation) and elevated uric acid levels (precipitating gouty arthritis). It may produce side effects of heartburn, abdominal cramps, nausea, vomiting and diarrhea. Consistent large doses of vitamin C can also produce a false negative result for colon cancer testing.

Vitamin C may interact with other medications an individual is currently taking. Taking aspirin with vitamin C may cause elevated blood level of aspirin in individuals. Individuals taking barbiturates, tetracyclines, estrogen or oral contraceptives may be required to take a vitamin C supplement.

Vitamin C may not be a vital component for circulation or oxygenation, but without this particular vitamin the body is deprived of the essential iron needed through out the body.

any suspected deficiency, a health care provider must confirm it and order treatment as necessary.

Treatments of scurvy, when ordered, follow different regimens based on the individual's disease process affecting the body. Ascorbic acid is available in capsule, tablets (extended release), solution, chewable or injection form. Treatment for scurvy may be seen in the following regimens.



Broccoli



Citrus



Tomatoes



Oranges

Use the following table as a quick reference for water-soluble vitamins.

Name	Food Source	RDA Plant	Amount
Vitamin B12	Seafood, shellfish, meat, poultry, eggs, milk, cheese	None	2 µg per day
Folic Acid	Organ meats	Green leafy vegetables, avocado, beets, kidney beans, broccoli, orange juice	400 µg per day
Vitamin B6	Pork, beef, chicken, tuna, salmon	Whole grain cereals, wheat germ, legumes, peanuts, soybeans, bananas	1.6–2 mg per day
Vitamin C	None	All citrus, cantaloupe, broccoli, tomatoes, green peppers, cabbage, Brussels sprouts	60 mg per day

CONTINUE



Fat-Soluble Vitamins

Since fat-soluble vitamins dissolve in fats, they are influenced by the same factors that affect lipid absorption. For example, the presence of bile salts in the intestine promotes the absorption of these vitamins.

As a whole, fat-soluble vitamins are stored in moderate quantities within various tissues, and because they are fairly resistant to the effects of heat, they are not usually destroyed by cooking or food processing as are water-soluble vitamins.



Vitamin A

Retinol, retinal, beta carotene - Vitamin A is processed in the body from the carotene of plants, especially yellow-orange and dark-green leafy vegetables. You will find the vitamin in oily saltwater fish, dairy products and eggs. The RDA is 800–1,000 international units (IU) per day.

Vitamin A is necessary for proper visual function at night, helps in the development of bones and soft tissue and maintaining healthy epithelial tissue. Many times you will see vitamin A (retinal, retinol) prescribed for acne, and for promoting the healing of wounds.

Deficiencies of vitamin A may be a result of an obstruction of bile, prolonged infection or fever, the malabsorption of fats or diarrhea. Vegetables can lose vitamin A due to over cooking in an open container, as heat and air cause oxidation.

Signs of a deficiency may include night blindness or photosensitivity, slow growth, bone and teeth deformities, along with impaired hearing. Of course these symptoms alone do not prove a deficiency, as health care providers must diagnose the deficiency. Once a deficiency is diagnosed, supplements may be necessary for infants fed unfortified skim milk or mild-substitute formulas, persons with prolonged infection or fever, or diabetics with hypothyroidism.

Individuals being treated with Accutane (a synthetic vitamin A product), should be cautioned and have it explained that pregnancy is contraindicated during treatment, as this product can cause fetal abnormalities. Accutane is also used to treat severe cystic acne (also known as nodular acne) Accutane may also cause increased intracranial pressure, possible liver changes and other adverse side effects associated with hypervitaminosis A. Symptoms of overdose (hypervitaminosis A) occur from a greater than 50,000 IU (15,000 mcg of retinol) include irritability and psychiatric symptoms, fatigue and lethargy, along with insomnia and headaches. Acute toxicity is denoted by increased intracranial pressure, vertigo, and coma. Caution must be taken with individuals with kidney or liver problems and diabetics.

Vitamin D

Calciferol, cholecalciferol, ergocalciferol - This is one vitamin the body is capable of synthesizing in small amounts through the action of the sunlight on the skin. Not everyone lives in a climate where this is possible throughout the year. Examples include individuals who may live in Washington state, or England, United Kingdom (UK). The dietary sources include fish oils and food products fortified with vitamin D, such as milk and cereals. The RDA is 400 IU/day.

Vitamin D is necessary for the maintenance of normal nerve and muscle functioning. It assists in regulating the absorption and metabolism of calcium and phosphorus for healthy bones and teeth, making it important during pregnancy and lactation.

Signs of deficiency are seen with the rickets disease process characterized by poor teeth and bone structure; osteoporosis as characterized by loss of bone density. Tetany is another disease process that is characterized by cramps, convulsions, twitching of the muscles and sharp flexion of the wrist and ankle joints. Prevention and treatment for vitamin D deficiencies include supplements prescribed such as calcifediol, calcitriol, or ergocalciferol which are carefully regulated. Some of the symptoms that may be present with a vitamin D overdose and toxicity include cardiac arrhythmias, vertigo, tinnitus, kidney damage or kidney stones. Severe symptoms may lead to hypocalcaemia and convulsions. For individuals with known cardiovascular disorders, kidney diseases, or are pregnant or lactating, extreme caution must be taken not to exceed the RDA of vitamin D.

Vitamin D treatment may interact with individuals who are taking digitalis and thiazide diuretics such as hydrochlorothiazide (HCTZ). An overdose of vitamin D may antagonize the actions of these drugs causing more damage to the individual. An additional interaction is mineral oil; it may interfere with the intestinal absorption of the vitamin.



Vitamin E

Vitamin E (tocopherol) is abundant in many natural forms. It is found especially in cereals, wheat germ, seeds, nuts, vegetable oils, eggs, meat and poultry. The RDA for vitamin E is 30 IU per day.

Vitamin E is necessary for normal metabolism, the protection of tissues of the eyes, skin, liver, and lungs. It assists in the regulation of vitamin A use and storage. Vitamin E protects RBCs from damage and decreases platelet clumping. Research is ongoing in the use and benefits of vitamin E supplements as one of the treatment protocols for the management of early Alzheimer's disease and for possibly slowing the progress of such memory loss symptoms. However, the supplement will neither cure nor prevent this debilitating disease.

Since this vitamin is so abundant, deficiency is related with other disease processes versus a lack of ingestion of the vitamin. The deficiency is found in association with alcohol abuse, malabsorption syndromes such as cystic fibrosis, pathologic conditions of the liver and pancreas, and sickle-cell anemia. Premature infants or low-birth weight neonates have also been found to be susceptible.

The signs of a vitamin E deficiency are not concretely established because of the other disease processes it is associated with. Premature infants may show irritability, edema or hemolytic anemia. Adults may show signs of muscle weakness or abnormal lab values with low RBC counts. The sign of an overdose of the vitamin (1,200 IU per day) is more

readily seen through prolonged clotting times. Because of this potential side effect, vitamin E supplements should be discontinued 10 days before surgery, and should not be taken while on anticoagulant therapy because of the increased risk of bleeding. Vitamin E interacts with an excessive use of mineral oil, decreasing the absorption of the vitamin.



Oils



Poultry

Vitamin K

Phytonadione or vitamin K is most often found in green or leafy vegetables. It is also found in cheese, eggs and vegetable oils. The RDA for vitamin K is 60–80 mg per day.

Vitamin K is necessary for blood clotting. This is prevalent in the use as prophylactic treatment for newborns at birth. The American Academy of Pediatrics recommends this course of treatment to prevent hemorrhagic diseases of the newborn. Vitamin K is also necessary for individuals with malabsorption syndromes, ulcerative colitis, coumarin overdose, and prolonged use of salicylate and long-term hyperalimentation antibiotics.

Signs of a vitamin K deficiency are increased clotting time, petechia, and bruising, and blood in both urine (hematuria) and in stool (melena). Treatment is prescribed as phytonadione (Mephyton tabs or Aquamephyton IM or SC). This course of treatment is only effective for bleeding disorders that are due to low concentrations of prothrombin in

the blood. It is not effective for bleeding from other causes, such as heparin overdose or trauma. Use the following table as a quick reference for fat-soluble vitamins.

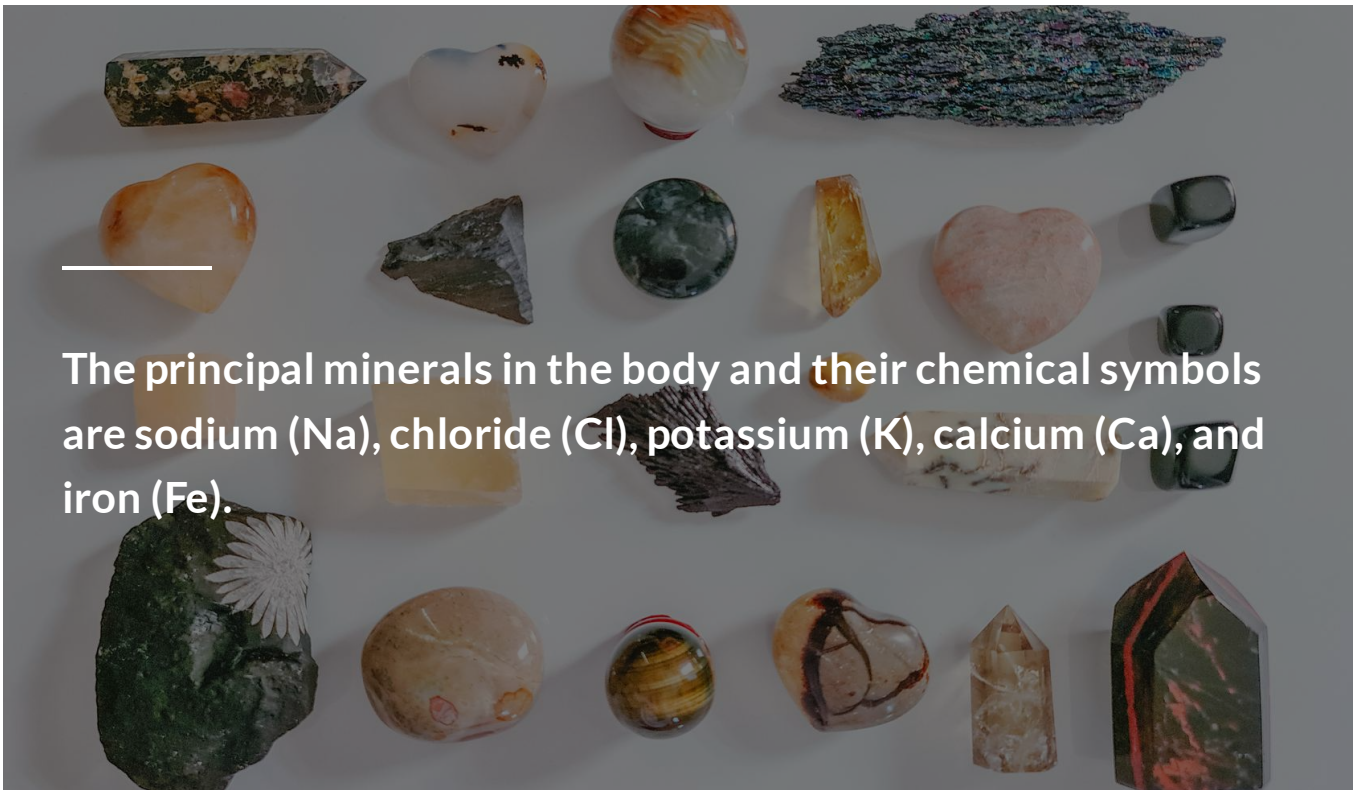
Name	Food Source	RDA Plant	Amount
Vitamin A	Oily saltwater fish, whole milk, cream, butter, cheese, egg yolks, fish liver oils	Dark-green leafy vegetables, deep yellow or orange fruits and vegetables	800–1,000 IU per day
Vitamin D	Fish oils, salmon, herring, mackerel, sardines, eggs, butter, milk	Fortified cereals	400 IU per day
Vitamin E	none	Vegetable oils, seeds, nuts, wheat germ, cereals	30 IU per day
Vitamin K	Egg yolk, cheese, liver	Vegetable oil, green leafy vegetables, cabbage, broccoli	60–80 mg per day

CONTINUE

Minerals

Carbohydrates, lipids, proteins and vitamins are all organic substances, but dietary minerals are inorganic elements that are essential to human metabolism. Minerals are usually extracted from the soil by plants, and we in turn obtain these minerals from the plant food sources or from the animal sources that have eaten the plants. The correct balance of each mineral is required for the maintenance of health (chemical balance homeostasis).

Minerals are responsible for approximately four percent of the body weight and are concentrated in the bones and teeth. The two minerals abundant in bones and teeth are calcium and phosphorus, nearly 75 percent of the body's minerals. Minerals dissolved in the body fluids are called electrolytes because they carry positive or negative electrical charges required for body activities. These activities include simple nerve impulse conduction to the blood formation, and the beating of the heart.



The principal minerals in the body and their chemical symbols are sodium (Na), chloride (Cl), potassium (K), calcium (Ca), and iron (Fe).

Sodium and Chloride

Both sodium and chloride are the principal minerals in the extracellular body fluids. Through experience we understand that blood contains approximately 0.9 percent sodium chloride, and the best source of these minerals is through table salt (NaCl).

The sodium element is readily absorbed from foods by active transport, and the kidneys, under the influence of the adrenal cortical hormone aldosterone, regulate the blood concentration of the sodium. When this hormone is released, the kidneys reabsorb sodium while expelling potassium.

Like sodium, chloride is widely distributed throughout the body, although it is seen in the highest concentration in the cerebrospinal fluid and gastric juices. Together with sodium, chloride helps to maintain the electrolyte balance (homeostasis) and regulate the pH level through the concentration of extracellular fluids in the body's cells.

Since these elements are readily available, a deficiency of these minerals is due to starvation or an extended time of fasting. The signs of a deficiency can be seen through an excessive amount of fluid loss from bleeding, diarrhea, and vomiting or excessive perspiration.

Matching

Match the correct vitamin or mineral with its source.

<div><div>≡</div><div>1</div></div> <div>Sodium and Chloride</div>	<div>table salt</div> <div>▼</div>
<div><div>≡</div><div></div></div> <div></div>	<div></div> <div></div>

2	Vitamin K	green or leafy vegetables	▼
≡ 3	Vitamin A	yellow-orange and dark-green leafy vegetables	▼
≡ 4	Vitamin D	sunlight	▼
≡ 5	Vitamin E	cereals, wheat germ, nuts, and eggs	▼
≡ 6	Vitamin C	citrus fruits, tomatoes, and broccoli	▼
≡ 7	Vitamin B6	meats, legumes, peanuts, and bananas	▼
≡ 8	Vitamin B12	poultry, eggs, fish, and milk	▼
≡ 9	Folic Acid	avocados, orange juice, and kidney beans	▼

SUBMIT



Complete the content above before moving on.



Mental Health and Psychology Adjustments

Even with all of the medical break-throughs, the mind is a great influence to healing that is still often over looked. The mind has and continues to prove to be one of the best healing components in the recovery process. If the patient believes they will recover and heal, chances are, they will. Just the reverse is also true. Understanding the purpose and expected outcome of medical treatment procedures is necessary knowledge that every medic needs to assist patients in their recovery. Illness and injury often have an obvious effect on people.

However, some adjust and cope with illness, injury and healing positively while others may struggle with despair, depression or other psychological problems. There are various psychological factors that can influence a patient's mental status while under the care of a health

care system. Medics should keep in mind there are sources available to assist in improving or maintaining a patient's mental well-being. Most notably, these sources include family, friends, supervisors, co-workers and clergy. Allowing as much time as possible for a patient to visit with such support people is crucial in the therapeutic process.

Medical Technician Guidelines

Patients often want to talk to the health care personnel whom they see on a frequent basis during clinic visits and hospitalization. This obviously means medics are prime candidates for such sessions.

It is important to keep these things in mind whenever conversing with a patient in regard to personal concerns:

- 1 Be a good listener and demonstrate a genuine concern.
- 2 Do not offer advice or solutions on matters that only the provider should address.
- 3 Refer the patient's concerns to the nurse or provider in a timely manner.
- 4 Finally, it is important to keep the patient's family in mind. Though local policies should be adhered to on matters such as visiting hours, the number of visitors permitted at any one-time, restricted treatment area, and so forth, and the staff must make every effort to keep the family informed and comfortable.

Responses to Illness or Injury

There are so many different types of major injuries and severe medical conditions that can occur we could never cover all the situations known to the medical community. Some of the major

injuries and severe medical conditions you may encounter are gunshot wounds, burns, spinal cord injuries, strokes, or heart attacks.

Although the conditions are very different, the patients may share many of the same feelings, including:



- Shock and Disorientation
- Fear and Anxiety
- Depression
- Guilt
- Post-Traumatic Stress Disorder

Depression and Anxiety

It has been reported that one third of hospitalized medical patients with chronic medical conditions and major injuries also suffer from psychological disorders such as depression or anxiety. Many psychological components of medical illnesses are still understudied, and often overlooked.

Psychological states, such as anxiety and depression, can alter the adjustment to illnesses, thereby causing poor health practices and interfering with social functioning. Health psychologists stress the importance of identifying and treating psychological disorders in patients with chronic diseases or major injuries. A healthy adjustment to these major changes or life stressors is linked to increased attempts to gain control over one's health.

Health psychologists believe it is important to educate people about the variety in responses to negative life events because it allows friends and family to respond in more constructive ways. Understanding and recognizing the patient's response to severe illness or injury is even more important for medical technicians these days.

With the number of wounded warriors we see direct from the battlefield or as they continue to heal, it is essential to always keep the patient's mental and spiritual well being in mind while caring for the physical wounds. While volumes have been written on the psychological effects of illness and injury, we will briefly cover a few of the common responses patients may have.



Depression



Anxiety

Shock and Disorientation

The immediate reaction to a major injury is normally a sense of shock and disorientation relating to the enormity of the event. You may have seen or heard the patient appeared “distant” or felt “numb.” This reaction is usually short-term, lasting a few days to a week. Following the initial shock, he or she might experience emotional turmoil exhibited by nightmares of being injured again, sleep problems, mental confusion, and disorientation. The quality of his or her family support and the medical care you provide, are key factors that will influence the patient’s healing and adjustment. There may also be local support groups to help the patient with the difficulties of returning to home and work.

Fear and Anxiety

There is little question a patient may experience fear and anxiety from a major injury. In fact, excessive anxiety generally contributes to the initial shock reaction. He or she may express fear and anxiety in varied ways.

- Feeling anger and exhibiting withdrawal behavior.
- Expressing a need for safety, security, and nurturing (through words or actions).
- Reverting to childlike behaviors when dealing with stress.
- Becoming aggressive, demanding, tearful, and more dependent on others.
- Focusing on thoughts of survival, comfort, and treatment procedures, which can influence fear.

Don’t forget you are supporting more than the patient receiving care. The patient’s family and close friends may also experience emotional shock, anxiety, fear, panic, and even guilt.

Depression

It is normal for the patient to grieve the loss of function and his or her body image, so depression is a common occurrence following a major injury. The patient may become very discouraged about what he or she can and can't do. Perhaps the patient may think he, or she won't be able to play with his or her children or provide for their emotional needs in the future. The patient might worry that his or her appearance will upset their spouse, thus interfering with their marital and intimate relationship. The patient may think he or she will never work again and will have concerns over financial problems.

If the patient remains depressed, has difficulty sleeping, worries about his or her situation, or suffers from a significant loss or gain of appetite, the patient or family should bring the concern forward. Additionally, if you notice the patient appears depressed or seems to be suffering from any unhealthy psychological indicators, notify the nurse or doctor. The health care provider may be able to help or refer him or her to the appropriate mental health professional.



Guilt

Guilt is another reaction that could be experienced after a major injury. The patient may be thinking, “I should have done something to prevent the accident,” “I should have taken just a little more time ...” or “I can’t do anything right.” Feelings of guilt can also be associated with

depression. If the patient is suffering from such negative feelings, they need to discuss their emotional condition with their doctor.

CONTINUE

Post-Traumatic Stress Disorder

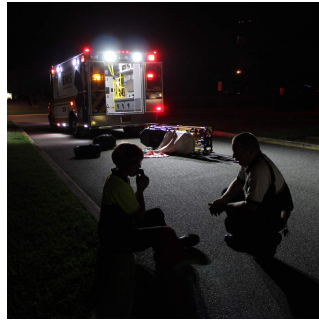
This is a significant concern if the patient has been in a wartime situation, suffered from a significant injury or even a thermal burn.

Signs include:

- Recurrent and intrusive recollections of the injury.
- Dreams of the event.
- Feeling of being wounded again.
- Psychological distress when the memory of the accident/incident is triggered.

Even though the event has ended, the patient may still experience physical and mental suffering that is associated with it. After a patient has been through inpatient rehabilitation and has been discharged, he or she may begin to feel isolated, depressed, perhaps in despair. Concerns about income, future jobs, and the daily demands of life will take their toll on the patient's well-being.

For the patient and family, they have entered a world where there is limited experience. No one in the family may understand all the patient's emotional responses. This period in recovery is a critical time for the patient and the family. Counseling and support groups are healthy ways to learn how to cope with the changes in life.



CONTINUE

Substance Abuse

The misuse or overuse of any substance is considered to be substance abuse, and it's seen in many forms. Substance abuse can involve both legal and illegal substances. The two areas of concern addressed here are alcohol and drug abuse when it impacts home, work or school. The reason behind substance abuse is unclear, it could be related to genetics or peer pressure. Substance abuse could also be caused by a mental disorder such as anxiety or depression.

Legal and illegal drugs are the **two** categories that are involved when discussing drug abuse. Any legal medication used to treat pain that is not prescribed by a certified provider is considered legal drug abuse. Any drug not approved for use is considered illegal drug abuse.

Click on the hotspots below to learn more about the different categories of illegal and legal drugs.





Stimulants

These drugs stimulate the central nervous system.



CBD Oil

CBD is a chemical found in marijuana. CBD doesn't contain tetrahydrocannabinol (THC), the psychoactive ingredient found in marijuana that produces a high. The usual CBD formulation is oil, but CBD is also sold as an extract, a vaporized liquid and an oil-based capsule. Food, drinks and beauty products are among the many CBD-infused products available online.



Narcotics

These are strong medications to help treat pain. Side effects include drowsiness, excitement/joy and a sense of well-being.



Depressants

These are drugs that depress the central nervous system. Side effects are a reduction in anxiety and drowsiness.



Hallucinogens

These drugs create false images and senses.



Marijuana

This drug is legal in some states and is appropriately prescribed by a certified medical provider to help treat pain and nausea from chemotherapy. The drug impacts the brain causing a “high” and will also adjust a person's mood.

CONTINUE



Alcohol Abuse

Alcohol dependence is classified as alcoholism, a condition that includes cravings, loss of control, physical dependence and tolerance.

- Cravings – When an individual must have a drink.
- Loss of Control – Not being able to stop once an individual has started to drink.
- Physical Dependence – when an individual exhibits withdrawal symptoms.
- Tolerance – When someone needs an excessive amount of alcohol to have the desired effect.

Alcohol Withdrawal

5 to 10 hours after your last drink: You may experience tremors (shaking), an increase or decrease in blood pressure, sweating, sleep disruptions, rapid breathing, vomiting, irritability, anxiety, and a rapid pulse. These symptoms typically peak within 24 to 48 hours.

12 to 24 hours: You may have hallucinations, meaning you see, hear, or feel things that aren't there. This can last up to 2 days or sometimes longer.

24 to 48 hours: You may have withdrawal-related seizures.

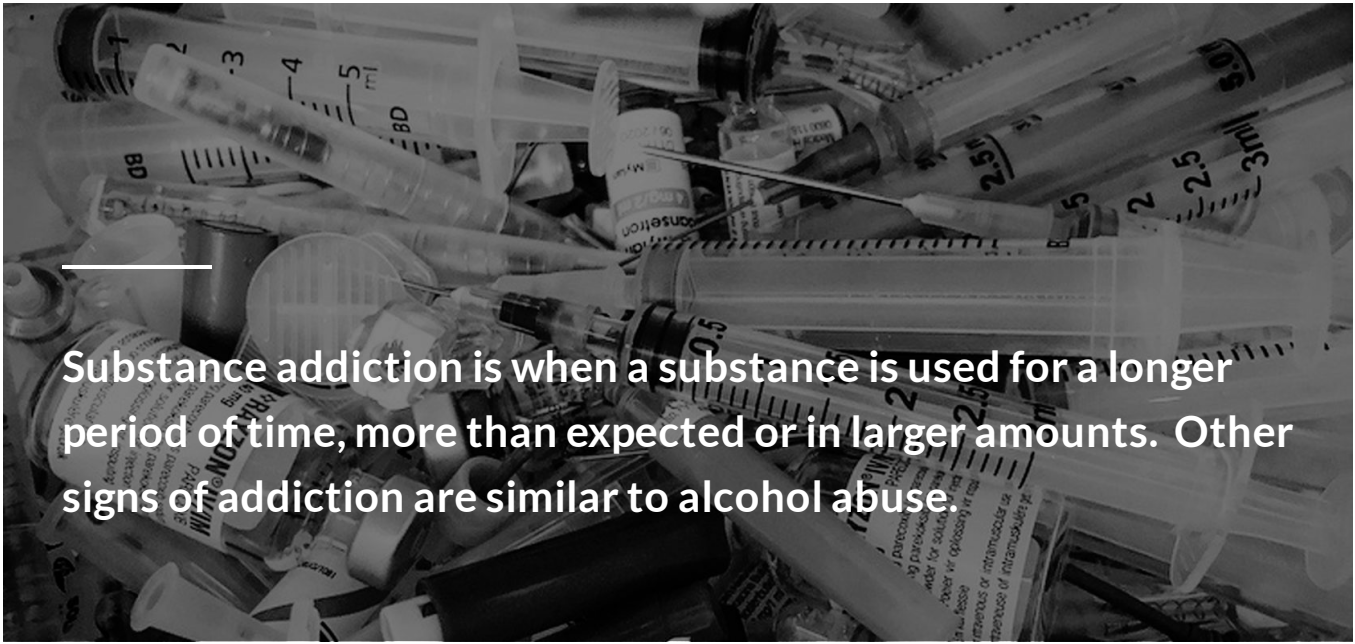
72 hours and beyond: Alcohol withdrawal symptoms tend to improve within 5 days. However, a small number of people have withdrawal symptoms that last for weeks.

Alcoholism

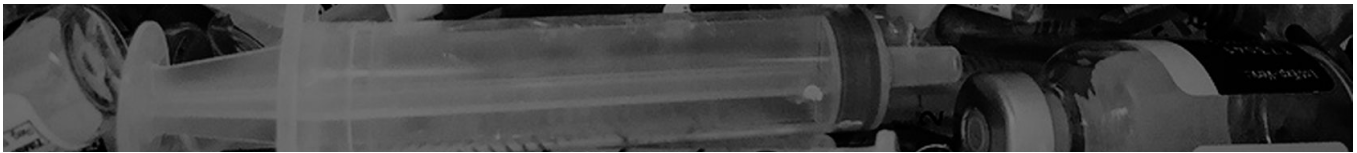
Alcoholism has many physical symptoms. While it's a mental addiction, the body also becomes addicted to chemicals in the brain that become dependent on the dopamine that alcohol releases. This can lead to serious symptoms of withdrawal and strong urges to consume more.

Here are some of the common physical symptoms of alcoholism:

- Cravings
- Poor coordination
- Dizziness
- Bowel issues
- Vomiting
- Tremors
- Fatigue
- Hangovers
- Dehydration



Substance addiction is when a substance is used for a longer period of time, more than expected or in larger amounts. Other signs of addiction are similar to alcohol abuse.



Treatments depend on what substance was used by the individual. Below are some of the treatments that are administered to someone who is experiencing a substance addiction.

- **Detoxification** – Toxins are a substance that causes harm to an individual's body, in some cases even death. Detoxification is the process of removing the toxins from the body.
- **Drug Therapy** – A drug that has similar effects that is provided slowly to assist with limiting the undesired effects.
- **Counseling** – The process in discussing an individual's thoughts and feelings with a psychologist.

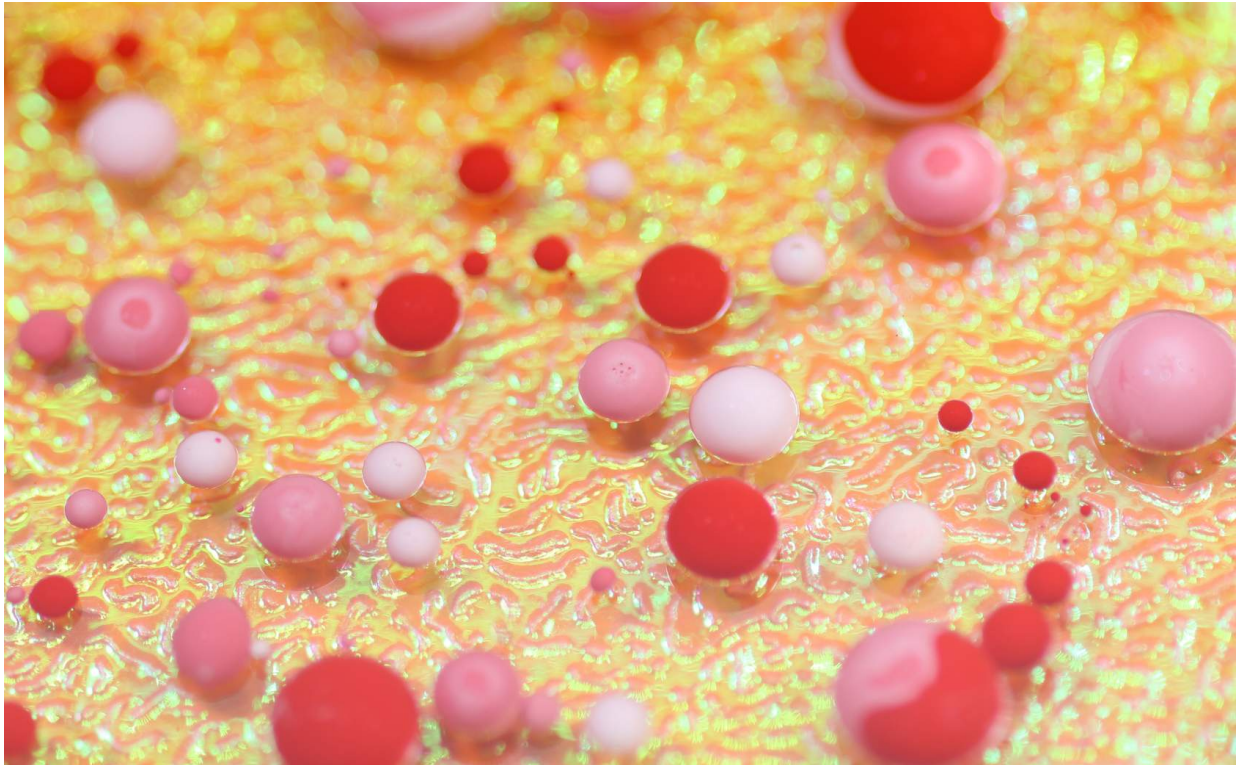
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Body Defenses and Healing Process

You have reviewed the basic needs, nutrition and physiology of the chemical balances needed for the body to function properly. As you may remember, there are some factors we can change or control. Your body will react to the influences it is exposed to and the treatment it may have to undergo. Now it is time to look at other factors that can influence health. Influences such as age, ethnic background and sex are the influences we cannot change and have to accept the health risks that may come with these factors.

This capability depends on the proper functioning of various organs and systems as well as the nature or extent of the disorder. The body's defenses are affected by a simple break

in the integumentary system or by a major illness or disease. While you may be able to control the break to the skin, an infant born with human immunodeficiency virus (HIV) must deal with this uncontrollable influence. Cells are the basic working functions to all processes, beginning with the white blood cells, the first line of defense to fight disease.



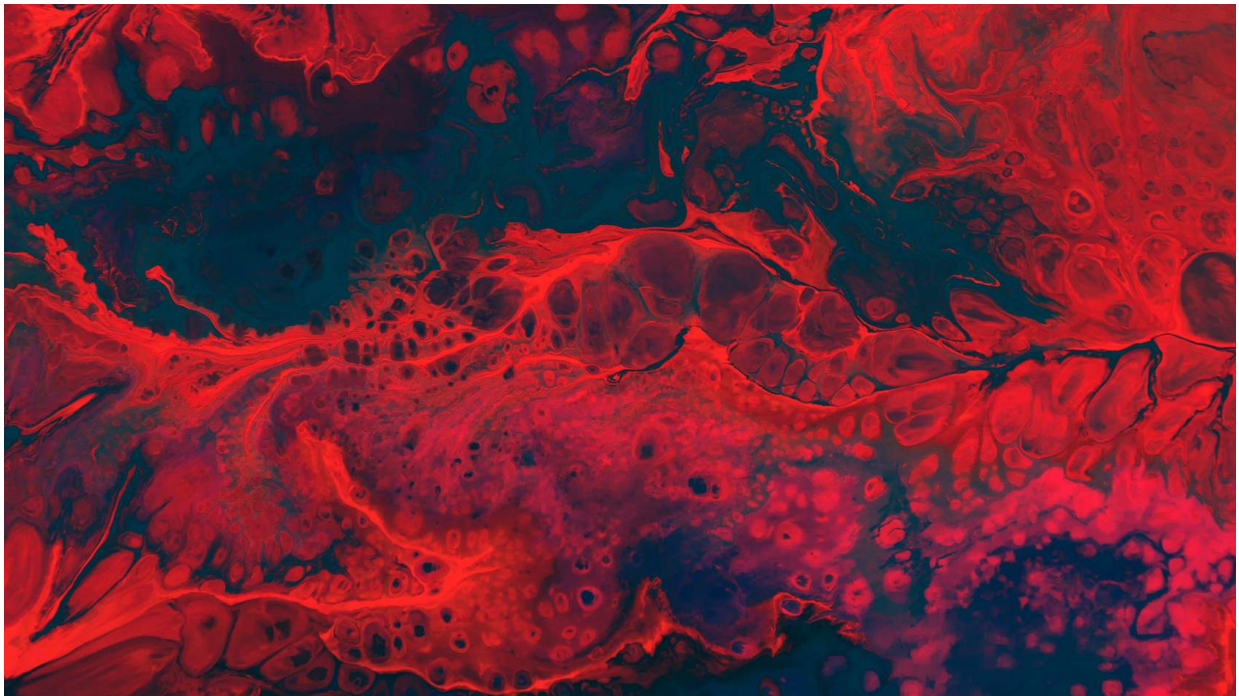
White Blood Cells

White blood cells (WBC), or leukocytes, do most of their work outside the circulatory system to protect against disease at the cellular level. The WBCs are transported to sites of infection by the circulatory system. There are five types of leukocytes that are distinguished by their size, nature of their cytoplasm and the shape of their nucleus. The five types are grouped into one of two categories, **granulocytes** and **agranulocytes**. Granulocytes are leukocytes that have granular cytoplasm, while the leukocytes that lack cytoplasmic granules are called agranulocytes.

GRANULOCYTES	AGRANULOCTYES	FUNCTIONS OF THE WHITE BLOOD CELLS
<p>Typical granulocytes are developed in the red bone marrow from hemocytoblasts and consist of three types of leukocytes: neutrophils, eosinophils and basophils. These granulocytes have a relatively short life span, averaging only 12 hours. Neutrophils have fine cytoplasmic granules, and a nucleus that consists of two to five sections. For this reason, neutrophils are also called polymorphonuclear leukocytes.</p> <p>Neutrophils account for 54–62 percent of the leukocytes in a typical adult blood sample. Eosinophils contain coarse, uniformly sized cytoplasmic granules with a blobbed nucleus (two lobes). These cells make up one to three percent of the total number of leukocytes. The last granulocyte is the basophil. The basophils are similar to eosinophils in size and the shape of their nuclei. The basophils have fewer more irregular shaped cytoplasmic granules that often obscure a view of the nucleus. These leukocytes account for less than one percent of the leukocytes.</p>		

GRANULOCYTES	AGRANULOCTYES	FUNCTIONS OF THE WHITE BLOOD CELLS
<p>Agranulocytes - The agranulocytes make up the last two types of leukocytes, the monocytes and lymphocytes. Monocytes generally arise from red bone marrow, while the lymphocytes are found in the organs of the lymphatic system as well as in the red bone marrow. Monocytes are the largest cell found in the blood. The nuclei vary in shape, round, kidney-shaped, oval or lobed.</p> <p>They usually make up three to nine percent of the leukocytes in a blood sample and live for several weeks or even months. The lymphocytes are usually only slightly larger than erythrocytes. Typically, lymphocytes contain a relatively large round nucleus surrounded by a thin rim of cytoplasm. The lymphocytes account for 25–35 percent of the leukocytes. Lymphocytes have an extremely long life span that may extend for years.</p>		

GRANULOCYTES	AGRANULOCTYES	FUNCTIONS OF THE WHITE BLOOD CELLS
<p>The leukocytes are the first line of defense in fighting diseases; this is accomplished in various ways. Some leukocytes phagocytize (engulf) bacterial cells in the body, while others produce antibody proteins that destroy or disable foreign particles. The most active phagocytic leukocytes are neutrophils and monocytes. Neutrophils ingest the particles the size of bacterial cells, while the monocytes can engulf cells much larger.</p> <p>When a microorganism invades the human body, the cells respond by releasing biochemicals such as histamine. The histamine dilates arterioles to allow more blood to flood into the capillaries. The tissue reddens producing the swelling inflammatory reaction where the damaged cells release chemicals that attract the leukocytes to the area quickly. The eosinophils help to control inflammation and allergic reactions by removing biochemicals associated with these reactions.</p> <p>Eosinophils are weakly phagocytic, but are attracted to and kill certain parasites enabling the body to fight disease. The basophils help to prevent intravascular blood clot formation by releasing heparin, and may increase blood flow to injured tissues by releasing histamine. Lastly, lymphocytes are important in the immunity process. The lymphocytes include B-lymphocytes (B-cells) that produce antibodies, and the T-lymphocytes (T-cells) that produce biochemicals called cytokine.</p> <p>Cytokine is a protein necessary for proper cell reproduction and division and is directly linked to the immune responses. When the T-cells have been invaded, and the cytokine is not released, severe immunocompromised disease may occur.</p>		



Lymphatic System and Immunity

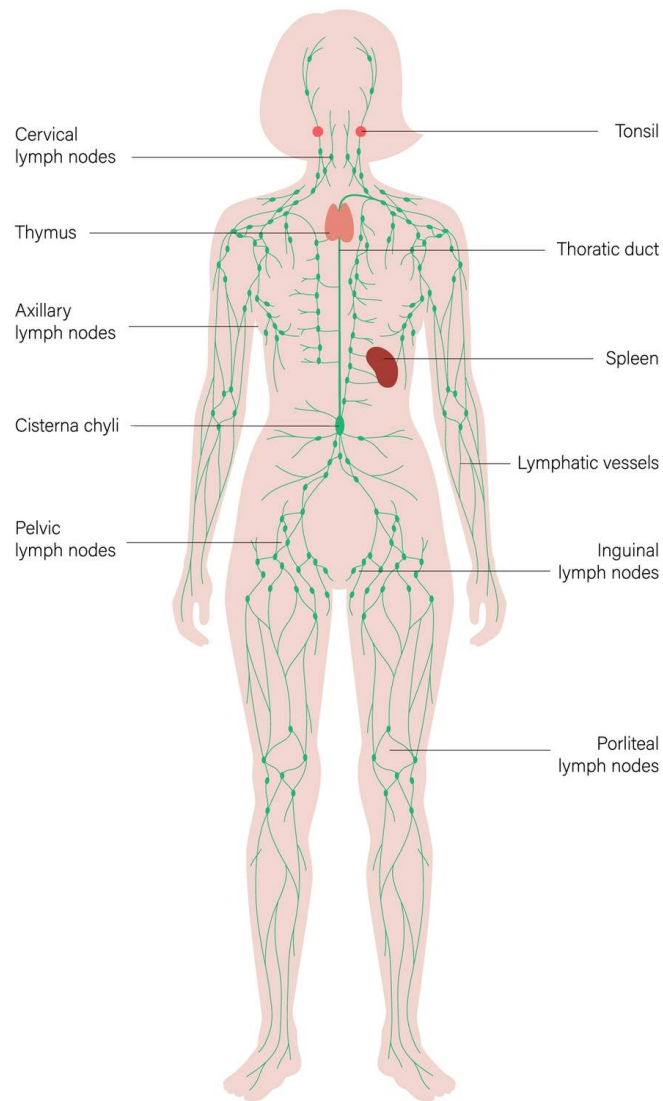
Lymphocytes are categorized within blood cells of the body, but are the foundational cell for the lymphatic system and the immunity process. Lymphocytes produce antibodies and cytokine protein products to assist the functions of immunity. When there is a breakdown of these lymphocytes, immune responses are affected.

The lymphatic system is closely associated with the cardiovascular system because it includes a network of vessels that assist the circulation of fluid through the body and help defend the body against invasion by disease-causing agents. To understand the functions of immunity, we need to begin with the components of the lymphatic system as a whole.

Components of the Lymphatic System

Lymphatic capillaries are the microscopic closed-ended tubes and contain the fluid called lymph. This fluid is essentially tissue fluid that has entered a lymphatic capillary. The lymph is carried through the lymphatic vessels that are similar to veins in having semi lunar valves to prevent back flow of lymph, but thinner. These lymphatic vessels

lead to the specialized organs called lymph nodes. After leaving the lymph nodes, the vessels merge to form the lymphatic trunk.



Lymph Nodes

Lymph nodes, or lymph glands, are located along the lymphatic pathways throughout the trunk of the body. The nodes contain large numbers of lymphocytes and macrophages that fight invading

microorganisms. Nodes occur singly or in groups associated with the mucous membranes of the respiratory and digestive tracts.

The tonsils are an example; they are composed of partially encapsulated lymph nodules.

Immune Responses

We understand that the B-cells and T-cells are produced by the lymphocytes; these cells are not activated until they have encountered the antigen for which they are specialized to react with. This action constitutes a primary immune response. During this response, plasma cells release antibodies immunoglobulin M (IgM), followed by immunoglobulin G (IgG) into the lymph. The antibodies are transported into the blood and then throughout the body, where they help to destroy the antigen causing microorganism or bacteria. This production and release of these antibodies continues for several weeks to continue to fight the disease. Detectable concentration of antibodies usually appears in the body fluids within five to ten days following exposure to antigens.

The concentration of antibodies is a direct result of the primary immune response. Following the primary immune response, some of the B-cells produced during the initial release of antibodies, clone and remain dormant to serve as memory cells. If the identical antigen is reencountered, the body uses these clones of these memory cells to enlarge. The B-cell then responds rapidly with the IgG to the antigen to destroy the disease before it produces wide spread disease in the body. This is called a secondary immune response. The secondary immune response helps to stimulate a slow release of the viral antigen after an initial infection. This constantly stimulates memory B-cells, which present the antigen to T-cells thus maintaining immunity.

The Primary Functions for Lymph Nodes

There are **two** primary functions for all lymph nodes, filtering potentially harmful particles from lymph before returning it to the bloodstream and immune surveillance provided by the lymphocytes and macrophages. Remember the lymphocytes and macrophages attack infecting viruses, bacteria and other parasitic cells brought to the

nodes through the lymphatic system. The macrophages in the nodes phagocytize and destroy the foreign substances, damaged cells and cellular debris.

THYMUS

SPLEEN

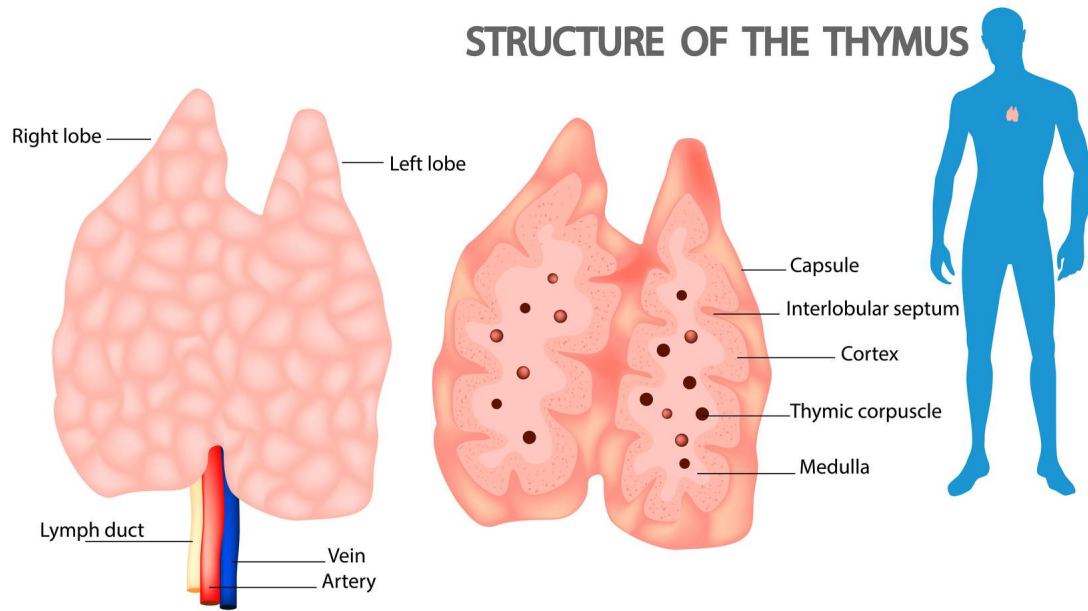
The thymus gland is a soft, bilobed structure enclosed in a capsule located within the mediastinum, in front of the aortic arch and behind the upper part of the sternum. The thymus is relatively large during infancy and early childhood up to about two years of age. After puberty it shrinks becoming quite small in an adult. The actual size varies from person to person, and in the elderly the normal lymphatic tissue is replaced by adipose and connective tissues.

The thymus is considered the primary central gland of the lymphatic system and functions in association with the endocrine system.

The endocrine activity depends on the hormone thymosin; which is composed of biologically active peptides critical to the maturation and development of the immune system. The lobes contain large numbers of lymphocytes that developed from precursor cells (thymocytes) originating in the bone marrow.

These thymocytes mature into T-cells that leave the thymus and migrate to the lymph nodes and spleen. T-cells primarily mediate cellular immune responses such as graft rejection and delayed hypersensitivity.

STRUCTURE OF THE THYMUS

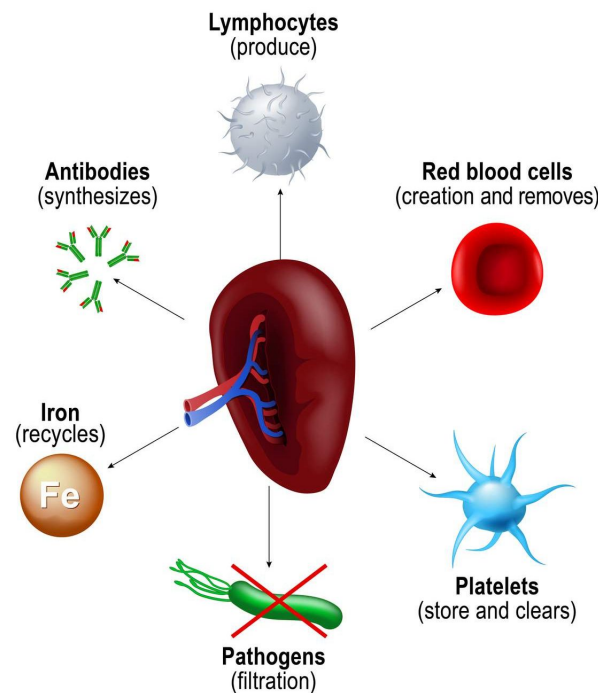


THYMUS

SPLEEN

This is the largest of the lymphatic organs, located in the upper left quadrant of the abdominal cavity, just below the diaphragm and behind the stomach. The spleen resembles the look of a large lymph node, enclosed in connective tissue, partially subdividing the organ into lobules. Within these lobes there are two types of tissue found, white pulp and red pulp.

The white pulp is distributed throughout the spleen as if like tiny islands, with the white pulp containing most of the lymphocytes. The red pulp contains numerous red blood cells, which gives its color, and many macrophages with some lymphocytes. The macrophages engulf and destroy foreign particles and the lymphocytes defend the body against infection that may be carried in the blood as it is filtered through the spleen.

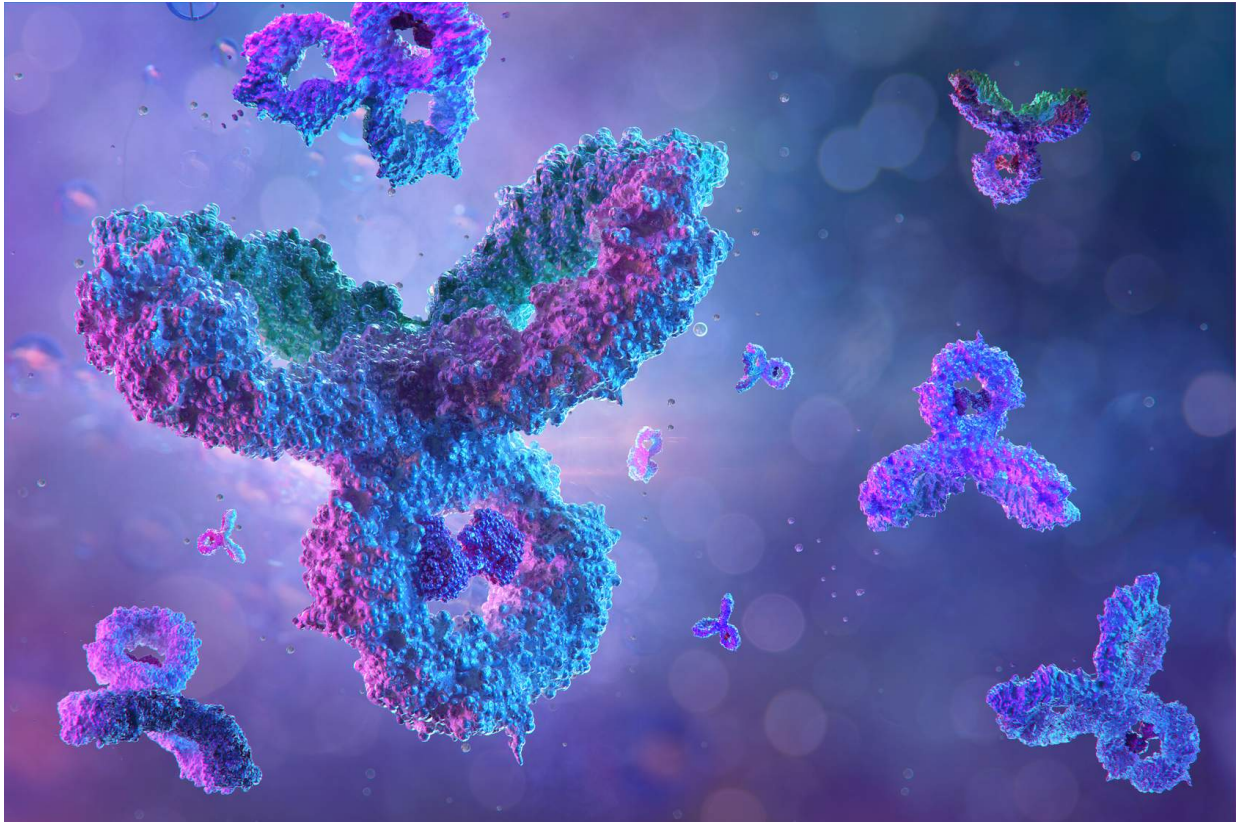


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Types of Immunity

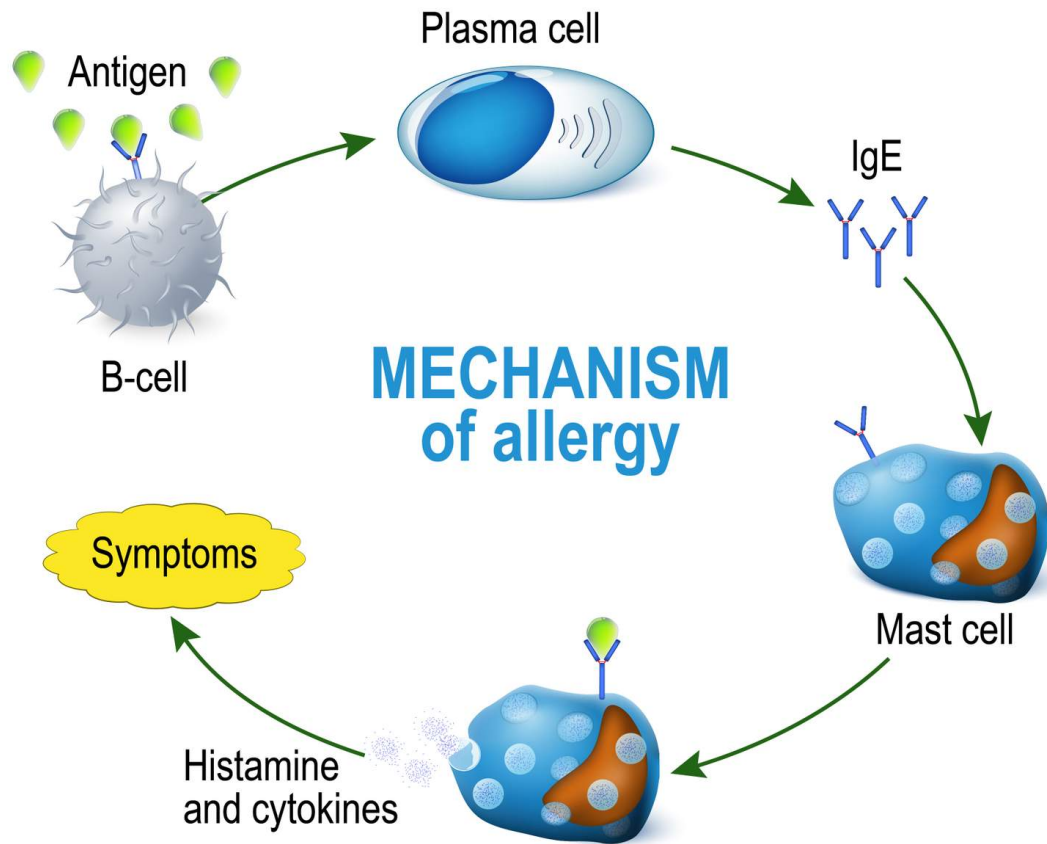
Just a generation ago, it was not uncommon to find school classrooms empty at certain times of the year due to several infectious childhood diseases, like measles, pertussis (whooping cough), mumps and even chicken pox. With these diseases, children usually suffered the illness only once due to the naturally acquired active immunity developed due to exposure of the illness. Today, most children in the US do not contract these childhood diseases due to vaccinations. A vaccine contains an antigen that can stimulate

a primary immune response against a particular disease-causing agent. With the vaccine, it does not produce the severe symptoms of the disease.

A vaccine may contain bacteria or viruses that have been killed or weakened so that they cannot cause a serious infection. Vaccines may also contain a toxoid (toxin of an infectious organism that has been chemically altered to destroy its toxic effects). At these low doses of the organism or bacteria, it may be sufficient enough for the foreign antigen to alert the immune response system. The vaccine causes a person to develop artificially acquired active immunity. There are cases where a virus changes so rapidly; the body can't defend against disease and the immune system starts to break down. This happens in cases of HIV, the virus that causes AIDS, which is constantly changing and making it very difficult to produce a vaccine. There are other instances where a person who has been exposed to an infectious disease and needs protections against the disease-causing agent, but lacks the time to develop the active immunity. This is seen in cases of hepatitis. In some instances it may be possible to inject the person with antiserum (ready-made antibodies of the infectious agent). Usually these antibodies are obtained from gamma globulin that has been separated from the blood plasma of a person who has already developed immunity against the particular disease.

The injection of gamma globulin produces an artificially acquired passive immunity. It is passive because an individual acquires the antibodies necessary for the body to recognize and fight the disease because the body did not develop them on their own. This type of immunity is relatively short lived, lasting no more than just a few weeks. This individual is still susceptible to the pathogen in the future; their lymphocytes were not involved in fighting against the pathogen that was needed for protection. The last type of immunity is specific to mother and child during pregnancy. Certain antibodies (IgG) pass from the maternal blood into the fetal bloodstream through the placental barrier. After entering the fetal cells, the antibodies are secreted into the fetal blood. The result is the fetus acquires a limited amount of immunity against the pathogens for which the pregnant woman has already developed active immunities. The fetus has developed naturally acquired passive immunity that remains in effect for six months to a year after birth. Use the following table as a quick reference for types of immunities.

Type of Immunity	Stimulus	Response
Naturally acquired active immunity	Direct exposure to live pathogens.	Symptoms of the disease stimulate the individual immune response.
Artificially acquired active immunity	Exposure to a vaccine. Pathogen or its components killed or weakened.	Stimulates the immune response without severe symptoms of the disease.
Artificially acquired passive immunity	Injection of gamma globulins containing antibodies.	Immunity for a short period of time without stimulating the individual's immune response.
Naturally acquired passive immunity	Antibodies passed through the placental barrier from a pregnant woman with active immunity.	Short-term immunity for the infant without stimulating the immune response.



Allergic Reaction

When you think of immune responses you may initially only think of the previous section and the types of immune responses. Allergic reactions are also classified as an immune response. The body cells react to pathogens in many of the same ways. Allergic reactions involve the sensitizing of antigens with antibodies, but with an allergic reaction, tissues may become damaged. Allergic reaction is also called a hypersensitivity reaction. In one form or another, allergic reactions affect everyone, but some people have inherited an ability to produce exaggerated immune responses. The antigens that trigger allergic responses are called allergens.

A delayed-reaction may occur in anyone. It is a result of repeated exposure of the skin to certain chemicals; household or industrial chemicals and cosmetics are some causes. When there is repeated contact, the presence of the substance activates the T-cells in large numbers and collects in the skin. The T-cells and macrophages that are attracted release chemical factors that produce an inflammation of the skin (dermatitis). This reaction usually occurs 48 hours after exposure, thus the delayed-reaction. A common example in the military treatment facility is the tuberculin skin test.

The test uses a tuberculin preparation of purified protein derivative (PPD) that is injected intradermally. If the individual T-cells have been sensitized (previously exposed to) to the antigens of the mycobacteria that caused tuberculosis, an allergic reaction occurs within 48–72 hours. This is classified as a positive test result. In this positive reaction, a localized region of the skin and subcutaneous tissue hardens. With this positive reaction it does not necessarily mean the individual has been exposed to active tuberculosis, just that they have been exposed to the mycobacteria causing the disease. In some countries the vaccine prepared from bacilli Calmette-Guerin (BCG) is used to immunize against tuberculosis. For these individuals, the tuberculin skin test is contra indicated. The absence of this reaction signifies the person's T-cells have not previously been exposed to the mycobacterial antigen. Some allergic reactions may occur within minutes after contact with a nonself substance.

This individual has inherited the ability to over produce immunoglobulin E (IgE) antibodies resulting in an immediate-reaction. With the immediate-reaction, the B-cells become sensitized when the allergen is first encountered and subsequent exposures trigger the allergic reaction. When a subsequent allergen-antibody reaction occurs, these cells release allergy mediators as histamine, prostaglandin D₂ and leukotrienes. These substances cause a variety of physiological effects in the body. The reactions include dilation of the blood vessels, increased vascular permeability that swells the tissues, contraction of the bronchial and intestinal smooth muscles, and the increasing of mucus production. These reactions are indicative of a severe inflammation reaction that is responsible for the symptoms of the allergy. Signs of these symptoms can be seen as hives, asthma, eczema or gastric disturbances.

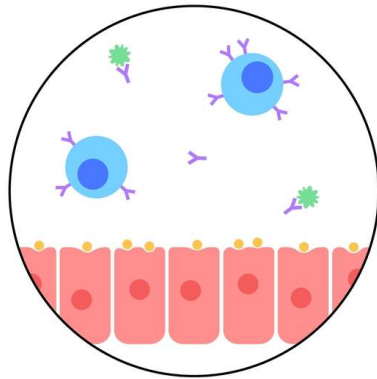
The most severe type of immediate reaction is anaphylactic shock. The individual may at first feel an inexplicable apprehension, and then suddenly break out in red hives and itch all over the entire body. The face, tongue and larynx begin to swell causing breathing difficulty. At this point of the reaction, if the person does not receive an injection of epinephrine, their airway is sure to close. The only other way of restoring breathing for this person is through a tracheotomy because the airway is so swollen that an endotracheal tube will be unable to pass by the larynx. Once breathing has stopped and is unable to be restored, loss of consciousness and death may occur within five minutes. Most often, anaphylactic shock results from an allergy to penicillin or insect sting. Fortunately, most individuals are aware of their allergy status and avoid these allergens. In addition, prompt medical attention is available in most areas of the country resulting in less than 100 people who die from anaphylactic shock.

Autoimmunity

There are times when the immune system backfires, making autoantibodies that attack the body's own cells. Some of the disorders that will elicit this immune response are rheumatic fever, ulcerative colitis, and Grave's disease. During this response, the virus "borrows" proteins from the body's cells during replication and incorporates them into the virus cell and gives the body cell some of the viral proteins.

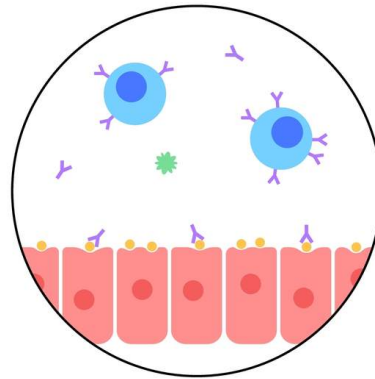
When the immune system identifies the virus to destroy it, it also recognizes the virus proteins in the body's cell and miss identifies the body cell as a viral cell that should be destroyed. Another way the body's cells become "invaded" with the viral proteins is through T-cells that escaped their "education" process during formation in the thymus. These T-cells were never able to identify "true T-cells" from the invaded cells and accepted the viral proteins only to become identified by the body as a "viral cell."

NORMAL IMMUNE RESPONSE



Normal immune response -
immune system attacks virus or infection

AUTOIMMUNE DISEASE



Autoimmune disease -
immune system attacks healthy cells and tissues

CONTINUE



Wound Healing

The body's defenses are automatic responses to disease and the invasion of microorganisms into the body. Some of the microorganisms may be a result of an external cause of injury. With injuries come wounds.

The physiological response for the body's healing process of wounds is accomplished in **three** different wound closure treatments: **primary, secondary and tertiary**-intention healing. The choice of wound closure will depend on how the injury occurred and how extensive

the wound is. With any wound there are three stages of wound healing: inflammation, reconstruction, and maturation.

Healing Stages

All wounds heal in much the same manner; inflammation to proliferate the site with blood cells, reconstruction, continued wound debridement and collagen formation, and finally maturation of the wound. Each stage is vital to the result of the scar or in worst case a continued wound with the complication of infection.

INFLAMMATION

RECONSTRUCTION

MATURATION

Inflammation occurs immediately at the site of injury at the cellular level. Previously, you learned how the blood cells and the immune responses invade the microorganisms at the cellular level. When injury occurs, the body’s first step of the healing process is to produce inflammation at the site. The primary purpose of the inflammatory response is to neutralize and destroy harmful agents, limit the spread to other tissues, and prepare the damaged tissue for repair.

Changes occur locally at the site of injury and systemically during the inflammatory stage. Systemic changes are seen in vascular alterations, hormonal response and the increased white blood cells (phagocytic actions). Vasodilation will produce the outward signs of the inflammatory stage seen as edema at the injured site, erythema resulting from the increased blood supply, increased temperature, pain stemming from pressure on the nerve receptors, and possible loss of function resulting from all of the changes.

Whenever a wound occurs, one of two responses occurs as the wound heals: either regeneration or replacement of the cells. The blood vessels will initially vasodilate to produce more circulation to the site, when the site has received enough cell support, platelet aggregation and the formation of fibrin occur producing a clot. A scab forms to protect the wound against the invasion of pathogens.

During this saturation of cells, complex chemical reactions bring phagocytic leukocytes to cleanse the wound by removing the cellular debris and engulfing the bacteria. Immature fiber cells and capillaries are formed moving into the remaining space. Epithelial cells migrate from the margins of the wound to the base of the scab forming a layer of epithelial tissue over the wound in about 48 hours. This stage of healing may last up to three to four days.



INFLAMMATION

RECONSTRUCTION

MATURATION

Reconstruction of a wound begins on the third or fourth day after injury lasting two to three weeks. Throughout reconstruction, macrophages continue to debris the wound and stimulate the fibroblasts to synthesize collagen. Collagen is the fibrous structural protein found in all connective tissue and is the main ingredient of scar tissue. During the inflammatory stage the immature capillaries are formed, providing oxygen and nutrients to support the collagen and for further synthesis of tissue. As the new tissue grows in, the wound begins to close.

The reconstruction stage is much longer when the secondary or tertiary-intention healing treatment process closes a wound. This is because granulation tissue is being constructed rather than collagen. Granulation tissue needs more of a blood supply than collagen tissue. With granulation tissue, the wound contracts and the skin surrounding the wound are pulled together. The cells are replaced with a different type of tissue versus the regeneration of tissue with similar structure and function.



INFLAMMATION

RECONSTRUCTION

MATURATION

This final stage involves the development of the scar and may take up to two years. Scarring is influenced by the degree of stress on a wound. By 15–20 days, the risk of wound separation or rupture is less likely. Scar maturation is the process of the collagen breaking and synthesizing by the macrophages to produce the strongest scar tissue it can. The formation of a scar appears soft with reddish granulation tissue.

As time progresses, the capillaries and connective tissue cells in the wound shrink and become tight, now appearing hard and reddish. Full scar maturation is evident when it becomes white and glossy in appearance. If there is an over growth of the collagen (too much synthesized) a keloid (often has a rope-like appearance) is formed. This is frequently seen in dark pigmented skin.

The three stages of wound healing are interwoven rather than linear. You may have different healing stages seen in one wound. The wound may be open or closed, clean or infected, causing the opportunity for other complications to occur.



Wound Closure

Wound closure and wound care will be covered more in-depth in a following unit. However, as wound healing is an integral part of the body's defense system, we will cover some basic information here. When there is an open wound there are three avenues of treatment used to close the wound: primary-, secondary-, and tertiary-intention closure.

With each type of closure additional treatments are used.

- **Primary-intention Closure** - When a wound with little tissue loss or damage, such as a surgical incision, is made primary-intention closure is used. The wound edges are approximated (brought together like a puzzle piece) and closure is accomplished by suturing or the use of staple. There are no open areas or dead space left in the wound so the risk of infection is decreased.
- **Secondary-intention Closure** - With a wound that has tissue loss such as a pressure ulcer or severe laceration, secondary-intention closure is used for treatment of the

wound. The edges of the wound are not approximated and the wound is left completely open to close from the inside to the out with granulation tissue and then scar tissue. With secondary intention, the process takes longer and the chance of infection is higher.

- **Tertiary-intention Closure** – This is also known as delayed closure because there is a delay in the suturing of a wound. Such wounds are sutured after the granulation tissue has begun to form. An abdominal wound left open for drainage and then later sutured or stapled closed is an example of the tertiary-intention closure.

CONTINUE

Personal Hygiene

Personal hygiene is an important aspect of nursing care. There are some factors to be mindful of that may impact it. For cultural diversity, some cultures believe daily hygiene, deodorant products and baths, are essential. Other cultures may not use deodorant products or bathe on a daily basis. A patient's economic status can potentially make hygiene products unaffordable. Mental or physical conditions can alter a patient's ability to perform self-care.

When caring for geriatric patients, personal hygiene becomes more important because aging brings atrophy of the skin. Tissue nourishment is diminished, and the skin becomes dry. It loses its elasticity, presents a wrinkled appearance, and is far more susceptible to infection. In addition, the skin is thin, delicate, and vulnerable to trauma. Daily skin care, frequent position changes, and a wrinkle-free bed will help keep the skin intact and free of infection and bed sores; such care also stimulates circulation. Use a mild or super fatty soap, if available, and a mild lotion for back rubs. Do not use alcohol as it tends to further dry the skin.

A patient's personal preference and timing to perform personal hygiene may be different from other patients. Follow your local protocol and the physician orders when performing all hygiene activities.





Oral Hygiene

The mouth acts like a freeway for bacteria to enter the body. Failure to clean it permits bacteria to grow and may result in a severe mouth infection. It may also increase the risk of stroke, heart disease, and pneumonia. Frequent cleaning prevents bad breath, removes food particles, refreshes the patient, and promotes a better appetite.

When assisting a patient with oral hygiene, gather the supplies and raise the head of the bed to 45 to 90 degrees. Turn the patient to the side facing you if he or she is unable to sit up. Prep the toothbrush then brush all surfaces of each tooth to include the gum line. Have the patient rinse and spit; repeat the brushing and rinsing steps as desired. Floss upon the patient's request or physician orders. Be sure to rinse and wipe the mouth after flossing. Report excessive bleeding of the gums.

Hair and Nails

Hair and nail care is an essential part of personal hygiene. Hair care stimulates circulation, promotes growth, and prevents loss. Neatly combed, brushed, or trimmed hair contributes to the appearance and morale of patients.

When providing hair care, use a clean comb or brush. Separate the patient's hair into three or four sections and comb or brush from the scalp to the ends, carefully removing all tangles. Style as ordered.

Nails that are not properly trimmed and cleaned will become brittle, thickened, and eventually curl inward against the flesh and exert pressure on the nail beds. This also opens a pathway for pathogens to enter the body and can cause pain. In addition, hangnails can cause skin inflammation, pain, and infection.

When providing nail care, soak the patient's nails for 5 to 10 minutes in warm soapy water. Clean under the nails and push the cuticles back to prevent hangnails then trim the nails with a nail clipper.





Shampoos

Washing a patient's hair depends on the activity level ordered by the physician or the strength of the patient. If the patient is confined to bed, a washing trough and bucket can be brought to the bed. Other methods include placing the patient on a stretcher or wheelchair and taking him or her to the sink.

When assisting a patient with shampooing, wet his or her hair then apply a small amount of shampoo to massage into the scalp. Massage with your finger pads to avoid scratching the scalp. Rinse thoroughly to remove all the shampoo; repeat washing and rinsing as needed. Apply conditioner if requested or ordered. Towel dry the hair and scalp then comb to remove tangles.

Shaving

You may be required to shave a male patient. Shaving provides a clean appearance and increases their well-being. If the patient has an electric razor, use it. Check the razor for cleanliness and make sure the cord is not frayed. If the patient or the unit does not have an electric razor, you must use a safety razor. However, safety razors should not be used for patients undergoing chemotherapy, has a low platelet count, or receiving an anticoagulant.

When shaving the patient, be careful with getting too close to the skin to avoid irritation. Apply a warm, moist towel to the face for a few moments, then soften the hair with shaving cream or lotion. Pull the skin taut and shave in the direction of hair growth. When finished, rinse and dry the patient's face. Apply aftershave or lotion as desired by the patient.



END OF LESSON

