ASC

Review For Kaplan's Nursing Exam

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REVIEW OF BODY SYSTEMS

SENSORY SYSTEM

NERVOUS SYSTEM

GASTROINTESTINAL SYSTEM

CARDIAC SYSTEM

CIRCULATORY SYSTEM

RESPIRATORY SYSTEM

RENAL SYSTEM

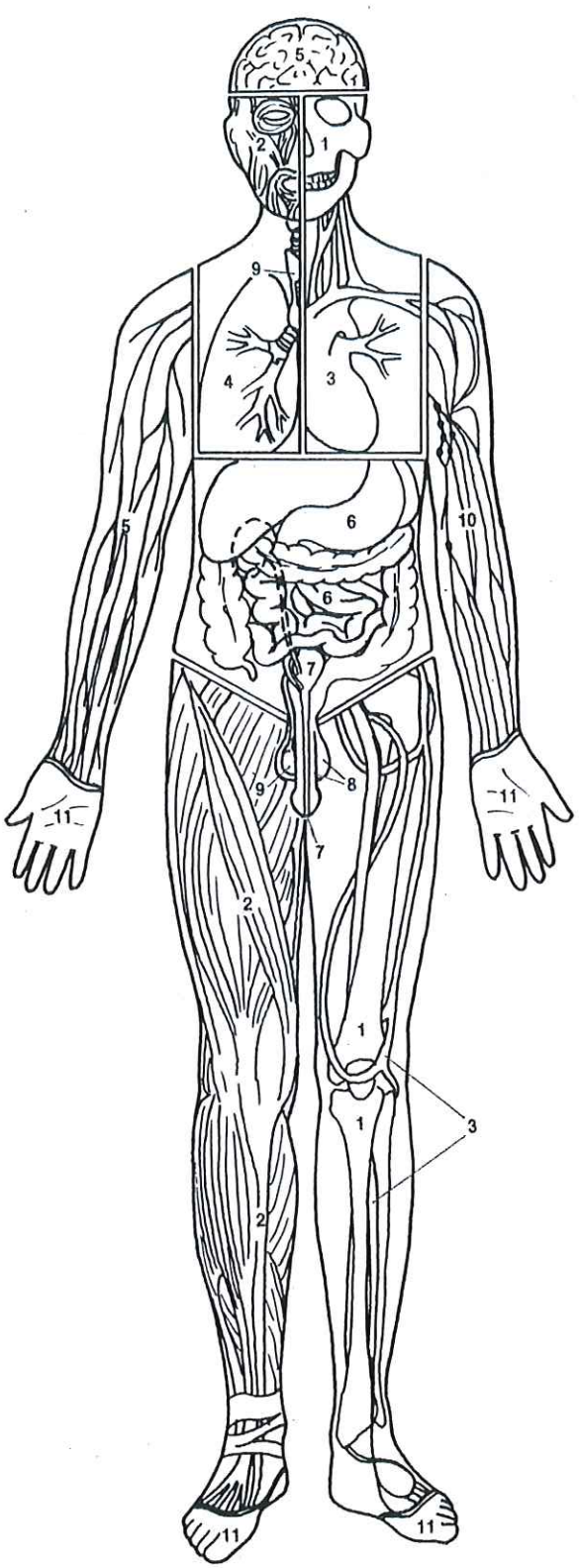
IMMUNE SYSTEM

ENDOCRINE SYSTEM

SYSTEMS OF THE HUMAN BODY

The human body is marvelously complex, and the greatest wonder is, complex as it is, how well it works most of the time. For purposes of study, we can divide the body into systems, though we should not forget that each system is itself highly complex and the dividing line between systems may not be distinct. All of the systems have specialized functions, but they are also closely related to one another; indeed their successful interaction is absolutely necessary for our survival.

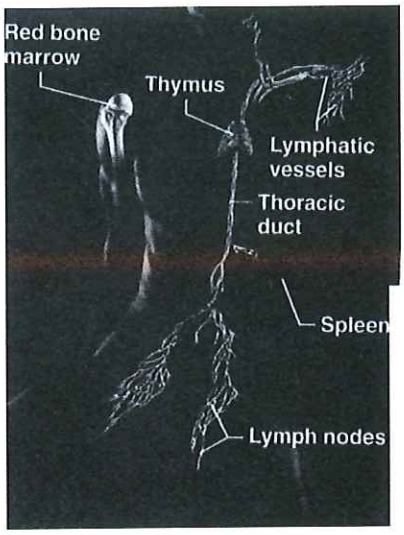
The *skeletal system* refers chiefly to the bones that support and protect the body. All the muscles that push and pull the skeleton make up the *muscular system*. The *circulatory system* consists of the heart and the tubes—arteries and veins—that transport blood. We breathe with our *respiratory system*, which supplies oxygen to the body's tissues and removes some wastes. The *nervous system*, whose primary components are the brain and the spinal cord, is our "master control," regulating all of our internal functions and providing us with information about the environment. We process food and eliminate some wastes with the *digestive system*. The *urinary system* is responsible for the elimination of most of the body's liquid chemical wastes. The *reproductive system* consists of those organs that characterize the sexes and enables us to conceive, bear, and give birth to offspring. The secretion of hormones, which regulate the body's functions chemically, is the job of the *endocrine system*. The *lymphatic system* works with the veins in draining fluid from tissues and helps defend the body against infection. The *skin*, the body's largest organ, encloses and protects all the body's systems.



CHOOSE YOUR OWN COLORS

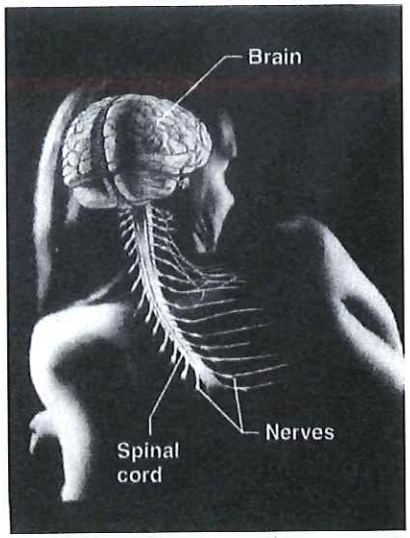
1. SKELETAL
2. MUSCULAR
3. CIRCULATORY
4. RESPIRATORY
5. NERVOUS
6. DIGESTIVE
7. URINARY
8. REPRODUCTIVE
9. ENDOCRINE
10. LYMPHATIC
11. SKIN

The following are x-rays of each system in the human body found in the anatomy student text book. Search online for more diagrams.



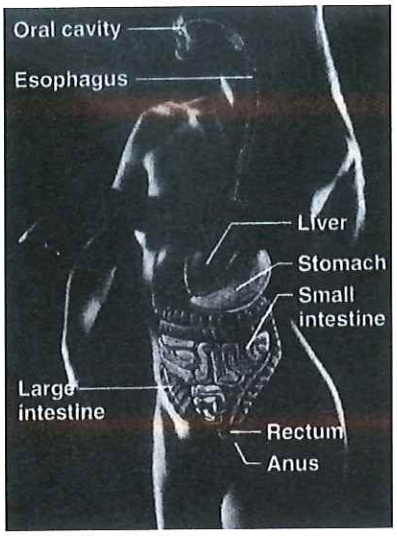
Lymphatic System/Immunity

Picks up fluid leaked from blood vessels and returns it to blood. Disposes of debris in the lymphatic stream. Houses white blood cells (lymphocytes) involved in immunity. The immune response mounts the attack against foreign substances within the body.



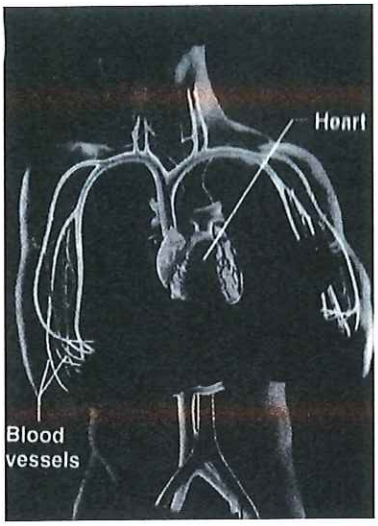
Nervous System

As the fast-acting control system of the body, it responds to internal and external changes by activating appropriate muscles and glands.



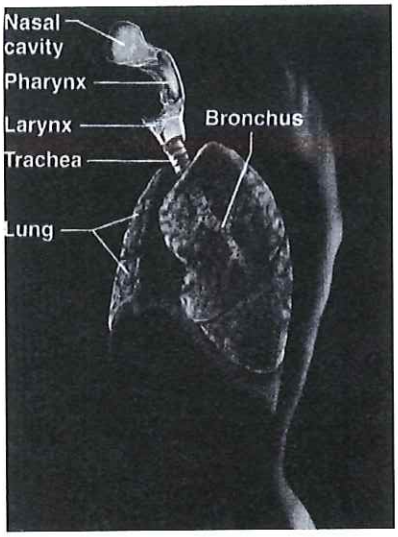
Digestive System

Breaks down food into absorbable units that enter the blood for distribution to body cells. Indigestible foodstuffs are eliminated as feces.



Cardiovascular System

Blood vessels transport blood, which carries oxygen, carbon dioxide, nutrients, wastes, etc. The heart pumps blood.



Respiratory System

Keeps blood constantly supplied with oxygen and removes carbon dioxide. The gaseous exchanges occur through the walls of the air sacs of the lungs.

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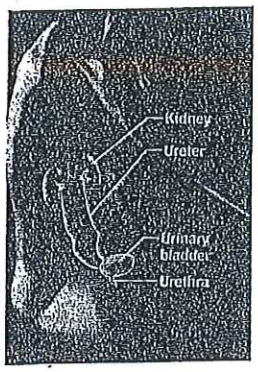
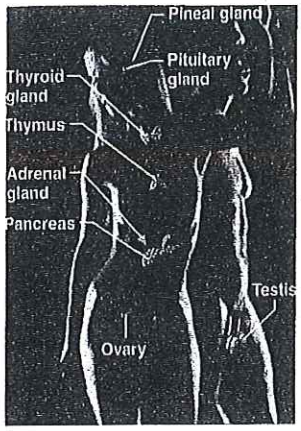
Urinary System

Eliminates nitrogenous wastes from the body. Regulates water, electrolyte and acid-base balance of the blood.



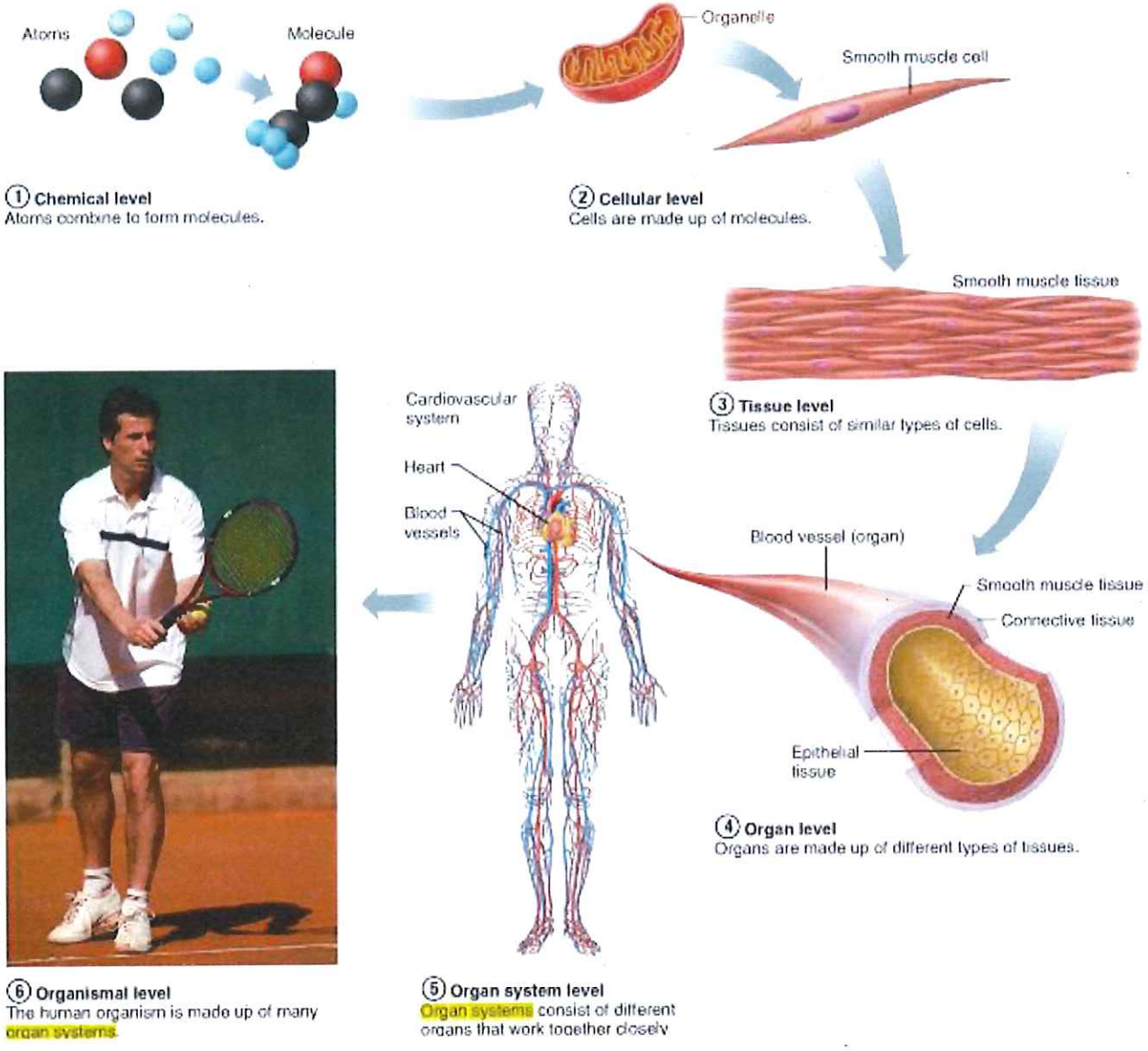
Endocrine System

Glands secrete hormones that regulate processes such as growth, reproduction, and nutrient use (metabolism) by body cells.



ATOM TO HUMAN ORGANISM

Atoms combine to form molecules. Cells are made up of molecules. Tissues consist of similar types of cells. Organs are made up of tissues. Organ systems consist of different organs that work together closely. The human organism is made up of many organ systems.



① **Chemical level**
Atoms combine to form molecules.

② **Cellular level**
Cells are made up of molecules.

③ **Tissue level**
Tissues consist of similar types of cells.

④ **Organ level**
Organs are made up of different types of tissues.

⑤ **Organ system level**
Organ systems consist of different organs that work together closely

⑥ **Organismal level**
The human organism is made up of many organ systems.

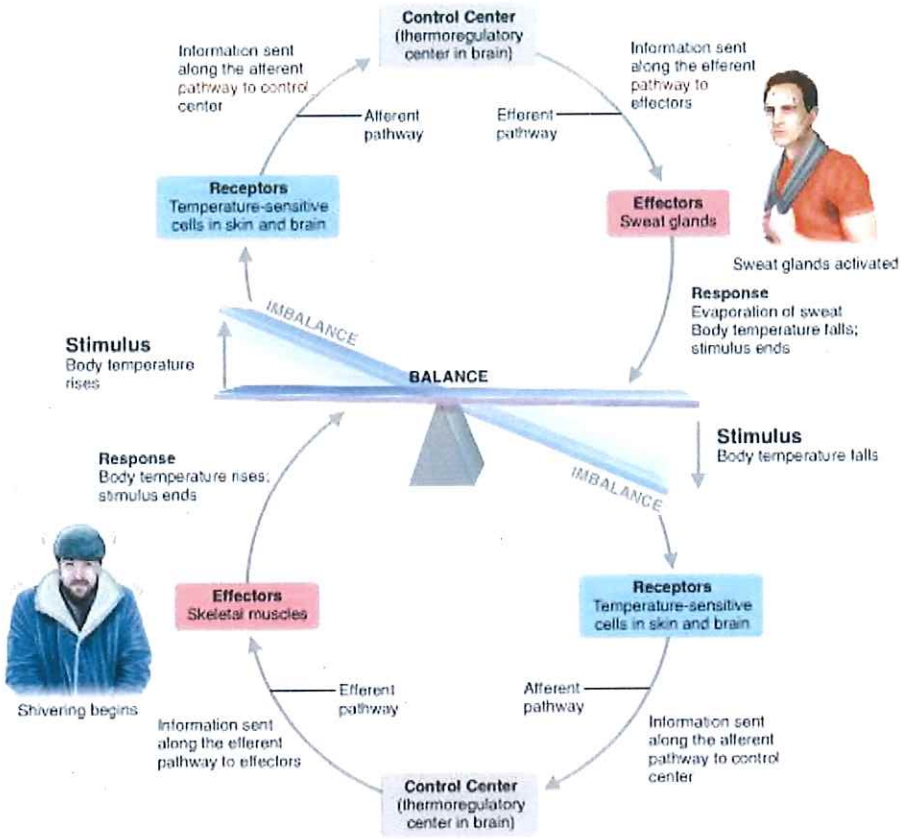
HOMEOSTASIS – DEFINITION

omeostasis in a general sense refers to stability, balance or equilibrium. It's the body's attempt to maintain a constant internal environment. Maintaining a constant internal environment with all that the cells need to survive (oxygen, glucose, minerals, ions, waste removal and so forth) is necessary for the well being of individual cells and the well being of the entire body. The adjusting of physiological systems within the body is called homeostasis regulation.

Homeostatic Regulation involves three parts or mechanisms:

1) The receptor
2) The control center
3) The effector

The receptor receives information that something in the environment is changing. The control center receives and processes information from the receptor. The effector responds to the commands of the control center by either opposing or enhancing the stimulus. This is an ongoing process that continually works to restore and maintain homeostasis.



Positive/Negative Feedback System

Negative Feedback: A reaction in which the system responds in such a way as to reverse the direction of change. Since this keeps things constant, it allows the maintenance of homeostasis.

Example: Thermoregulation

Home Heating System

Blood Glucose Level (see figure above)

Positive Feedback: a response is to amplify the change in the variable. This has a destabilizing effect, so does not result in homeostasis. Positive feedback is less common.

Examples: Blood Clotting

Childbirth

Cruise Control is a metaphor for homeostasis.

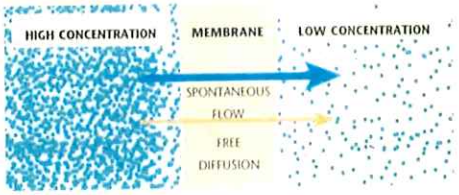
Pathways that can alter homeostasis: Nutrition, toxins, psychological, physical digestion.

OSMOSIS, DISTRIBUTION, TRANSPORT PASSIVE AND ACTIVE TRANSPORT

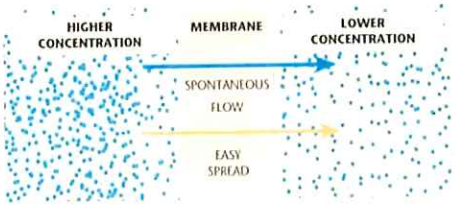
When the internal and external chemical compositions of a cell are examined, it can be seen that the substances do not have equal distribution on both sides of the bounding membrane.

The ability of molecules to pass through this membrane, in fact, depend on their chemical and physical properties. Some will move based on the laws of free distribution, however, others are helped by various membrane structures as they need the cell to expend some energy before they can cross through. The are several different ways in which a molecule can pass into or out of a cell. The components involved all have to obey the laws of fluid dynamics, however.

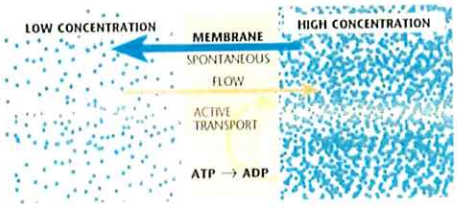
The flow or osmosis of solvent through the membrane depends on the specific concentrations of the fluids on either side. The higher the concentration of the molecules and ions of one of the solutions relative to the other, the higher the osmotic pressure. The net flow of solvent tends to even out the concentration on both sides of the membrane. Overall, there is therefore a motion of molecules of solvent from B to A.



1. In the above illustration, it can be said that the molecules of solvent are distributed through the membrane, which means that their transition is governed solely by the osmotic pressure. In the cell, however, there is passage in both directions not only from water and gas, but also of substances held in solution. This mechanism ensures that if the amount of water inside the cell decreases, it is immediately replaced, ensuring the conservation of optimal endocellular conditions.

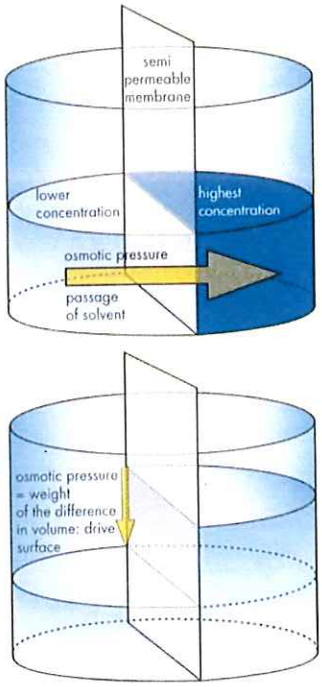


2. The speed at which dissolved substances are distributed through the membrane is governed by the concentration gradient - moving from highest to lowest. The rate of transfer does not remain the same, however - at first there is an initial acceleration, until a certain concentration is reached within the cell. From then the movement slows down until equilibrium is achieved, when it stops altogether. It only resumes when the internal concentration decreases again. This type of dissemination is typical of substances such as sugar, a common source of cell energy.



3. In some cases - for example with some ions, the cell needs concentrations much higher than those which surround it. In these cases, the movement of molecules through the membrane is directed against the gradient of concentration. For this to happen, the cell has to expend energy - this process is referred to as active transport. As an example, many cells continuously expel sodium ions (Na^+). To do this requires a series of functional changes in the three-dimensional structure of the membrane. This is something that can only be achieved with an input of energy, however - this is produced from the processing of ATP into ADP.

There are flows of other substances which, while going against a gradient of concentration, have no need for energy produced by the cell. This is what happens when an unwanted negative ion is exchanged for another one that is needed. Again, the molecules that form the membrane actively take part in the transport, but as there is no waste of energy the phenomenon is referred to as passive transport.



▲ Osmosis
This physico-chemical phenomenon occurs when a semi-membrane separates two solutions with different concentrations. As the system tends to equilibrium, the solvent tends to cross the membrane until the concentration of solutes on both sides is not equal, that is flowing towards the more concentrated solution, and increases the volume. Thus, the osmotic pressure decreases until the weight exerted on the surface of separation causes an "excess" as "compensation".

▲ Red cells
The red blood cells (or erythrocytes) have normally a rounded and flattened shape. However, if you find them in an environment too rich in salts (hypertonic) they lose a lot of water which controls the form - like the one on the right - very abnormal compared to the one on the left.

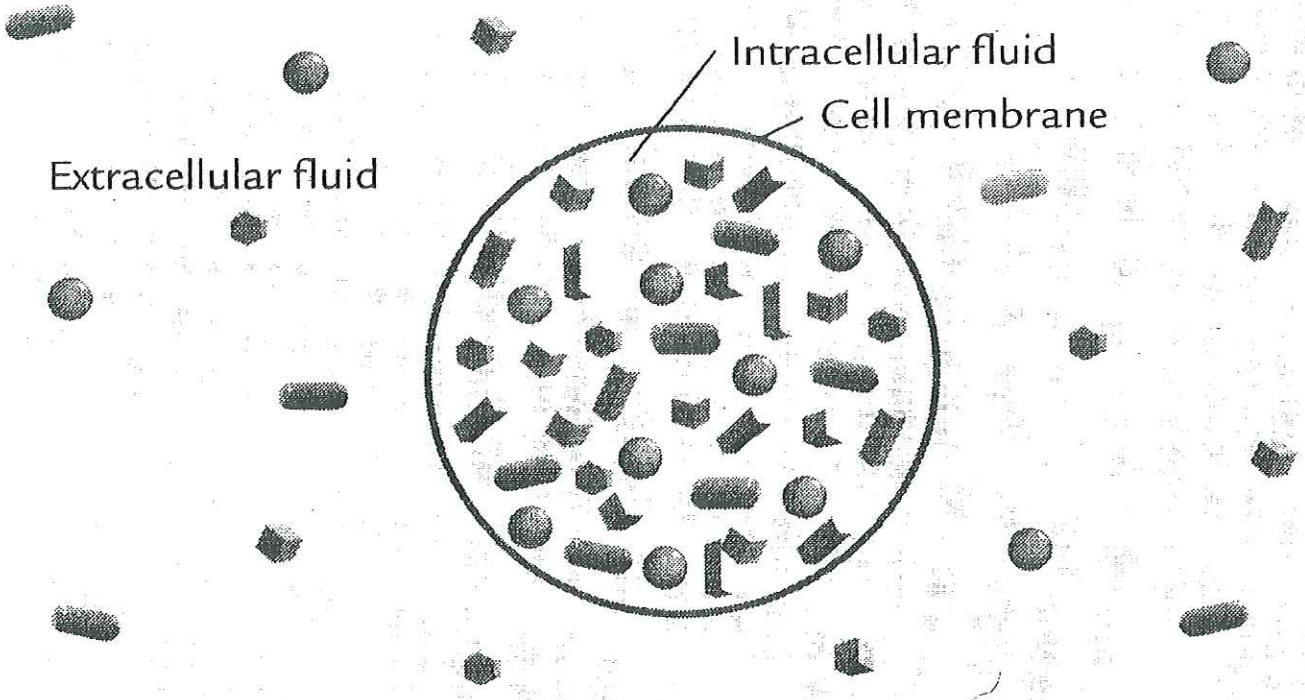


FIGURE 6.10 The cell membrane separates the extracellular fluid from the intracellular fluid. In this figure, a situation is shown in which there are more solute molecules inside the cell than there are outside of it. Assume the shaded shapes are solute molecules and the remaining space is filled with water.

The exchange of fluids from the Extra Cellular Fluid to the Intracellular Fluids is by osmosis.

60 % of our body is water. Water is the universal solvent in which a variety of solvents are dissolved. Solutes may be classified broadly as electrolytes and non-electrolytes. The primary ions of electrolytes are sodium, potassium, calcium, magnesium, chloride, hydrogen phosphate and hydrogen carbonate.

Muscles and neurons are activated by electrolyte activity between the Extra Cellular Fluid and Intra Cellular Fluid. The Extra Cellular Fluid has sub-compartments interstitial and the vascular space.

SENSATION SITES

You keep in touch with the outside world with your sensory organs and their nerves and receptors on the surface of your body.

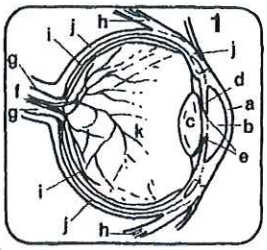
1. SIGHT
Light enters the eye through the lens and is focused on the *retina,* which is lined with photoreceptor neurons called *rods* and *cones.* Rods respond to dim light; cones are stimulated by bright light and are specialized to detect color. The photoreceptors send impulses to *ganglia* (a group of nerve cell bodies) near the front of the retina. The ganglia lead to the *optic nerve,* which in turn transmits impulses to the visual center in the occipital lobe of the brain.

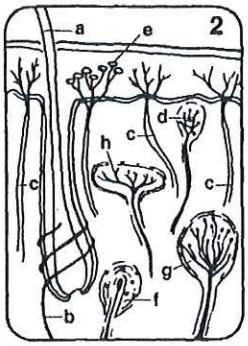
2. SENSATIONS OF THE SKIN
Touch sensors are closest to the skin's surface on your fingertips and near strands of hair. Pressure sensors lie deeper. Pain sensors are bare dendrites. Heat and cold sensors are different from one another and appear randomly over the entire body.

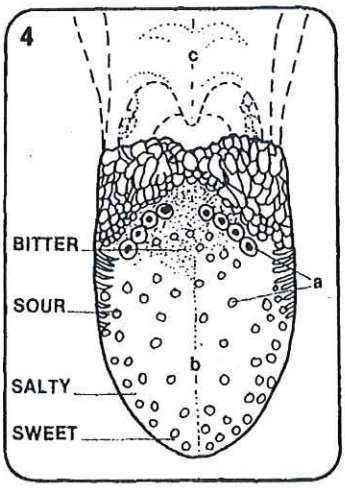
3. SMELL
The *olfactory nerve cells* detect particles given off by objects. The particles generate an impulse that travels over the olfactory tract to the cortex of the brain. After constant exposure to an odor, our olfactory nerves become temporarily deadened.

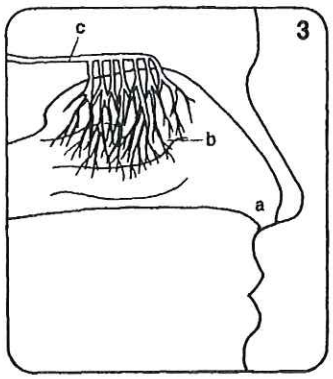
4. TASTE
Food mixes with saliva and enters pores, the *lingual papillae,* on the tongue. Embedded beneath these pores are the chemical receptors that distinguish sweet, salty, bitter, and sour.

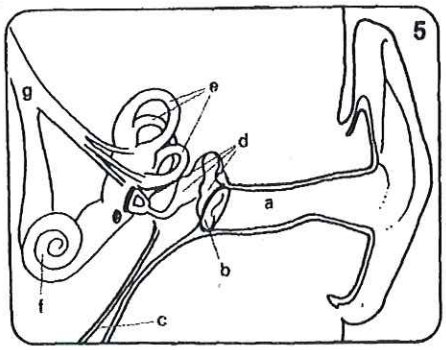
5. HEARING
Sound waves enter the *auditory canal* and vibrate the *tympanic membrane* or eardrum. Three tiny bones—the *hammer, anvil,* and *stirrup*—link the inside of the eardrum to the *cochlea,* which is filled with fluid and lined with nerve endings. The vibrations move through the liquid to the sensors and are transmitted to the brain as sound impulses. The *semicircular canals* help to establish our sense of balance.





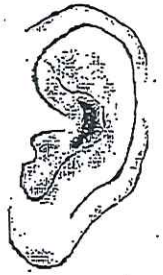




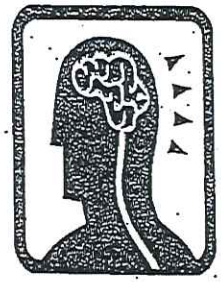


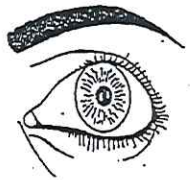
The aging process occurs gradually over a period of years. There are physiological, external changes that take place in the body. The most obvious is the thinning of hair and color changes. Wrinkles develop as skin loses its elasticity. Muscle tissue is replaced by fat. Older people shrink in height. The senses begin to deteriorate. With the decline in the bodies' regulating mechanisms, the body is less able to adapt to external changes. Elderly people are more sensitive to the extremes of temperature changes and take a longer time to recover from illness. There are also changes in the Proprioperception in the Elderly.

SENSORY SYSTEM

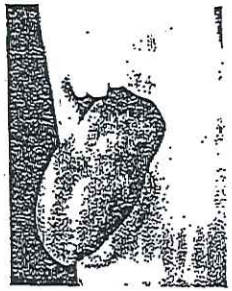


- Human Sensory Receptors are:
- Chemosensor
- Mechanoreceptor
- Nociceptor
- Photoreceptor
- Thermoreceptor

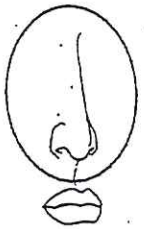




The Human Eye



The Palm



The Nose

NERVOUS SYSTEM

The nervous system is a control and communication system, consisting of the *brain, spinal cord, nerve cells,* and *nerve fibers*, that runs throughout the body. It originates and coordinates physical reactions to the environment and controls involuntary muscles and organs such as the heart and lungs. It also maintains *homeostasis*, that is, a balanced state within the body.

It regulates the heart and its functions. It triggers the electrical functions of the heart. It initiates the firing of the SA node also called the pacemaker of the heart.

CENTRAL NERVOUS SYSTEM (CNS)

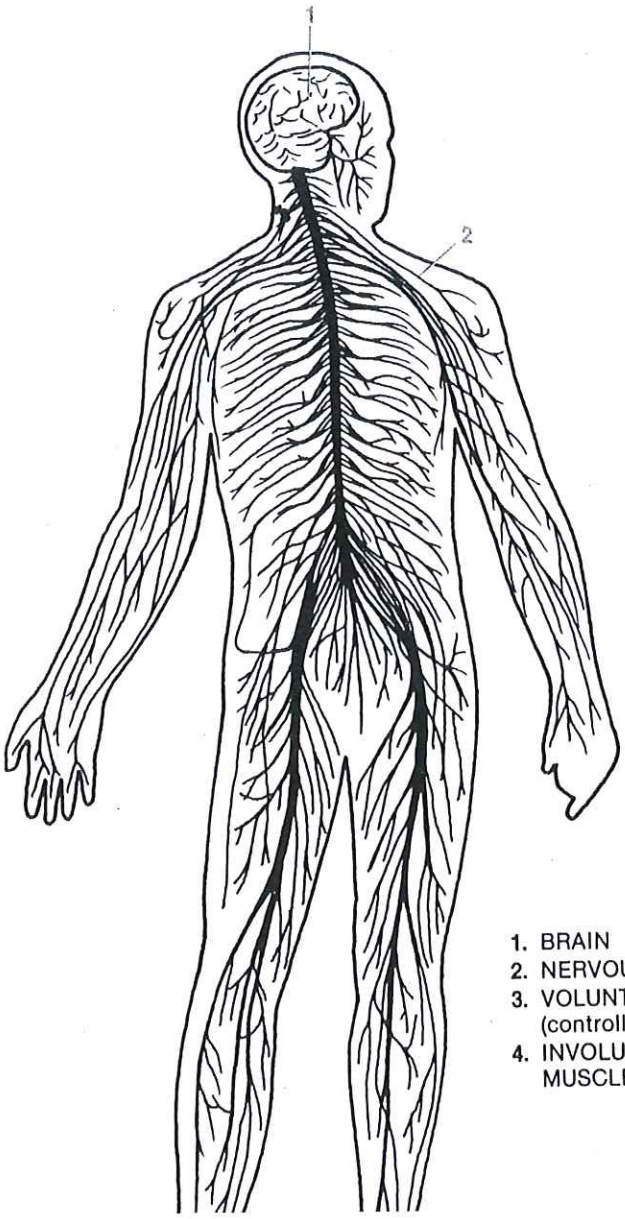
The brain and spinal cord make up the CNS, the control center for the movement and actions of the entire body. Messages from outlying receptors and sensors arrive at the CNS, where they are interpreted; the CNS then sends out reaction impulses.

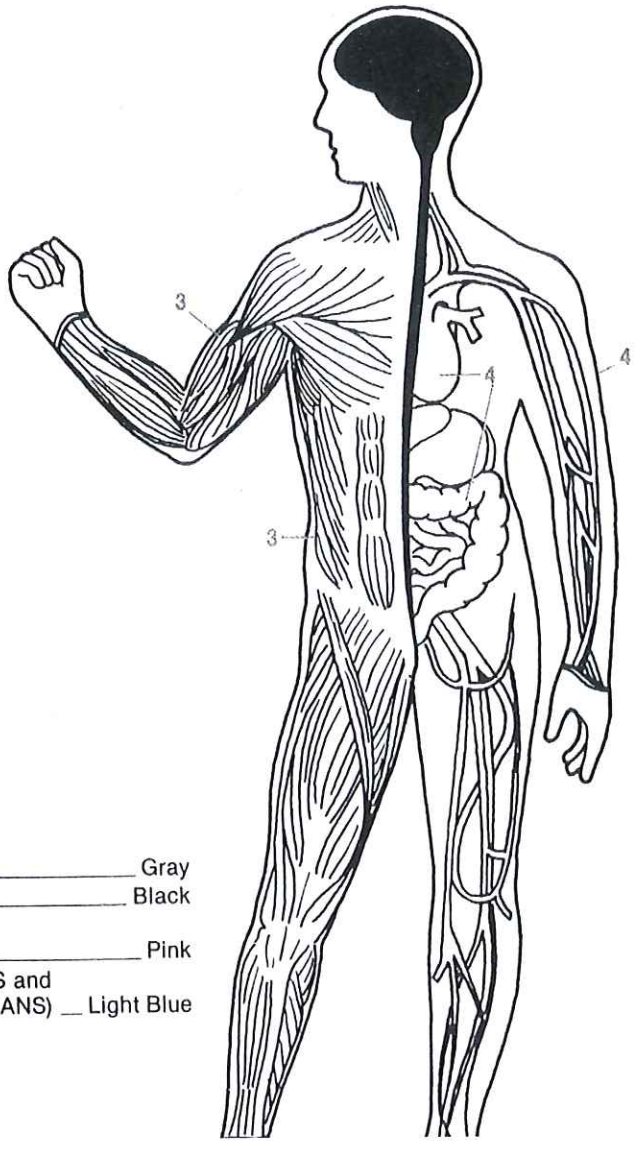
PERIPHERAL NERVOUS SYSTEM (PNS)

The first of the two parts of the PNS is the *afferent system*, which carries messages from the sensors to the CNS for processing. The second part, the *efferent system*, carries the CNS's commands to the muscles and organs.

AUTONOMIC NERVOUS SYSTEM (ANS)

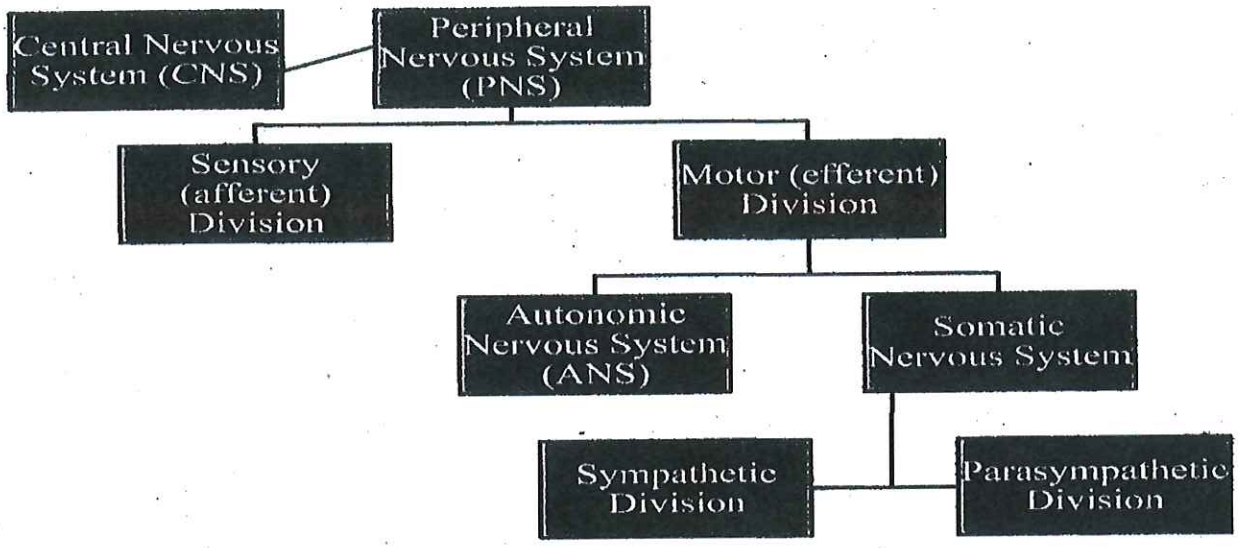
The ANS regulates the involuntary internal organs, muscles, and glands.





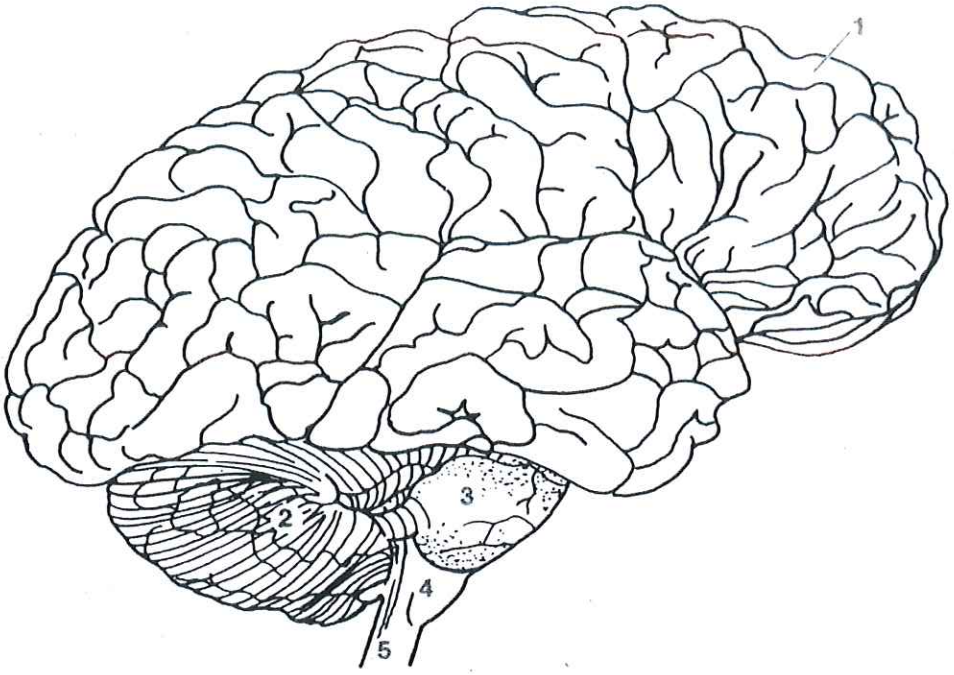
1. BRAIN _____ Gray
2. NERVOUS SYSTEM _____ Black
3. VOLUNTARY MUSCLES (controlled by PNS) _____ Pink
4. INVOLUNTARY ORGANS and MUSCLES (controlled by ANS) __ Light Blue

STRUCTURE OF THE NERVOUS SYSTEM



Nervous System

Part	Function
CNS*	
Brain	
Cerebrum	Consciousness, creativity, thought, morals, memory
Lower portions	Reception of sensory data, coordination of muscular activity, homeostasis
Spinal cord	Automatic reflex actions
PNS**	
Cranial nerves, spinal nerves	Carry sensory information to motor impulses from the CNS
Autonomic system	Those cranial and spinal motor nerves that control internal organs



BRAIN - DEFINITION

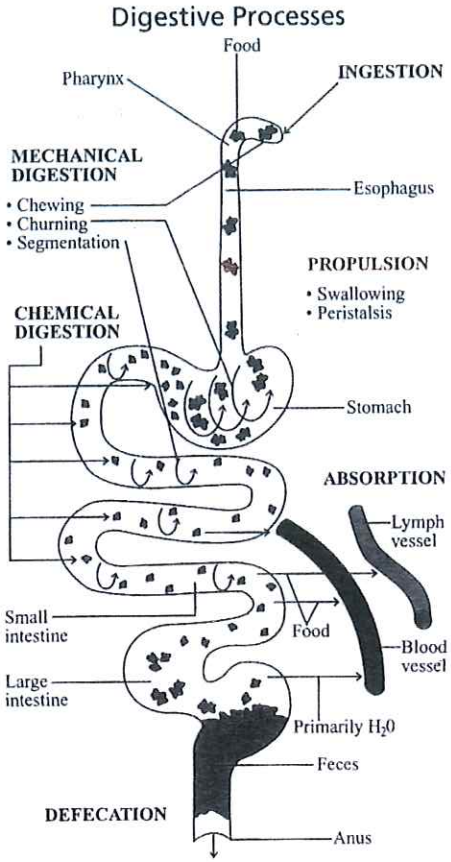
The **brain** is the most complex and specialized organ of the body. **Brain cells** differ from other cells since they send signals to adjoining cells more quickly. The brain is covered by three protective membranes, the meninges that also extend downward to encase the spinal cord. The main part of the brain, the cerebrum, is divided into right and left halves, the hemispheres. The outer surface of the cerebrum is the cortex. It is wrinkled and irregularly shaped, with deep furrows that increase the brain's surface area. The forebrain, located in the front of the cerebrum, is the site of the most complex functions of human thought and action. These functions include memory, judgment, reasoning, speech, and the formation of words. The forebrain also is the seat of emotions and what we know as personality traits, and receives and sends messages to the other parts of the brain that control less complex functions. The midbrain controls vision and eye reflexes, many visceral or involuntary muscle activities, and motor responses of the head and torso. The midbrain connects the forebrain to the hindbrain, which consists of the cerebellum and pons and is located behind and below the cerebrum. The hindbrain is responsible for coordinating muscular activity and amplifying cerebral stimuli on their way to the muscles. It cannot initiate a muscular contraction, but it can keep muscles in a state of partial contraction. The pons is a pathway between the two halves of the cerebellum and a relay between the midbrain and the medulla. Within the pons is the pneumotaxic center, which plays a role in breathing. The medulla oblongata, an elongation of the base of the brain that joins with the spinal cord, controls the activity of internal organs, including respiratory and digestive organs, the heart, and glands.

ffector Organs	Sympathetic Effect	Parasympathetic Effect
Eye *(pupil)*	Dilates pupil	Constricts pupil
Eye *(ciliary body)*	Bulges lens for close vision	-------
Lacrimal gland	-------	Stimulates tear secretion
ubmandibular gland	Inhibits saliva secretion	Stimulates saliva secretion
Sublingual gland	Inhibits saliva secretion	Stimulates saliva secretion
Parotid gland	Inhibits saliva secretion	Stimulates saliva secretion
Sweat glands	Stimulates sweating	-------
Arrector pili muscles	Stimulates contraction	-------
Lung *(bronchioles)*	Dilates	Constricts
Lung (*mucous glands)*	Inhibits secretion	Stimulates secretion
Heart *(heart rate)*	Increases rate	Decreases rate
eart *(coronary vessels)*	Increases blood flow	Constricts blood vessels
Heart *(pump strength)*	Increases force	Slows and steadies heart
Blood vessels	Constricts in most organs	Little effect
Liver	Stimulates hydrolysis of glycogen	-------
Spleen	Stimulates contraction	-------
Stomach	Inhibits secretion, motility	Stimulates secretion
Pancreas	Inhibits exocrine secretion	Stimulates exocrine secretion
Intestines	Inhibits secretion, motility	Stimulates secretion, peristalsis
Adrenal glands	Stimulates secretion of hormones	-------
Urinary bladder	Relaxes muscle, contracts sphincter	Stimulates contraction
Penis	Ejaculation of spermatozoa	Erection due to vasodilation
Vagina/Clitoris	Contraction of vagina	Erection of clitoris

Study of the Sympathetic Nervous System-"Fight or Flight" helps us understand the changes in the Body System's Organs.

Study of the Parasympathetic Nervous System-"Rest and Digest" reflects the relaxation of the Body System's Organs

Gastrointestinal System



DEFINITION OF SYSTEM – When blood is pumped from the left ventricle of the heart, much of it passes down the dorsal aorta to the organs of the abdomen. Chief among these organs are those of the digestive tract.

FUNCTION OF SYSTEM – Break down food so cells can be nourished. It is broken down: Mechanically

Chemically

Absorption

IMPORTANT FACTS

Within the digestive tract the food is broken down to nutrient molecules small enough to be absorbed by the villi of the small intestine. Digestive enzymes are produced by the digestive tract and by the pancreas. In addition the liver produces bile, an emulsifier that plays a role in the digestion of fats. Bile, which is stored in the gallbladder, enters the small intestine along with the pancreatic enzymes. Following the absorption of nutrients, blood passes from the region of the small intestine to the liver by the way of hepatic portal vein.

Without a regular supply of energy and nutrients from the digestive system, all body systems would soon suffer. The digestive system absorbs organic substances, vitamins, ions and water that are needed all over the body. Food goes through three types of processes: Digestion

Absorption

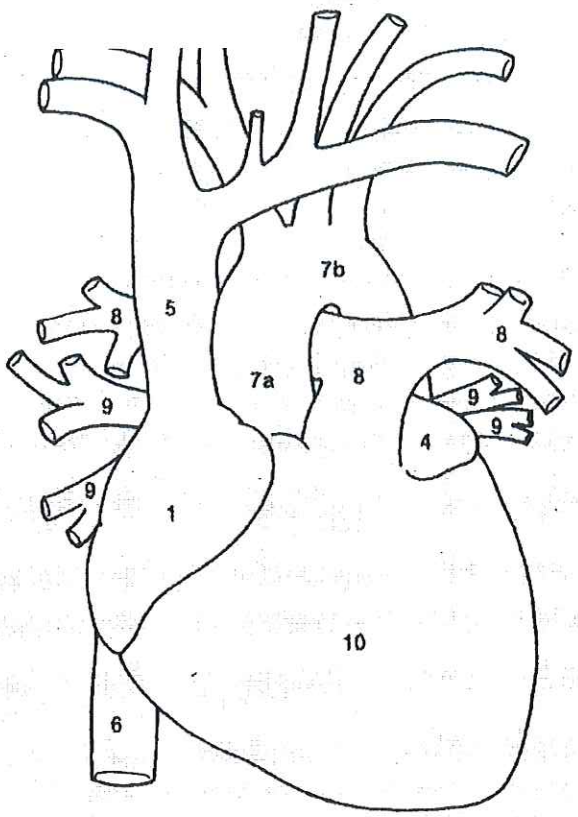
Elimination

HEART - Cardiac System

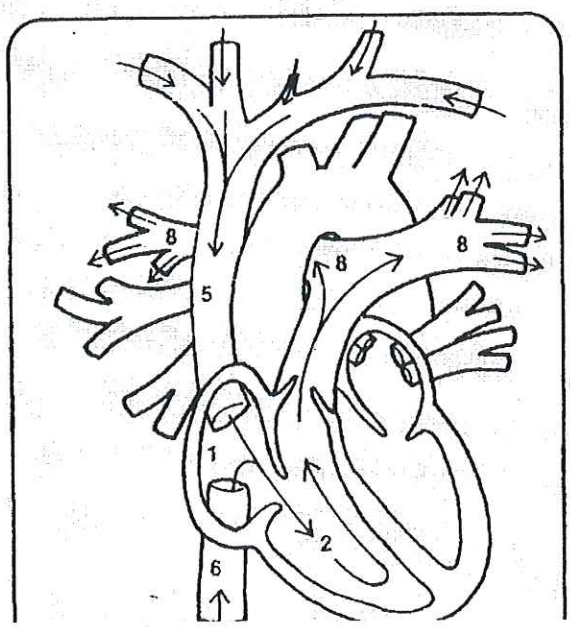
The heart is the key organ of the circulatory system. It is a bit larger than a man's fist—about twelve centimeters long, nine centimeters wide, and six centimeters thick. This hollow muscle is located to the left of the sternum between the second and fifth ribs and is enclosed in the *pericardium*, a membranous sac with a fibrous layer outside and a serous one inside, which protects the heart and anchors it in place. Between the two layers is a watery lubricant that minimizes friction when the heart beats. The heart is surrounded by the lungs, each of which has a notch, the *cardiac impression*, the heart fits into.

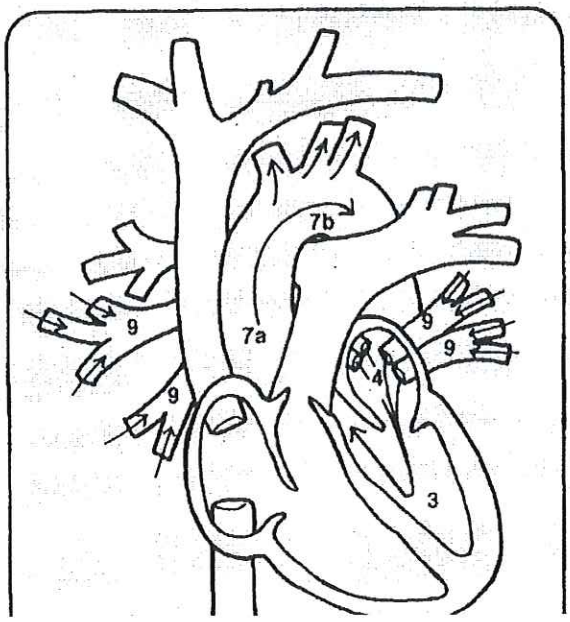
Each half of the heart has two chambers, the *atrium* (upper) and the *ventricle* (lower). Blood returning to the heart enters the right atrium from three veins: the *superior vena cava*, which runs from the upper torso and limbs; the *inferior vena cava*, which carries blood from the lower torso and limbs; and the *coronary sinus*, which circulates venous blood from the walls of the heart. The blood is pumped through the *tricuspid valve* (which has three cusps or flaps) into the right ventricle. From there it goes to the *pulmonary artery*, the only artery that carries unoxygenated blood, which carries it to the lungs. In the lungs the blood exchanges carbon dioxide for oxygen. The enriched blood then goes to the left atrium, where it passes through the strong *bicuspid* or *mitral valve* into the left ventricle. Finally the blood leaves the heart through the *aortic semilunar valves* and flows into the *aorta* and through the body.

The heart beats involuntarily, that is, the brain doesn't have to command it to pump blood. Instead various sensors monitor the body's activities and the consequent demands for more or less blood. For example, there are pressure receptors in the aorta that respond to changes in arterial pressure. The *aortic reflex* slows the heart when the pressure gets too high; the *carotid sinus reflex* increases the heart rate when the pressure becomes too low in the arteries that serve the brain. Chemoreceptors increase the heartbeat if they detect a lack of oxygen or an increase of carbon dioxide.

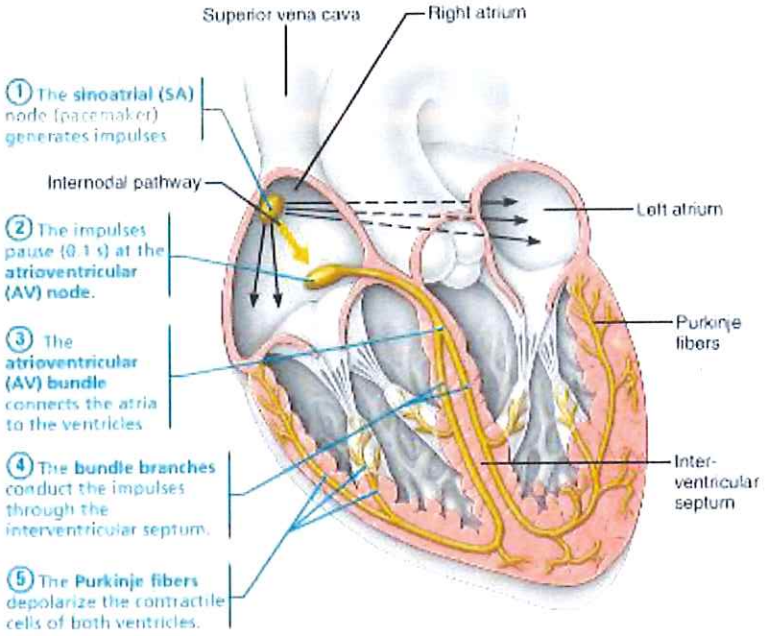


1. RIGHT ATRIUM _____ Light Purple
2. RIGHT VENTRICLE _____ Blue
3. LEFT VENTRICLE _____ Red
4. LEFT ATRIUM _____ Orange
5. SUPERIOR VENA CAVA _____ Light Blue
6. INFERIOR VENA CAVA _____ Dark Blue
7. a. ASCENDING AORTA and b. AORTIC ARCH _____ Pink
8. PULMONARY ARTERY _____ Green
9. PULMONARY VEIN _____ Yellow
10. HEART _____ Purple





Cardiac System



(a) Anatomy of the intrinsic conduction system showing the sequence of electrical excitation

Figure 18.14 Cardiac intrinsic conduction system and action potential succession during one heartbeat.

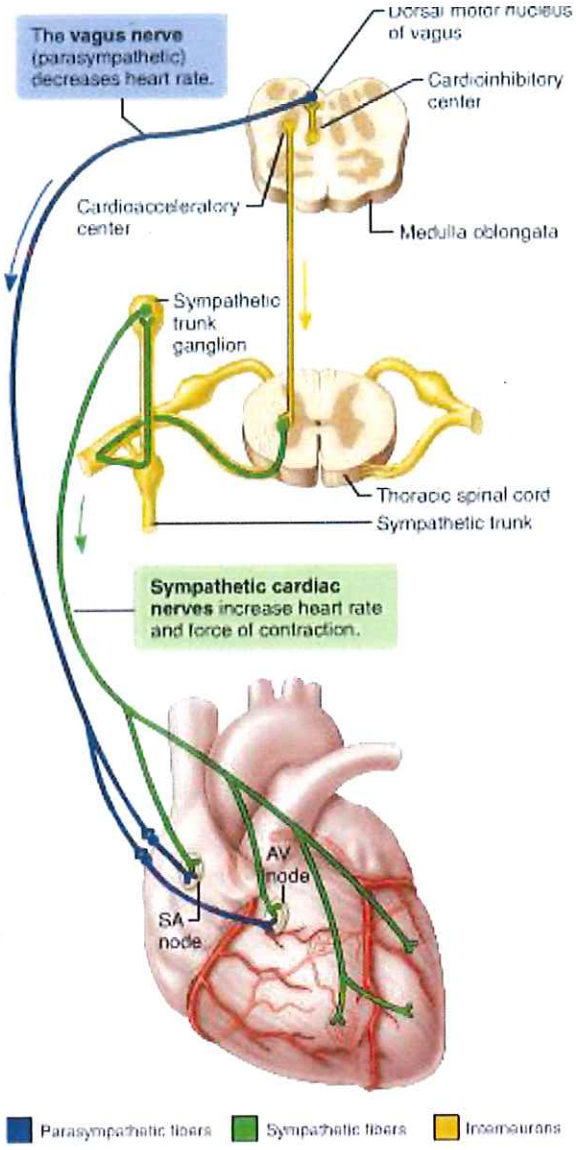
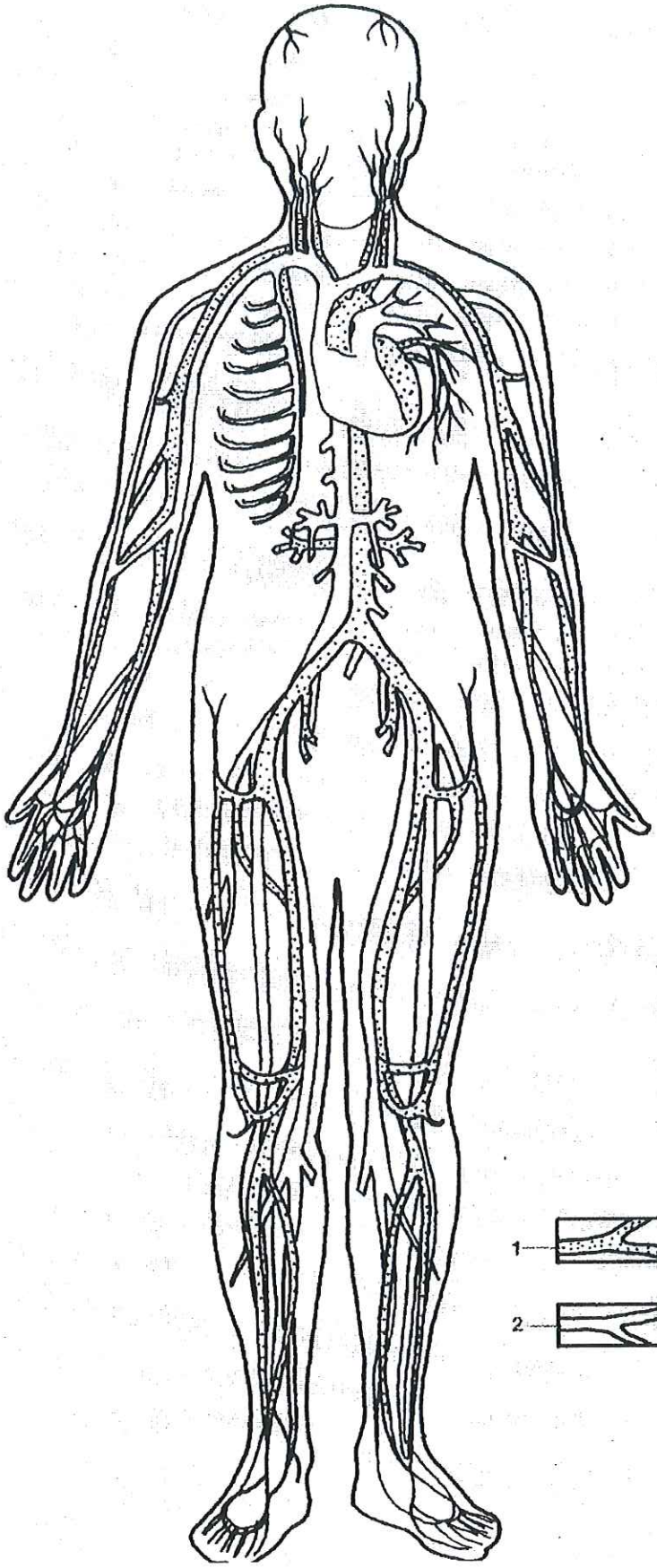


Figure 18.15 Autonomic innervation of the heart.

CIRCULATORY SYSTEM



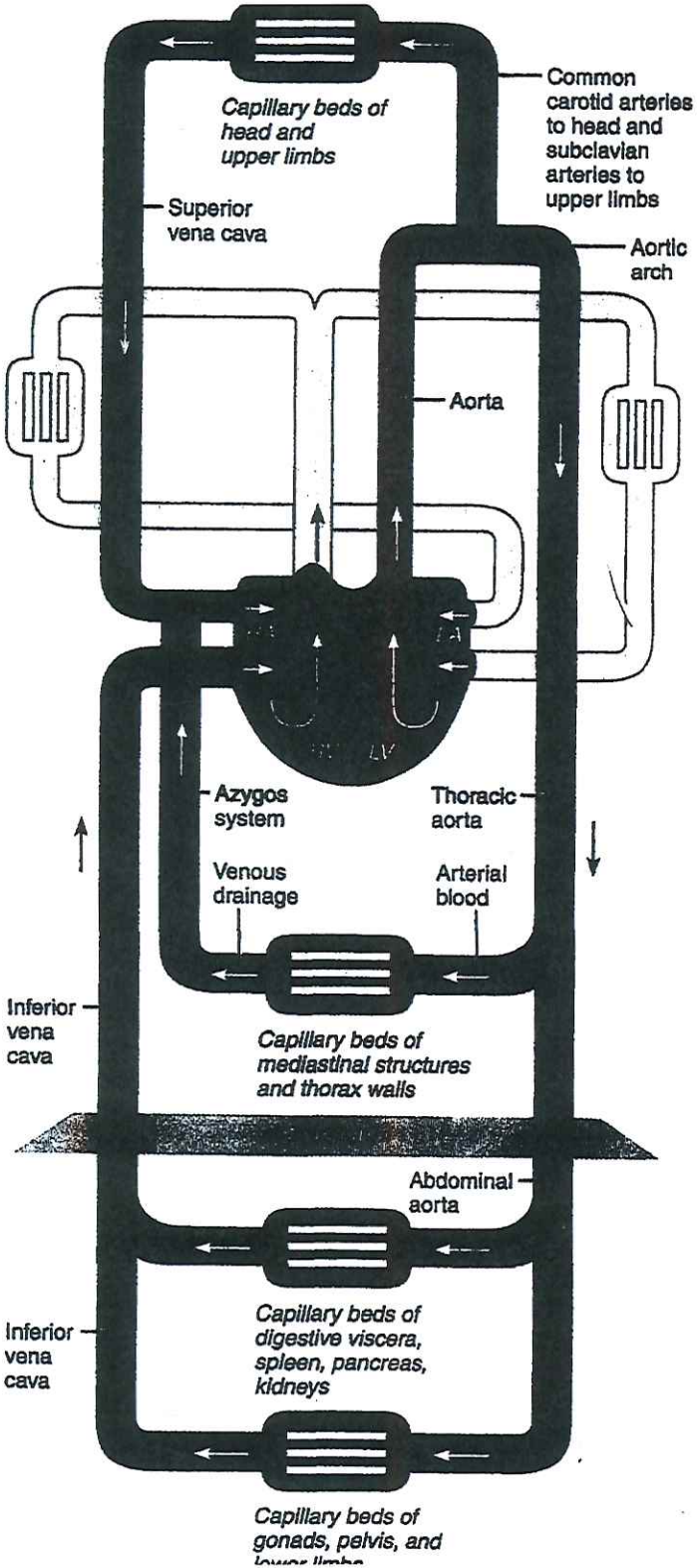
The circulatory system supplies oxygen and nutrients to every cell of the body and removes wastes and carbon dioxide. The system consists of *blood*, which carries the nutrients and wastes; the *heart*, which pumps the blood; and a closed system of tubes (*arteries* and *veins*) that carries the blood to and from the body tissues. The arteries transport blood enriched with oxygen and nutrients; the veins carry depleted blood. The artery that leaves the heart is very large, but it divides again and again into smaller and smaller branches. The tiniest of these branches are called *capillaries*, which are only seven to nine microns wide—so small that blood cells must pass through in single file. The capillaries are the site of the exchange of nutrients and wastes between the blood and the tissue cells. Interlacing capillary beds are found throughout the body except in the cartilages, cuticles, nails, hair, and the cornea of the eye. The depleted blood moves back toward the heart through the *venous system*. First the tiniest blood vessels unite in the capillary beds to form *venules*, then the venules combine again and again until they form the largest veins. The heart pumps the depleted blood to the lungs, where carbon dioxide is exchanged for oxygen, and to the liver and kidneys, which remove wastes.

Large arteries provide direct "express" service to major areas of the body such as the brain, lungs, arms, and abdomen; these arteries don't begin to subdivide until they reach the appropriate area. Press your finger against one of these arteries and you will feel the pump stroke or beat of the heart. This is the pulse.

gainst the blood vessel walls and is created by a beating heart. Damage to the inner layers of the blood vessels can cause the vessels to bulge and eventually rupture. This can be life threatening. Stress can elevate blood pressure. Stress can also elevate one's Basil Metabolic Rate

Renal System -

1. ARTERIAL CIRCULATION _____ Red
2. VENOUS CIRCULATION _____ Blue



CIRCULATORY SYSTEM

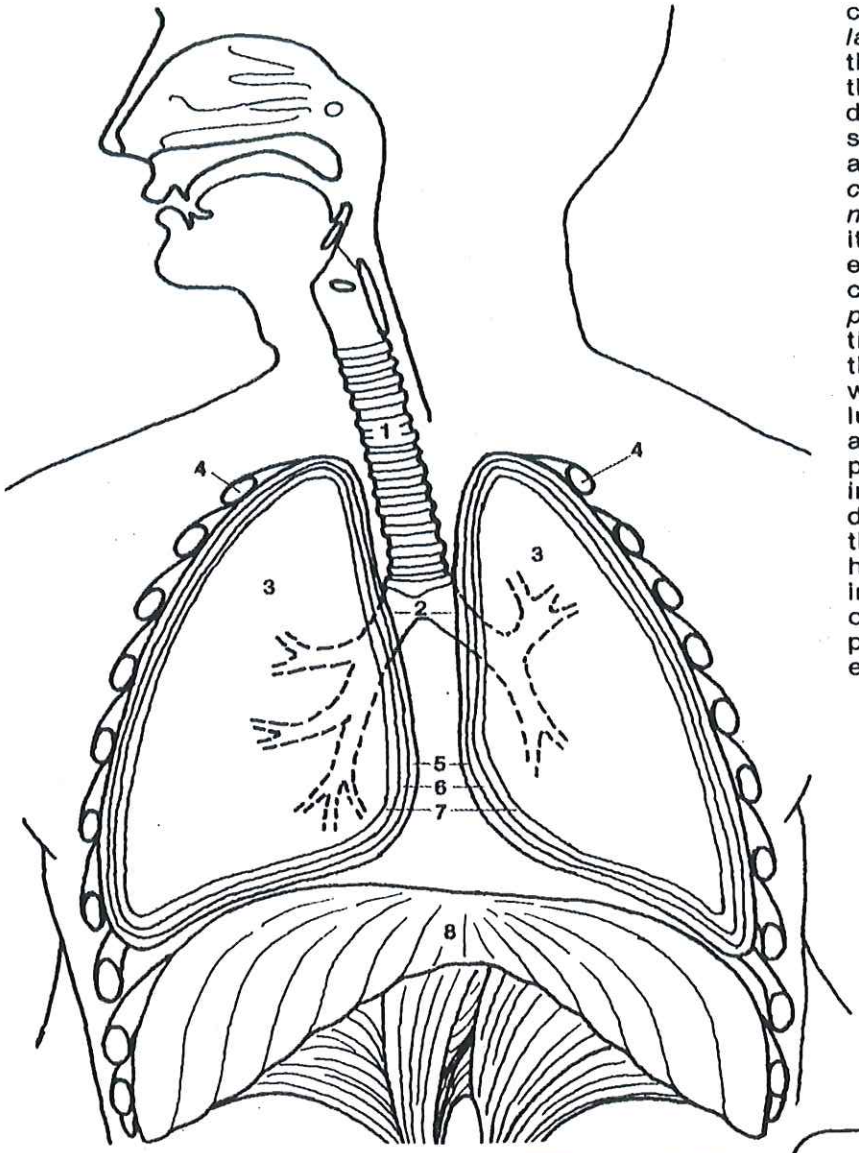
Table 1 - Formed Elements

Name	Function
Red blood cells	Transport oxygen and hydrogen io
White blood cells	Fight infection
Platelets	Assist blood clotting

Table 2 - Plasma

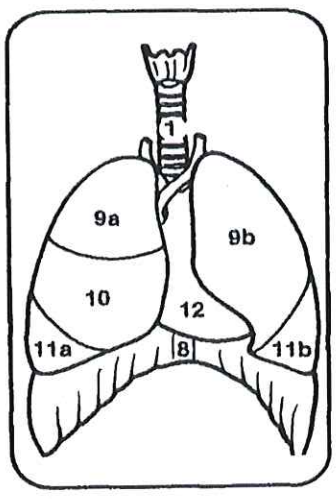
Component	Function
Water	Provides fluid environment
Proteins	Create osmotic pressure, aid clotting, and help buf
Nutrients	Required for cellular metabolism
Wastes	Produced by cellular metabolism
Salts	Aid metabolic activity and help buffer blood
Hormones	Chemical messengers

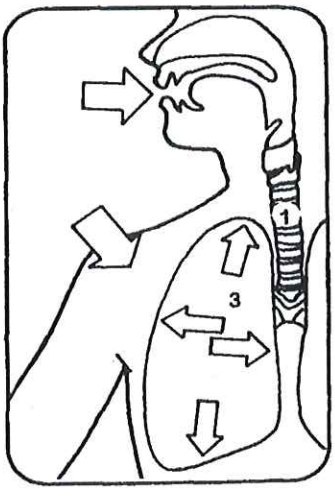
RESPIRATORY SYSTEM

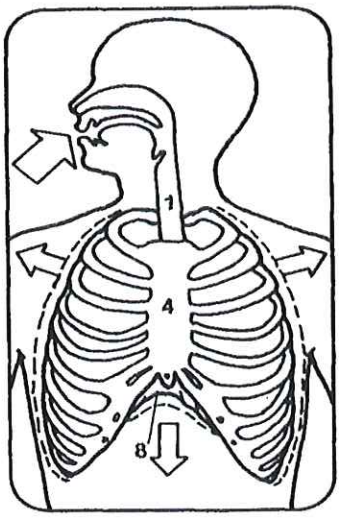


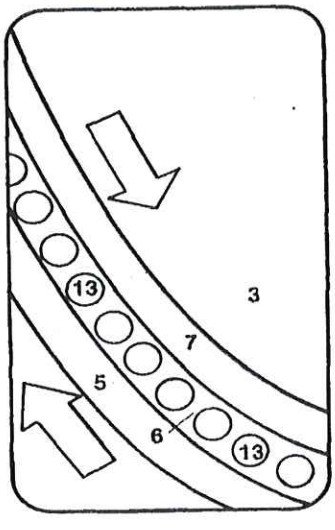
Every cell in the body converts oxygen to energy and generates carbon dioxide as a waste product. *Ventilation* is the term for the process of breathing oxygen in and carbon dioxide out. The respiratory system consists of the *nose*; *nasal cavities*, which filter and condition incoming air; the *pharynx* or throat; the *larynx* or voice box; the *trachea* or windpipe; the *lungs*; the *bronchi* or branching air tubes in the lungs; and the *air sacs*, the actual site of the oxygen-carbon dioxide exchange. The lungs are protected by the strong rib cage and, underneath, the diaphragm; they are surrounded by two serous membranes, the *visceral pleurae*. The lungs in turn surround the *mediastinum*, an interpleural space, that contains the heart in its pericardial sac and parts of the trachea, bronchi, esophagus, blood vessels, and nerves. The thoracic cavity is lined by a membrane called the *parietal pleura;* between it and the visceral pleurae is a potential space, the *intrapleural space*, containing only a thin fluid that acts as a lubricant for the pleurae, which thus slide frictionlessly as the lungs move. The lungs open their inner air chambers to the outside atmosphere; thus when the lungs are at rest the air pressure is the same inside and outside the body. As inhalation begins, the ribs, thoracic muscles, and diaphragm increase the size of the thoracic cavity, thereby lowering the air pressure in the lungs. The higher pressure outside the body then forces more air into the lungs to equalize the air pressure inside and outside. During exhalation the muscles and ribs compress the lungs, raising the air pressure inside until it exceeds the pressure outside — and the air rushes out.

1. TRACHEA _____ Blue
2. BRONCHUS _____ Light Blue
3. LUNG _____ Gray
4. RIB CAGE _____ Yellow
5. PARIETAL PLEURA _____ Pink
6. INTRAPLEURAL SPACE ____ Yellow-Green
7. VISCERAL PLEURA _____ Orange
8. DIAPHRAGM _____ Red
9. **a.** RIGHT SUPERIOR and
   b. LEFT SUPERIOR LOBES ___ Light Orange
10. RIGHT MIDDLE LOBE _____ Light Green
11. **a.** RIGHT INFERIOR and
    b. LEFT INFERIOR LOBES ___ Light Brown
12. HEART _____ Purple
13. LUBRICATING FLUID _____ Green







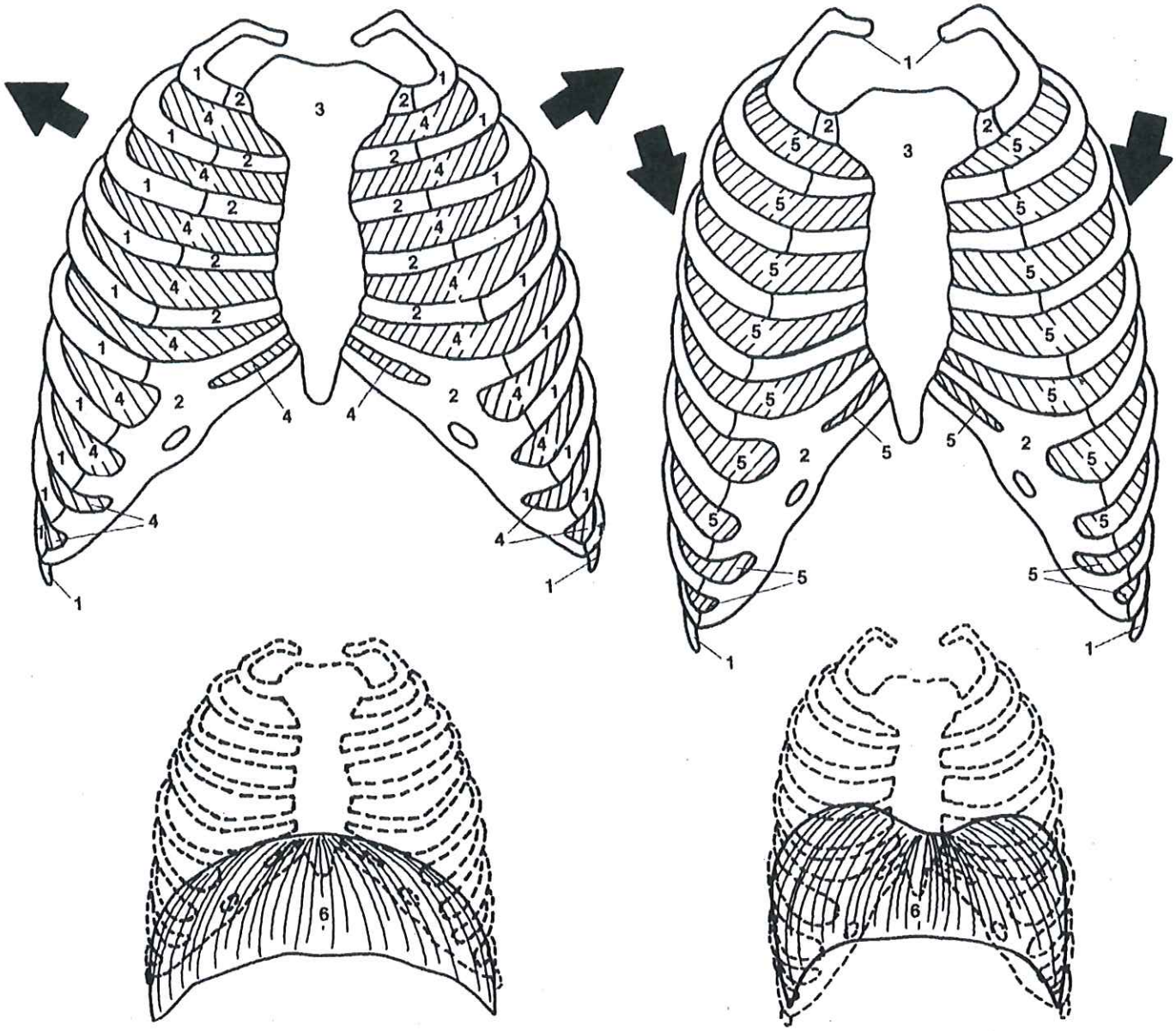


BREATHING MECHANISM

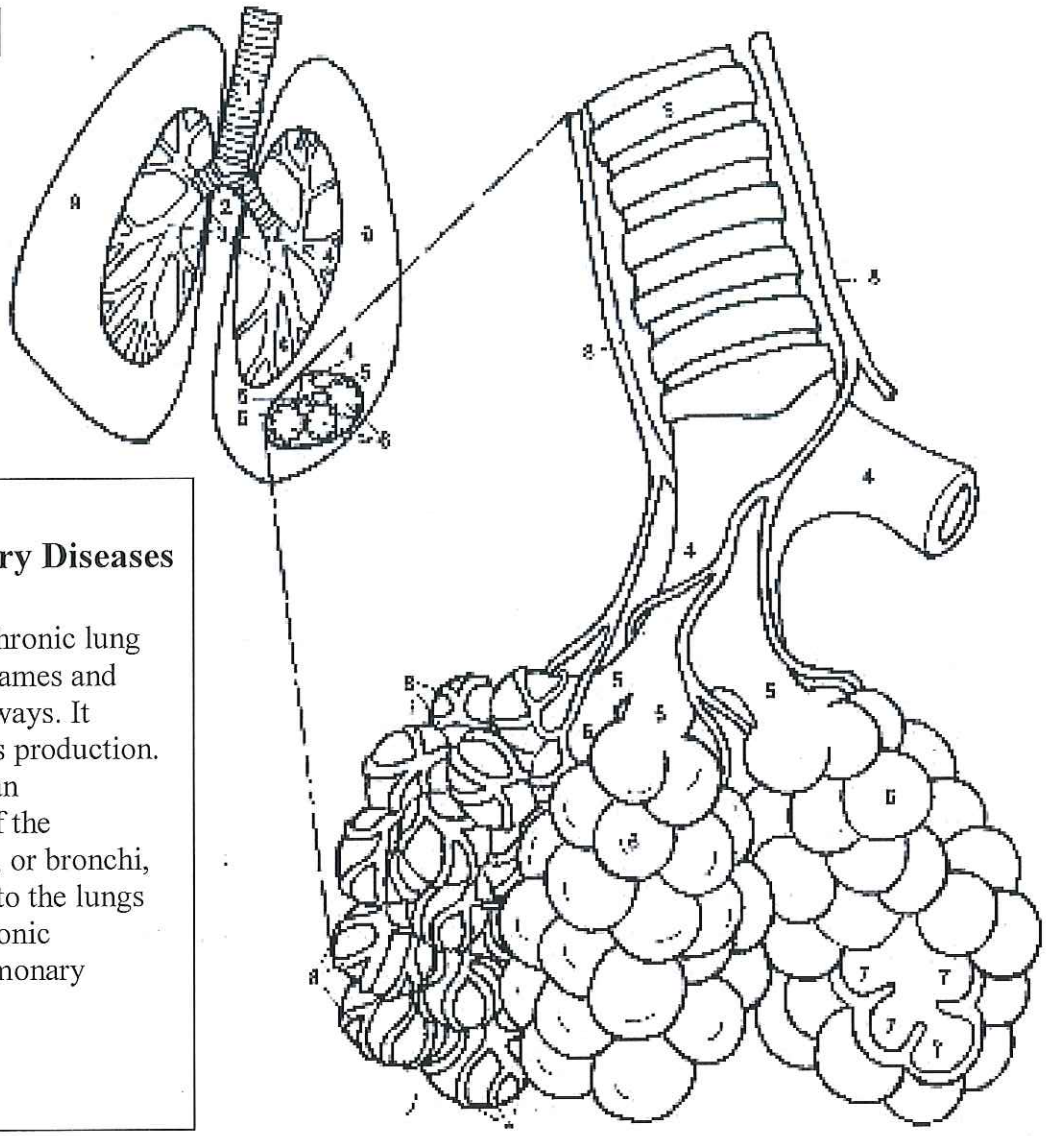
No conscious muscle force is required for *inspiration* (breathing in) or *expiration* (breathing out). Before the breathing cycle begins your lungs are at rest and the air pressure in them equals the pressure outside. Then the diaphragm contracts, which increases the vertical measure of the thorax. The central tendon pulls downward and flattens the diaphragm. The external intercostal muscles pull the ribs upward and outward; this increases the diameter of the rib cage. During deep inhalation the neck and back muscles help elevate the ribs. As a result of all this, the lungs are pulled by the parietal and visceral pleurae and expand—it's like having your hands glued to a balloon and pulling it wider. The air molecules inside the lungs now must fill a larger volume, which reduces the air pressure. The relatively higher pressure of air outside the body forces air into the body's airways and the lungs in order to equalize the pressure inside and outside.

During expiration the diaphragm and external intercostals relax and the elastic lungs attempt to spring back to the smaller size they were before inspiration. As the air space in the lungs gets smaller, the pressure in the lungs increases until it exceeds the air pressure outside the body. The cycle ends when the air rushes out of the lungs to equalize the pressure within and without, carrying with it the waste gas carbon dioxide.

1. RIBS _____ Yellow
2. COSTAL CARTILAGE _____ Yellow-Green
3. STERNUM _____ Green
4. EXTERNAL INTERCOSTAL MUSCLES _____ Orange
5. INTERNAL INTERCOSTAL MUSCLES _____ Pink
6. DIAPHRAGM _____ Red



ALVEOLI

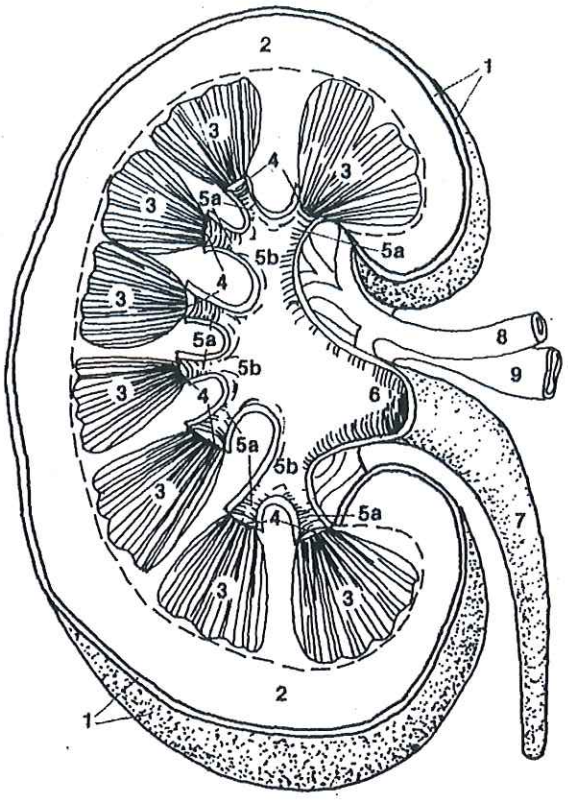


3 Major Respiratory Diseases

1. Asthma – is a chronic lung disease that inflames and narrows the airways. It increases mucus production.
2. Bronchitis - Is an inflammation of the bronchial tubes, or bronchi, that bring air into the lungs
3. COPD- Is a chronic obstructive pulmonary disease

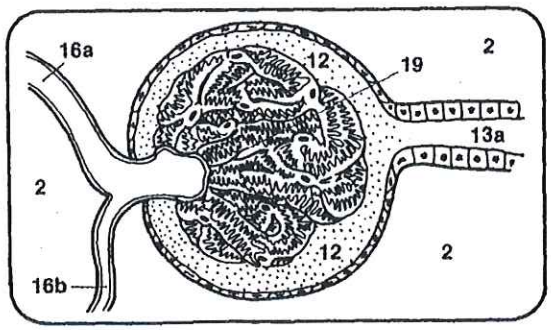
When you breathe in, the air in the alveoli is 21 percent oxygen, .04 percent carbon dioxide, and 79 percent nitrogen; but the blood cells coming back to the lung have already given up some of their oxygen to tissues throughout the body and thus carry less oxygen and more dioxide – a chemical imbalance on the two sides of the alveolar-capillary membrane. Thus the two gases try to equalize their pressures: oxygen passes from the alveoli through the membrane and to the blood, and carbon dioxide diffuses through the membrane to the air sac. The large area of the alveoli makes for a very efficient exchange: oxygen is replenished in about one-fifth of a second.

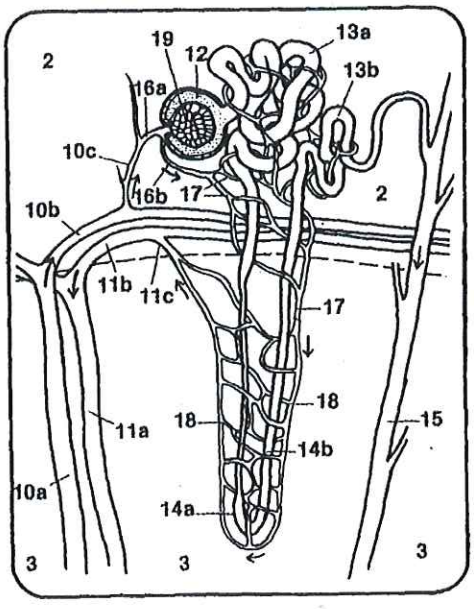
Renal System – Kidneys

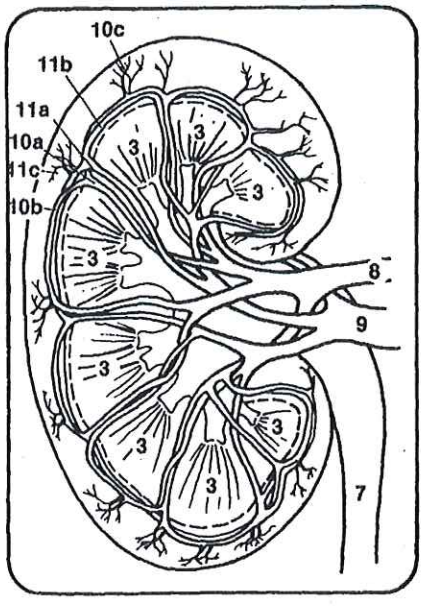


The two kidneys filter out chemicals and electrolytes from the bloodstream. Blood enters each kidney from the large *renal artery* that comes directly from the aorta. The artery divides and subdivides into a maze of arterioles, and each arteriole ends in a coil of capillaries, a *glomerulus*. The coils insert into a cup-like part of the nephron, *Bowman's capsule*. A great deal of water, wastes, glucose, and salts are filtered into each capsule. From the capsule the fluid enters a tubule that passes through a network of capillaries. Many of the fluids, compounds, and minerals diffuse back into the blood and return to the bloodstream. Nitrogenous wastes, excess water, and salts pass into increasingly larger tubules and flow into the *renal pelvis* as urine. Blood returning from the kidney to the bloodstream has very few impurities in it.

The kidneys have a great deal of extra capability. If one kidney is destroyed or removed, the other becomes enlarged and can provide the filtration of the original two. The kidneys also help to maintain the body's delicate acid-alkaline balance by excreting or reabsorbing acidic hydrogen or alkaline bicarbonate ions.







1. RENAL CAPSULE _____ Light Purple
2. CORTEX _____ Flesh
3. MEDULLA (pyramid) _____ Orange
4. PAPILLA _____ Yellow
5. a. MINOR and b. MAJOR CALYCES _____ Green
6. RENAL PELVIS _____ Light Green
7. URETER _____ Light Blue
8. RENAL ARTERY _____ Red
9. RENAL VEIN _____ Dark Blue
10. a. INTERLOBAR, b. ARCUATE, and c. INTERLOBULAR ARTERIES _____ Red
11. a. INTERLOBAR, b. ARCUATE, and c. INTERLOBULAR VEINS _____ Blue
12. BOWMAN'S CAPSULE _____ Gray
13. a. PROXIMAL and b. DISTAL CONVOLUTED TUBES _____ Light Brown
14. a. DESCENDING and b. ASCENDING HENLE'S LOOPS _____ Brown
15. COLLECTING DUCT _____ Light Orange
16. a. AFFERENT and b. EFFERENT ARTERIOLES _____ Red
17. ARTERIOLE _____ Red
18. VENULE RECTAE _____ Blue
19. GLOMERULAR CAPILLARIES _____ Purple

Immune System Response

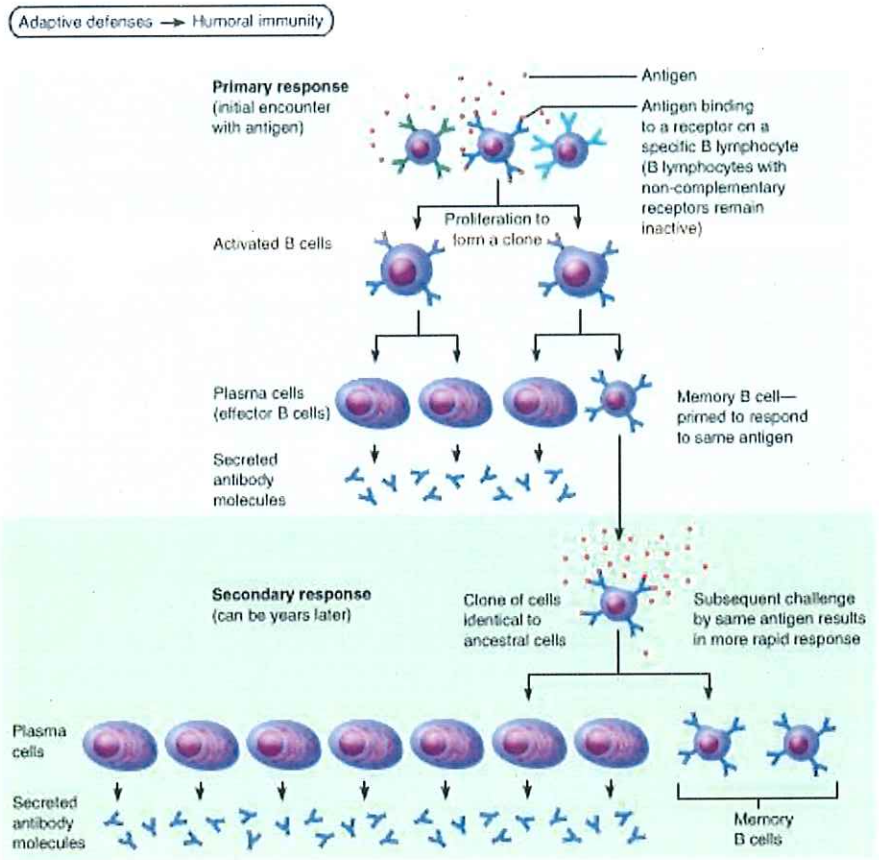


Figure 21.11 **Clonal selection of a B cell.**

Leukocytes (white blood cells, WBCs)	Spherical, nucleated cells	4800–10,800		
Granulocytes				
▪ Neutrophil	Nucleus multilobed; inconspicuous cytoplasmic granules; diameter 10–12 μm	3000–7000	D: about 14 days LS: 6 hours to a few days	Phagocytize bacteria
▪ Eosinophil	Nucleus bilobed; red cytoplasmic granules; diameter 10–14 μm	100–400	D: about 14 days LS: about 5 days	Kill parasitic worms; complex role in allergy and asthma
▪ Basophil	Nucleus bilobed; large purplish-black cytoplasmic granules; diameter 10–14 μm	20–50	D: 1–7 days LS: a few hours to a few days	Release histamine and other mediators of inflammation; contain heparin, an anticoagulant
Agranulocytes				
▪ Lymphocyte	Nucleus spherical or indented; pale blue cytoplasm; diameter 5–17 μm	1500–3000	D: days to weeks LS: hours to years	Mount immune response by direct cell attack or via antibodies
▪ Monocyte	Nucleus U or kidney shaped; gray-blue cytoplasm; diameter 14–24 μm	100–700	D: 2–3 days LS: months	Phagocytosis; develop into macrophages in the tissues

ENDOCRINE SYSTEM

Hormones are essential to our understanding of the body's metabolism or normal functioning. Endocrine glands secrete hormones directly into the bloodstream, not just to a special organ; thus these secretions reach every part of the body. Hormones influence the flow of substances through cell membranes and often work together, which means that a hormonal imbalance may interfere with normal body functions.

THYMUS
The thymus is not always classed as an endocrine gland. It becomes most developed during a child's early years. Apparently its purpose is to initiate antibody formation in the blood.

THYROID
The two lobes of the thyroid gland are located on either side of the trachea and secrete iodine-based hormones that regulate physical and mental growth, oxidation, heart rate, blood pressure, temperature, glucose absorption, and the utilization of glucose.

PARATHYROID
There are four parathyroid glands, all located next to the thyroid. Their secretions control the use of calcium in bone growth, muscle tone, and nervous activity.

PITUITARY
Located at the base of the brain, the pituitary gland secretes hormones that influence other glands. The pituitary gland regulates skeletal growth, the development of the reproductive organs, secretions from the ovaries and testes, the stimulation of the mammary glands to provide milk, blood pressure, the performance of smooth muscles, the reabsorption of water in the kidneys, and the functioning of the adrenal cortex, which becomes more active during times of stress. Pituitary disorders may result in giantism or dwarfism.

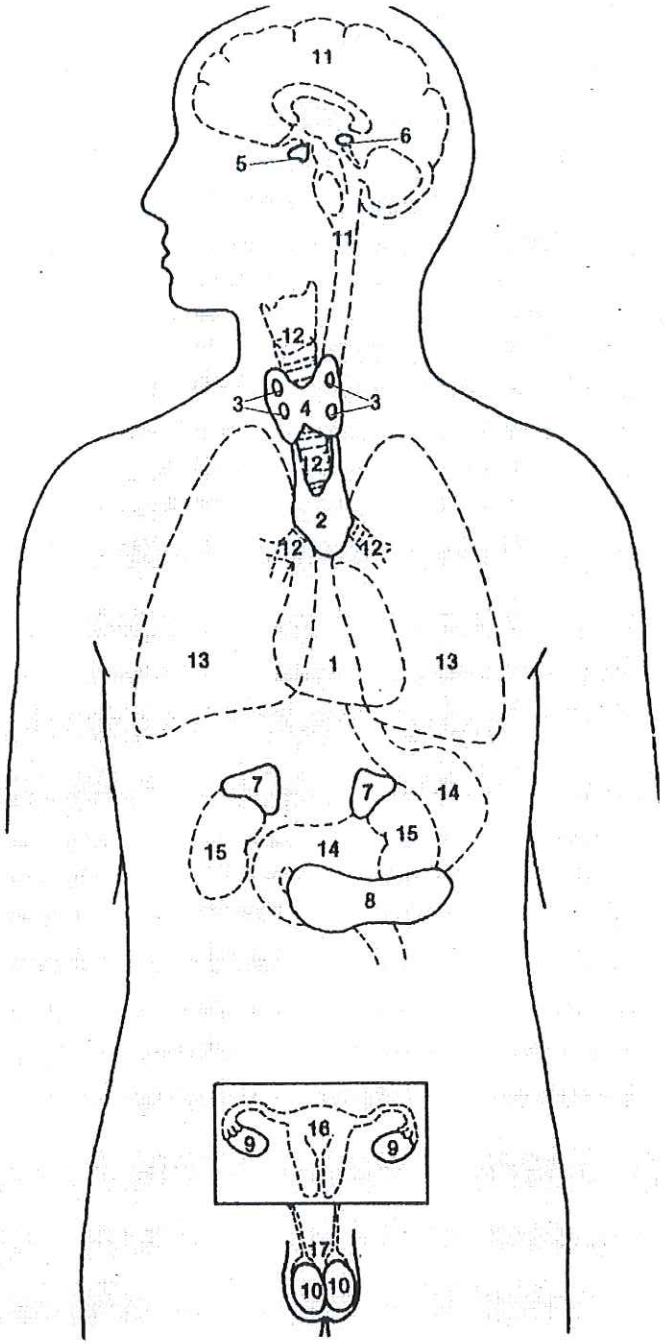
PINEAL
The function of the pineal gland is unknown, but it is very active metabolically. It is about the size of a pea and located at the base of the brain.

ADRENAL
Located above the kidneys, the adrenal gland secretes *cortisol*, which regulates the metabolism and the balance between salt and water levels. During emergencies it also secretes *adrenaline (epinephrine)*, which increases the heart rate and stimulates the liver and nervous system.

PANCREAS
The level of sugar in the blood is controlled by the pancreas's secretion, *insulin*. Sugar diabetes results when the level of insulin in the blood is relatively low.

OVARIES
Ovaries are found only in women. They secrete the two female hormones—*estrogen*, which produces female characteristics and initiates female bodily functions; and *progesterone*, which affects the endometrial lining of the uterus.

TESTES
Only men have testes. They secrete *testosterone*, the male hormone, which controls the growth of body hair and beard, body size, and the deepening of the voice.



1. HEART _____ Purple
2. THYMUS GLAND _____ Orange
3. PARATHYROID GLAND _____ Pink
4. THYROID _____ Brown
5. PITUITARY GLAND _____ Turquoise
6. PINEAL GLAND _____ Light Brown
7. ADRENAL GLAND _____ Red
8. PANCREAS _____ Light Green
9. OVARIES _____ Yellow
10. TESTES _____ Dark Green
11. BRAIN and SPINAL CORD _____ Gray
12. TRACHEA and BRONCHUS _____ Blue
13. LUNGS _____ Light Blue
14. STOMACH _____ Green
15. KIDNEYS _____ Light Purple
16. UTERUS and FALLOPIAN TUBES _____ Yellow-Green
17. SCROTUM _____ Flesh

Table 4 - Major Endocrine Glands and Their Major Hormones

Name	Hormone	Function
Hypothalamus	Hypothalmic-releasing and release-inhibiting hormones	Regulate anterior pituitary hormones
Anterior pituitary	Thyroid-stimulating	Stimulates thyroid
	Adrenocorticotropic	Stimulates adrenal cortex
	Gonadotropic	Stimulates gonads
Posterior pituitary	Antidiuretic	Promotes water reabsorption by kidney
Thyroid	Thyroxin	Increases metabolic rate
Parathyroid	Parathyroid	Maintains blood calcium and phosphorus levels
Adrenal cortex	Glucocorticoids (e.g., cortisol)	Promotes gluconeogenesis
	Mineralocorticoids (e.g., aldosterone)	Promotes sodium reabsorption by kidneys
Adrenal medulla	Epinephrine and norepinephrine	Stimulates fight or flight reaction
Pancreas	Insulin	Lowers blood sugar level
	Glucagon	Raises blood sugar level
Gonads	Androgens (male) Estrogens and progesterone (female)	Promotes secondary sex characteristics

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