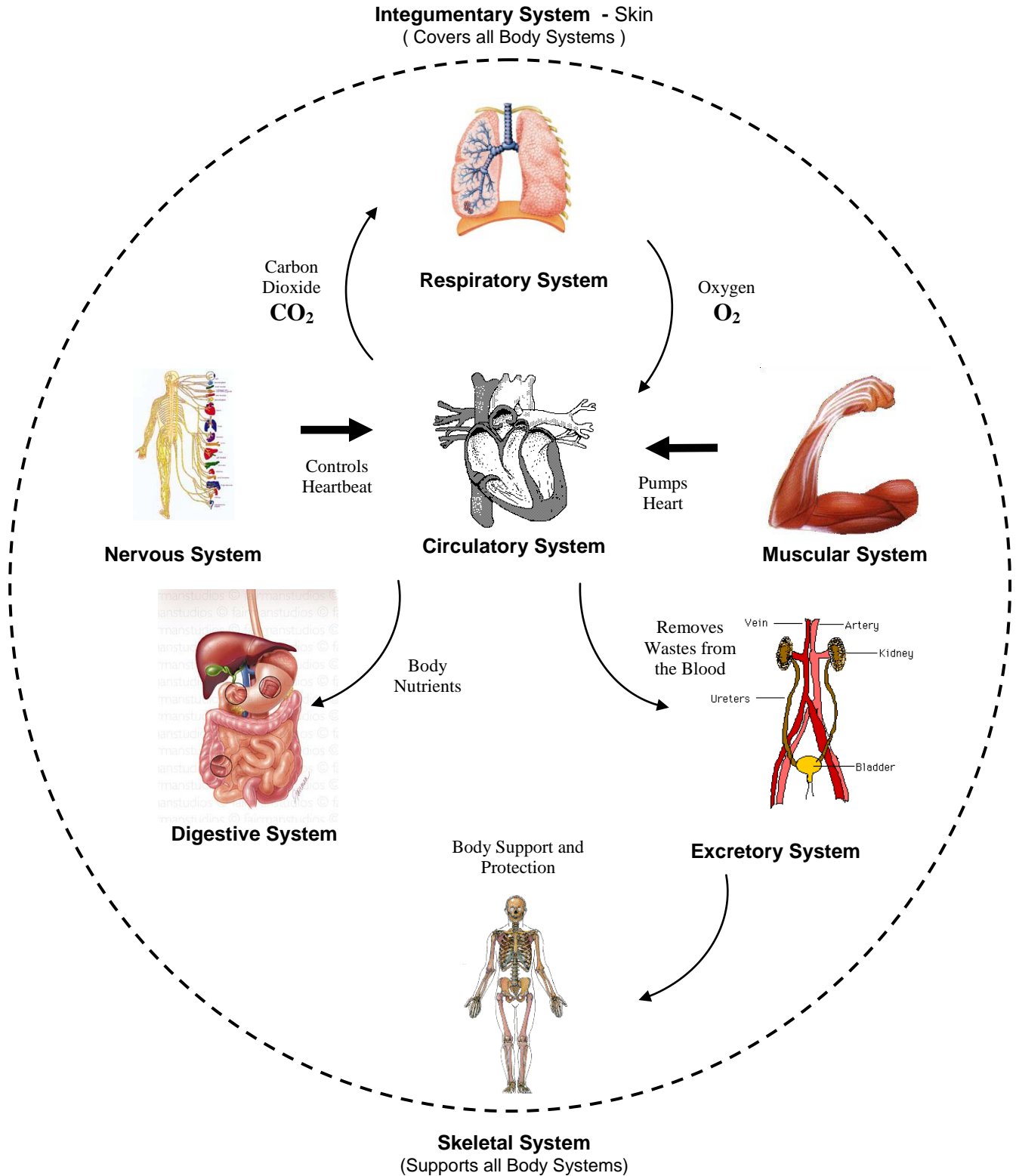


Body Systems Interact



BODY SYSTEM

Organs

Functions

Circulatory



“The Transportation Network”

heart
arteries
veins
capillaries
blood

- transports oxygen, food and wastes throughout the body
- defends body against disease
- connects to all other systems

Respiratory



“The Breath of Life”

nose
mouth
trachea
diaphragm
bronchi
lungs

- transports oxygen from the outside air to the blood inside the body
- transports carbon dioxide from the blood inside the body to the air outside of the body

Digestive



“The Processing Network”

salivary glands
mouth
esophagus
Stomach
liver
pancreas
gall bladder
small intestine
large intestine

- breaks down food mechanically in the mouth and then transports them using peristalsis through the other organs breaking down the food into smaller particle, using enzymes, to be absorbed and transported throughout the body.

Nervous



“The Communications Network”

<http://faculty.washington.edu/chudler/introb.html>

brain
spinal cord
nerves
sensory organs
(eyes, ears,
nose, skin, etc.)

- coordinates and controls the actions of all the organs and organ systems of the body
- detects, processes and responds to environmental stimuli that is external or internal

Excretory



“Waste Removal Network”

kidneys
bladder
lungs
skin
liver

- removes chemical and gaseous wastes from the body

Skeletal/Muscular/Integumentary



“The Structural Network”
“Movement Network” “Sensory Network”

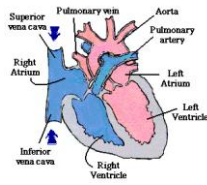
bones
cartilage

muscles
tendons

skin

- provides a moveable frame of support and protection for the body, soft tissue organs and the body systems throughout the body
- senses pain, pressure & Temperature changes

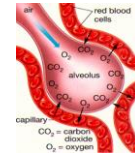
The Circulatory system transports food and gases throughout our body.



The blood vessels that carry blood away from your heart and transport it to all part of the body are called **arteries**. The blood is returned to the heart from all parts of the body by the **veins**. Arteries and veins are connected by **capillaries**, which allow the exchange of nutrients and gases. Capillaries have two adaptations for this:

- they are made of specialized epithelial tissue that is **only one layer thick**
- they are **very narrow** so that blood cells must pass through in single file

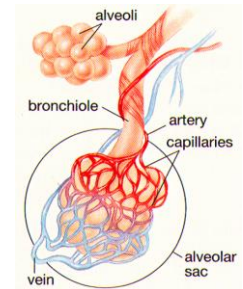
Oxygen goes from the alveoli to the capillaries and **Carbon Dioxide** goes from the capillaries to the alveoli



Breathing is the process, which moves air in and out of the lungs. The **diaphragm** muscles cause the air to be pushed out of and pulled into the lungs.



Diffusion occurs between the **alveoli** (tissues of the respiratory system) and the **capillaries** (tissues of the circulatory system)

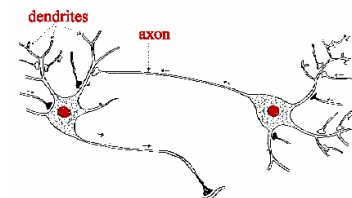


Food enters your body through the mouth and then passes to the stomach and intestines. It is broken down along the way into usable, soluble particles that can be used by different cells. (Figure 3.2)

There are two types of digestion:

- **mechanical digestion** involves the physical breakdown of food into useable pieces.
- **chemical digestion** breaks down the smaller pieces using **enzymes**

Nervous tissue is made entirely of specialized cells called **neurons**. A neuron's job is to **send and receive messages**. Small branches in the neuron, called **dendrites**, **receive messages**, which then pass them on through the cell body to the axon. The **axon** then **passes the messages on** to neighboring dendrites at a **synapse**.



Waste removal in the body is done through the organs of the **excretory system**. (The respiratory and circulatory systems also assist in the process) **Ammonia** is a chemical waste that the body produces when cells break down protein. The **liver** converts the ammonia to a less harmful substance called **urea**. The urea is carried to the kidneys, where it is mixed with water, and other salts to produce **urine**. The urine is transported to the bladder through the **ureter** tubes. The **bladder** expands and then releases the urine out through the **urethra**. The **skin** also gets rid of waste (excess salt that the body does not need). This process, called '**sweating**' also keeps you cool. **Urine can also reveal diseases** – That is why you often take a urine test for a doctor to determine if certain processes in the excretory system are functioning properly. (See Section 4 Notes)

Healthy Life Style

Proper care means maintaining healthy organs and organ systems. This can be accomplished with clean air and water, nutritious foods, exercise and sleep. This is a healthy lifestyle, which makes you feel better and helps your body resist disease. Your **immune system** will work best when you are well fed and rested.

Blood - The Body's Transportation System

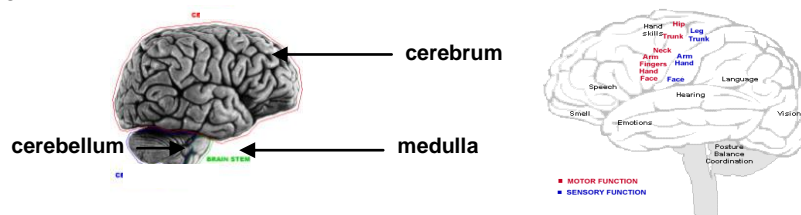
The blood vessels of the circulatory system form a complex network linking the outside environment with the internal environment of the body. The blood supplies all the living cells in the body with the nutrients they need to carry out their functions. The circulatory system must work closely with the respiratory system (which supplies the oxygen) and the digestive system (which supplies the nutrients)

(Composition) About 8% of an adult's body weight is blood, made up of:

Component	% of blood (by volume)	Main Function
plasma	55%	carries nutrients, waste products, hormones, and blood cells
red blood cells	44%	carries oxygen (because they have hemoglobin – an iron- rich chemical, which attracts oxygen)
white blood cell	less than 1%	defends the body against infection and disease
platelets	less than 1%	causes the blood to clot (thicken) at site of wounds to prevent blood loss

Digestion begins in the **mouth** with the mechanical breakdown of food. **Saliva** (produced by the salivary glands) mixes with the food to make it easier to swallow. **Salivary amylase**, an **enzyme**, begins the chemical digestion process by breaking the large starch molecules into smaller sugar molecules. The **epiglottis** is a flap of skin that covers the windpipe so that food will not enter the lungs. The food is pushed down the **esophagus** by contractions of muscle tissue. This is called **peristalsis**. The stomach churns the food mixing it with gastric juices (composed of mucus, hydrochloric acid, water and digestive enzymes). The **mucus** helps to protect the stomach from digesting itself. The food then enters the **small intestine** where chemical digestion continues with digestive enzymes added from the pancreas. The inner surface is covered with **villi**, which increase the surface area for absorption of the nutrients that have been digested. **Microvilli** further this absorption of nutrients. In the **large intestine**, digestion is complete and those nutrients that have not been absorbed are formed into **feces**, which collect in the **rectum** and release from the body through the anus.

The nervous system consists of two main divisions: the central nervous system, which is composed of the brain and the spinal cord. The brain receives stimuli from the outside world through sensory organs in the body. Internal stimuli are also received from inside the body. It reacts to all this stimuli and responds appropriately. The brain is divided into three main sections:



The **spinal cord** connects the brain to the peripheral nervous system. It contains **interneurons**, which connect one neuron to another.

- the **peripheral nervous system** is made up of the cranial (head) and spinal nerves, which travel to all parts of the body

Sensory neurons carry information from the body to the central nervous system. **Motor neurons** carry information from the central nervous system to the muscles and organs. The responses to these stimuli can be **automatic** (**autonomic nervous system**) or **voluntary** (**somatic nervous system**).

The nervous system allows each of the systems of the body to respond to changing conditions and make adjustments in order to maintain a stable internal environment, allowing the cells to function properly.

Disorders and Diseases

Relationship to/with Other Body Systems

Arteriosclerosis – build-up of cholesterol
 High blood pressure - hypertension
 Heart attack
 Anemia

The circulatory system works with each of the other systems, supplying the nutrients they need, to perform their functions.

Lung Diseases
 & Disorders
Lung Cancer
Respiratory diseases

The muscular system works with the nervous system to move the diaphragm so that gas exchange can take place. The circulatory system carries throughout the body.

Appendicitis
Cirrhosis of the liver
Colorectal Cancer
Crohn's Disease
Digestive Diseases
Peptic Ulcer
Stomach Disorders
Pancreatic Diseases

Once the nutrients have been chemically broken down by the digestive system they are transported by the Circulatory system and the excretory system then removes the wastes. This is coordinated by the nervous system, while the muscular system works with the skeletal system in the process of moving the nutrients.

Alzheimer's Disease
Brain Cancers
Epilepsy
Meningitis...
Multiple Sclerosis...
Muscular Dystrophy...
Parkinson's Disease...
Stroke...

The Central Nervous System coordinates the Peripheral Nervous System and all other systems of the body

Disorders
gout
renal failure
nephritis
urinary tract infections
kidney stones

The wastes are carried to the excretory system by the circulatory system and the digestive system while the muscular system helps to coordinate the removal of waste with messages from the nervous system

Bone Diseases
 Bone Cancer
Muscular Dystrophy
MS
 Skin Cancer
Multiple System Disorders

These systems work together to move the structural frame of the body, with each system intact. The nervous system coordinates these movements and responds to the changes it receives from the environment inside and outside the body.

Disorders of the Circulatory System include: **high blood pressure** (hypertension), heart attacks (damage to heart muscle) and High blood pressure, or **hypertension** ('*the silent killer*') can lead to **strokes** (brain damage).

Measuring Blood Pressure

The device used to measure blood pressure is called a **sphygmomanometer** (an inflatable cuff wrapped around the arm, with a pump attached – which is used to inflate it). The blood flow is slowed and then listened to by a doctor, with a **stethoscope**. Blood pressure indicates: The volume of blood, Heart rate, Artery size, Artery elasticity and Blood viscosity

Disorders of the Respiratory System (Smoking-Related diseases)

If the lining of the lungs becomes inflamed, it can lead to **bronchitis** (which makes breathing more difficult), which can further lead to damage of the lung tissue, causing **emphysema** (shortness of breath), which is a permanent condition. **Lung cancer** is caused by the tar and smoke in cigarettes, which cause the lung cells to grow out of control (tumors are formed) and overcome healthy cells.

Disorders of the Digestive System

Painful **ULCERS**; sores on the lining of the stomach, originally thought to be caused by stress, are caused by H. pylori (*Helicobacter pylori*), a bacteria present in the stomach. High fiber diet is important, the fiber is used by the colon to process waste materials. Low-fiber can irritate the colon wall and lead to **colon cancer**.

Long-term stress, smoking, excessive use of alcohol or aspirin can lead to a **peptic ulcer**.

The Reflex Response

Sensory and motor nerves work together, sometimes not involving the brain. This is known as a **reflex**.

- Quivering muscles generate heat.
- 90% of heat loss is through the skin (most of the rest is through the lungs).
- Hairs on the skin stand on end when the tiny muscle cells near the surface contract, creating '*gooseflesh*' (Goosebumps)
- Fluffing body hair (in animals with thick fur) reduces heat loss by improving insulation

Feeling flushed (red and hot) happens because tiny blood vessels in the skin expand, which increases blood flow. Sweating helps cool down your body as moisture evaporates from the skin surface.

The nervous system helps to keep your body temperature stable by monitoring conditions outside, using temperature receptors in the skin. The information is then transmitted to the **hypothalamus** (section of the brain which regulates body functions), which then decides what action needs to be taken – increasing activity to raise the temperature or, reduce it to prevent heat loss.

Response to stimuli is coordinated by the nervous system (brain, spinal cord and nerves) and the **endocrine system** (glands that produce **hormones**).

Developing A Theory For Disease

If you lived in before the 17th Century, chances are that a simple cut or broken bone would have killed you. This is because of infection and the lack of knowledge about cleanliness.

The First Vaccine

In the late 1700's **Edward Jenner**, an English country doctor, developed the first vaccine. He noticed that milkmaids who had cowpox (a mild form of smallpox) did not get smallpox. He began infecting people with cowpox so that they would become immune to smallpox, and it worked – the first **vaccine** was created. The last case of smallpox reported was in 1979.

Watch Out Germs!

Louis Pasteur was the first person to identify living micro-organisms as "germs". He suggested, and later proved his theory that these germs were the cause of most infectious diseases. The process of heating food, to kill the micro-organisms, worked. The process was called pasteurization and is still used today.

Cleaning Up The Germs

Once doctors knew that 'germs' caused disease, other discoveries followed. **Joseph Lister** determined that these germs were entering his patients wounds, so he introduced the practice of cleanliness and sterilization to surgery.

Nutritional Research

During the time of discovery, explorers would travel on ships for very long periods of time. The only foods they could take along were ones that wouldn't spoil. Many sailors developed **scurvy** as a result – with open sores, bleeding gums, loose teeth, and an unsteady gait. James Lind treated these sailors by feeding them oranges and lemons. It was later discovered that scurvy was caused by a lack of Vitamin C. Researchers have discovered that various diseases can be treated by proper dietary choices.

Factors That Affect The Healthy Function of Body Systems

Diet, exercise, drugs, injury and disease can affect body systems and how they perform their functions. Scientific Research has also determined that there are many factors, which can affect your cells, and consequently, your body systems.

These factors include: Inherited diseases or conditions, Sensitivity (allergies) to environmental conditions; such as smog, pollen, dust, dairy products, or peanuts (**Asthma** is a condition, which reflects this kind of sensitivity), how you respond to physical, emotional and psychological stresses and how you treat your body in general – making healthy choices, instead of unhealthy choices. Disorders, which can hospitalize Americans include:

- circulatory system (15%)
- digestive system (11%)
- respiratory system (10%).

The **circulatory system** must work closely with the **respiratory system** (which supplies the oxygen) and the **digestive system** (which supplies the nutrients)

How the Respiratory and Circulatory Systems Connect

The respiratory system exchanges oxygen and carbon dioxide, while the circulatory system transports those gases throughout the body. The interaction between these two systems happens in the tissues of the lungs. Breathing (the exchange of gases) moves air in (inhalation) and out (expiration) of our bodies.

How the Digestive and Circulatory Systems Connect

The transfer of food particles, from the digestive system to the circulatory system, takes place at the inner lining of the small intestine, through millions of tiny, finger-like projections, called villi, which contain a network of capillaries. The transfer of food particles is possible because of absorption (the villi absorb the food particles from the capillaries and then transport the nutrients to the cells, to be used as fuel).

Factors Affecting the Circulatory System

Certain conditions place people at greater risk of contracting a circulatory system disorder:

- **Smoking** (nicotine causes blood vessels to constrict, increasing the heart rate and raising blood pressure – carbon monoxide competes with oxygen in the lungs, reducing the blood's ability to carry oxygen)
- **Poor diet** (may produce a **high Cholesterol (a lipid – 'fat') level**. Too much of a type of food that has a high content of fat will cause a build-up of cholesterol in the walls of the arteries. This build-up, called **arteriosclerosis**, makes it more difficult for blood to flow and can lead to a **heart attack**.)
- **Little exercise** (makes fatty deposits increase, because the nutrients are not used up completely).

A Healthy Circulatory System

The heart circulates the blood throughout the body by pumping it to where it can supply nutrients and remove wastes.



Factors Affecting the Respiratory System - SMOKING -

The Contents of Cigarettes

There are over 400 different chemicals in a cigarette. Tar, carbon monoxide, and nicotine are the most destructive. **Tar** is a sticky substance formed when the cigarette is burned. As it is inhaled, the tar settles on the surface of organs (lungs) and interferes with the function of the cilia (to move mucus out of the respiratory tract). **Carbon monoxide** is also released when the cigarette is burned and gets absorbed by the red blood cells, during gas exchange. Less oxygen is absorbed by the red blood cells, causing the heart to work harder and faster. **Nicotine** is an addictive drug that causes the heart to speed up, and raises the blood pressure.

Besides smoking, air pollution and industrial by-products (coal dust) can lead to disorders of the respiratory system.

Factors Affecting the Digestive System

Food provides nutrients in the form of carbohydrates, fats, proteins, vitamins, minerals and water – which provide energy and materials used for growth, development and repair. Some foods cause poor health and promote disease (like refined sugar and low fibre foods) if consumed in large quantities over long periods of time. Starch and sugars are carbohydrates and provide the body with its main source of energy. Fats are also essential in our diet, providing us with energy and cushioning the internal organs from shock. Proteins are essential for growth and repair of body tissues. Minerals and vitamins are also needed for good health.