

Chapter 16

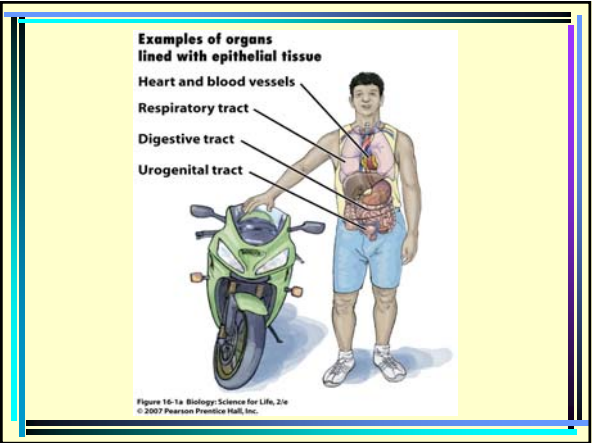
Organ Donation: Tissues, Organs, and Organ Systems

16.1 Tissues

- A _____ is a group of similar cell types that perform a common function
- Four main types of tissues
 - _____
 - _____
 - _____
 - _____

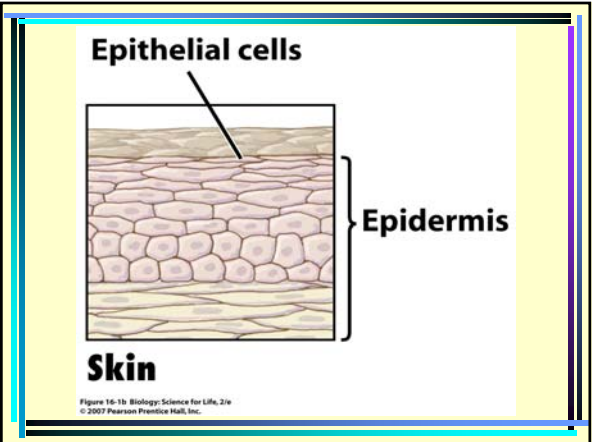
Epithelial Tissue

- Epithelial tissue, or epithelia:
 - _____
 - _____
 - _____



Epithelial Tissue

- Epithelial tissue is only anchored on one surface
 - The unattached surface is either exposed to the outside or to internal body fluids
- Examples:
 - Blood vessels
 - ✓ Attached to wall of vessel
 - ✓ Outer surface is exposed to bloodstream
 - Outer layer of skin (epidermis)
 - ✓ Attached to underlying layers
 - ✓ Exposed to air



Epithelial Tissue

- Epithelial cells functions:
 - _____
 - ✓ Skin cells protect against injury and ultraviolet light
 - ✓ Protect the body from water loss and pathogens
 - _____
 - ✓ Skin cells form glands that secrete mucus, oil, and sweat
 - _____
 - ✓ Cells in the blood vessels and intestines absorb nutrients

Epithelial Tissue

- There is a constant loss of epithelial cells
 - They are replaced by mitosis about every two weeks
 - Skin cells are rubbed off by clothing
 - Cells that line the mouth are rubbed off by food

Connective Tissue

- Connect organs and tissues to each other
- Are not tightly packed
- 6 types of connective tissue – all composed of cells in a _____ of protein fibers and an amorphous, gel-like ground substance
- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____

Loose Connective Tissue

- Connects epithelia to underlying tissue
- Holds organs in place
- Acts as padding under the skin
- There is a loose weave of the fibers in the matrix

Loose Connective Tissue

- **Fibroblasts**
 - These cells secrete the proteins that comprise the matrix
- Matrix: main structural feature of loose connective tissue
- 2 important proteins in the matrix – collagen and elastin
 - Collagen fibers: Give connective tissue great strength
 - Elastin fibers: Able to stretch without breaking
 - Wrinkles in skin are caused by degradation of these proteins (through age, sunlight, smoking)

Loose connective tissue

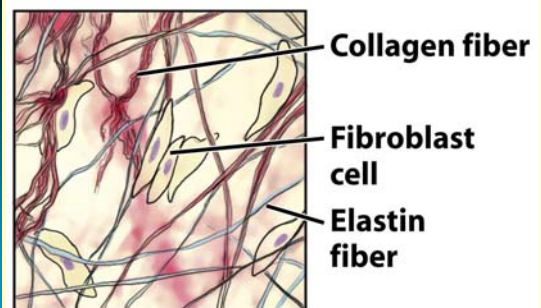
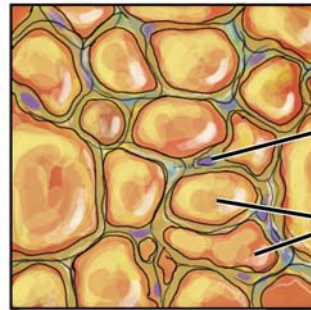


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Adipose Tissue

- Adipose tissue is _____
- It connects the skin to underlying structures
- Insulates and protects organs
- Specialized for synthesis and storage of lipids
- A fat droplet fills the cytoplasm of these cells and sinks when the fat is used for energy
- Cells are the main component of this tissue
- Only a small amount of matrix

Adipose tissue



Cell nucleus

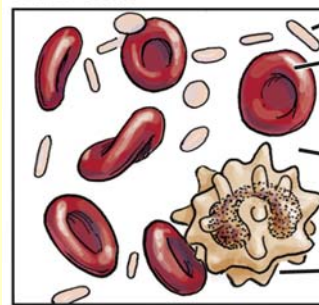
Fat droplets

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Blood

- Blood is a tissue that circulates throughout the body
- Transports oxygen and nutrients to cells
- Blood cells are suspended in a liquid and protein rich matrix called plasma
- White cells – _____
- Red cells – _____
- Platelets – _____

Blood



Platelet

Red blood cell

Plasma

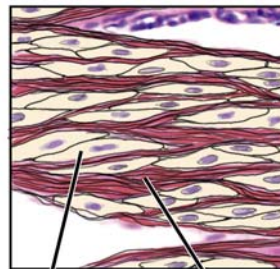
White blood cell

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Fibrous Connective Tissue

- Forms tendons that connect muscles to bones
- Forms ligaments that connect bones to each other at joints
- Cells are called fibroblasts
- Collagen fibers of matrix are the most common feature

Fibrous connective tissue



Fibroblast cell

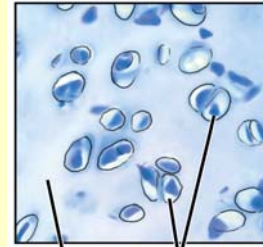
Parallel collagen fibers

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Cartilage

- Provides flexible support for ears and nose
- Allows for shock absorption
- At joints, ends of bone are covered in cartilage for smooth gliding where joint surfaces contact each other
- Cells are _____ that secrete substances to form a dense matrix
- Matrix is rich in collagen and other structural proteins

Cartilage (at the end of a bone)



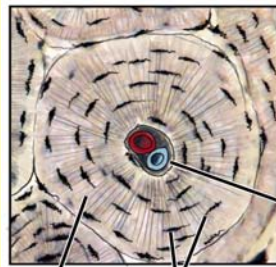
Matrix Chondrocytes

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Bone

- Bones of the skeleton are connected at joints
- Rigid tissue of cells called osteocytes
- The _____ secrete a substance that hardens into a solid matrix of collagen and calcium and other minerals
- The calcium and other minerals in bone are a reservoir in case the body's levels of these substances is low
- There are central canals inside bones to house nerves and blood vessels

Bone



Matrix Osteocytes

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Muscle Tissue

- Specialized tissue capable of contracting
- Composed of bundles of cells called muscle fibers
- The muscle fibers contain proteins that cause the muscle to contract when signaled
 - _____
 - _____

Muscle Tissue

- Differentiated according to function:
 - _____ – such as walking – requires conscious thought
 - _____ – such as the beating of the heart – requires no conscious thought
- Differentiated according to presence of bands of actin and myosin
 - _____ muscle – bands are present
 - _____ muscle – bands are absent
- Smooth muscle does have actin and myosin, but not in a banding pattern

Muscle Tissue

➤ There are 3 muscle tissue types:

1. _____
2. _____
3. _____

Cardiac Muscle

- **Cardiac** muscle is found only in the heart tissue
- Involuntary striated tissue
- Contractions produce a coordinated heart beat to pump blood throughout body

Cardiac muscle (e.g., heart)

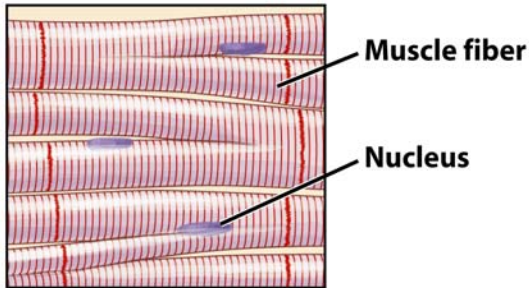


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Skeletal Muscle

- **Skeletal muscle** is usually attached to bone
- Produces movement of body parts
- Voluntary striated muscle
- Exercise causes an increase in skeletal muscle
 - Size of cells – not number of cells

Skeletal muscle (e.g., biceps)

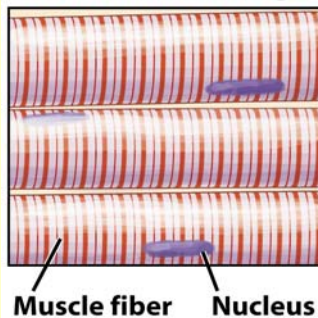
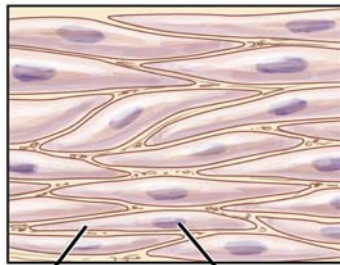


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Smooth Muscle

- **Smooth muscle** is involuntary and not striated
- Found in blood vessels and internal organs, like in the digestive system
- Contracts slowly but can remain contracted for a long time

Smooth muscle (e.g., intestine)



Muscle fiber **Nucleus**

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Nervous Tissue

- Found in brain, spinal cord, and nerves
- Cells called neurons conduct and transmit electrical impulses
- Helps the body sense stimuli
- Process the stimuli
- Transmit signals to and from the brain out to the rest of the body

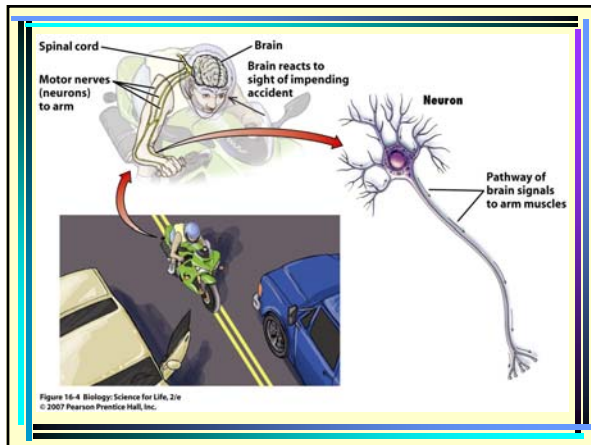


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Tissue Donation

- With consent, tissue can be removed from a person declared brain dead or from a person who has suffered cardiac death
- Brain death occurs when the cerebrum and brain stem of the brain cease to function
 - Cerebrum – largest part of brain and controls movement and higher mental functions
 - Brain stem – at base of brain – controls automatic functions like heartbeat, respiration, and swallowing

Tissue Donation

- Common causes of brain death:
 - Accidents of motorcycles and automobiles
 - Drowning
 - Ruptured blood vessels
- No recovery; different from a coma
- Cardiac death is when _____
- After a motorcycle accident which results in either brain death or cardiac death, the family may be asked to consent to organ donation

Tissue Donation

- Different types of tissue can be donated
 - Bones for bone cancer patients
 - Tendons, ligaments and cartilage for joint reconstruction
 - Veins serve as bypass material for heart surgery
 - Skin for burn victims
 - Cornea of eye for patients with vision loss

Tissue Donation

- Removed tissue is checked for contamination by bacteria and viruses to avoid rejection by recipient
- Tissue is then frozen and stored in tissue banks – sometimes as long as five years

Tissue Donation

- Tissue donation is not normally rejected
 - Recipients do not need to be genetically similar to donors
 - Usually don't need drugs to repress the immune system

16.2 Organs and Organ Systems

- Organs are _____
- _____
- Organ system: _____
- _____

Organs and Organ Systems

- There are levels of organization:
 - _____
 - _____
 - _____
 - _____

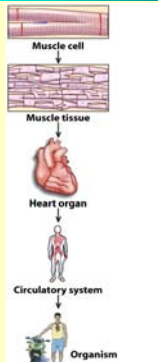


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Organs: The Liver as a Model Organ

- The liver
 - Large reddish brown organ
 - Located in the right side of abdominal cavity below diaphragm
 - Divided into four lobes
- In close contact with gall bladder
 - Greenish sac

The Liver as a Model Organ

- Liver structure:
 - Connective tissue separates the liver into **lobules**
 - There is a central vein in each lobule that allows blood to reach all parts of the liver

Human liver



Figure 16-6a. Biology: Science for Life, 2/e
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Liver tissue



Figure 16-6b. Biology: Science for Life, 2/e
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Liver lobules

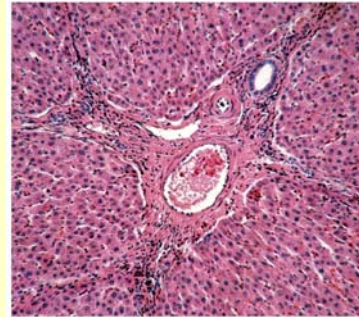


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The Liver as a Model Organ

- Epithelial cells, called _____, make up the bulk of the liver and filter the blood
- The filtering removes toxic materials, dead cells, pathogens, drugs, and alcohol

The Liver as a Model Organ

- One organ: ex. the liver
 - Composed of different tissues – epithelia and connective – that work together to perform a function (filtering the blood)
- The liver is part of both the circulatory and digestive systems
 - As a part of the circulatory system, it synthesizes blood-clotting factors, detoxifies harmful substances in the blood, regulates blood volume, and destroys old blood cells
 - As an accessory part of the digestive system, it helps metabolize fats and other nutrients

Organ Systems: The Digestive System

➤ There are eleven organ systems in the human body

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____


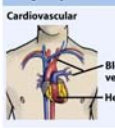


Organ system	Function	Organ system	Function
 <p>Digestive</p>	<p>Ingests and breaks down food so that it can be absorbed by the body</p>	 <p>Cardiovascular</p>	<p>Enables the transport of nutrients, gases, hormones, and wastes to and from cells of the body</p>
 <p>Excretory</p>	<p>Eliminates liquid wastes; regulates water balance</p>	 <p>Endocrine</p>	<p>Secretes hormones into bloodstream for regulation of body activities</p>

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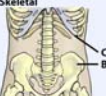
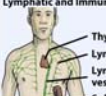
Organ system	Function	Organ system	Function
 <p>Respiratory</p>	<p>Enables gas exchange, supplying blood with oxygen and removing carbon dioxide</p>	 <p>Nervous</p>	<p>Senses environment, communicates with and activates other parts of the body</p>
 <p>Skeletal</p>	<p>Provides mechanical support for the body; mineral storage; red blood cell production</p>	 <p>Lymphatic and immune</p>	<p>Protects against infections</p>

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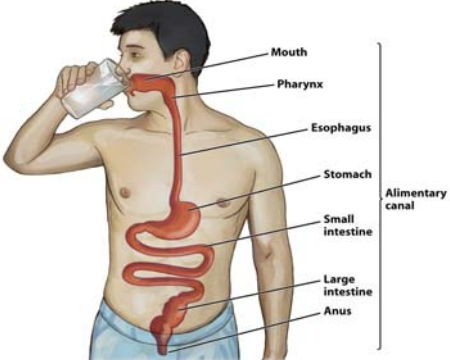
Organ system	Function	Organ system	Function
 <p>Muscular</p>	<p>Enables movement, posture, and balance via contraction and extension of muscles</p>	 <p>Reproductive—Female</p>	<p>Produces eggs, and supports the development of offspring</p>
 <p>Integumentary</p>	<p>Protects body from environment, injury, and infection; stores fat</p>	 <p>Reproductive/Male</p>	<p>Produces and delivers sperm and associated fluids</p>

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Organ Systems: The Digestive System

- Metabolizes food so body can use the energy
- Food is broken down successively as it passes from mouth to anus through a tube called the _____ or **digestive tract**
- The food is exposed to the actions and secretions of several organs and glands



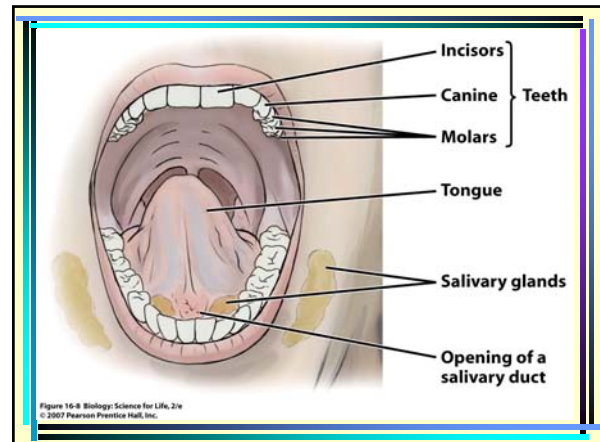
Mouth
Pharynx
Esophagus
Stomach
Small intestine
Large intestine
Anus

Alimentary canal

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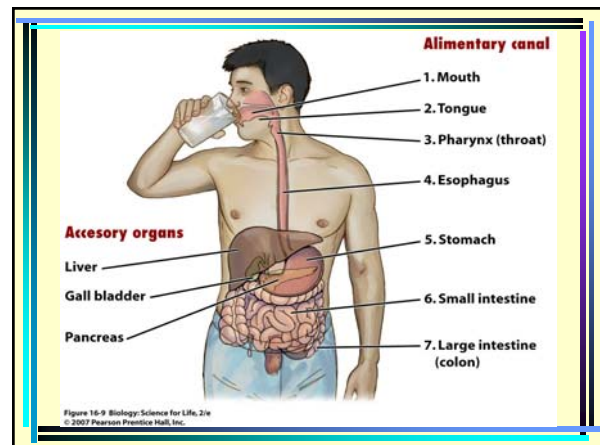
The Digestive System

- Digestion begins in the _____
 - Chewing breaks the food into smaller pieces
 - This mechanical digestion creates more surface area
- Chemical digestion also begins in the mouth
 - Saliva is secreted from salivary glands under the tongue
 - Saliva contains **salivary amylase**, _____



The Digestive System

- The _____ has taste buds that help you taste food
- The tongue shapes the chewed food into a _____, a ball of food
- The bolus is pushed to the back of the mouth and is swallowed, entering the digestive system



The Digestive System

- When you swallow, food moves from your mouth to your _____
 - It forms the back of the throat and branches to feed into:
 - ✓ The _____ (to the lungs)
 - ✓ And the _____ (to the stomach)
- The _____ is a flap of skin covering the trachea to prevent food from entering the trachea and lungs

The Digestive System

- The _____ brings the bolus of food to the _____ through rhythmic contractions of the smooth muscles of the esophagus called _____
- Further breakdown of food occurs in the stomach, which has a very low pH (acidic)
 - Causes quick metabolism of _____
- Other digestive enzymes are secreted by stomach epithelia
- To prevent damage to the stomach itself, the epithelia also secrete _____

The Digestive System

- The digested food mixes with the enzymes and becomes _____
- The chyme is slowly moved into the _____
- The chyme is neutralized by other secretions when it enters to prevent damage to the small intestine
- The small intestine is about 20 feet long in an adult
- It is the major organ for _____
 - This is where most of the nutrients are absorbed

The Digestive System

- **Accessory organs**
 - _____: secretes many of the digestive enzymes that are used in the small intestine
 - ✓ Secretions from the pancreas neutralize stomach acids that enter the small intestine and contain enzymes that break down carbohydrates, fats, proteins, and nucleic acids

The Digestive System

- **Liver:** produces _____, which contains water, pigments and salts that help dissolve fats
 - ✓ The liver also helps to metabolize and store nutrients
 - ✓ It is able to convert excess carbohydrates and proteins into fat, which is then exported and stored in adipose tissue
 - ✓ It also serves as a storage site for some vitamins and excess glucose as glycogen
 - ✓ The liver removes glucose from the blood when glucose levels are high, such as after a meal, and stores them as glycogen
 - ✓ When a meal has not been eaten recently, blood glucose levels fall, and the liver breaks the bonds between glucose molecules in glycogen and releases glucose monomers into the bloodstream

The Digestive System

- _____: stores and concentrates bile, which will be released into the small intestine to help dissolve fats
 - ✓ Concentrating bile involves removing water from it
 - ✓ If too much water is removed the result is _____ – crystallized bile

The Digestive System

- The inside of the small intestine consists of many epithelia cells that absorb nutrients into the bloodstream
- Absorption of the products of digestion in the small intestine is facilitated by **villi** – projections of cells that increase the surface area
- Each individual villus has many smaller projections in the plasma membrane of the cell called **microvilli** that transport nutrients into the blood vessels inside each villus

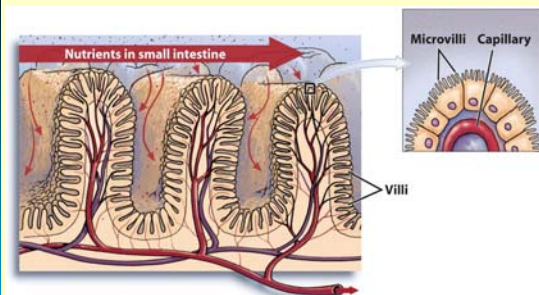


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The Digestive System

- After passing through the small intestine, most of the food has been broken down into basic monomers and has been absorbed
- Any material that has not been absorbed moves into the _____
- The remaining material travels through the large intestine (also called the _____)
- The material is excreted as feces, consisting mainly of indigestible plant fibers

The Digestive System

- Like all organ systems, the digestive system consists of many organs working together to perform a common function
- The failure of some of these organs can compromise the system's ability to function properly

Organ Transplants

- Intestines damaged by infection or cancer can sometimes be replaced by transplants
- Pancreas transplants for diabetics are occurring more frequently too
- Some organs such as the gallbladder and stomach are not transplanted
 - It is possible to live without them

Organ Transplants

- Failure of a some components of a system can be catastrophic
- If the liver fails, there is a severe impact on digestive and circulatory systems

16.3 Regulating the Internal Environment

- _____ is the ability to maintain a relatively stable internal environment under a variety of external conditions
 - Results from collective effort of cells, tissues, organs and organ systems
- Animals regulate
 - _____
 - _____
 - _____
 - _____

Regulating the Internal Environment

- **Thermoregulation:** _____
- **Endotherms** _____
 - Humans and all other mammals and birds
- **Ectotherms** _____
 - Most invertebrates, fish, amphibians, and reptiles

Regulating the Internal Environment

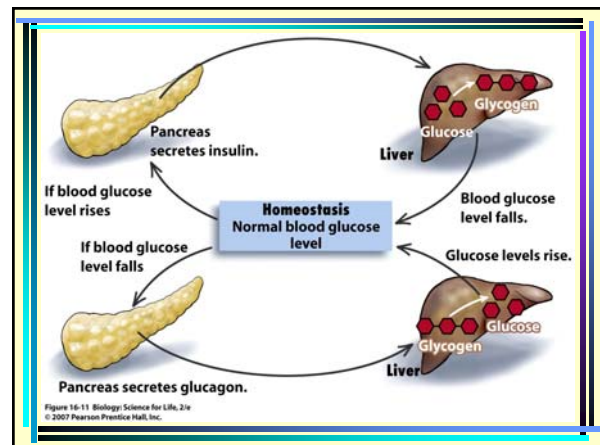
- These physical and chemical properties need to stay within a narrow range
- This occurs through feedback – information that is sent to a control center, which in turn directs a cell or tissue or organ to respond by turning up or turning down a given process; it can be negative or positive
 - Negative Feedback – negates change
 - Positive Feedback – promotes change

Negative Feedback

- The product of the feedback process serves to _____
- Thermoregulation in endotherms
 - As body temperature increases, a signal is sent by the brain causing the blood vessels to dilate and activate sweat glands
 - ✓ This allows heat to escape
 - When the body temperature cools, the blood vessels near the skin surface constrict, muscles shiver, and body temperature increases

Negative Feedback

- Regulation of blood-glucose level
 - As food is digested, the blood-glucose level increases
 - This stimulates the pancreas to produce insulin, a hormone that stimulates the liver to remove glucose from the blood and store it as glycogen (a polymer of glucose)
 - When most of the glucose has been removed from the blood, the pancreas secretes the hormone glucagon – which stimulates the liver to break down glycogen and put the glucose back into the bloodstream



Positive Feedback

- The product of the feedback _____
- Childbirth
 - During childbirth, hormones cause muscles of uterus to contract
 - The uterine contractions stimulate the release of hormones – causing the contractions to intensify – creating more and longer contractions

Organ Donation

- People who die from brain injury can be organ donors
- Victims of cardiac deaths can donate only tissue because any lack of oxygen can cause organs to deteriorate
- In a brain death, the donor will be placed on a respirator to maintain oxygen flow to the organs
- A suitable recipient is found by searching databases – most of which have long waiting lists

Organ Donation

➤ Organ donors and recipients must have the same blood type and other markers on the surface of their tissues

➤ This is to _____

Organ Donation

➤ The most commonly transplanted organs are

- _____
- _____
- _____
- _____