

Life Science
Energy
Chapter 26

THE RESPIRATORY SYSTEM

metabolism: the total of all reactions occurring in a living organism

metabolic rate: the rate at which an organism uses energy

basal metabolic rate: the rate at which an organism uses energy when it is inactive

What 2 systems provide the raw materials for metabolism?
respiratory & digestive

Functions of the respiratory system:

- 1) breathing
- 2) gas exchange between the atmosphere and the blood
- 3) preventing foreign substances from entering during breathing
- 4) phonation (speaking)

Body's most common source of energy: glucose

inhale: breathe in **exhale:** breathe out

STRUCTURES OF THE RESPIRATORY SYSTEM

1) nose and nasal cavities

nasal septum: separate the 2 nasal cavities

ciliated mucous membranes: line the nasal cavities

Functions of the ciliated mucous membranes:

- 1) filters bacteria, smoke, and dust particles from the air
- 2) warms and moistens air

If anything irritates nasal membranes, it stimulates sneezing. mucous: a thick, sticky substance that filters the air entering the body

2) pharynx:

(commonly called the throat) muscular tube lined with a ciliated mucous membrane

about 5 inches long

extends from the back of the nose to the esophagus

sometimes called the "control center" for incoming substances, since it serves both the respiratory and digestive systems

There are 7 openings into or out of the pharynx:

- 1) 2 openings of nasal cavities

- 2) 2 passageways to middle ear-space (Eustachian tubes)
- 3) opening of mouth
- 4) esophagus (passageway to stomach)
- 5) larynx (passageway to stomach)

3) larynx:

(voice box)

short passageway from the pharynx to the trachea

walls consist of cartilage pieces held together by several muscles and ligaments

has a pair of mucous membrane folds known as the vocal chords (or folds)

Actually there are 2 sets of cords.

The more superior set, called the **false vocal cords**, functions primarily to protect the glottis.

The inferior set, the **true vocal cords**, produces the voice.

Pitch (the highness or lowness of the voice) is caused by changing the tension of the true vocal cords

Loudness is controlled by changing the force of the air going through the cords

glottis: the space between the folds vocal chords

in females are thinner and shorter (they vibrate more rapidly)

epiglottis: a thin, flexible flap in front of the larynx; folds over and blocks the glottis during swallowing

4) trachea:

(windpipe) the tube that carries air between the pharynx and the lungs

about 4 1/2 inches long

lined by the ciliated mucous membrane - traps matter such as dust, pollen, and smoke

ends behind the heart, where it divides into 2 bronchi

5) bronchi:

(singular, bronchus)

the 2 branches off the trachea

function: carrying air to and from the lungs

bronchi branch and rebranch to form bronchioles

6) bronchioles:

carries air to and from the alveoli within the lungs

7) Alveoli

alveoli: (singular, alveolus)

the microscopic sacs in which the exchange of gases takes place in the lungs

walls only 1 cell thick surrounded by capillaries

How does this exchange take place? By diffusion

humans use only about 1/8 of their lung capacity

breathing: the process of inhaling and exhaling air
air is moved by muscles

thorax: chest cavity

diaphragm: muscle that separates the thorax from the abdomen; main muscle used in breathing

BREATHING DISORDERS

asthma: a disorder characterized by difficulty in breathing because the bronchioles become constricted; sometimes caused by mold spores or other airborne substances

bronchitis: an inflammation of the bronchi and the bronchial tubes

collapsed lung: a condition in which the alveoli of the lungs are not inflated; may be caused by incomplete expansion of lungs in premature babies or by accidental puncture of chest wall

common cold: an infection of the mucous membranes of the nose, throat, and other parts of the respiratory system; if not controlled, it may cause bronchitis and pneumonia

emphysema: a degenerative condition in which the lungs overexpand and the walls of alveoli lose their elasticity and often rupture; fluids fill the lungs

hay fever: a disorder characterized by sneezing, running nose, and itching of eyes, nose, and throat; caused by an allergic reaction to the pollen of ragweed and other plants

hiccupping: a disorder that seems to be caused by irregular contractions of the diaphragm while the glottis is closed; there is no known useful functions for hiccups

lung cancer: a disease with a variety of symptoms; breathing is difficult because abnormal growths of tissue block the air passages in the lungs; most commonly results from inhaling tobacco smoke

pleurisy: an inflammation of the pleural membranes, causing painful breathing; usually occurs as a complication of pneumonia and tuberculosis

pneumonia: a disease in which the lungs are inflamed because of a bacterial or viral infection; the symptoms are usually fever, pain, and a severe cough

tuberculosis: an infectious disease that can affect any part of the body; the most common type attacks the lungs and results in formation of tubercles (bumps) of abnormal tissue; caused by a bacterium

THE DIGESTIVE SYSTEM

digestion: the breaking of food into smaller substances

assimilation: the process by which living cells convert nutrients into cellular structure

mechanical digestion: the process of breaking food into smaller pieces and mixing it with the digestive juices

chemical digestion: the breaking down of food into substances usable by the cells

GROUPING OF ORGANS OF THE DIGESTION SYSTEM:

1) **alimentary canal:** the digestive tract mouth, pharynx, esophagus, stomach, and intestines peristalsis: muscular contractions that move food along the alimentary canal

2) **accessory organs:** organs that secrete substances that are carried through ducts (tubes) to the alimentary canal liver, pancreas, gallbladder, and salivary glands

FUNCTIONS OF THE DIGESTIVE SYSTEM:

1) the breakdown of foods both mechanically and chemically

2) the absorption of foods

- 3) the adjusting of concentrations of various foods in the bloodstream
- 4) destroying harmful substances that enter the body through the mouth and nose

MOUTH

Food mixes with saliva from the salivary glands (3 pairs of salivary glands)

the saliva moistens and lubricates the food for easy swallowing

salivary glands secrete a digestive enzyme--amylase
amylase: begins the breakdown of starch to sugar

mastication: the chewing of food

4 different types of teeth are involved in mastication:

- 1) incisors (8): flat, narrow, blade-like surfaces for cutting and biting food
- 2) canines [(4)-cuspid]: tear food
- 3) premolar (8): crush food
- 4) molars (12): grinding food

ESOPHAGUS

muscular tube that is lubricated by many mucous glands so that the food can be easily pushed downward by peristaltic contractions

the word esophagus means "I will carry down."--its only function

it only requires 3-6 seconds for food to move from the mouth to the stomach

produces no digestive enzymes

STOMACH

Mechanical & chemical digestion occur in the stomach.

cardiac sphincter: muscular valve that controls food going into the stomach; keeps food in the stomach

can hold about 2 quarts of food

the thick, muscular walls of the stomach churn the food and mix it with the acidic gastric juices which contain enzymes for protein digestion

these enzymes would also digest the walls of the stomach if the walls were not protected by the slimy mucous from the mucous membrane lining the stomach

the duration of churning may be 4 hours for coarse foods like celery and spinach foods like oatmeal and

pudding move through the stomach quickly

although the stomach lining does not absorb many food molecules, it does absorb alcohol, water, and certain drugs

chyme: food in a semi-liquid state

pyloric sphincter: controls food moving into the small intestine

SMALL INTESTINE

about 23 feet long;

about 1 inch in diameter

most of digestion and absorption of food occurs here

duodenum: first section of the small intestine; about 10 inches

as partially digested food from the stomach passes into the duodenum, the acidity of the food stimulates the intestinal lining to secrete hormones these hormones stimulate the pancreas, gallbladder, and intestinal lining to

secrete enzymes and other materials into the duodenum for digestion, which converts food into small molecules
villi: (singular, villus) microscopic, fingerlike structures that line the wall of the small intestine

LARGE INTESTINE (COLON)

about 5-6 feet long
2 1/2 inches in diameter
little or no digestion occurs

functions:

- 1) removal of waste materials (called feces)
- 2) absorb water and minerals

also serves as an ideal site for growth of bacteria and yeasts that produce vitamins B1, B2, B12, and K
there are many beneficial bacteria and yeasts reproducing in the colon; about 25% of the weight of dried feces consists of dried bacteria and yeasts

LIVER

each liver cell may perform more than 500 separate functions
called "master chemist of the body"

Liver receives blood by way of the **portal vein**

makes bile, a greenish fluid that breaks up lipids into droplets

the liver secretes about 1/2 liter (1 pint) of bile a day

bile is stored in the **gallbladder**

PANCREAS

a soft, pinkish-white gland about 6-9 inches long; 1 inch wide

about 97% of the pancreas cells produce digestive juices that contain enzymes for digesting carbohydrates, fats, and proteins

most of the remaining pancreas cells produce hormones (insulin) involved in regulating the amount of sugar in the blood

DISORDERS AND DISEASES OF THE DIGESTIVE SYSTEM

Cirrhosis of the liver: a disease of the liver characterized by the formation of dense connective tissue and deposits of fatty tissue; may be caused by drinking alcoholic beverages, infections by bacteria and viruses, or breathing certain poisonous gases

Constipation: a condition of difficult egestion because of dry, hard fecal material; usually caused by insufficient amount of fruits, vegetables, and water in the diet

Diarrhea: a condition of frequent egestion of watery fecal material; usually caused by viral infections; may occur after a period of emotional stress

Diverticulosis: the condition in which sacs or pouches have formed in the wall of the large intestine; usually no inflammation is experienced; commonly occurs in people who suffer from constipation for long periods

Flatus: a condition of gas in the digestive tract that results from chemical digestion of foods; may also result from drinking too many carbonated beverages or from swallowing air while eating too fast

Food Poisoning: an illness that results from swallowing food which has begun to decay or food contains toxic substances such as insecticides, lead, or mercury

Heartburn: a burning sensation in the esophagus caused by acidic liquid moving upward from the stomach; called heartburn because the pain seems to come from the heart

Jaundice: a condition in which the skin and white of the eye appear yellow because of excessive bile in the blood; may be caused by diseases of the liver or blockage of bile ducts by gallstones

Mumps: a viral infection of the salivary glands, causing swelling, fever, and painful swallowing

Peptic ulcer: an ulcer (sore) occurring in the lower esophagus, stomach, or duodenum; usually caused by too much acid in the stomach

Vomiting: a rapid emptying of the stomach contents through the mouth; usually caused by some irritant to the stomach lining