

2018 Anatomy & Physiology (B&C) Overview and Digestive System Handout

prepared by

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DISCLAIMER - This presentation was prepared using draft rules. There may be some changes in the final copy of the rules. The rules which will be in your Coaches Manual and Student Manuals will be the official rules.

BE SURE TO CHECK THE 2018 EVENT RULES for EVENT PARAMETERS and TOPICS FOR EACH COMPETITION LEVEL

TRAINING MATERIALS:

- **Training Power Point** presents an overview of material in the training handout
- **General Handout and Training Handouts for Each System**
- **Sample Tournament** has sample problems with key
- **Event Supervisor Guide** has event preparation tips, setup needs and scoring tips
- **Internet Resource & Training Materials** are available on the Science Olympiad website at www.soinc.org under Event Information.
- **A Biology-Earth Science CD, an Anatomy/A&P CD (updated 2016)** as well as the **Division B and Division C Test Packets** are available from SO store at www.soinc.org

BASIC ANATOMY AND PHYSIOLOGY

- **Skeletal System**
- **Muscular System**
- **Integumentary System**
- **Major Diseases**
- **Treatment and prevention of diseases**

Systems –Anatomy & Physiology (B/C) with rotating 3 body systems each year on a 4 year rotation schedule

Year 1	Skeletal	Muscular	Integumentary	(2016 and 2020)
Year 2	Nervous	Sense Organs	Endocrine	(2017 and 2021)
Year 3	Respiratory	Digestive	Immune	(2018 and 2022)
Year 4	Cardiovascular	Lymphatic	Excretory	(2019 and 2023)

PROCESS SKILLS - observations, inferences, predictions, calculations, data analysis, and conclusions

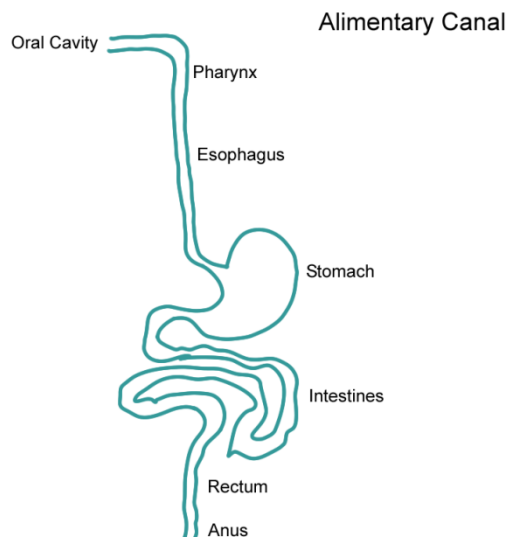
Digestive System -Training Handout

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Consists of the digestive tract (the alimentary canal and the gastrointestinal tract) and its accessory organs

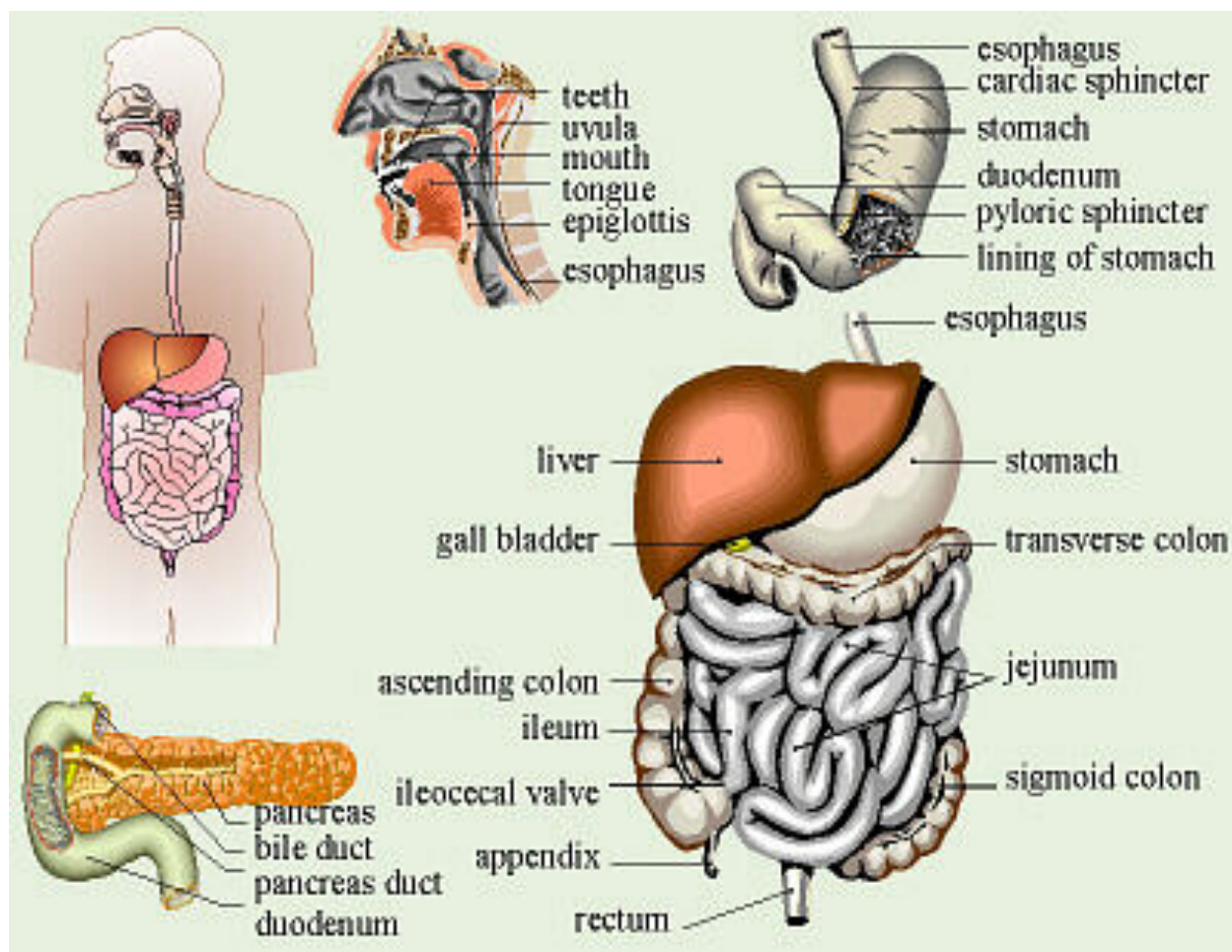
Alimentary Canal - Continuous tube from mouth to anus consisting of:

- Mouth
- Pharynx
- Esophagus
- Stomach
- Small Intestine
- Large Intestines



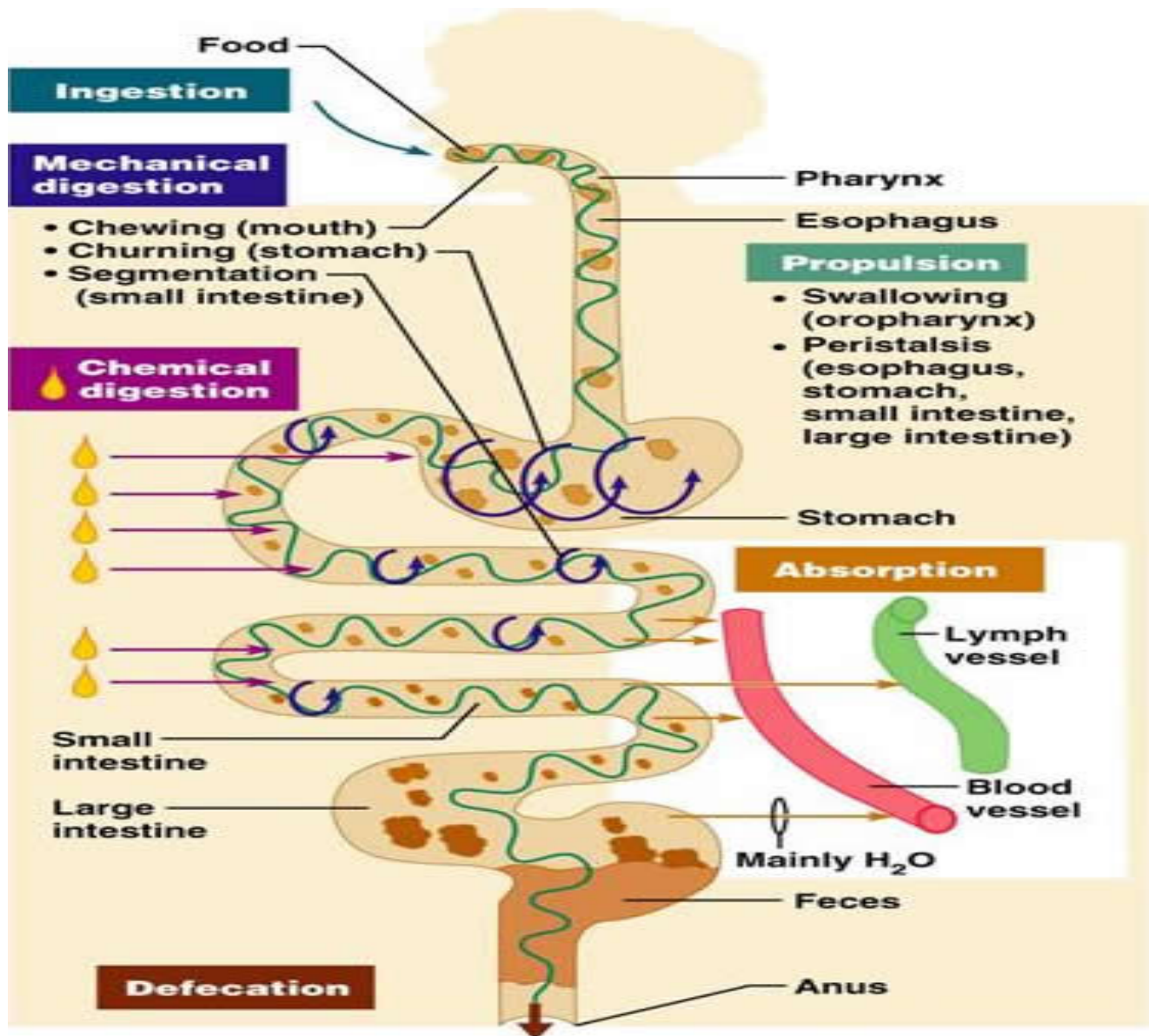
Accessory Organs – Secrete fluids into digestive tract

- Salivary Glands
- Liver
- Gallbladder
- Pancreas



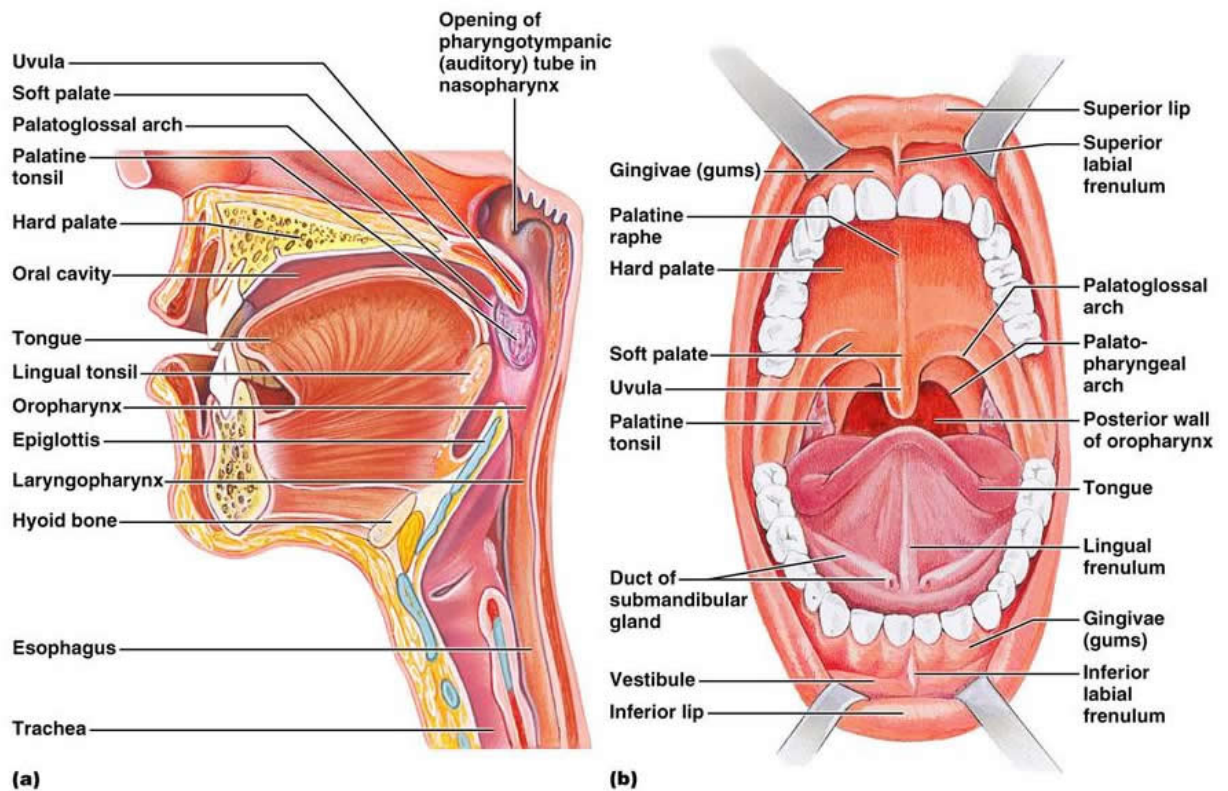
Digestive Process Involves:

- **Ingestion** – intake of food
- **Digestion** – breakdown of food bit by bit into molecules small enough to be absorbed
- **Mechanical Digestion** – physical breakdown of food
- **Chemical Digestion** – chemical breakdown of macromolecules to monomers
- **Absorption** – transport of productions into the blood
- **Elimination (Defecation)** - elimination of undigested waste



Digestive Tract Organs -

Mouth:



- O pens to outside to facilitate feeding
- Aids in preparation of food for digestion - foods are broken down mechanically into a bolus by chewing with saliva is added as a lubricant from the auxiliary saliva glands. Saliva contains amylase, an enzyme that digests starch
- Serves as an organ for speech and pleasure
- Includes
 - **cheeks** – form lateral walls of the oral cavity
 - **lips** – help determine temperature and texture of food
 - **tongue** – aid in mixing food, help to manipulate food by pushing food to teeth and moving food to pharynx for swallowing, have taste buds to sense chemical stimuli in food
 - **palate** – forms roof of the oral cavity
 - **teeth** – two sets of teeth: primary (baby teeth) and secondary (adult teeth)

Types of teeth:

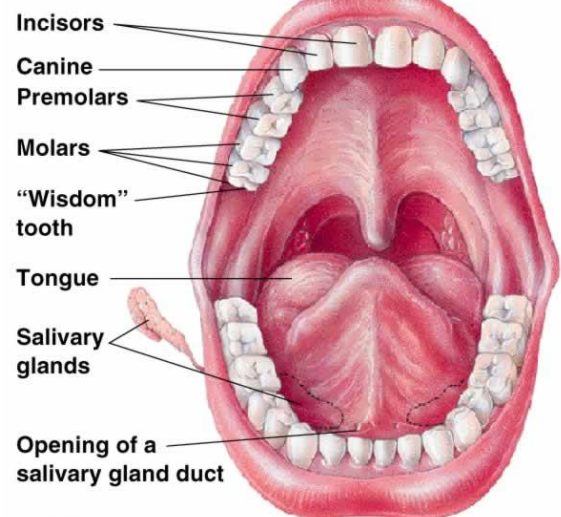
Incisors (8) – for biting food

Canines (4) - for grasping and tearing food

Bicuspids (8) – for grinding and crushing food

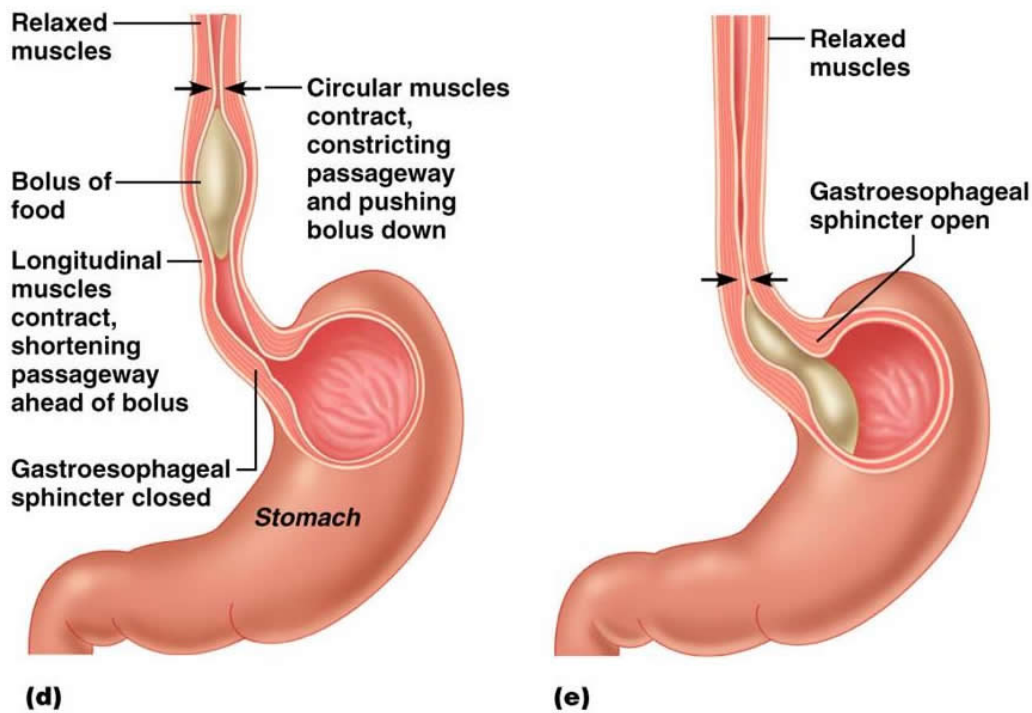
Molars (12) – for grinding food

TEETH



Esophagus:

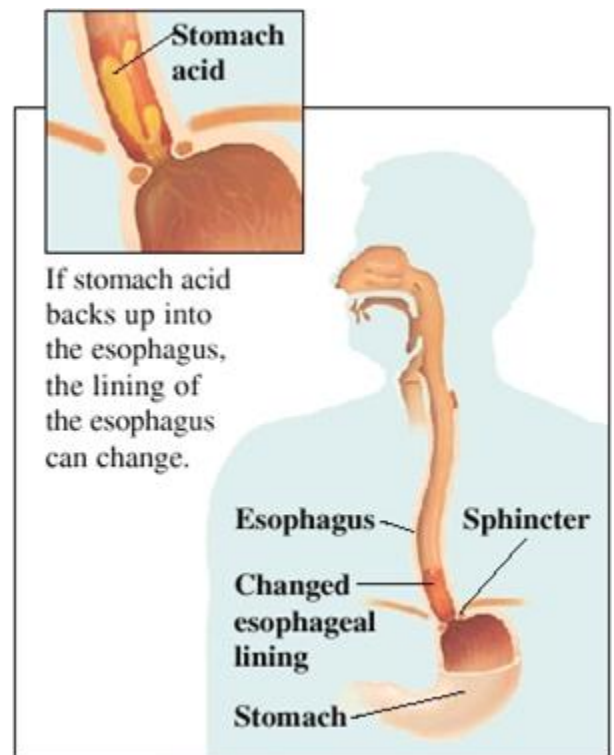
- a simple tube between the mouth and stomach
- peristalsis aides in swallowing the bolus of food from the mouth



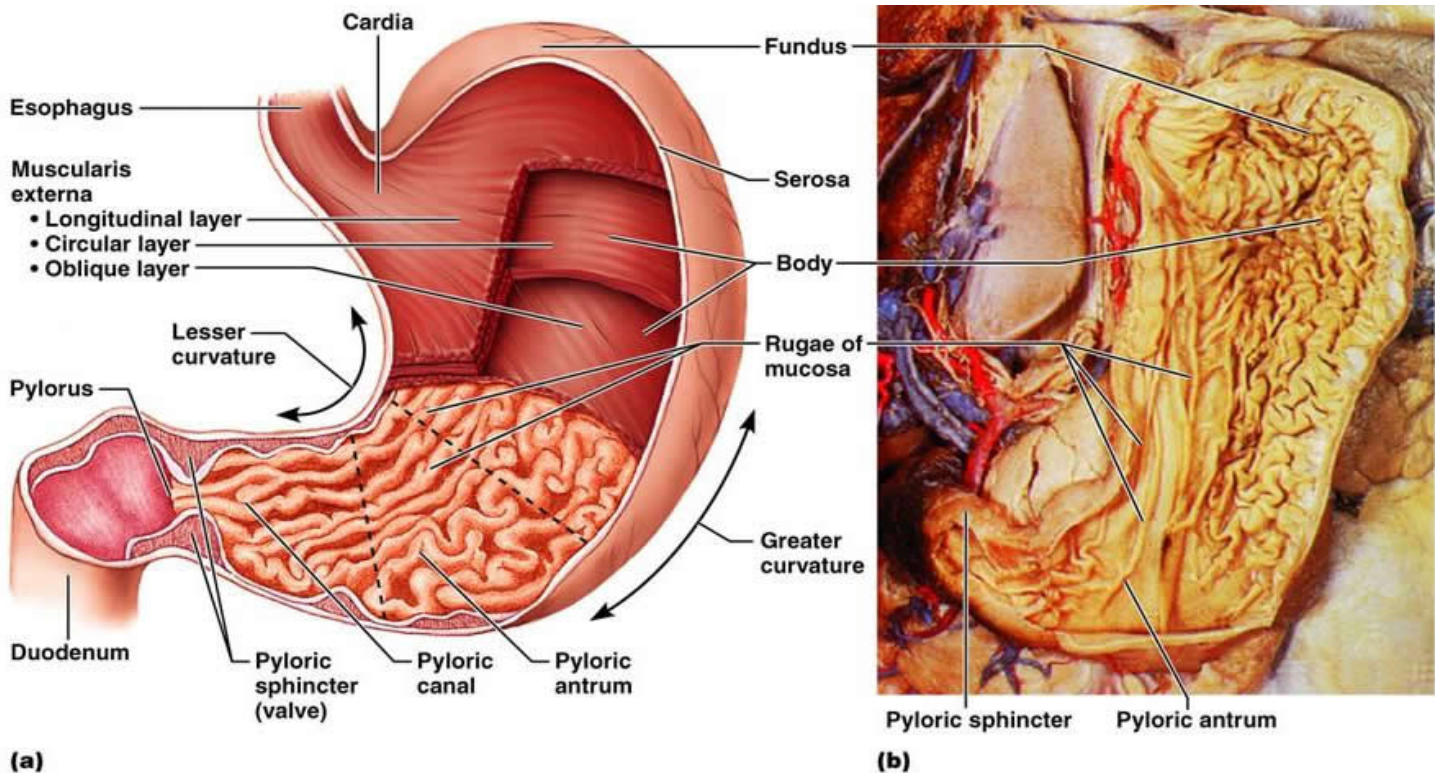
Movement of Materials – via peristalsis or alternating waves of contraction and relaxation of smooth muscles that move materials through the digestive tract

peristalsis- a wavelike movement that progresses along some of the hollow muscular tubes of the body, such as the intestines. It occurs involuntarily, induced by distension of the walls of the tube. Alternate contraction and relaxation of the circular and longitudinal muscles tends to push the contents of the tube forward.

Acid Reflex can occur if stomach acid backs up into the lining of the esophagus. If the problem persists, it can lead to erosion of the esophageal lining



Stomach:

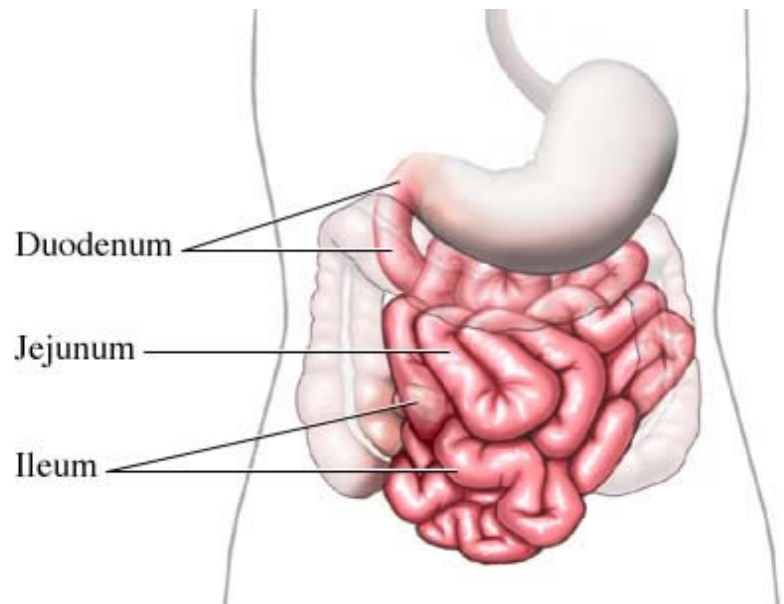


Stomach facts:

- Enzymatic digestion of proteins initiated and foods reduced to liquid form.
- Wall of stomach is lined with millions of gastric glands – secrete 400 to 800 ml of gastric juice per meal
- Several kinds of cells located in gastric glands with different functions
 - Parietal cells** – produce hydrochloric acid (active transport is used to increase concentration of H^+ ions in gastric juice) and intrinsic factor(binds vitamin B_{12} so it can be absorbed by the small intestine)
 - Chief cells** – produce and secrete **pepsinogen** the precursor to the enzyme **pepsin**
 - Mucus secreting cells** – form mucus which protects stomach lining from hydrochloric acid
 - Hormone secreting cells** – produce hormone **gastrin** when food arrives
- Absorption from the stomach – very little absorption occurs in the stomach – some water, ethanol (quick effects of alcohol consumption), drugs as aspirin (quick pain relief), and certain ions are absorbed

Small Intestine:

- most of chemical enzymatic digestion occur
- almost all nutrients are absorbed
- Accessory glands – liver, gall bladder, and pancreas provide secretions to assist with chemical enzymatic digestion



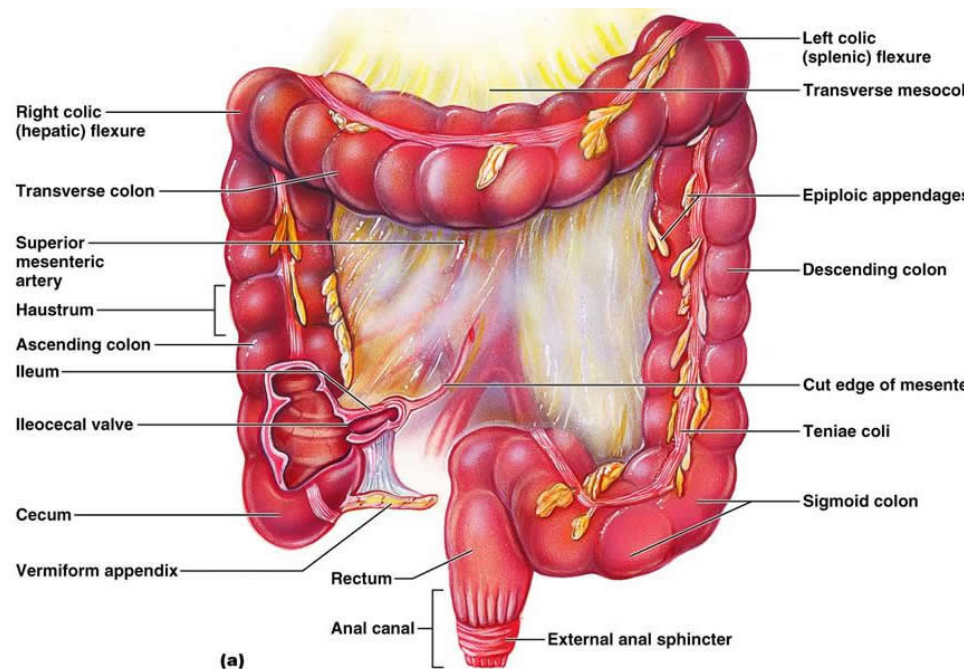
Large Intestine:

Colon:

- liquid residue – mainly water with undigested material
- water is absorbed,
- bacterial fermentation takes place
- feces are formed.

Rectum: collects undigested waste

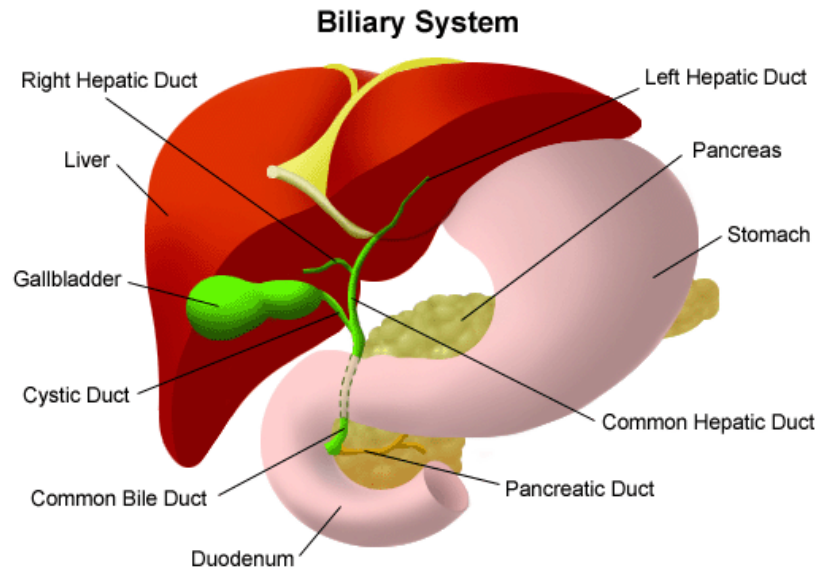
Anus: expels undigested waste – muscles to control exit and prevent leakage.



Accessory Organs

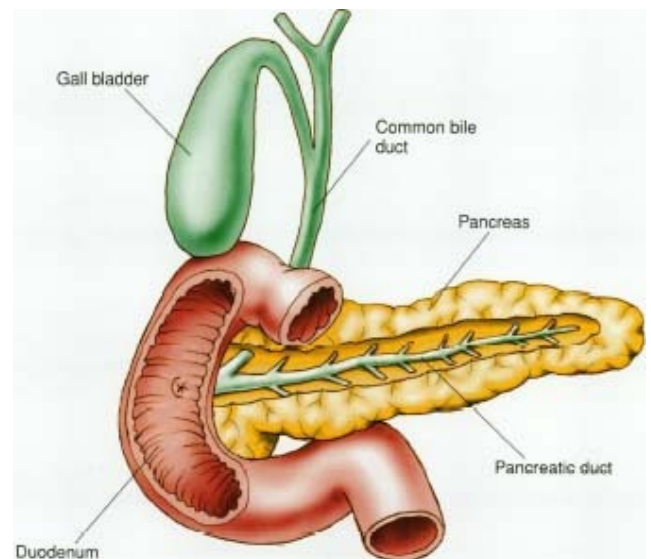
Salivary Glands - secretes salivary amylase in saliva into the mouth for breakdown of starch

Liver: - provides bile salts to the small intestine, which are critical for digestion and absorption of fats.

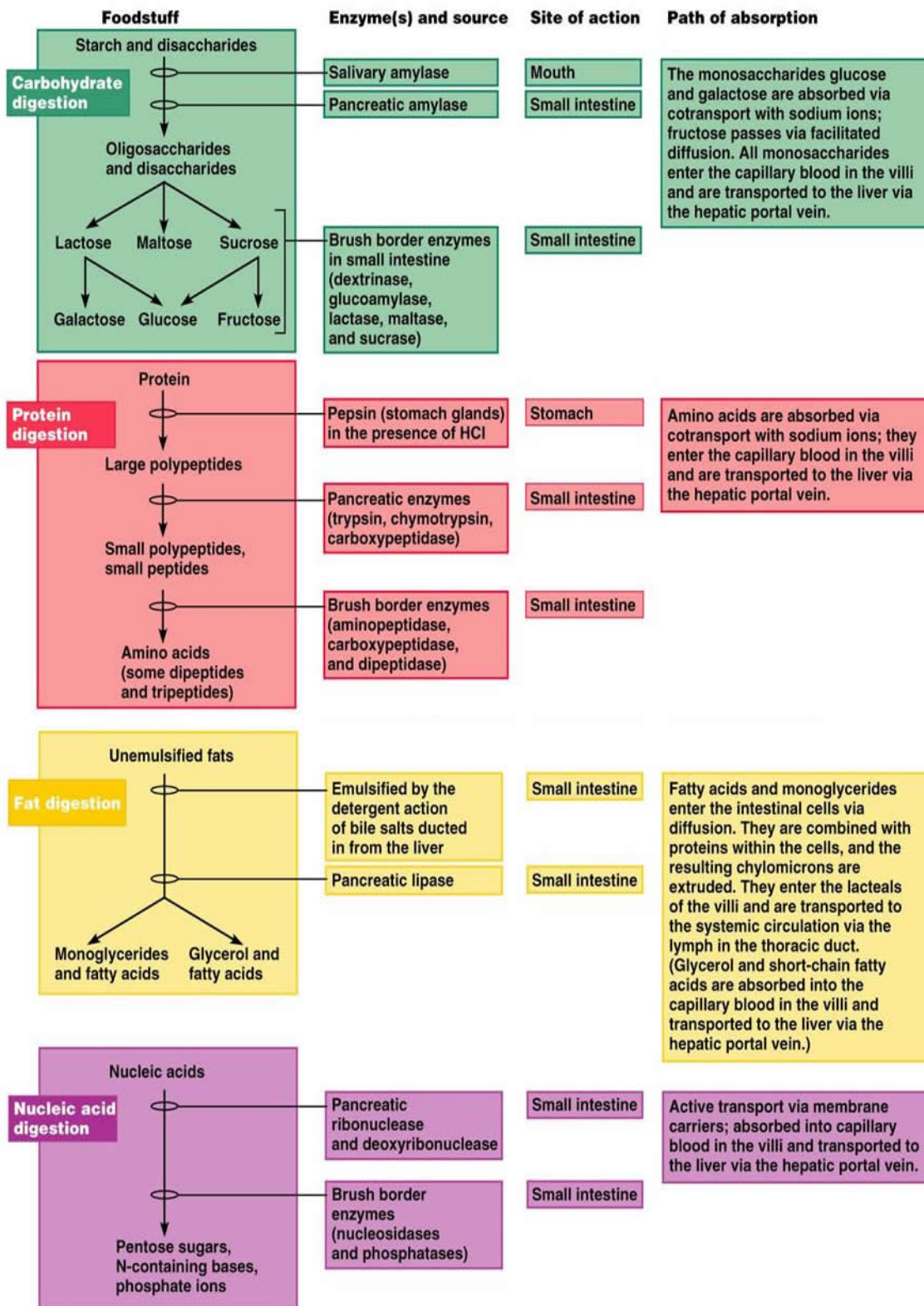


Gallbladder – stores bile

Pancreas - provides digestive enzymes to the small intestine which are critical for digestion of fats, carbohydrates and protein.



Chemical Digestion



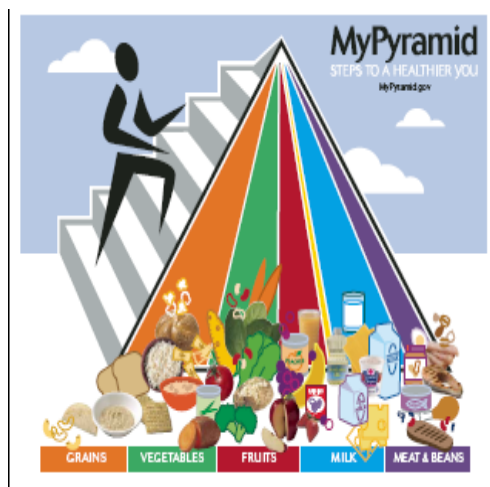
Role of Fiber in Digestion

- Fiber is found mostly in plant sources like fruits, vegetables, grains and legumes
- There are two types – insoluble fiber and soluble fiber
- **Insoluble fiber** is a type of fiber which cannot be dissolved in water
- Insoluble fiber draws water to the intestine, increasing the bulk and softness of waste products
- Soluble fiber which can be dissolved in water
- **Soluble fiber** can be digested slowly and it slows the digestive process and keeps the stomach fuller longer leaving the body feeling full for a longer period of time
- Digestion and absorption of carbohydrates are slower so that glucose (sugar) in food enters the bloodstream more slowly, which keeps blood sugar on a more even level
- The slow absorption of sugar gives the body an opportunity to regulate blood sugar levels

New Food Group Pyramid

2000 calorie diet

- **Grains** – 6 oz daily
- **Vegetables** – 2 ½ cups daily
- **Fruits** – 2 cups daily
- **Milk** – 3 cups daily
- **Meats and Beans** – 5 ½ oz daily



Sample label for Macaroni & Cheese

Nutrition Facts	
Serving Size 1 cup (228g)	
Serving Per Container 2	
Amount Per Serving	
Calories 250	Calories from Fat 110
% Daily Value*	
Total Fat 12g	18%
Saturated Fat 3g	15%
Cholesterol 30mg	10%
Sodium 470mg	20%
Total Carbohydrate 31g	10%
Dietary Fiber 0g	0%
Sugars 5g	
Protein 5g	
Vitamin A	4%
Vitamin C	2%
Calcium	20%
Iron	4%

* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Food Labels

- Serving Size
- Serving per container
- Calories
- Nutrients – g and % Daily values
- Vitamins and Minerals-
• % Daily Values
- 2000 calorie diet

DISORDERS AND DISEASES OF THE DIGESTIVE SYSTEM

- **Stomach and duodenal ulcers** – open sores or lesions found in the stomach or duodenal lining - most ulcers (80 percent of gastric ulcers and 90 percent of duodenal ulcers) develop as a result of infection with a bacterium called **Helicobacter pylori (H. pylori)**.
- **Cancers of the digestive system** – cancers that occur in various areas of the digestive system
- **Diarrhea** – loose, watery, and frequent stools or bowl movements – prolonged it can cause dehydration
- **Lactose Intolerance** - the inability to digest and metabolize **lactose**, a sugar found in milk caused by a lack of the enzyme lactase in the digestive system
- **Hepatitis** – inflammation of the liver commonly caused by three viruses – hepatitis A, B, and C
- **Appendicitis** – inflammation of the appendix
- **Crohn's disease (National)** – inflammation of parts of the digestive tract caused by ulcers which cause pain and diarrhea
- **GERD (National)** – gastroesophageal reflux disease – lower esophageal sphincter opens spontaneously or does not close properly allowing gastric juices to rise into esophagus
- **Diverticular Disease (National)**
- **Celiac disease (National)** – an immune disease where people can't eat gluten (a protein found in wheat, rye, and barley).