

## 1. General Information

Every living organism needs food for energy and building material

Each organism usually has a specific method of ingesting and absorbing food

Different organisms need different types of food in different amounts

An organisms' food requirements is based on complexity, and habitat

Procurement – to obtain

**Photosynthetic autotrophs** – plants. These create their own food through photosynthesis

**Ingestive heterotrophs** – animals. These intake food in order to acquire nutrients

**Absorptive Heterotrophs** – fungi. These absorb nutrients from their environment

The cells use nutrients, most notably glucose, to fuel cellular respiration to produce ATP

## 2. Digestion in Animals

**Digestion** – the process of breaking down large food molecules into smaller, simpler molecules

Different animals have different methods of digestion

Physical VS chemical – physical is chewing, grinding, etc. Chemical is the use of enzymes

**Intracellular digestion** – digestion that takes place inside of the cell

Lysosomes, which produce digestive enzymes, break down molecules within the cell

Most types of plant digestion are intracellular

**Extracellular digestion** – digestion that takes place outside of cells

Enzymes are secreted into a special digestive cavity

Most animals use extracellular digestion

**Pinocytosis** – cell drinking - the infolding of the cell membrane in order to intake large molecules

**Phagocytosis** – cell eating - the use of the body to absorb physical pieces of solid food

Pinocytosis and phagocytosis are mainly used by unicellular organisms

Simple multi-cellular organisms have a gastrovascular (sac like) cavity, with a circulating stomach

Complex multi-cellular organisms have digestive systems

Food usually remain in the digestive system for long periods of time

**Herbivores** – eats cellulose, molar teeth, long digestive tracts

**Carnivores** – eats meat, canine teeth, special enzymes for digesting proteins, short tract

**Omnivores** – eats both meat and plants, both types of teeth, medium tract

Digestive functions include done using enzymes, hydrolysis, and absorption

**Alimentary Canal** (Gastrointestinal Tract) – 30ft long, includes the esophagus, stomach, both intestines

**Accessory organs** – organs that aids in digestion and provides enzymes (pancreas, liver, gall bladder)

## 3. Human Digestion – the Alimentary Canal

**Oral Cavity** – mouth – food enters the body here. The oral cavity receives/tastes food, begins digestion

**Tongue** - aids in chewing, swallowing, taste, the strongest muscle in the body, enables speech

**Teeth** – breaks food into smaller pieces to increase surface area

**Salivary Glands** – produces saliva that lubricates food

**Salivary amylase** – enzyme that breaks down carbohydrates

**Antimicrobial agents** – substances that fight microbes and bacteria

**Pharynx** – throat – receives chewed food from the mouth

Tonsils – lymph glands that trap bacteria

Epiglottis – blocks food from the lungs, allows only air or food to pass at the same time

Esophagus – empties food into the stomach

Peristalsis – muscular contracts that move the food through the esophagus

Uvula – blocks food from entering the nose

**Stomach** – storage pouch, allows for discontinuous feeding. Digests food by churning

**Churn** – mixes food/liquids together

**Enzymatic Digestion** – digestion with enzymes in the stomach

**Sphincter** – a circular muscle that seals the stomach from other organs during digestion

**Gastric Juices** – enzymes that aid in digestion

**Gastrin** – stimulates production of gastric juice Pepsin

The food in the stomach soon becomes a soup like paste

The paste is held in the stomach by contraction of the **pyloric valve**

Every now and then the valve relaxes and releases the paste into the small intestines

**Small Intestines** – the greatest amount of digestion occurs here, food is absorbed here also

**Villi** – small fingerlike projection in the walls of the small intestines

**Capillaries** – tiny, thin walled blood vessels that nutrients can diffuse through

**Lymph** – a blood vessel that transports tissue fluid

**Duodenum** – First 12 inches of the small intestine

**Ileum** - last 12 inches of small intestine, holds a sphincter that holds food in the small intestines

**Large Intestines** – colon - holds **feces** (waste) – absorbs some matter left over from the small intestines

**Rectum** – holds waste until defecation (removal of waste products)

**Anus** – the end of the digestive tract, wastes exit the body here

#### 4. Human Digestion – the Accessory Organs

**Liver** – largest glandular organ, produces bile (a fat emulsifier), the most versatile organ

Acts as a detoxifier by storing poisons

Stores glycogen and vitamins

Manufactures antibodies

Produces heparin, an acid that thins blood, and blood plasma proteins, which thicken blood

Removes wastes (urea)

**Gall Bladder** – small cone shaped organ beneath liver

Muscular storage sack that stores bile produced by the bile

Gallstones – chunks of solid matter in the gall bladder, causes pain

**Pancreas** – long, thin organ behind stomach

Produces hormones (insulin and glucagons)

**Pancreatic juice** – pancreatic amylase, breaks up carbohydrates

**Trypsinogen Base – Trypsin** – breaks up polypeptides

**Lipase** – breaks up fats

**Secretin** – stimulates production of pancreatic juice

**NaHCO<sub>3</sub>** – sodium bicarbonate, neutralizes stomach acid

#### 5. Human Digestion – breakup of fats, carbohydrates, and Proteins

**Fats** – broken up in the small intestines using Lipase because fats are not water soluble

Fats are converted into fatty acids and glycerol

**Carbohydrates** – broken up partially in the mouth, then in the small intestines

Mouth – Starch combines with water to form maltose

Small Intestines – maltose gets converted into glucose

**Proteins** – Digested partially in the stomach, then more in the small intestines

**Stomach** – proteins are broken into polypeptide chains using pepsin

**Small intestines** – polypeptide chains are broken down into amino acids using trypsin

#### 6. Nutrition – different foods have different nutritional values

**Carbohydrates** – CH<sub>2</sub>O – empirical formula for carbohydrates – main source of energy

**Monosaccharides** – glucose, fructose

**Dissacharides** – sucrose, maltose

**Polysaccharides** – starch, cellulose

Increasing the intake of dietary fiber tends to lower the chance of colon cancer

1gram of carbohydrates yields 4kcal of energy

**Lipids/Fats** – CHO – general formula for fats – long term energy storage

1gram of fats yields 9 kcal of energy

**Saturated fats** – animal fat, solid at room temperature, all single bonds

**Unsaturated fats** – plant fat, liquid at room temperature, contains double and triple bonds

**Cholesterol** – a type of fat in animal product foods, essential to life, used in cell membranes

Also used to synthesize sex hormones and vitamin D

Too much cholesterol can clog arteries and cause heart problems

Low density Lipoproteins - tends to deposit cholesterol and fats in the arteries

High Density Lipoproteins – tends to remove cholesterol and fats in the arteries

Exercise, weight control, a healthy diet, and a diet low in saturated fat is healthy

**Proteins** – CHCN – general formula for proteins – used for building material

1g of protein yields 4kcal of energy

There are 20 amino acids that humans need; we can manufacture about 11 of them

**Essential Amino Acids** – amino acids that can't be synthesized in cells, must include in diet

Americans eat way too much protein than they need

**Vitamins** – needed in small amounts, don't supply energy, but needed to build bones and tissues

**Water soluble** – B complex, C, cannot be stored

**Fat soluble** – A, D, E, K

Humans need 13 different vitamins in their diet

**Minerals** – inorganic substances are needed in small amounts for building bones/tissues

**Magnesium** – used in chlorophyll

**Calcium, Phosphorous** – development of bones and teeth, metabolism, pH balance

**Potassium, Sodium** – body water and pH balance, nerve and muscle activity

**Zinc** – necessary for normal sense of taste and smell, metabolism

**Water** – main ingredient in all life, 64% in humans

Primary solvent, maintains body temp, transports materials, removes waste, aides in digestion

## 7. Diet and the Food Pyramid

**Food Pyramid** – established by the Dept. of Agriculture for recommended daily intake amounts

**Nutrition** – study of diet and health and explores how food affects the body

**Bread Group** - Bread, Cereal, Rice, Pasta, other whole grains

6 – 11 servings, 1 serving = 5 ounces

Provides complex carbohydrates, riboflavin, niacin, thymine, iron, protein, magnesium

**Vegetables** – how many kinds of veggies can you think of?

3 – 5 servings

Provides Vitamins A, C, potassium, magnesium, dietary fiber

**Fruits** – Those things you eat when you're on a diet

2 – 4 servings

Vitamins A, C, Potassium, Dietary Fiber

**Meats** – chicken, beef, pork, and anything else you can think of

2 – 3 servings

Proteins, phosphorous, vitamins B6, B12, Zinc, Magnesium, Iron, Niacin, thymine

**Diary** – milk, cheese

2 – 3 servings

Calcium, protein, riboflavin, Vitamin B12

**Fats and sugars** – you know what these are. You eat them. You eat a lot of them

0 servings, or as the labels read, use sparingly

Lipids, fats, sugars