ZOO 102
Organization of Mammalian Body.

TOPIC: Digestive system of Mammals.

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WHAT IS DIGESTION?

- Mechanical Breakdown
- Chemical Breakdown

of organic foods into smaller units for absorption.

To reduce or convert to a more absorbable form that can be transported to the cells for use.

IMPORTANCE OF FEEDING AND DIGESTION.

- Mammals must eat to survive.
- Mammals need to maintain their highly ordered and complex nature.
- They need to promote vital activities of the body like energy release, growth and repair, secretions, storage and maintenance of internal osmotic Ph.

Type of Digestion in mammals.

Extracellular Digestion.

- Large and bulky food particles can be ingested.
- Enzymes are secreted into gut and the products of their action absorbed.
- More specialised and efficient digestive tract.
- Digestive tract is smaller compared to lower animals.
- Food waste easily discarded in a complete digestive system.

ORGANS OF THE DIGESTIVE SYSTEM

(A tube that commences at the mouth and ends at the Anus).

1. ORAL CAVITY OR MOUTH:

- Beginning of the digestive tract.
- Provided with teeth and tongue for grasping, masticating and swallowing the food.
- The tongue also captures and gathers food.
- Three pairs of salivary glands which secretes saliva (750mls daily in man) which contains the enzyme amylase.
- The three glands are submaxillary, parotid and sublingual.

2. PHARYNX

- Throat cavity for passage of food.
- Secretes no enzyme.
- Complex reception chamber receiving five openings from

*Nasal cavity

*Mouth

*Middle ear

*Oesophagus

*Trachea via epiglottis.

So it is advisable not to talk when eating.

3.OESOPHAGUS OR GULLET.

- Distensible muscular tube a.k.a food pipe.
- Between the pharynx and stomach.
- Has no digestive enzymes.
- Opens to the stomach at the cardiac sphincter.
- The oesophagus is about 8 inches long, and is lined by moist pink tissue called mucosa in man which is protective.

4. STOMACH

- Found between the oesophagus and small intestine.
- Muscular chamber that receives recently ingested food.
- Secretes mucus and enzymes, gastric juice and Hydrochloric acid.
- Macerates ,sterilizes and initiates food digestion
- Has three main regions Cardiac (anterior), Fundus (central) and Pyloric (posterior).

THE MAMMALIAN STOMACH.

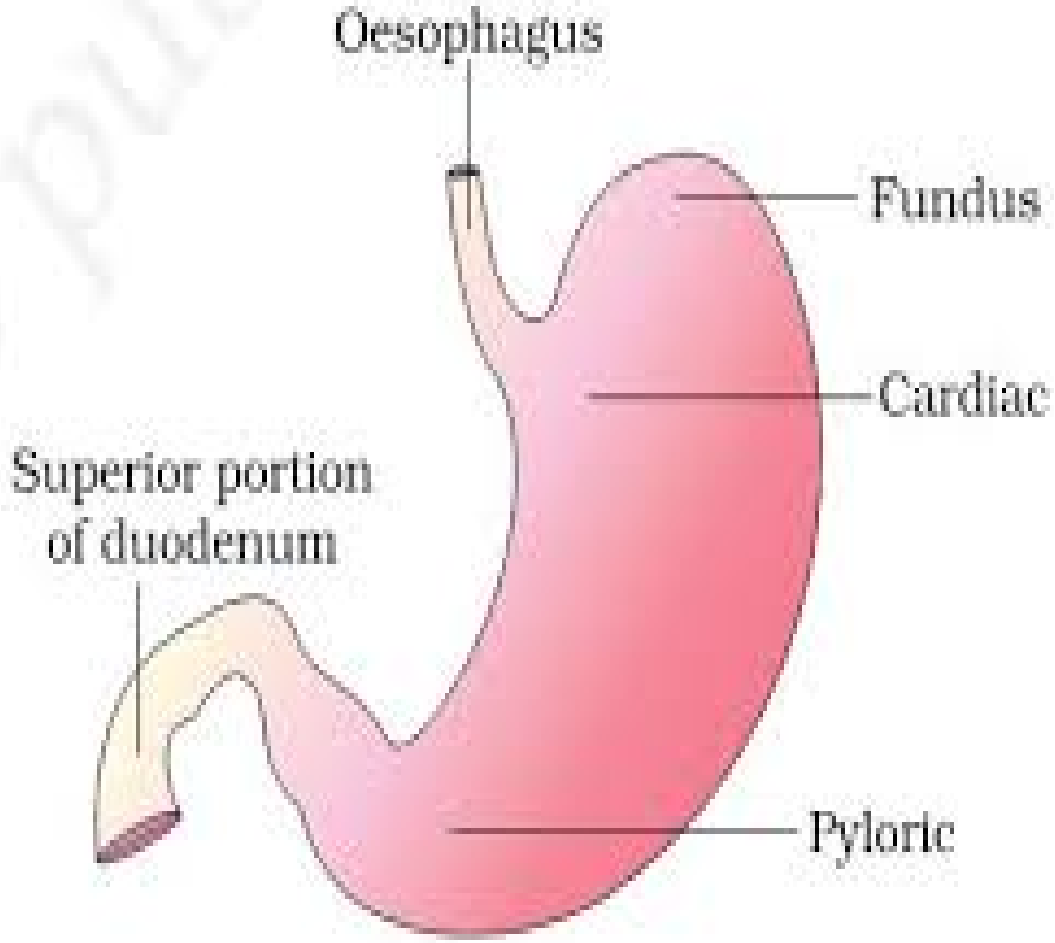
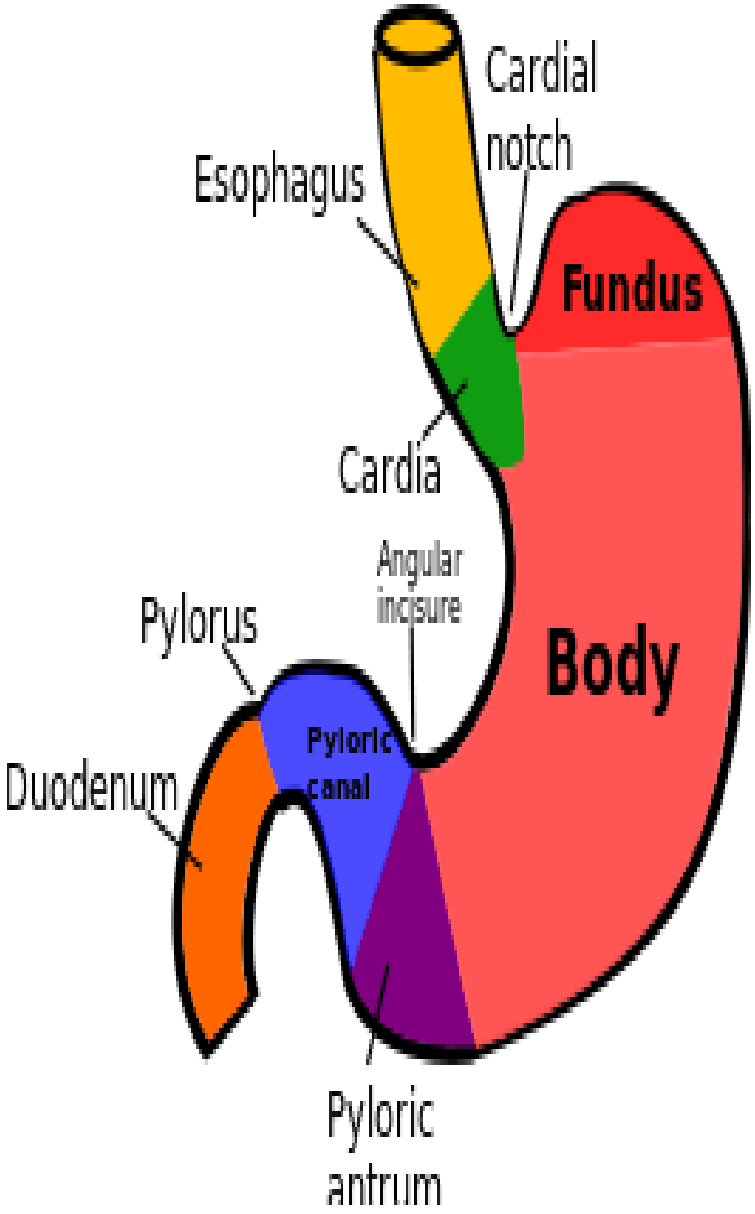


Figure 16.3 Anatomical regions of human stomach



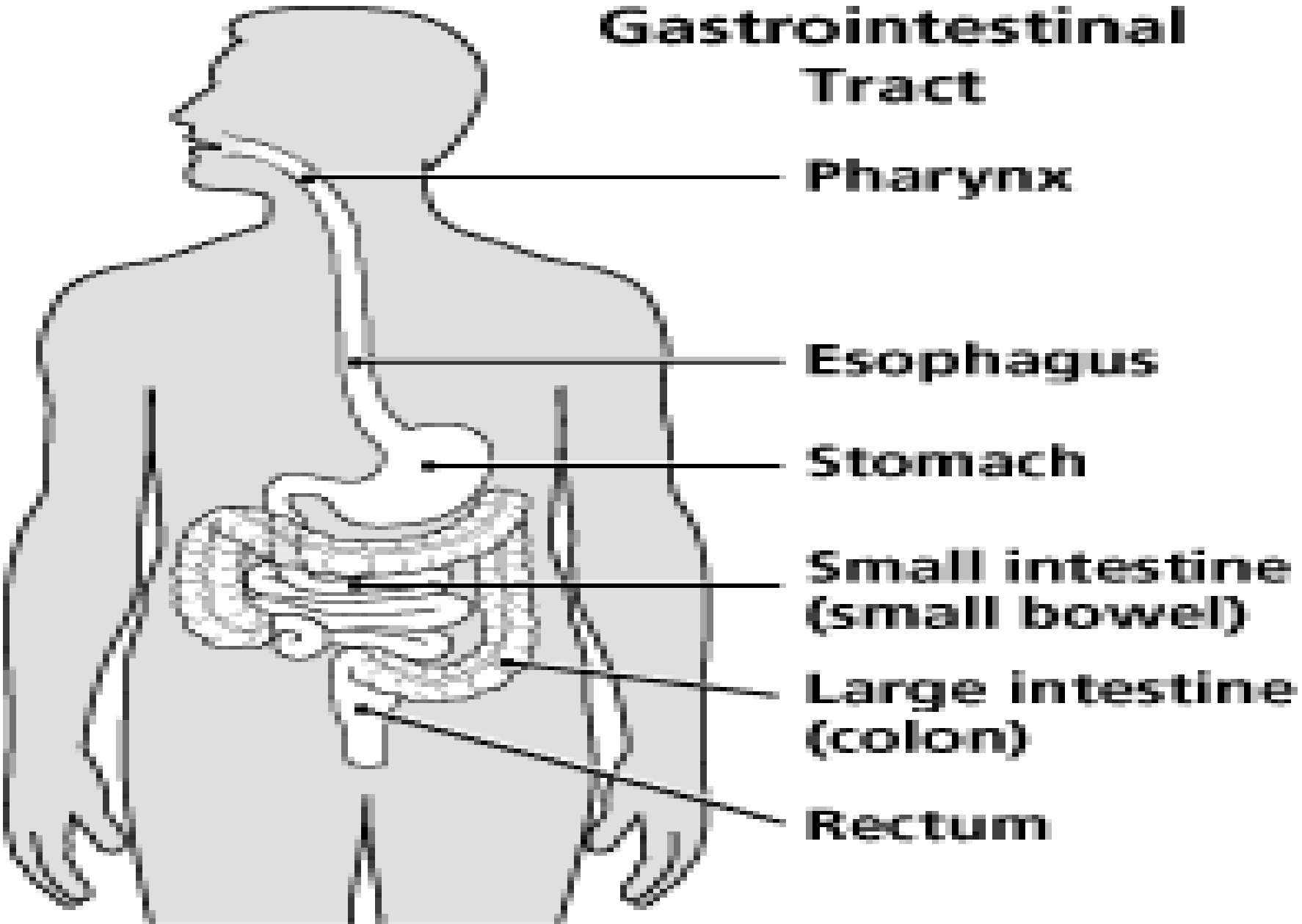
5. THE SMALL INTESTINE.

- Principal digestive and absorptive area of the gut.
- Divided into Duodenum, jejunum, ileum (6.7m long in man).
- Has four histological layers: Mucosa, Submucosa, Muscularis externae and Serosa or Peritoneum.
- Has finger like projections called microvilli which increases the surface area for absorption.

6.LARGE INTESTINE OR COLON.

- Larger in diameter but shorter in length(1.8m in man).
- Starts at the coelic caecum and the vestigial vermiform appendix (has immune defense).
- Has no microvilli but has lubricating glands.
- It has ascending, transverse and descending and sigmoid portions.
- It terminates in the rectum and anus.
- Escorts wastes from the body.

THE HUMAN DIGESTIVE SYSTEM.



ACCESSORY ORGANS OF DIGESTION.

- **LIVER:** Empties bile into the duodenum by way of the bile duct leading from the gall bladder where bile was stored.
- **SPLEEN:** filter for blood. It helps ward off infections and maintains body-fluid balance.
- **PANCREAS:** Pancreatic juice are produced and goes to the duodenum by pancreatic duct.
- **MESSENTERIES:** This holds the stomach, intestines, liver, spleen and pancreas in place. They also carry blood and lymph and nerves to the abdominal organs.

PROCESS OF DIGESTION.

- **Ingestion**: Food intake.
- **Digestion:** Mechanical and chemical breakdown of food.
- **Absorption and assimilation**: Incorporation of digested food into system.
- **Egestion:** Expulsion of undigested food.

DIGESTION IN THE MOUTH.

- Food is broken down mechanically by the teeth.
- Food is mixed with saliva (Ph 6.7-6.8) which contains enzyme amylase.
- Amylase acts on carbohydrate foods and splits into two glucose fragments.
- Saliva mucin lubricates food for ease of swallowing.
- The tongue pushes the food bolus towards the pharynx.

DIGESTION IN THE STOMACH.

- Gastric juice which contains Pepsinogen, pro-rennin ,lipase and HcL are secreted by reflex action.
- HcL activates Pepsinogen to enzyme pepsin and pro-rennin to rennin which is found in suckling mammals.
- HcL also lowers the Ph of the stomach(1.5-2.0) and sterilizes the stomach content
- There is hydrolysis of protein by pepsin which breaks peptide bond to give polypeptides.
- Products of digestion is now called Chyme.

DIGESTION IN THE SMALL INTESTINE.

- **Bile** (Ph 8) from the liver contains no enzymes but salts (sodium taurocholate and sodium glycocholate) reduces the surface tension of fats and enhances emulsification.
- **Pancreatic juice**
- neutralizes acidic Chyme from the stomach.
- contains Trypsin and Chymotrypsin which acts on protein.
- contains carbonxylpeptidase (splits amino acids), carbohydrase amylase and lipase which works more rapidly.

Intestinal juices

- Effective only in neutral or alkaline medium.

Activators

- Secretin: stimulates flow of pancreatic juice.
- Cholescystokinin: contraction of gall bladder

inhibitor

- Enterogastrone: inhibits acid secretion from stomach

Enzymes: Aminopeptidase: splits off amino acids

Maltase, sucrase, lactase and invertase

Absorption: Food materials already broken down are absorbed into the bloodstream.

DIGESTION IN THE LARGE INTESTINE.

- Chyle more watery and low in nutrients is now in the L.I.
- Water and minerals are re-absorbed to form semi solid feaces (SSF).
- SSF consists of undigested food residue ,bile pigments, bacteria and heavy metals
- The bile pigments (biliribin and biliverdin) color the feaces.
- Egestion or defeacation, a co-ordinated muscular action by the rectal walls eliminates feaces via anus.

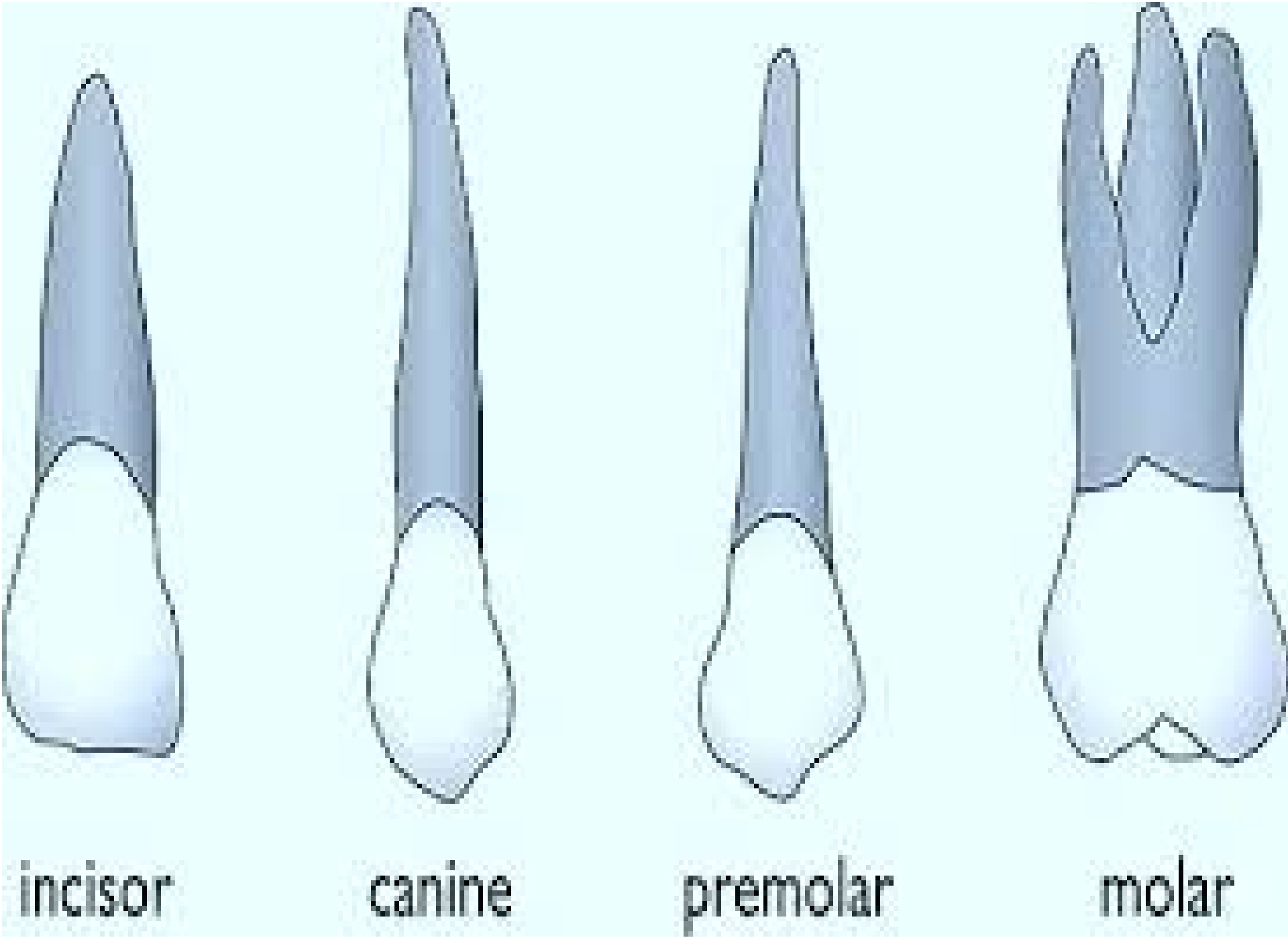
FEEDING MECHANISMS

Mammalian teeth.

Heterodont (different types) & diphyodont (2 successive)dentition.

- **INCISORS**: Biting, snipping and cutting.
- **CANNINES:** Seizing, piercing and tearing.
- **PREMOLARS& MOLARS:** Shearing, slicing, grinding and crushing.

Toothless Mammals: Whales, monotremes e.g. Anteaters.


incisor
canine
premolar
molar

FEEDING HABITS OF MAMMALS.

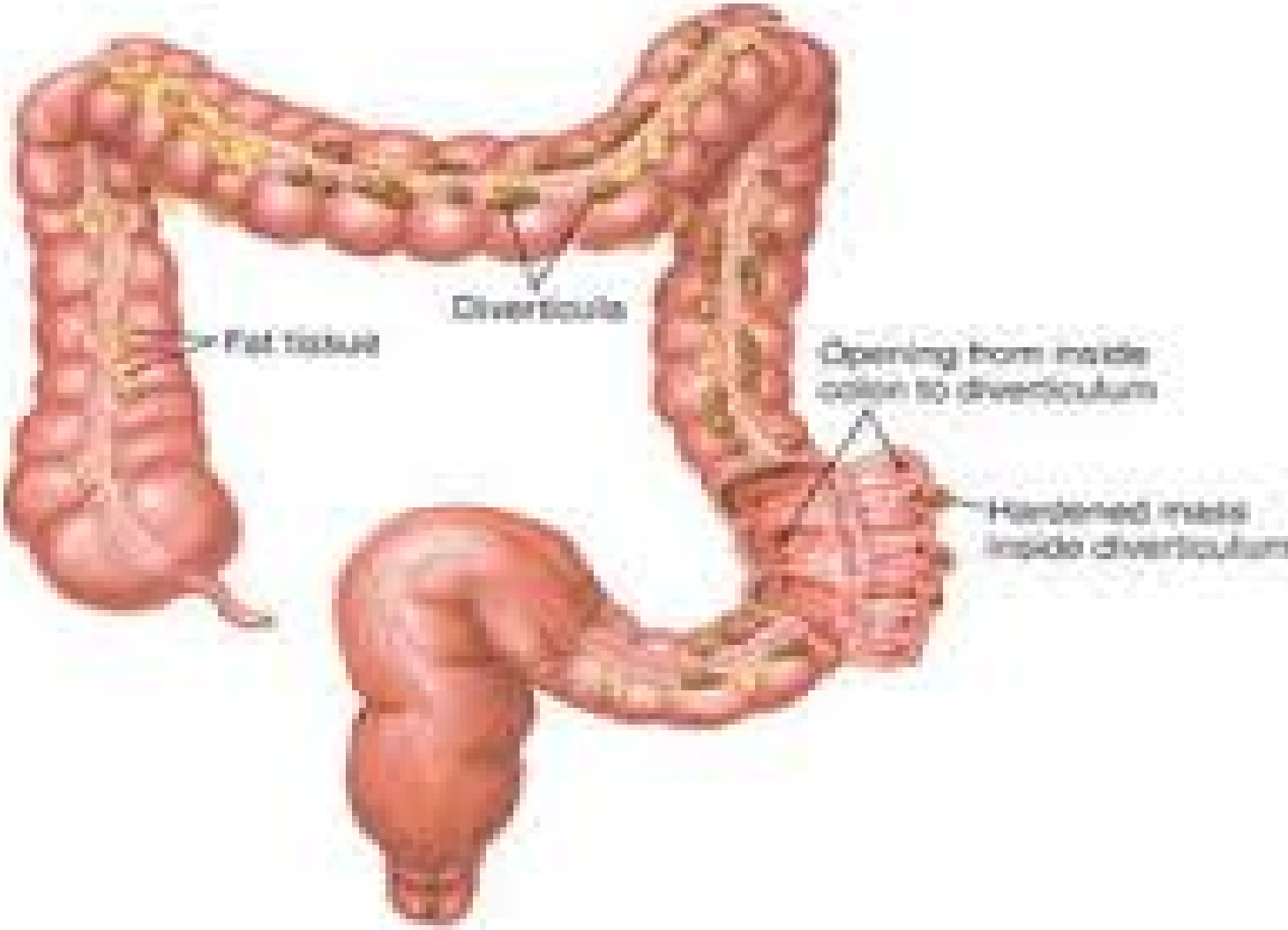
HERBIVOROUS MAMMALS:

Features of the digestive tract.

1. **Have well developed molars and long digestive tracts.** Plants are more difficult to digest than flesh.

Ruminants: (chew the cud) have four chambered stomach viz Omasum, Abomasum, reticulum and rumen e.g. Cattle, antelope

Diverticulum: Horses and Rabbits have a pouch called diverticulum for fermentation and absorption of food.


Diverticula
Fat tissue
Opening from inside colon to diverticulum
Hardened mass inside diverticulum

2. Feed on plant vegetation

Browsers or grazers on grasses e.g. ungulates like horses, swine, antelopes, sheep, goats , Zebra and cattle.

Gnawers and Nibblers on vegetation e.g. rodents and rabbits.

CARNIVOROUS MAMMALS.

- Feed on the flesh of other animals
- They capture their prey.
- Highly developed canines and locomotive power
- Acute senses of smell and sight.
- Digestive tract are shorter and simple because meat is easy to digest.E.gs Lions, tiger, foxes, cheetah, leopard

INSECTIVOROUS MAMMALS.

Feed on insects :

Moles,
shrew,
bats,
anteaters,
raccoons,
pangolin,
armadillos.

OMNIVOROUS MAMMALS.

*Live on both plant and Animal food.

*All teeth well developed

Pigs

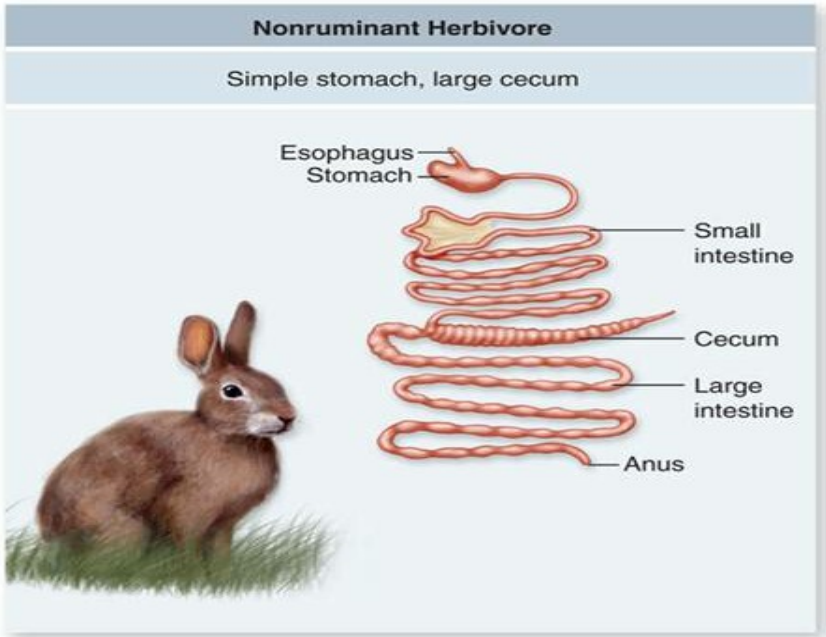
Rats

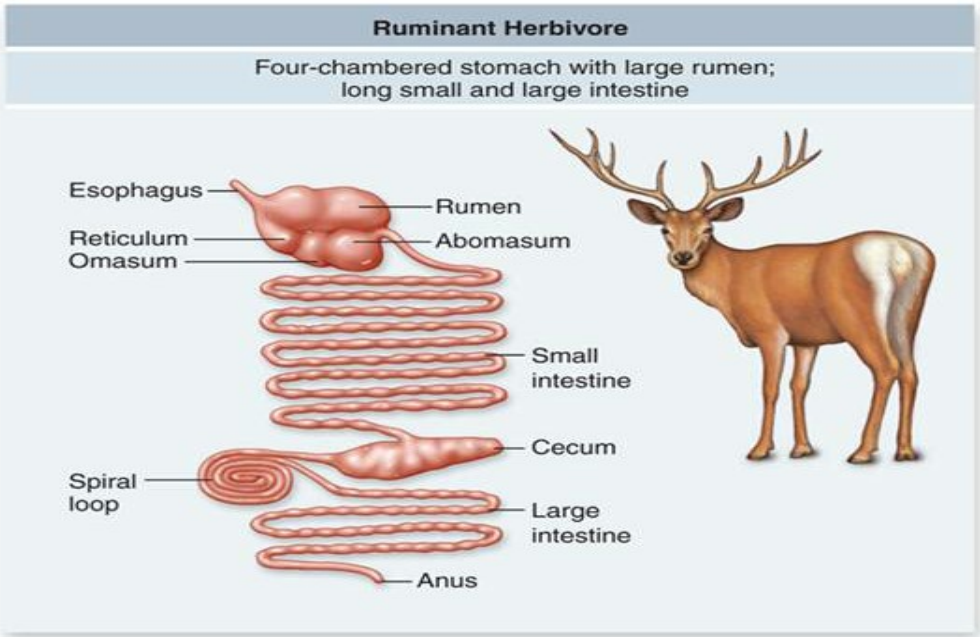
Bears

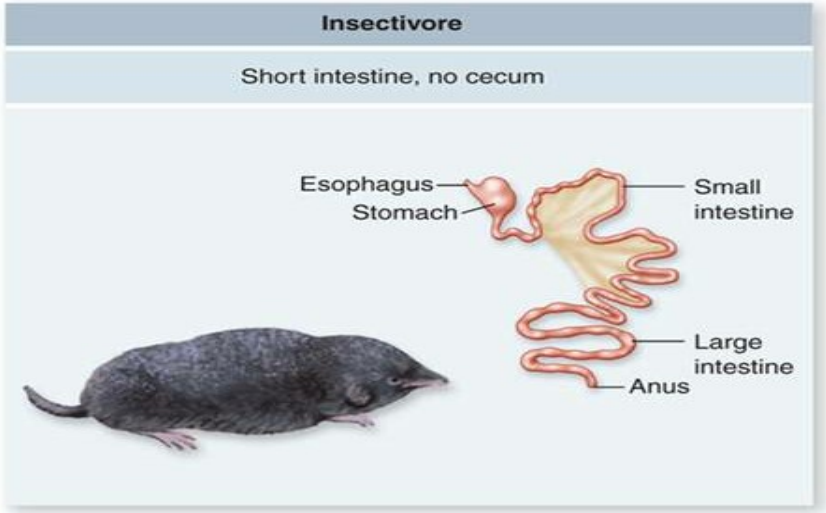
Primates

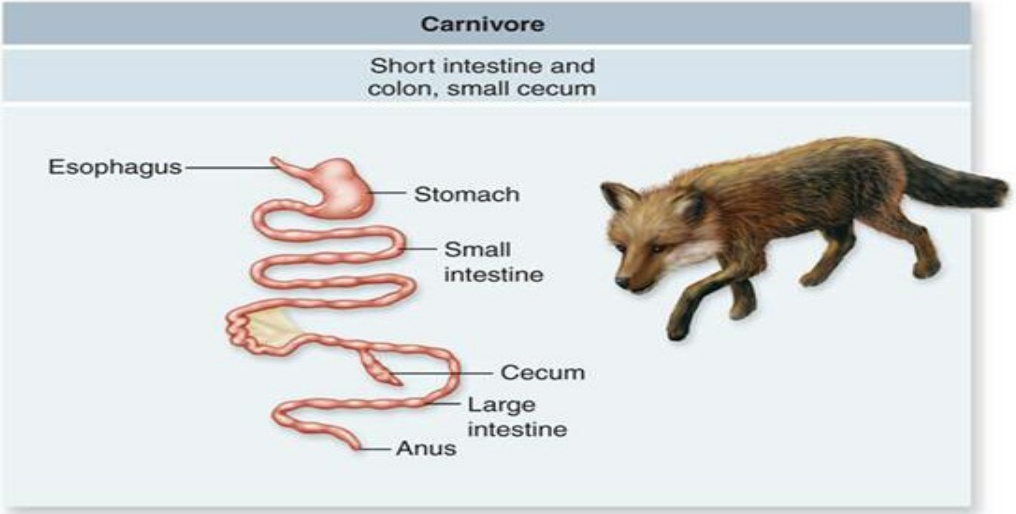
Man.

Diverse kinds of mammalian digestive system.









NUTRITION IN MAMMALS.

- Nutrition is the sum of the processes by which living organism receives food materials from there environment and uses them to promote vital activities.
- Such materials are called nutrients.
- Organic Nutrients are Carbohydrates, Protein, Fats & oils and Vitamins.
- Inorganic nutrients are mineral salts and water.
- A balanced diet must contain all these nutrients in the right proportion.

ORGANIC NUTRIENTS AND FUNCTIONS:

They are obtained from living organisms

Carbohydrates

*Fuel for energy demands of the body.

*Synthesis of various substances and structures like protoplasmic.

*Stored temporary as glycogen in the liver.

*They supply heat as a result of burning activity.

DEFICIENCY AND SOURCES OF CARBOHYDRATES.

- **Deficiency:**

Fatigue due to insufficient glucose

- **Sources**

*Starches from plant food e.g. rice, yam, maize

*Sugars e.g.

glucose, fructose, galactose, sucrose, lactose, maltose and cellulose.

PROTEIN AND FUNCTIONS.

- Needed for synthesis of body protein and other nitrogen compounds in the body.
- They contain amino acids which are constituents of body tissue and replacement of tissue.
- They are required for production of enzymes, hormones, haemoglobin and plasma proteins.
- Source of energy in place of carbohydrates.

DEFICIENCY AND SOURCES OF PROTEIN.

- **Marasmus**: General undernourishment.
- **Kwashiorkor**: Protein malnourishment.
- Ill health, impaired development, wound healing and increased susceptibility to infection.

Sources

- First class protein: Animal sources e.g. beef,fish
- Second class protein: Plant sources e.g. beans

FATS AND OILS FUNCTIONS.

- Provide energy and heat for the body.
- Hold vital organs in place and protect from injury.
- Essential constituents of protoplasm and precusor for prostaglandins hormone.
- Has good satiety value and slows hunger.
- Subcutaneous fat acts as insulators preventing loss of heat.
- Assist in Absorption of the fat soluble vitamins (ADEK).

DEFICIENCY AND SOURCES OF FATS AND OILS

- Deficiency occurs only in malabsorption of fats.
- Patients fed intravenously without fat for a long time.
- Saturated fats might cause Arteriosclerosis.

Sources

- Saturated fat: Animal fat e.g. mutton, butter, cheese
- Unsaturated fat: Plant fat. e.g. vegetable oil.

Vitamins: Fat soluble

TYPES	OTHER NAMES	FUNCTIONS	DEFICIENCY	SOURCES
A (A1 & A2)	**Retinol**	Healthy epithelial tissue & Normal cell growth Visual photochemistry Dark adaptation Developments of bones and teeth Smooth skin	Mucous membrane infections Keratomalacia Night blindness Xeropthalmia or dry eye Growth retardation Dried and rough skin.	Carrots Green and yellow Leafy Vegetables.
D (D2 & D3)	**Calciferol, Sunshine vitamin**	Absorption of calcium from intestine and calcification of the skeleton.	Rickets in children Osteomalacia in adults Dental caries.	Skin irradiation with U.V Sunlight
E	**Tocopherol, Antisterility vitamin**	Reproduction, body tissues and membranes.	Sterility and abortion muscular weakness, anaemia	Green plant tissues, grains
K	**Antihaemorragic vitamin**	Blood clotting, prevents neonatal breeding and	Bleeding, anaemia, haemorrage, less ability for blood clot	Green vegetables. Tomatoes

VITAMINS : WATER SOLUBLE

Types	Other names	Functions	Deficiency	Sources
B1	**Thiamine**	Co-enzyme in pyruvate metabolism	Nervous system degeneration (Beriberi),cessation of growth and heartbeat.	Eggs ,cereals yeast.
B2	**Riboflavin**	Flavoprotein co-enzyme	Non specific digestive disturbances and ariboflavinosis	Milk, yeast, cereals.
B3	**Niacin.**	Maintains nervous system & digestion, carbohydrate metabolism and keeps the skin healthy.	Pellagra, dermatitis Nervous disorders, loss of appetite	Green leaves yeast, kidney, cereals, eggs
B12	**Cyanocobalamin**	Red blood formation and treatment of pernicious anaemia.	Pernicious anaemia	Liver, Kidney Heart Bacteria in stomach

INORGANIC NUTRIENTS:

are not obtained from living organisms.

***Mineral salts**

- **Calcium:** For Bones, teeth,nerves,heart& blood.
- **Iron:** For Haemoglobin and enzymes.
- **Phosphorus**: For Bones and Teeth
- **Iodine**: Prevents goitre of thyroid gland.
- **Fluorine:** For teeth and skeleton
- **Sodium:** For blood plasma and osmotic balance.
- **Potassium:** Present in body cells
- **Zinc:** for wound healing and growth.
- **Magnesium:** For soft tissues, teeth and bones.
- **Copper**: Promotes RBC production with iron.

WATER AS AN IMPORTANT INORGANIC NUTRIENT.

- Involved in chemical reactions of the body.
- Basis of intra and extra cellular fluids.
- Aids digestion and excretion.
- Protoplasmic constituent.
- Constituents of body secretions and excretions.
- Universally taken to quench thirst.
- Prevents friction of joints in lubricating fluids like synovial fluid.
- 65-70% of total body weight.

- Hope you enjoyed the lecture?
- Any comments or questions?

THANKS FOR LISTENING.