FOOD NUTRIENTS

CARBOHYDRATES

- Examples are sugars, starches (pasta, potatoes, flour) and cellulose (fibre)
- Contain carbon, hydrogen and oxygen with the ratio of hydrogen atoms to oxygen atoms as 2H : 1O
- An immediate source of energy for the body
- In the process of respiration, glucose sugar and oxygen give energy and wastes of carbon dioxide and water
- 3 forms of carbohydrates are:
  1.Monsaccharides (Simple Sugars e.g. glucose in honey, and fructose in fruit)
  2. Disaccharides (Double Sugars e.g. sucrose, lactose, maltose)
  3. Polysaccharides (e.g. starch, cellulose)
- All carbohydrates are broken down to simple sugars (monosaccharides) by enzymes in the digestive tract

PROTEINS

- Examples are meat, eggs, beans
- Some body proteins are muscle, haemoglobin, hormones and enzymes
- Long-chain molecules made of amino acids
- Contain carbon, hydrogen, oxygen, nitrogen and usually sulphur and phosphorus
- Used to repair and build body tissues, but can be used as a last source of energy
- Digestive enzymes break down proteins into amino acids
- There are over 30 amino acids. Plants can make their own amino acids from simpler substances. However, cannot synthesise about 20 amino acids, so must eat them in the diet. These 20 are called essential amino acids.

LIPIDS (FATS AND OILS)

- Examples are butter and oils
- Contain carbon, hydrogen and oxygen
- Each molecule is composed of 1 glycerol molecule and 3 fatty acid molecules
- Bile and digestive enzymes break down lipids into fatty acids and glycerol
- Used as a source of energy, as a structural and an insulating material

VITAMINS

- Help to control chemical reactions in the body
- Are only required in small amounts
- Deficiencies and excesses of vitamins may cause disease

VITAMIN	SOURCE	EFFECTS OF DEFICIENCY
A (retinol)	Carrots, tomatoes, leafy vegetables, egg yolk, milk, cheese	Poor night vision, skin infections
B1 (thiamin)	Wholemeal bread, eggs, milk, cheese	Beriberi(loss of appetite,weakness)
B2 (riboflavin)	Eggs, milk, cheese, yeast	Pellagra(skin infections, mental illness)
C (ascorbic acid)	Citrus fruit, green vegetables	Scurvy(bleeding gums, loss of teeth)

D (calciferol)	Eggs, cod liver oil, butter, milk	Rickets(deformed bones)
E (tocoperol)	Green vegetables, wheatgerm, milk	Anaemia
K (phylloquinone)	Green vegetables	Impairs blood clotting

MINERAL IONS

- e.g. salts containing sodium, calcium etc.
- Help build strong bones and teeth, needed for healthy nervous function, and used in the clotting of blood
- Lack can cause disease

MINERAL	SOURCE	EFFECTS OF DEFICIENCY
Calcium	Milk, cheese, green vegetables	Rickets(poor bones and teeth)
Iron	Meat, eggs liver, vegetables	Anaemia
Iodine	Fish, water	Goitre(poor growth and development)
Fluorine	Drinking water	Poor teeth
Phosphorus	Dairy foods, eggs, meat, vegetables	Poor bones, teeth and muscles
Potassium	Meat, fruit, vegetables	Affects nerves, muscles and blood
Zinc	Green vegetables, onions, liver	Part of the hormone called insulin

TESTS FOR CHEMICAL COMPONENTS OF FOOD

CHEMICAL	TEST	POSITIVE RESULT
Protein	Add a few drops of copper sulphate solution to the food sample, then a few drops of sodium hydroxide solution and mix well.	Blue-purple
Starch	Add a few drops of iodine solution to the food sample.	Blue-black
Glucose	Add an equal volume of Benedict's solution to the food sample and warm in a very hot water bath for a few minutes.	Orange-red
Lipid (Fats and Oils)	Rub a food sample onto brown paper and allow it to dry.	Translucent spot

THE HUMAN DIGESTIVE SYSTEM

3 PROCESSES IN DIGESTION

1. Ingestion – the mechanical taking in of food, chewing and swallowing
2. Digestion – The breakdown of food into smaller particles by physical or chemical means
3. Absorption – the absorption of these smaller food particles from the digestive tract into the blood

Did You Know That…? A "warm-blooded" or endothermic animal eats more than a "cold-blooded" or ectothermic animal because much of the energy from food is used to keep us warm.

2 TYPES OF FOOD BREAKDOWN

1. Physical or Mechanical Breakdown – e.g. chewing, mixing with bile
2. Chemical Breakdown – e.g. enzymes, hydrochloric acid

PARTS AND FUNCTIONS OF THE HUMAN DIGESTIVE SYSTEM

Refer to the diagram of the Human Digestive System in your textbook.

Mouth

- Ingests food
- Teeth physically break down food by chewing
- Saliva lubricates food
- The enzyme, salivary amylase also called ptyalin, breaks down starch into simple sugar, glucose

Pharynx

- At the back of the mouth cavity
- Both food and air pass through here

Oesophagus

- Tube between mouth and stomach
- A flap called the epiglottis closes over the top of the windpipe or trachea when swallowing, so that food does not enter the respiratory tract
- The walls of the digestive tract from the oesophagus to the anus are muscular, and contract rhythmically to move food. The muscular contractions are called peristalsis.

Stomach

- 2 circular muscles called sphincters surround the entry and exit of the stomach to control the flow of food
- Food remains in the stomach for about 3 hours where it physically broken down by the churning muscular contractions of the stomach wall muscles
- Gastric juice contains hydrochloric acid and has a pH of 1 without food, and 3 with food.
- HCl helps to kill bacteria, and works in association with the enzyme, pepsin, to partially break down proteins.
- The stomach lining contains mucus to prevent damage from the acid
- Only alcohol and a few drugs can be absorbed through the stomach wall into the blood

Small Intestine

- Long tube that is about 7 metres long and 2.5 cm in diameter
- 3 parts of the small intestine are duodenum, jejunum and ileum
- Most of digestion occurs in the small intestine
- The enzymes of the small intestine do not function on the acidic stomach contents. First, an alkaline substance from the pancreas is secreted into the duodenum to neutralise the stomach acid.
- A green substance called bile that is made in the liver and stored in the gall bladder is released into the duodenum to break the large fat particles into smaller fat particles
- Enzymes from the pancreas also break down food chemically. Amylase breaks starch into simple sugars. Lipase breaks lipids into fatty acids and glycerol. Peptidases and Trypsin break down proteins into amino acids.
- After the food into broken into smaller particles, it is absorbed through finger-like projections called villi on the walls of the small intestine into blood capillaries.

Large Intestine

- Thicker in diameter than the small intestine
- Water is absorbed from the remains of undigested food to make faeces
- Bacteria produce Vitamin B in the large intestine
- Mucus lubricates the faeces
- The appendix is attached to part of the large intestine. It may be part of the body's immune system.
- Diarrhoea is the condition of more liquid faeces when the large intestine is infected.

Rectum

- Storage area for faeces at the end of the large intestine
- There is a sphincter surrounding the anus, the hole through which faeces passes on defaecation.
- Constipation is the condition of dry hard faeces as a result of low fibre in the diet.

Did You Know That…?

- A person swallows the equivalent of half a bucket of saliva daily.
- The Etruscans made the first false teeth with gold 3000 years ago.
- Toilet paper was invented in 1899 by the Scott brothers in America.

THE ROLE OF THE LIVER IN DIGESTION

- Bile - The liver produces bile which is stored temporarily in the gall bladder, and then secreted into the duodenum (first part of the small intestine) for the emulsification of lipids. Bile is also alkaline and aids in the neutralisation of stomach acid in the small intestine.
- Sugar Conversion - After a meal, excess simple sugars in the bloodstream pass to the liver and are converted and stored as glycogen. However, between meals, the glycogen is converted back to simple sugars and released into the bloodstream. In this way, the blood sugar remains constant.

COMPARISON BETWEEN THE DIGESTIVE TRACTS OF HERBIVORES AND CARNIVORES

- Cellulose is a complex carbohydrate that is a major component of leaves and grasses. Humans refer to cellulose as fibre, as it stimulates peristalsis and passes out in the faeces. Humans cannot digest cellulose.
- Only a few organisms, such as fungi, protozoans and bacteria, can break down cellulose with an enzyme called cellulase.
- Herbivores have a symbiotic relationship with these organisms that live in the herbivores' digestive tracts. The micro-organisms receive food and shelter and, in return, digest cellulose anaerobically into smaller molecules that the host can absorb.
- Some herbivores have a caecum or hind-gut, where the small and large intestines join and where further breakdown of cellulose can occur. However, the faeces of these animals (e.g. horses, koalas, possums and rabbits) contain much cellulose.
- Other herbivores have a more effective rumen or fore-gut before the stomach, where partly digested plant matter can be regurgitated into the mouth for further chewing and swallowed again. Ruminants mammals include cattle, sheep, kangaroos and wallabies.