INTRODUCTION TO FOOD & DIGESTION

THE CHEMICALS OF LIFE

All living things, including humans, are made up of chemical substances. These substances are either organic (contain carbon) or inorganic (don't contain carbon). Organic substances include carbohydrates, fats and oils, and proteins. Inorganic substances include salts and water.

The food we eat is made up of both organic and inorganic substances. It provides us with the energy to work and play, and the raw materials to build new cells. All the food we eat is broken down by our digestive system and transported to every part of our body by our circulatory system.

Carbohydrates: provide energy

Protein: needed for repair and growth

Fats: rich source of energy

Food is like a fuel to the human body. We need to eat regularly to make sure that we have a more or less constant supply of fuel.

To live healthily, we need to eat a balanced diet. This means that we should eat food that provides us with carbohydrates, proteins, fats, minerals, vitamins, fibre and water in the right amounts to keep us healthy.

CONSTITUENTS OF FOOD

Carbohydrates give us energy that can be used in respiration. Sugar and starch are both carbohydrates. Sugar is found in sugary foods, biscuits, cakes, etc. It can also be found in milk and fruit. Starch is found in bread, potatoes and cereals. Starch occurs in plant cells as starch grains.

Fats and *oils* also give us energy. Fats actually provide more energy than carbohydrates but fat is more difficult to digest. Fats occur in both animal and plant food. Butter, dripping and lard are animal fats obtained from cows and pigs. These fats are solid at room temperature, though if you heat them they become liquid. Plant fats are normally liquids at room temperature and we call them oils. Two well-known examples would be corn oil and olive oil. These are both used in cooking.

Proteins help to build up our body; they form important structures like muscles and tendons and are also important as enzymes. A certain amount of protein is present in most foods, but it's particularly plentiful in milk, eggs and meat. Proteins form the main structures of the body, like the muscles and skin so we need proteins for growth and bodybuilding and for repairing tissue.

Water is essential for life. Most of the cytoplasm in every cell is made up of water. It is essential that it is included in our diet. A person can go without food for several weeks, but would die in a few days from lack of water.

Minerals are another necessary part of our diet. Mineral salts contain certain chemical elements. All these elements have particular jobs to do. Some examples of the minerals we need are sodium, calcium, iron and iodine.

Vitamins are organic substances needed in the diet. Each vitamin has a specific job to do. If any one of them is missing from the diet a person could get very ill and could possibly die. They are needed in very small amounts and are known by letters, e.g., Vitamin A, B, and C.

Dietary fibre (or roughage) keeps food moving along the gut and helps prevent constipation and cancer of the colon. Unrefined foods, like wholemeal bread, bran cereals, fresh fruit and vegetables, have plenty of fibre in them. That's one reason why such foods are so good for us.

FOOD ADDITIVES

Nowadays all sorts of food additives are added to foods. These additives can be natural or synthetic. Additives can do a number of things to the food they're in.

They can:

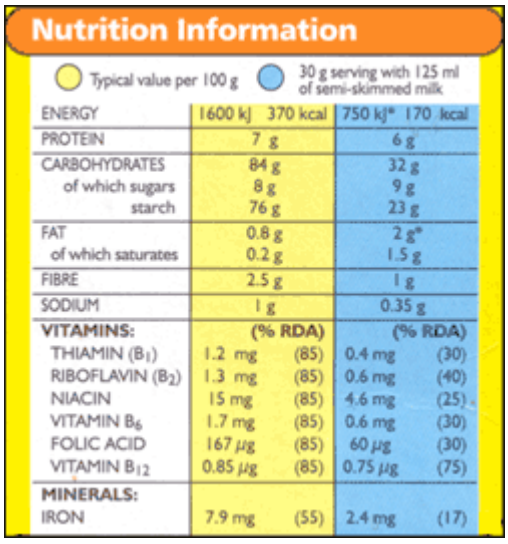
- Sweeten, flavour or colour the food.
- Increase its shelf life by stopping microorganisms from growing on it (preservatives).
- Give food the right consistency, maybe thickening it (emulsifiers and stabilisers).
- Prevent oxidation when food is exposed to air (anti-oxidants). Oxidation makes fats and oils go rancid and fruits, such as apples and bananas, turn brown.

Dried fruit: contain preservatives

Ice cream: contains thickening agents

Sweets: contain colourings

All packaged foods and drinks in European Union countries are required to display a full list of additives, either by name or E number. This enables shoppers to know exactly what they are buying. All the ingredients of packaged foods can be found listed on the packets. You can also find the energy levels listed on the packets.



Nutrition Information

	Typical value per 100 g		30 g serving with 125 ml of semi-skimmed milk	
ENERGY	1600 kJ	370 kcal	750 kJ*	170 kcal
PROTEIN	7 g		6 g	
CARBOHYDRATES	84 g		32 g	
of which sugars	8 g		9 g	
starch	76 g		23 g	
FAT	0.8 g		2 g*	
of which saturates	0.2 g		1.5 g	
FIBRE	2.5 g		1 g	
SODIUM	1 g		0.35 g	
VITAMINS:		(% RDA)		(% RDA)
THIAMIN (B_1)	1.2 mg	(85)	0.4 mg	(30)
RIBOFLAVIN (B_2)	1.3 mg	(85)	0.6 mg	(40)
NIACIN	15 mg	(85)	4.6 mg	(25)
VITAMIN B_6	1.7 mg	(85)	0.6 mg	(30)
FOLIC ACID	167 µg	(85)	60 µg	(30)
VITAMIN B_{12}	0.85 µg	(85)	0.75 µg	(75)
MINERALS:				
IRON	7.9 mg	(55)	2.4 mg	(17)

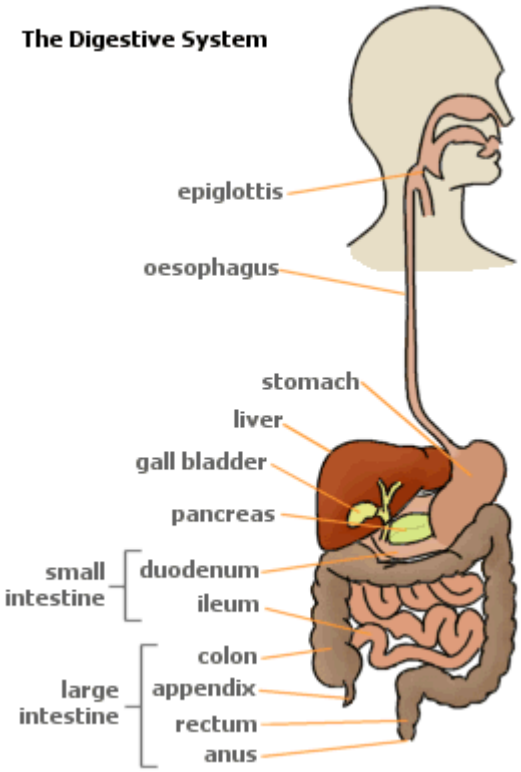
Food labels list the nutritional information of packaged foods

DIGESTION

Proteins, fats and carbohydrates are huge molecules and are too big to fit into the tiny little blood vessels that surround the digestive system. These foods need to be broken down so that they are small enough to pass into our blood. Vitamins, minerals and very simple sugars are already small enough and are in the right form so they don't need to be digested.

Food is taken in through the mouth to the stomach and into the small intestine where it is digested. *Digestion* is the complete breakdown of food so it can be absorbed and used by the body for energy. Digested food is absorbed into the blood stream. Food takes about 24 hours to digest. There are organs and glands that produce digestive juices that help with digesting this food. These glands are the salivary (spit) glands, the pancreas and the liver.

The *alimentary canal* is a muscular tube running from the mouth to the anus. As the food goes down the alimentary canal the muscles in it contract and relax and this squeezes the food all the way down. The word for this squeezing is called *peristalsis*.



THE STAGES OF DIGESTION

In the mouth large chunks of food are broken down into much smaller particles. This is called *mechanical digestion*. Teeth chew the food and mix it with saliva from the salivary glands. This is helped by our tongue and by the hard and soft pallet in our mouths. There are digestive juices in the saliva that start the process of digestion. The food travels from our mouth to our stomach down a tube called the oesophagus.

Once the food gets down into the stomach, it's mixed around by very strong stomach muscles. The large molecules that are still present (proteins, fats and carbohydrates) have to be broken down into much, much smaller molecules. This is called *chemical digestion* and involves special chemicals called *enzymes*.

The food moves from the stomach to the small intestine. The small intestine is a long muscular tube about 5 metres long. More digestive enzymes are released here to help break the food down. Once the food is broken down, it is absorbed through the walls of the small intestine. The inside of the small intestine is infolded so that it has a very large surface area.

The liver is the largest organ in the human body. It is a very important organ with many essential functions, including digestion. It produces yellowish liquid called bile that is stored in the gall bladder. The bile passes into the small intestine through a tube called the bile duct. Bile helps to break down fats.

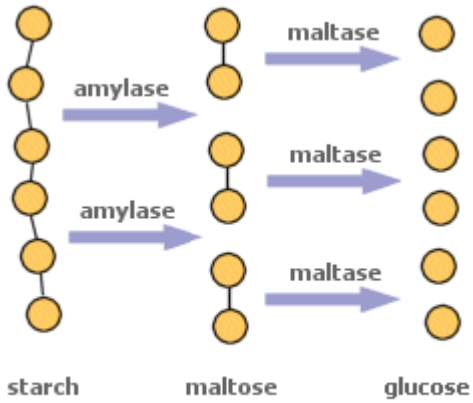
The remaining material, undigested food and water pass from here to the large intestine. Vitamins, minerals and most of the water from the undigested remains are absorbed from the large intestine into the blood. Faeces are pushed into the rectum where we excrete it when we go to the toilet.

ENZYMES

Enzymes are chemicals that break down food. They help speed up the rate at which food can be digested. Salivary glands and the pancreas produce and pour their enzymes through tubes into the digestive canal.

Without enzymes food would take a very long time to digest, but with them it only takes a few hours. Enzymes have a definite shape and are not used up in the reaction. One enzyme can be used many times over. Enzymes can either join or break up two molecules.

The substance an enzyme acts on is called the *substrate*.



Chemical Digestion of Starch