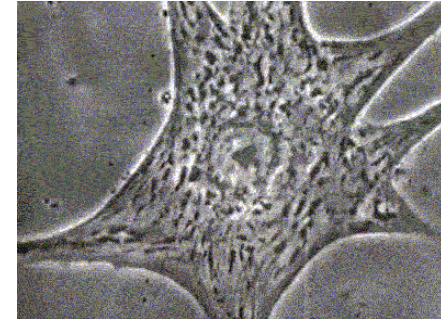


# FOOD

## Why do we need food?

1. As a source of energy - keeps our cells and us alive.
2. To make chemicals for our metabolic reactions.
3. As raw materials for growth and repair of our cells and body.



## What's in our food?

There are **6 common elements** found in food,

Carbon (C), Hydrogen (H), Oxygen (O),  
Nitrogen (N), Phosphorous (P), Sulphur (S).

There are **5 elements found as salts**,

Sodium (Na), Magnesium (Mg), Chlorine (Cl),  
Potassium (K), and Calcium (Ca).

There are **3 trace elements**,

Iron (Fe), Copper (Cu) and Zinc (Zn).

# Biomolecules

**Are chemicals made inside a living thing.**

The 4 major biomolecules found in food are,  
Carbohydrates, Lipids (fats and oils), Proteins and Vitamins.

## 1. Carbohydrates

Carbohydrates are made up of Carbon, Hydrogen and Oxygen. (C,H,O).  
They are in the **ratio 1:2:1**. There's twice as much Hydrogen as Carbon/Oxygen  
The ratio is often written as  $C_x(H_2O)_y$ . Glucose has the formula  **$C_6H_{12}O_6$** .

There are 3 types of Carbohydrates,

**Monosaccharides** -

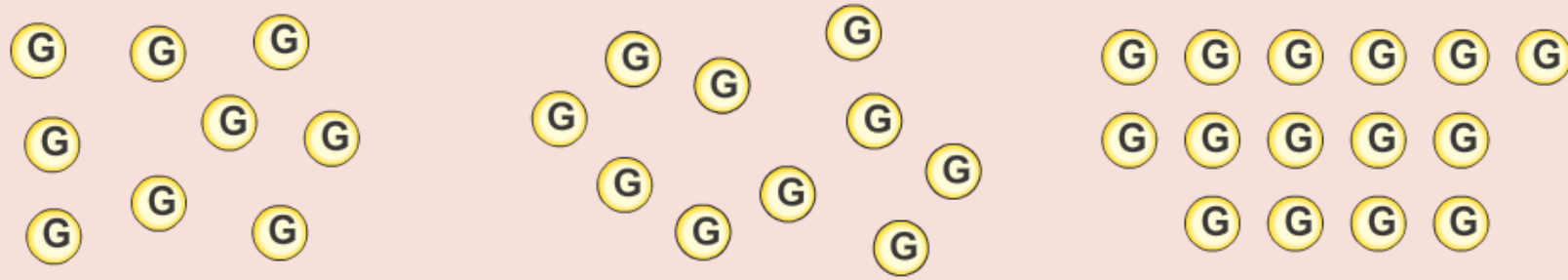
These are **single** sugars that are sweet, e.g. **Glucose**, Fructose.

**Disaccharides** -

These are **double** sugars that are also sweet, e.g. **Sucrose**.

**Polysaccharides** -

These are chains of **many** sugars that are not sweet to taste. e.g. **Starch**



**Monosaccharide**  
(glucose)

3.2 Types of carbohydrates (where **G** = glucose)

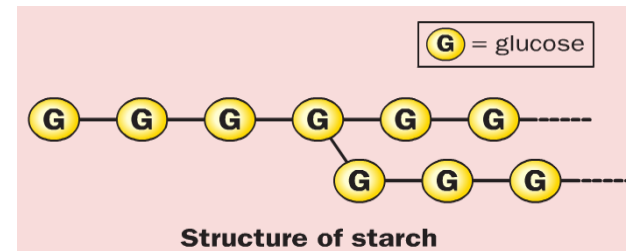
# Polysaccharides

There are 3 that you need to know.

(i) **Starch** - made of long chains of glucose.

It is stored by plants as a **storage polysaccharide** e.g. potatoes

Starch is broken down by Amylase (saliva) into Maltose (disaccharide).



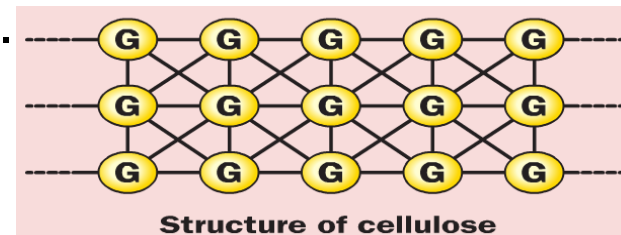
(ii) **Cellulose** - made of long chains of glucose that are cross chained.

Cellulose is harder to break apart and harder to digest.

It is used as fibre or roughage in the diet.

It is a **structural polysaccharide**

and used in **plant cell walls** e.g. lettuce



(iii) **Glycogen** - made of long chains of glucose also.

It is used as a **storage polysaccharide** in animals.

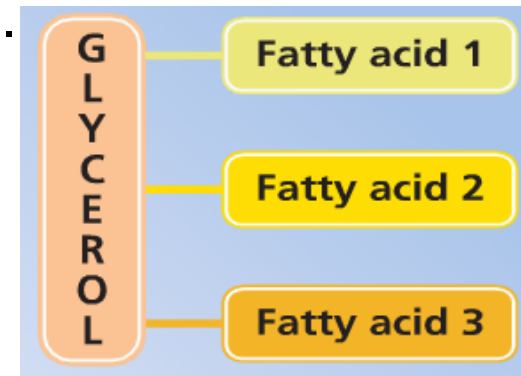
It is broken down to release glucose for energy in muscles.

It is stored in the liver, brain and muscles.

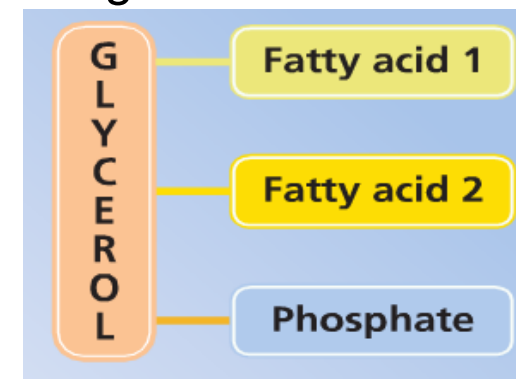
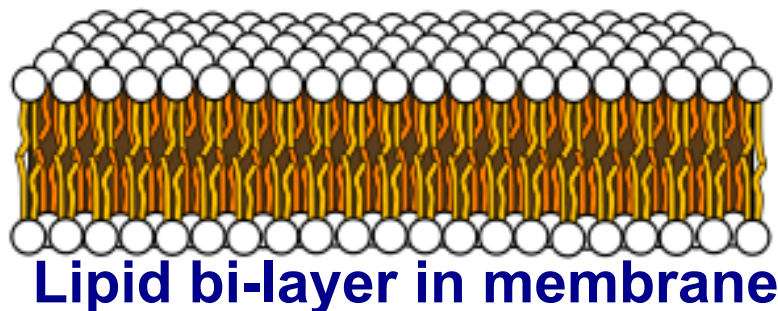
## 2. Lipids (Fats and Oils)

Lipids are made up of Carbon, Hydrogen and Oxygen. (C,H,O). They are **not** found in any **ratio**. They have very **little Oxygen**. **Fats** are lipids that are **solid** at room temperature (20°C) and **Oils** are lipids that are **liquid** at room temperature.

**Triglycerides**- are the way lipids are structured. They have 1 Glycerol with 3 fatty acids.



**Phospholipids**- have 1 of their fatty acids replaced with a phosphate. They are extremely important as they make up cell membranes. Without a cell membrane life would never have begun.



## 3. Protein

Proteins contain C, H, O and Nitrogen (N).

**Hint:** The word protein ends in **N**.

There is no ratio for the atoms but they are very complex and large.

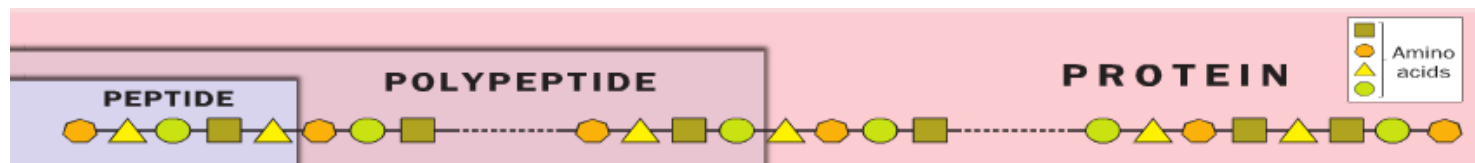
### Structure

Proteins are made of amino acids (there are 20 common types)  
Amino acids are held together by a peptide bond.

A **peptide** is made of 20 or less amino acids.

A **polypeptide** has more than 20 amino acids.

A **protein** is a long chain polypeptide with over 200 amino acids.



Once a protein is made it is folded so that it can begin to work.

A **prion** is a protein that hasn't folded properly and causes

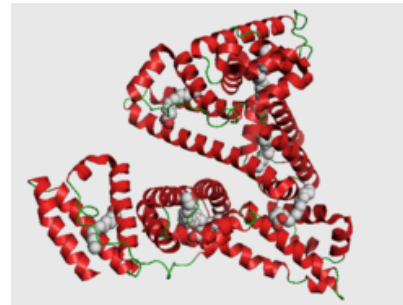
**Mad Cow Disease**



## Types of Proteins

**Fibrous Proteins**- are long threads with no folding, e.g. **keratin** in hair, nails and feathers.

**Globular Proteins**- have lots of folds that make them form round shapes. e.g. **albumen** in egg white. and **Enzymes**.



## Sources of Proteins

Meat, fish, eggs, nuts, milk, peas and beans are all rich in protein. Amino acids are not stored in the body and have to be broken down. The **liver** pulls the amino acids apart by **deamination**. The amine part is converted to **urea**, which is then carried by the blood to the **kidneys** where it becomes **urine**. The urine is then excreted.



# 4. Vitamins

Vitamins are a complex substance that the body cannot make.

## Water soluble vitamins

**Vitamin C** (ascorbic acid) is soluble in water.

It is found in citrus fruits such as lemons and oranges.  
Lack of vitamin C leads to scurvy (bleeding gums).



## Fat soluble vitamins

**Vitamin D** (calciferol) is soluble in fat.

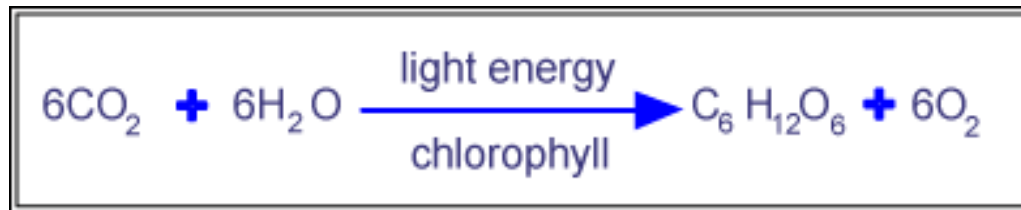
It's found in liver, fish oils, milk and egg yolk.  
Vitamin D is also made by ultraviolet rays on the skin.  
Lack of vitamin D leads to rickets (weak bones).



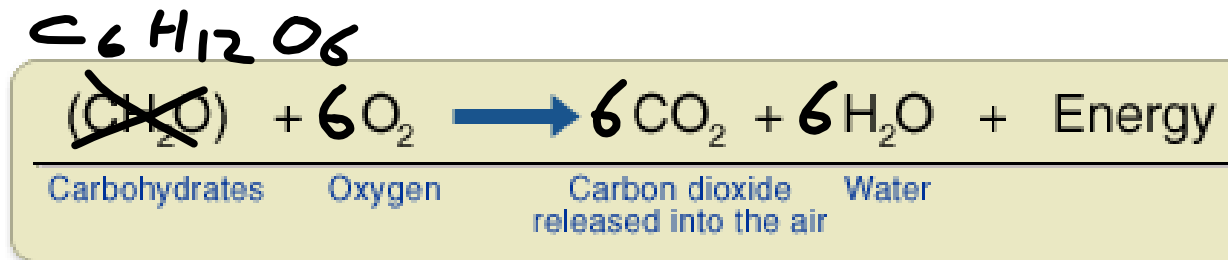
## Energy Transfer Reactions

Metabolic reactions can be divided into Anabolic reactions and Catabolic reactions.

**Anabolic reactions** convert small molecules into larger ones. e.g. Photosynthesis  
**Anabolic reactions** take in energy to **ADD** the pieces together.



**Catabolic reactions** convert large molecules into smaller ones. e.g. Respiration  
**Catabolic reactions** release energy as the pieces are **CUT** into smaller bits.



## Roles of Biomolecules

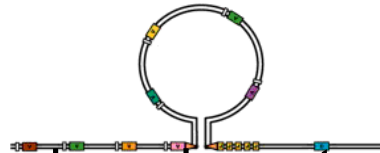
### Structural Role

Cellulose (Polysaccharide) is used in plant cell walls.  
Keratin (protein) is used in hair, feathers and nails.  
Lipids are a source of energy. They have twice as much energy as carbohydrates.  
The lipids act as an insulator in animals and protect organs.  
Lipids and phosphates bond to form phospholipids in cell membranes.



### Metabolic Role

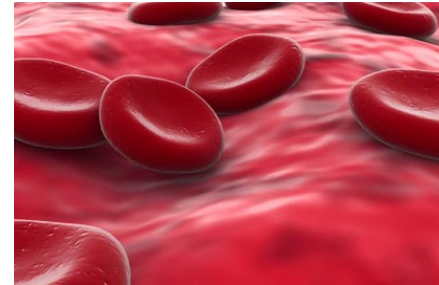
Lipids and carbohydrates are broken down to release energy in respiration.  
Proteins are found in enzymes and control most chemical reactions in the body.  
Some proteins are Antibodies that fight infection and other proteins are hormones.



# Minerals

Minerals are needed by plants and animals in small amounts.

1. **Calcium** - to form cell walls and animal bones.
2. **Nitrogen/Sulfur** - to form muscle tissue.
3. **Sodium** - to form cell and body fluids (tears, saliva, etc.)
4. **Iron** - forms haemoglobin, the pigment that carries Oxygen in red blood cells.
5. **Magnesium** - forms chlorophyll, the pigment that catches sunlight energy.



# Water

Makes up around 60% of humans and 90% of plants.  
Life began in water and all living things are still dependent on it today.

1. It is the liquid in which all metabolic reactions take place.
2. It provides the basis for transport systems in organisms.
3. It's the environment in which many organisms live.



Water is found in the cells cytoplasm, blood plasma and tissue fluid.  
It is a very good solvent and carries many molecules.

Photosynthesis - water is split and used to provide hydrogen and electrons

Respiration - water is formed as an end product that we breath out.

It is very important in plant cells so that they can keep their shape.

It is a good absorber of heat and maintains body temperature.

# Food Experiments

1. Reducing Sugar (**Glucose**) - **Heat** required  
Benedicts Solution  
Colour change from **Blue** to **Brick Red**.



2. **Lipids** (Fats/Oils) - No heat required  
Brown paper and butter/oil  
Colour change from **Brown** to translucent.



3. **Proteins** (Milk) - No heat required  
Biuret Solution - Copper sulphate + Sodium Hydroxide  
Colour change from **Blue** to **Purple** (lilac).



4. **Starch** - No heat required  
Iodine Solution  
Colour change from clear to **Blue/Black**.

