PROTEINS

- Most important and most diverse molecules in organisms

Structure: made up of C,H,N,O (sometimes S)

- an unbranched POLYMER made up of subunits (monomers) called AMINO ACIDS

- also called a POLYPEPTIDE: a group of amino acids linked together by PEPTIDE bonds

Peptide Bond: holds 2 amino acids together
- made by removing water

Ex. 50 amino acids – contain 49 peptide bonds
- made by removing 49 water molecules

Question: how many water molecules removed if the polypeptide contains 135 AMINO ACIDS? ________________ water molecules

Essential Amino Acids

- There are 20 different amino acids available to make a polypeptide (or protein). Of the 20, twelve (12) are nonessential because they are made by our body.
- But 8 must be EATEN to ensure all 20 amino acids are available to build the protein – these 8 are the essential amino acids
Protein Shape

Proteins are long chains of amino acids, sometimes a few thousand amino acids long. The functional groups (R) of amino acids either ATTRACT or REPEL one another. This causes the polypeptide shape to take on one of two types of structures:

- **GLOBULAR** – globe-like, rounded in shape
  - wrap into coils
  - often soluble in aqueous solutions
  - ex. Haemoglobin, found in red blood cells

- **FIBROUS** – fibres
  - folded into sheets
  - long, filamentous structure
  - usually insoluble
  - ex. Collagen, found in hair, Keratin, found in skin

SHAPE DETERMINES FUNCTION

Some proteins work like a LOCK and KEY

If the SHAPE of the key is CHANGED, the key (PROTEIN) will not work properly.
PROTEIN FUNCTION

1. ENZYMES: these proteins speed up chemical reactions by acting as CATALYSYS
   - almost every chemical reaction in your body is sped up with the help of these protein catalysts

2. TRANSPORTERS: these proteins help transport materials throughout the body
   - ex. Protein HORMONES: chemical messengers like INSULIN
     Haemoglobin: protein in RBC, contains IRON
     -helps blood carry OXYGEN and CARBON DIOXIDE gases

NOTE – Enzymes and Transporter proteins are usually GLOBULAR proteins

3. SUPPORT CELL and BODY STRUCTURES
   ex. Collagen: this FIBROUS protein gives strength to bones, cartilage and tendons
   - muscle is mostly made of fibrous proteins

4. ENERGY SOURCE
   In emergency situations, ex. starvation, muscle can be broken down and turned into glucose by the liver to provide the body with energy.

PROTEIN SYNTHESIS

Cells make proteins by combining the 20 different amino acids together in the PROPER ORDER according to the instructions found in the genetic code – (the DNA in the nucleus).

This process is done by the RIBOSOMES.

Note: We will do an example of protein synthesis following the note on nucleic acids.
DENATURATION OF PROTEINS

DENATURATION: the change in the 3-D shape of a protein caused by environmental factors

If peptide bonds are weakened, a denatured protein can return to normal once conditions return to normal. However, once the peptide bonds are broken, the protein can no longer function properly. It is useless.

Environmental factors: these can cause denaturation

- high temperatures (ex. fever, > 40 °C)
- acidic or basic changes (slight changes in pH)
- very salty (or sugary) conditions

Problems associated with denaturation:

High fevers (> 40 °C) may cause many CRITICAL BRAIN ENZYMES to become denatured. This could lead to seizures and worse, death.

BENEFITS:

- Curing meats: lots of salts and other spices used
- Pickling: salt and vinegar (low pH)

These chemicals denature proteins found in bacteria, the main cause of food spoilage. By destroying the bacteria, the food can last longer.

- Blanching: placing food in boiling water for a few seconds should kill any enzymes responsible for the BROWNING of fruits and vegetables

- Cooking meats (and other foods):

The heat breaks down most of the FIBROUS protein in meat making it easier to ingest and digest.

ASSIGNMENT: UNDERSTANDING CONCEPTS

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