PROTEINS

- Proteins are found in every cell and are vital to its function and have their own specific purpose
- Proteins are polymers built from smaller amino acids.

FUNCTIONS OF PROTEINS

- • Building new tissue and maintaining existing tissues.
- • Enzymes (biological catalysts)
- • Hormones – regulate body functions.
- • Neurotransmitters
- • Haemoglobin – transport of oxygen
- • Antibodies – defences against foreign substances
- • Biological buffers – act as an acid or base

AMINO ACIDS

- There are 20 amino acids in the human body. 9 are essential
- Every amino acid consists of a carboxy group (COOH) and a an amino group (NH_2)
- The list of the 20 amino acids are on page 189-190. (Will be handy to remember these)
- The general formula for amino acids is:

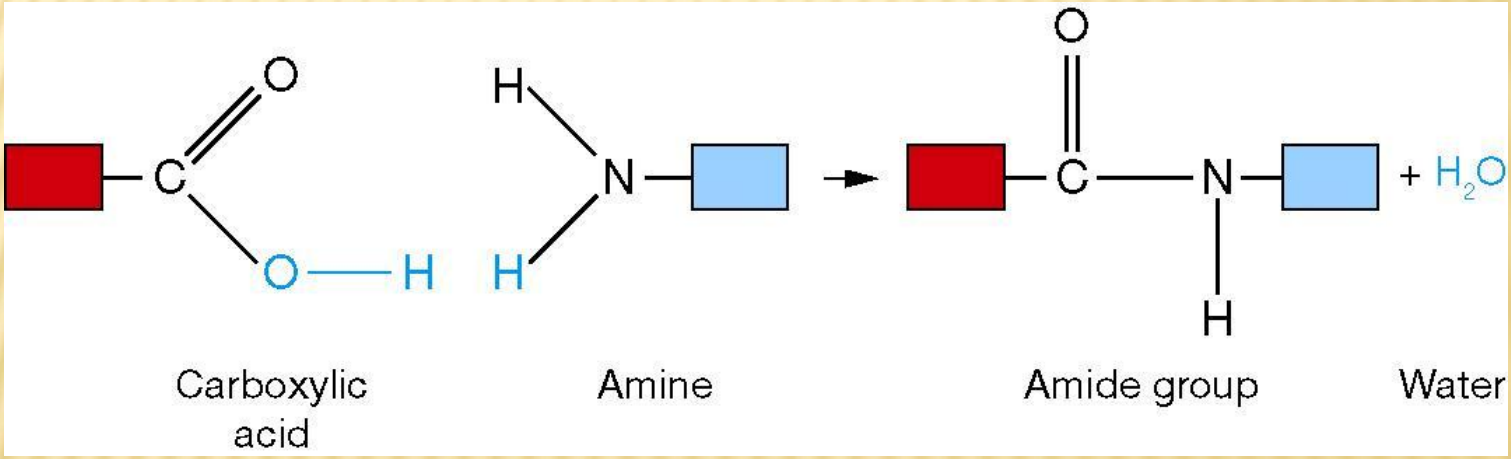
$$H_2N\text{-}CHZ\text{-}COOH$$

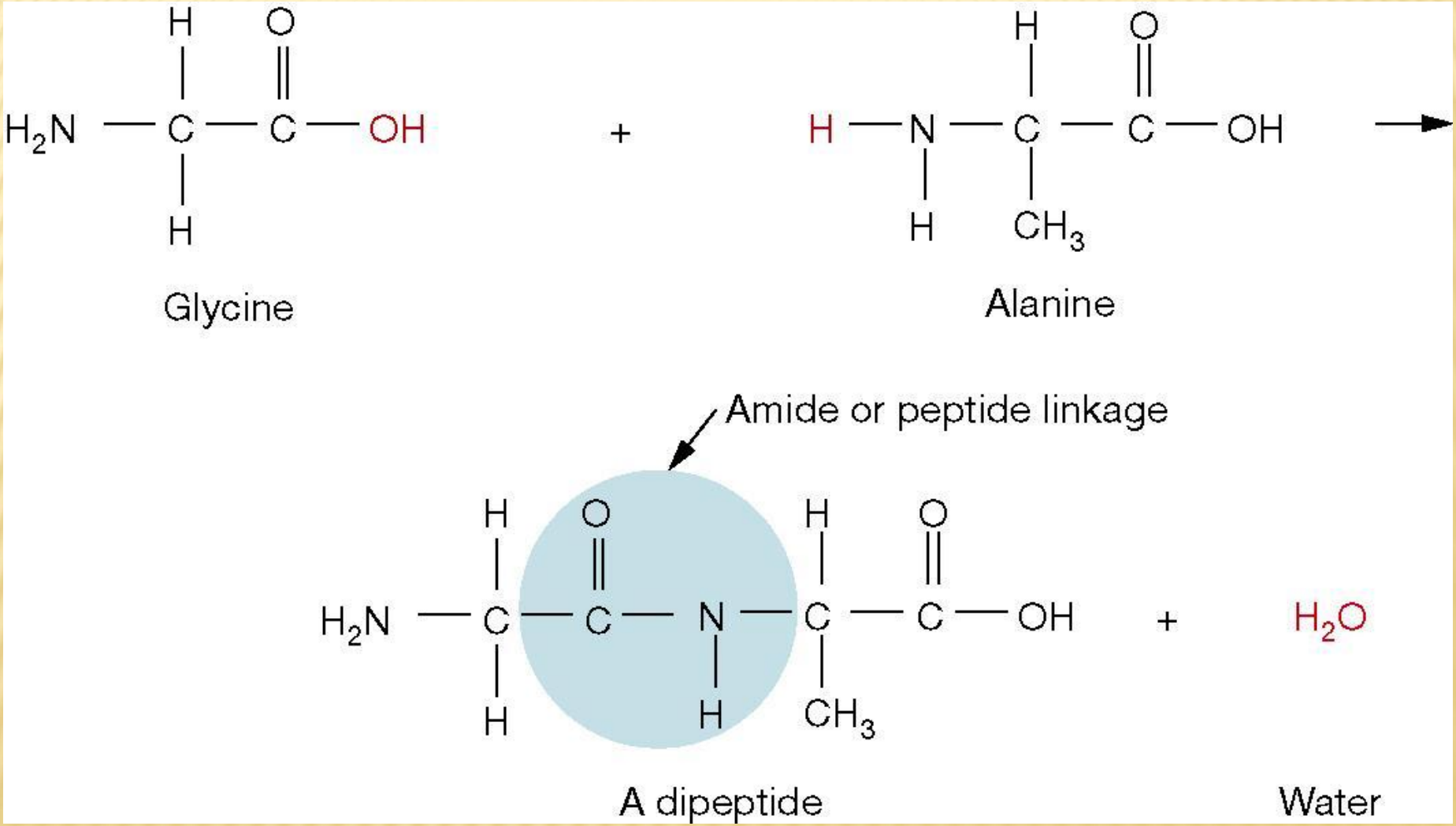
- What makes amino acids different from each other is the **Z** group. This is the side chain on the molecule
- Draw the structure of the 2-amino acids or the alpha-amino acids
- Why do you think amino acids are soluble in water?

- When an amino acid is placed in water the amino group can act as base and the carboxy group as an acid
- This type of molecule is called a **zwitterion** or **dipolar ion**

PROTEIN STRUCTURE

- When a carboxy group combines with an amine group a condensation reaction occurs to form an amide functional group –CONH-




Glycine
Alanine
Amide or peptide linkage
A dipeptide
Water

- When the protein polymers are formed, the amino acids join to form long unbranched chains.
- When two amino acid molecules react together a dipeptide is formed, when three react together a tripeptide if formed.
- A polypeptide is a polymer made up of amino acids
- The role that the protein plays in the body is dependent on the shape of the protein.

STRUCTURE OF A PROTEIN

- Primary structure
- Secondary structure
- Tertiary structure

From the text in your own words summarize table 12.9 on page 193

Then complete

Task: Worksheet 19 SWB page 80.

DIGESTION OF PROTEINS

- Starts in the stomach and is completed in the small intestine.
- Enzymes, which are proteins, catalyse the hydrolysis reaction to form dipeptides and then amino acids.
- The enzymes in the stomach have a preferred acidic pH.
- The amino acids are then absorbed into the bloodstream.
- The body cannot store proteins so a balanced diet of proteins each day is required.
- Unused protein is broken down in the liver and the unwanted N atoms eliminated as urea in urine.
- Amino acid → glucose/fat + ammonia(toxic) → urea (soluble and low toxic)

ENZYMES – BIOLOGICAL CATALYSTS

- Enzymes are specialist proteins that act as catalysts for reactions in living systems.
- Enzymes are specific for a particular reaction and are denatured by heat or a change in pH.
- Enzymes speed up reactions. They control the manufacture of complex substances, such as skin and blood, as well as the breakdown of chemicals to provide energy.

- Compared to inorganic catalysts:
- Enzymes produce faster reaction rates.
- They operate under milder conditions.
- Enzymes are more sensitive.
- Enzymes are more selective.
- They need an active site and often have cofactors which assist in the reaction.
- A reactant molecule is called the substrate.

- Selectivity of enzymes is its most important feature. This selectivity arises because the shape and functional groups in the active site of the enzyme allow it to bind only this certain substances. This is described as the 'lock and key'.
- Possible types of bonds that can form between active site and substrate are:
- -ion – dipole (Zn^{2+} and O=C)
- - hydrogen bonds (N-H and O = C)
- - ionic interactions (O^- and NH_3)
- - dispersion forces and dipole-dipole

- Denaturation is a change that destroys the biological activity of a protein. Could be due to increased temperature, change in pH or the addition of various chemicals.
- Optimum temperature is 40^{o}C and pH is dependent on which enzyme it is.
- Coagulation is the clumps of denatured proteins that can form.

Complete worksheet 20 from your student workbook

- Diseased or injured tissues produce specific proteins that can be used in diagnosis. A cell that is diseased or injured may release specific proteins that are unique to the organ.
- Modern analytical techniques are used to identify protein markers. These include mass spectrometry, infrared and NMR spectroscopy and advanced chromatographic techniques, as well as 2D electrophoresis.

- Electrophoresis is the movement of electrically charged particles under the influence of an electric field.
- Heart attack: When the heart is damaged troponin, creatine phosphokinase and lactate dehydrogenase, specific cardiac enzymes, are released.
- Prostate cancer: Treatment may include surgery, chemo and radiation therapy.
- **Complete worksheet 22**