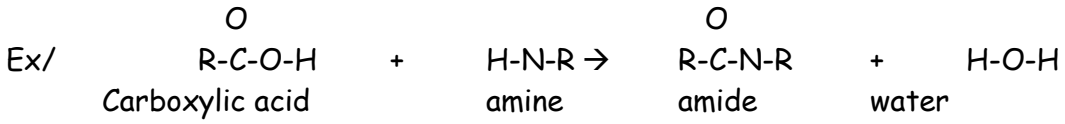
Proteins

Proteins

- The genetic information in DNA codes for the production of different types of proteins
- Enzymes make reactions proceed much faster
- Structural proteins are found in bones and cartilage
- Transport proteins carry substances across the cells membrane
- Hormones signal for changes in cellular activities
- Immunoglobulins fight foreign invasion
- All of these proteins are made from combinations of only 20 amino acids (8 of which are essential and cannot be synthesized so must be eaten)
- See Fig.29 p.42-43
- An amino acid is made from an amino group, a carboxyl group, a hydrogen and one or more atoms called a side chain (R group) in which all parts are covalently bonded to the same C atom (see Fig.28 on p.41)

- At the heart of all amino acids is an amide linkage (see Fig.30 p.43)
- An amide linkage occurs when a carboxylic acid reacts with an amine



- Amino acids become linked by peptide bonds through a process called protein synthesis
- A polypeptide chain is formed when three or more amino acids are joined
- The sequence of amino acids is unique for each protein and represents the protein's primary structure

The 3-D Nature of Proteins

- Fibrous proteins have polypeptide chains organized in strands or sheets (important to the shape, internal organization and movement of cells)
- Globular proteins (most enzymes) have their chains folded into compact, rounded shapes
- The amino acid sequence determines if a protein will fold, coil, or remain stretched out

Structural Proteins

- Primary structure is the unique sequence of amino acids in a polypeptide chain (see Fig. 31a on p.44)
- There are an infinite number of polypeptides that can be produced from 20 amino acids
- Secondary structure is the coiling and folds in a polypeptide cause by hydrogen bonds between atoms near the peptide bonds (see Fig.31b)
- The tertiary structure are formed by interactions among the R groups (see Fig.31c)

Functional Proteins

- The quaternary structure are formed by incorporating two or more polypeptide chains (see Fig.31d)

- Denaturation occurs when molecules lose their 3-D shape following the disruption of weak bonds
- the protein may uncoil or assume a new shape
- once the physical or chemical factor is removed, the protein may assume its original shape
- when the change in protein shape is permanent, coagulation is said to have occurred

- This can be caused by changes in temperature, pH, ionic concentration or other environmental factors

Nucleic Acids

- Nucleic acids store hereditary information that determines the structure and function of living things
- These instructions are encoded in a coiled chain of deoxyribonucleic acid (DNA)
- Ribonucleic acid (RNA) reads the DNA and transports the instructions for making protein to the ribosomes in the cell
- Both DNA and RNA are nucleotide polymers that consist of a 5 carbon sugar (ribose or deoxyribose), a phosphate group, and a nitrogenous base (see Fig. 42a on p.53)
- There are five nitrogenous bases: adenine (A), and guanine (G) are double-ring purines, while cytosine (C), thymine (T), and uracil (U) are single-ring pyrimidines (see Fig.42c)
- DNA contains A,T,G and C, while RNA contains A,G,U, and C
- DNA is a double stranded molecule (running antiparallel to one another) held together by hydrogen bonds
- Adenosine triphosphate (ATP) is a nucleotide used to deliver energy from one reaction site to any other reaction site
- Other important molecules include NAD^+ and FAD (used to make ATP), $NADP^+$ (used in photosynthesis), and cAMP (used as a messenger in hormone interactions)