BODY BUILDERS

Protein accounts for about 80 per cent of the dry mass of all the soft parts of an animal body (i.e. excluding the skeleton). Plants contain a lower proportion.
Proteins are derived from amino acids joined together by peptide bonds.
The name protein is given to naturally occurring polypeptides containing more than about 40 amino-acid residues (the term 'residue' is used for an a-amino acid which has lost the elements of water in forming a peptide bond). The number of potentially different proteins is virtually infinite: 20 a-amino-acids are used in their formation, and they can, in theory, be linked in any possible permutations of sequences and total number.
Living organisms need to synthesise new protein continuously, partly to support growth and partly to replace proteins which are broken down during the process of living. In contrast to plants and bacteria, animals must obtain their amino acids from proteins in their diet. The proteins are first hydrolysed to their constituent amino acids, in processes catalysed by enzymes in the stomach and in the intestine. The constituent amino acids pass into the blood stream and then to the liver and other tissues where, under the influence of nucleic acids, they are converted into the proteins required by the body. Of the 20 amino acids that constitute naturally occurring proteins, 12 can be synthesised in the human body from other amino acids. However, eight are described as essential amino acids; their residues must be present in the diet since they cannot be synthesised in the human body.
Each protein is defined by the number and nature of its constituent amino-acid residues and the sequence in which these are arranged.
Folded proteins can be assigned to one of two groups, the fibrous proteins and the globular proteins. Fibrous proteins are usually insoluble in water and form important structural features. Examples are keratin (in hair and feathers) and collagen, the material which makes up tendons, ligaments and connective tissue.
Globular proteins are mostly soluble in water. Enzymes are a particularly important group of globular proteins. They are the catalysts which enable living organisms to bring about necessary reactions at body temperature.
Since the forces that determine the shape of a protein are relatively weak, the shape can readily be disrupted, and this is known as denaturation. Denaturation can usually be reversed.

(from: Norman-Waddington, *Modern Organic Chemistry*, Bell & Hyman)

1 *Answer these questions about* Body builders.

a. Do animals and plants contain the same proportion of proteins?
b. What are proteins?
c. How many amino acids are proteins derived from?
d. Why do living organisms need to synthesize proteins?
e. How do animals get their amino acids?
f. What is meant by 'essential amino acids'?
g. Can you name some fibrous proteins and say where they are found?
h. What are enzymes and what is their task?
i. What is meant by 'protein denaturation'?

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2 *Which of these verbs can replace the phrasal verbs below as they are used in* Body builders: enter, explain, form, produce? *Tip: copy the pairs in your indexed book.*

a. account for .....
b. bring about .....
c. make up .....
d. pass into .....

3 *Match past participles* a-f, *as they are used in* Body builders, *with their synonyms* 1-6. *Tip: copy the pairs in your indexed book.*

a. derived from	☐	**1.** defined
b. broken down	☐	**2.** developed out of
c. converted into	☐	**3.** disrupted
d. required by	☐	**4.** divided into
e. described as	☐	**5.** necessary to
f. assigned to	☐	**6.** transformed into

4 *Use the nouns below to complete the passage* Proteins in the diet.

adult, amino acids, animal, antibodies, carbohydrates, child, children, cultures, deficiencies, diet, enzymes, haemoglobin, insulin, machinery, plant, protein, sources, strength

We need protein in our food because it constitutes the basic (1) ..... of all life. Take away the water in our bodies, and most of what is left in our muscles, organs, blood cells, skins, nail, hair, teeth and bones is (2) ..... The (3) ..... that build up and break down other molecules, disease-fighting (4) ....., oxygen-carrying (5) ....., certain hormones like (6) .....: all these chemicals are proteins. They are continually being used up or worn away, and protein from our (7) ..... is used to replace them, or, in growing (8) ....., to build them up. Like fats and (9) ....., proteins can be burned for energy. Twenty (10) ..... go to make up all human proteins, of these the (11) ..... needs a dietary supply of 8, the growing (12) ..... 9 or 10. All (13) ..... foods are complete protein (14) ..... (15) ..... proteins are generally incomplete but they are often complementary, that is, the (16) ..... of one food are counterbalanced by the (17) ..... of another. Long before the world knew anything about amino acids, many (18) ..... have adjusted their diets to take advantage of protein complementarity.

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