Proteins

2.4.U1 Amino acids are linked together by condensation to form polypeptides. AND

2.4.S1 Drawing molecular diagrams to show the formation of a peptide bond.

1. Condensation of amino acids is a polymerisation reaction. A chain of amino acids joined together is called a polypeptide. These building reactions are part of the anabolic metabolism.  
   1. What structure mediates and controls the formation of polypeptides?
   2. Apart from the above structure what else is needed for the reaction to occur?
   3. Draw and annotate a structural diagram below to outline how two generalised amino acids (i.e. use the R-group nomenclature) into a dipeptide through condensation, producing a peptide bond.

2.4.U2 There are 20 different amino acids in polypeptides synthesized on ribosomes.

1. How many different amino acids do we know of?
2. How many of these amino acids are synthesised by ribosomes?
3. List three examples of amino acids synthesised by ribosomes.



1. **Extension:** Outline the process by which the remaining amino acids are created.

2.4.U3 Amino acids can be linked together in any sequence giving a huge range of possible polypeptides.

1. State the three key ideas that explain the huge range of possible polypeptides:



1. If a polypeptide contains just 5 amino acids calculate the how many different polypeptides can be created.

1. State both the name of the longest polypeptide known and approximately how many amino acids it contains.

2.4.U4 The amino acid sequence of polypeptides is coded for by genes.

1. Outline the central dogma of genetics.

2.4.U6 The amino acid sequence determines the three-dimensional conformation of a protein.

2.4.U5 A protein may consist of a single polypeptide or more than one polypeptide linked together**.**

1. The R-groups of an amino acid are classified as having one of a number of different properties. List the properties can they possess.



*n.b. the below question is helpful to SL students for a more complete understanding, but is required knowledge for HL students as it covers 7.3.U7 to 7.3.U10*

1. Extension: complete the table to outline the four different levels of protein structure. *(n.b. although you don’t need to be able to outline the different levels of structure knowing of them helps to understand the different functions proteins have and why)*

|  |  |  |
| --- | --- | --- |
|  | **Notes** | **Fibrous or Globular** |
| **Primary (polypeptide)** | * *The order / sequence of the amino acids of which the protein is composed* * *Formed by covalent peptide bonds between adjacent amino acids* * *Controls all subsequent levels of structure* | *Neither (– will fold to become one of the subsequent levels of structure)* |
| **Secondary** |  |  |
| **Tertiary** |  |  |
| **Quaternary** |  |  |

1. Distinguish between globular and fibrous proteins

|  |  |  |
| --- | --- | --- |
|  | **Fibrous** | **Globular** |
| **Location of R groups** |  |  |
| **Shape** |  |  |
| **Function** |  |  |
| **Solubility** |  |  |
| **Amino acid sequence** |  |  |
| **Stability** |  |  |
| **Examples** |  |  |

2.4.U7 Living organisms synthesize many different proteins with a wide range of functions.

1. Complete the table to describe each of different functions that proteins have in and outside of cells.

|  |  |  |
| --- | --- | --- |
| **Function** | **Description** | **Key examples** |
|  |  | Rubisco |
| Muscle contraction |  |  |
|  | Tubulin is the subunit of microtubules that give animals cells their shape and pull on chromosomes during mitosis. |  |
|  |  | collagen |
| Blood clotting |  |  |
|  | Proteins in blood help transport oxygen, carbon dioxide, iron and lipids. |  |
| Cell adhesion |  |  |
| Membrane transport |  |  |
|  |  | Insulin |
| Receptors |  | rhodopsin |
| Packing of DNA |  |  |
|  | This is the most diverse group of proteins, as cells can make huge numbers of different antibodies. | immunoglobulins |

2.4.A1 Rubisco, insulin, immunoglobulins, rhodopsin, collagen and spider silk as examples of the range of protein functions.

1. Take notes to outline each of the key examples of protein function.

|  |  |
| --- | --- |
| Rubisco: |  |
| Insulin: |  |
| Immunoglobulin: |  |
| Rhodopsin: |  |

|  |  |
| --- | --- |
| Collagen: |  |
| Spider silk: |  |

2.4.U8 Every individual has a unique proteome.

1. The proteome is unique to every individual.
   1. Define the term genome.

* 1. Define the term proteome.
  2. Aside from the genome what affects the proteome?
  3. Explain why the proteome is larger and more varied that the genome.

2.4.A2 Denaturation of proteins by heat or by deviation of pH from the optimum.

1. Describe the term denaturation. Refer to the structure of the protein in your answer.
2. What factors can commonly cause denaturation and how?