# Module 2- Macromolecules of the cell

## For each of the six biological polymers listed, indicate which of the properties apply. Each polymer has multiple properties, and a given property may be used more than once.

Polymers:

(a)  Cellulose

(b)  Messenger RNA

(c)  Globular protein

(d)  Amylopectin

(e)  DNA

(f)  Fibrous protein

Properties  
1. Branched-chain polymer  
2. Extracellular location  
3. Glycosidic bonds  
4. Informational macromolecule

5. Peptide bond  
6. beta linkage  
7. Phosphodiester bridge  
8. Nucleoside triphosphates  
9. Helical structure possible

10. Synthesis requires a template.

A: 2-3-6

B: 4-7-9-10

C: 4-5-9-10

D: 1-3-9

E: 4-7-9-10

F: 4-5-9-10

## Protein Bonds

|  |  |  |
| --- | --- | --- |
| **Bond** | **Amino Acids** | **Levels of Structure** |
| Peptide | All | Primary |
| Hydrogen | All | Secondary |
| Disulfide (covalent) | Cysteine | Tertiary |
| Hydrogen | All | Secondary |
| Hydrophobic | Leucine | Tertiary, Quaternary |
| Ionic | Glutamate | Tertiary, Quaternary |

## Features of Nucleic Acids

For each of the following features of nucleic acids, indicate whether it is true of DNA only (D), of RNA only (R), of both DNA and RNA (DR), or of neither (N).

(a)  Contains the base uracil. R

(b)  Contains the nucleotide deoxythymidine monophosphate. N

(c)  Is usually double-stranded. D

(d)  Is a polymer. DR

(e)  Contains a phosphate group. DR

(f)  Is an inherently directional molecule, with an N-terminus on one end and a C-terminus on the other end. N

## Wrong Again. For each of the following false statements, change the statement to make it true, and explain why it is false as written:

(a) Nucleic acids are polymers consisting of chemically ~~identical~~ repeating nucleotide monomers.

(b)  A protein may have an alpha helical secondary structure. An alpha helix is spiral in shape and stabilized by covalent bonds between the NH group and the CO group in the adjacent polypeptide backbone.

(c)  Whereas a protein can be denatured by high-temperature treatment, extremes of pH both of which disrupt ~~generally have no effect on~~ tertiary structure.

(d)  Nucleic acids are synthesized from monomers that contain a high. Energy phosphodiester bond. They are already activated and do not require carrier molecule.

~~are activated by linking them to a carrier molecule in an energy-requiring reaction.~~

(e)  The disaccharide sucrose comprises two monosaccharide ~~glucose~~ monomers covalently linked together.

(f)  A beta-pleated sheet is an extended sheet-like conformation with the R groups of successive amino acids jutting out on the alternating ~~same~~ side of the sheet.

(g)  It is not easy to predict the final folded structure of a protein from its amino acid sequence using today’s powerful supercomputers.

## Telling Them Apart. For each of the following pairs of molecules, specify a property that would distinguish between them, and indicate two different tests that could be used to make that distinction:

(a)  The protein insulin and the DNA in the gene that encodes insulin

Phosphodiester bonds in DNA but not in protein.

(b)  The DNA that encodes insulin and the messenger RNA for insulin

Presence of purine thymine or pentose deoxyribose in DNA but not in RNA.

(c)  Starch and cellulose

Starch repeating unit: alpha-D glucose Cellulose repeating unit: beta-D glucose.

Use the enzyme amylase that can digest alpha (1-4) but not beta (1-4).

(d)  Amylose and amylopectin

Starch occurs in branched amylose alpha (1-6) glycosidic bonds or unbranched amylopectin alpha(1-4) glycosidic bonds.

(e)  The monomeric protein myoglobin and the tetrameric protein hemoglobin

Presence of 4 subunits in hemoglobin but not in myoglobin.

(f)  A triacylglycerol and a phospholipid with a very similar fatty acid content

Presence of glycerol but absence of phosphorus in triacylglycerol.

(g)  A glycolipid and a sphingolipid

Carbohydrate group (glycolipid) instead of phosphate group. (sphingolipid).

(h)  A bacterial cell wall polysaccharide and chitin