

# Carbohydrates and lipids · supported focus

International Baccalaureate · IB Diploma · Biology · SL

## Scope and prerequisites

Supported SL focus. First assessment 2025; current subject brief acquired; full Biology guide not acquired. Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

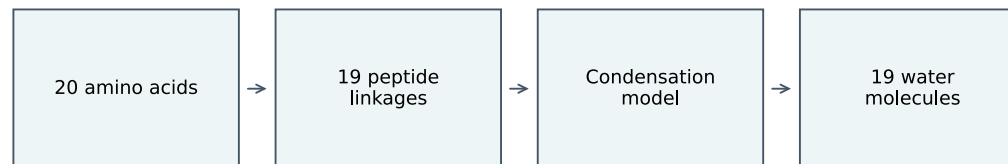
## Biomolecule structure: bonds, polarity and function

### ■ What would explain this observation?

- Starch, a triglyceride and a protein can all contain carbon, hydrogen and oxygen, yet their structures and functions differ. An element list alone does not identify a biomolecule.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

### ■ Build the model

- Carbohydrates include monosaccharides and polymers joined by glycosidic bonds. A triglyceride has glycerol joined to three fatty acids by ester bonds. Proteins contain amino-acid residues joined by **peptide bonds**; side chains and folding contribute to their properties. These structures support storage, membrane or functional roles depending on the molecule.
- peptide bond : A covalent linkage between amino-acid residues; **hydrolysis** : Breaking a linkage using water.



### ■ Choose evidence that can test it

- Condensation forms a linkage with a small molecule such as water released in the simplified model; hydrolysis uses water to break such a linkage. Polymer sequence, branching, polarity and three-dimensional shape matter. Saturated fatty acids have no carbon-carbon double bond, while unsaturated fatty acids have at least one; this difference can influence packing under stated conditions.
- Use labelled molecular models and identify the actual linkage rather than memorizing shapes alone. Compare an attributed structure with the proposed function, mark polar and non-polar regions where justified, and distinguish a monomer from a residue within a polymer. Food tests provide evidence of chemical groups under specific conditions, not complete molecular structures.

### ■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: a single unbranched peptide formed from 20 amino acids contains 19 peptide linkages. In a simplified condensation accounting model, forming these links releases 19 water molecules. A triglyceride formed from one glycerol and three fatty acids has three ester linkages and releases three waters in the corresponding model. These are linkage counts, not complete pathways in living cells.

### Example:

A single unbranched peptide contains 35 amino-acid residues. How many peptide bonds join them? Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

### ■ Check the conclusion and its limits

- Not every protein is an enzyme, and not every catalyst is a protein. Lipids are not all polymers of repeating monomers. A protein can lose function when its folding changes without every peptide bond being broken.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

### **Warn:**

Every protein is an enzyme and every lipid is a repeating-monomer polymer. This claim is false: Not every protein is an enzyme, and not every catalyst is a protein. Lipids are not all polymers of repeating monomers. A protein can lose function when its folding changes without every peptide bond being broken.

### **Key:**

Biomolecule structure: bonds, polarity and function: Condensation forms a linkage with a small molecule such as water released in the simplified model; hydrolysis uses water to break such a linkage. Polymer sequence, branching, polarity and three-dimensional shape matter. Saturated fatty acids have no carbon-carbon double bond, while unsaturated fatty acids have at least one; this difference can influence packing under stated conditions.