

Molecular Visualisation

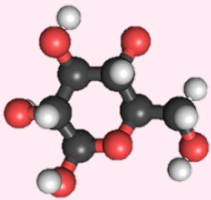
Introduction

Organic compounds are molecules that contain carbon and are produced by living organisms (with some exceptions). The four main types of organic molecules found in every cell are carbohydrates (sugars), lipids, proteins and nucleic acids.

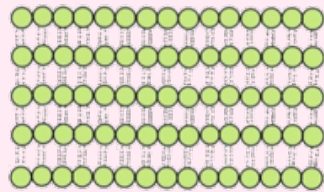
Molecular visualisation programs use computer software to construct 3-dimensional images of a wide variety of biomacromolecules. These programs can be used to explore and understand how the structure of different organic molecules relate to their biological properties.

Main Organic Compounds

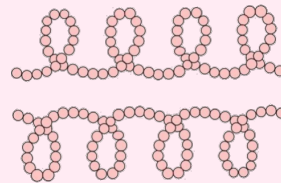
Carbohydrates



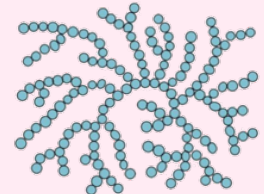
Glucose



Cellulose

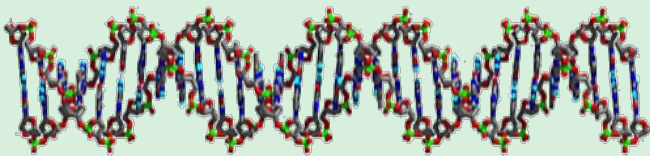


Amylose



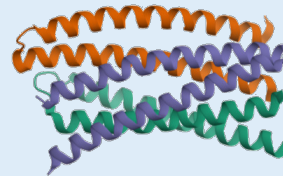
Glycogen

Nucleic Acids

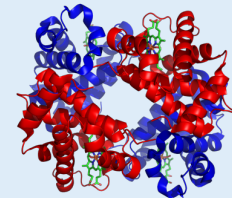


DNA (Double Helix)

Proteins

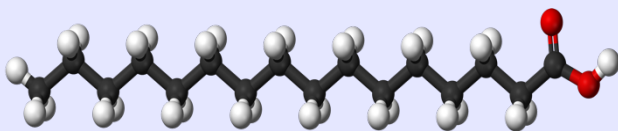


Fibrous

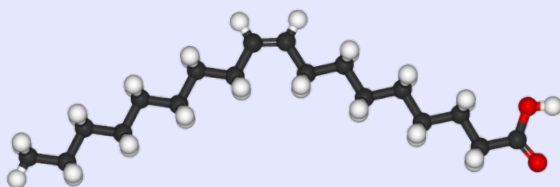


Globular

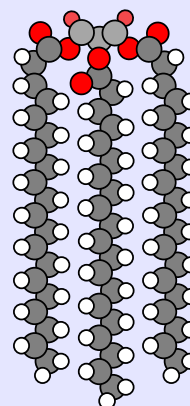
Lipids



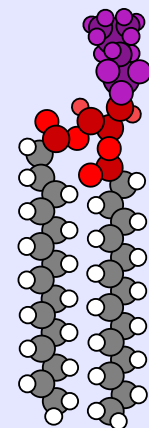
Saturated Fatty Acid



Unsaturated Fatty Acid



Triglyceride



Phospholipid

Materials

Go to the BioNinja site and access the Molecular Visualisation page (Course → Practical Work):

- Link: <https://ib.bioninja.com.au/Molecular-Visualisation.html>

Methodology

- Click on each of the links to a biomolecule file – this will load the file in the Jmol applet
- To manipulate the molecule, move the cursor over the molecule and press: *control + click*
 - To change the model format (wireframe, ball and stick, etc.) select: *Style → Scheme*
 - To show hydrogen bonds, select: *Style → Hydrogen Bonds → On*
 - To create a surface rendering, select: *Surface → Molecular Surface*
 - To colour certain components, select: *Colour → By Scheme → Choose a component*

PART 1: Carbohydrates

Compare the polymers of glucose: cellulose, glycogen and starch (amylose *and* amylopectin).

1. Outline the difference in structure between cellulose and glycogen (or amylopectin)

2. Suggest how the structures of cellulose and glycogen support their respective functions in cells

PART 2: Lipids

Compare the structures of a saturated, mono-unsaturated and poly-unsaturated fatty acid.

3. Outline the differences between the fatty acids and explain how this would affect melting point

4. Describe the prevalence of the different fatty acids in oils (plants) and fats (endotherms)

5. Outline how a phospholipid differs from a triglyceride and relate this to its role in membranes

PART 3: Proteins

Compare the different types of amino acids, as well as a protein with one versus multiple chains.

6. Explain how the sequence order of amino acids (primary structure) determines protein shape

PART 4: Nucleic Acids

Compare the structures of a nucleotide, polynucleotide chain (DNA) and adenosine triphosphate.

7. Describe how DNA nucleotides are combined and arranged to form a double helix structure

8. Outline how ATP differs from a nucleotide and relate this to its function as an energy molecule