

## **Table of Contents**

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## The Cell

- Eukaryotic – eukarya
- Prokaryotic – archaea and bacteria

<b>Nucleolus</b>	Makes ribosomal components
<b>Ribosome</b>	<ul style="list-style-type: none"> <li>• Made of protein and rRNA</li> <li>• Synthesise proteins from amino acids               <ul style="list-style-type: none"> <li>❖ <u>Bound</u> <ul style="list-style-type: none"> <li>○ Associated with RER</li> <li>○ Makes proteins for export (membrane) &amp; organelles</li> </ul> </li> <li>❖ <u>Free</u> <ul style="list-style-type: none"> <li>○ Float in cytosol</li> <li>○ Make cytosolic proteins</li> </ul> </li> </ul> </li> </ul>
<b>Endomembrane system</b>	<p>Nuclear envelope → rough ER —vesicles→ golgi → membrane</p> <p><b>Smooth ER</b></p> <ul style="list-style-type: none"> <li>• Diverse functions</li> <li>• <u>Examples</u> – lipid synthesis</li> </ul> <p><b>Rough ER</b></p> <ul style="list-style-type: none"> <li>• Makes and modifies proteins</li> <li>• Packaged in vesicles</li> </ul> <p><b>Golgi</b></p> <ul style="list-style-type: none"> <li>• Layers of flattened, membranous sacs (phospholipid bilayer)</li> <li>• Process               <ul style="list-style-type: none"> <li>❖ <i>Cis</i> face – exocytosis; vesicle fuses with membrane</li> <li>❖ Enzymes modify proteins</li> <li>❖ <i>Trans</i> face – endocytosis; vesicle buds from membrane</li> </ul> </li> </ul> <p><b>Vesicles</b></p> <p>Lysosome – digestive enzymes hydrolyse molecules</p>
<b>Cytoskeleton</b>	<p>Protein based fibres</p> <p><b>1) Microfilaments (7-8nm)</b></p> <ul style="list-style-type: none"> <li>• Movement – cytoplasmic streaming, contraction of muscles</li> <li>• Network to maintain shape</li> </ul> <p><b>2) Intermediate filaments (8-12nm)</b></p> <p>Proteins for structural function</p> <p><b>3) Microtubules (25nm)</b></p> <ul style="list-style-type: none"> <li>• Made of tubulin</li> <li>• <u>Function</u> – track for organelle, whole-cell movement (cilia / flagella)</li> </ul>

## Development of Eukaryotes

- 1) Endosymbiosis –prokaryotes living in another cell
- 2) Infolding of prokaryotes plasma membrane

# Building Blocks of Cells

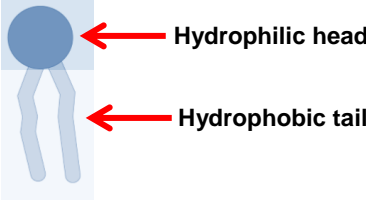
## Carbon Macromolecules

All polymers, except for lipids

### Carbohydrates

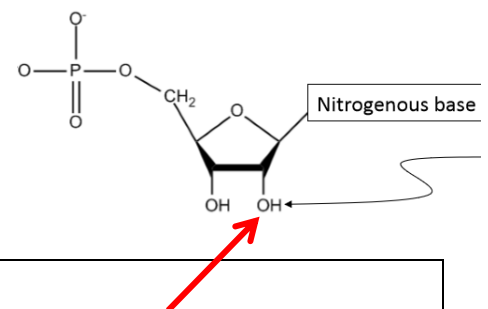
**Glycosidic bond** – covalent bond joining a carbohydrate to another group

### Lipids

<b>Fats</b>	<ul style="list-style-type: none"> <li>1 glycerol covalently bonded to 3 fatty acids</li> <li><b>Oils</b> – fats that are liquid at room temperature</li> </ul>	
<b>Phospholipids</b>	<ul style="list-style-type: none"> <li>Amphipathic</li> <li>Form                             <ul style="list-style-type: none"> <li>❖ Membranes</li> <li>❖ Micelles</li> <li>❖ Vesicles</li> </ul> </li> </ul>	
<b>Steroids</b>	Covalently linked rings	
<b>Waxes</b>	Fatty acids covalently bonded to other groups	

### Nucleic Acids

- Polymers of nucleotides
- Nucleotides
  - ❖ Joined by phosphodiester bond
  - ❖ 5' to 3' orientation
- Complimentary bases H bond



DNA	RNA
<ul style="list-style-type: none"> <li>Pentose is deoxyribose</li> <li>Double-stranded helix</li> <li>Antiparallel strands</li> </ul>	<ul style="list-style-type: none"> <li>Pentose is ribose (extra O)</li> <li>Single stranded</li> <li>Uracil replaces thymine</li> </ul>

## Proteins & Enzymes

### Amino Acids

- 22 AA
- Body synthesis 13
- Always have
  - ❖ Amino group
  - ❖ Carboxylic group

### Proteins

- Polypeptides** – chain of AA joined by peptide bonds
- Protein** – one or more polypeptide chains folded into a 3D globular shape
- Folding
  - ❖ Depends on 1° structure
  - ❖ Assisted by chaperone proteins

## Structure

<b>Primary (1°)</b>	<ul style="list-style-type: none"> <li>AA sequence of polypeptide</li> <li>N to C terminal</li> </ul>
<b>Secondary (2°)</b>	<ul style="list-style-type: none"> <li>H bonds between atoms of the polypeptide backbone</li> <li>Types <ul style="list-style-type: none"> <li>❖ <math>\alpha</math> helices</li> <li>❖ <math>\beta</math> pleated sheets</li> </ul> </li> </ul>
<b>Tertiary (3°)</b>	Interaction between side chains of a polypeptide
<b>Quaternary (4°)</b>	<ul style="list-style-type: none"> <li>Two or more polypeptides coming together to form a protein</li> <li><u>Not</u> required for function</li> </ul>

## Metabolism

**Metabolism** – chemical reactions

- Catabolism – breaking down organic matter to release energy
- Anabolism – using energy to make cellular components

## Enzymes

- Catalytic proteins → lower  $E_a$  → increase rate of reaction
- Active site binds to substrate
- An enzyme is substrate specific
  - ❖ Sidechains
  - ❖ Shape

## Influences on Activity

- Concentration, pH, temperature
- Cofactors – inorganic molecules necessary for catalysis
- Inhibitors
  - ❖ Change active sites shape
  - ❖ Mimic substrate

## Membranes and Communication

### Fluid Mosaic

- Semi-permeable structure containing proteins 'embedded' in a phospholipid bilayer
- Phospholipids
  - ❖ Lateral movement and rotation
  - ❖ Rarely 'flippase'

Saturated		Unsaturated		Cholesterol
<ul style="list-style-type: none"> <li>Straight tails</li> <li>Can pack together</li> </ul>		<ul style="list-style-type: none"> <li>Bent tails</li> <li>Can't pack together</li> </ul>		<ul style="list-style-type: none"> <li>Cold – maintains fluidity</li> <li>Hot – limits fluidity</li> </ul>
