# BIOL1040 Study Guide Sample

**Introduction:** BIOL1040 is perhaps one of the hardest first year subjects due to both the 85% final exam and the amount of content involved. However it is conquerable and these study notes will be of great assistance to attaining that high grade or if you would like to simply pass. These notes are written out module by module for semester 2 so there is plant content but no biochemistry content though everything else is the same. Furthermore these notes are written out in fact form (simple short dot points) as much as possible, instead of an onslaught of sentences and paragraphs, to help make learning content simpler as we tend to remember facts easier than giant paragraphs (i.e. the capital of Australia is Canberra or the largest living mammal on Earth is the blue whale etc). Only critical diagrams and graphs have been included to reduce excessive pages being used up.

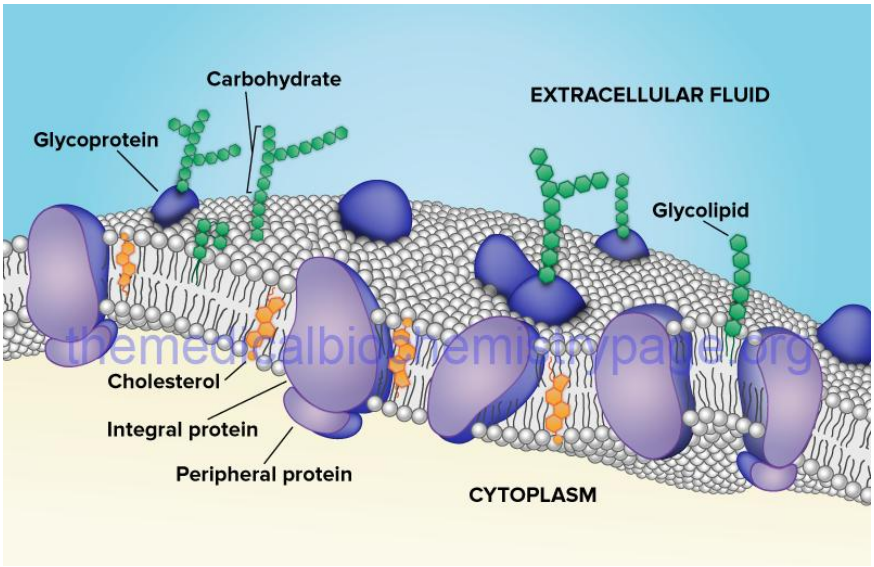
The way these notes are set out is module by module (7 modules in total) with broad concepts or terms underlined and the facts/dot points following. Each module summary also contains a brief introduction as to what this module encompasses. Further to this, these notes are a comprehensive and concise summary of the course and hence everything on these notes is worth understanding and preparing for the EOS exam.

## Module 1 Summary

Module 1 explores the features of the phospholipid bilayer and introduces cell to cell communication (can be difficult to get your around first go but these notes have been carefully written to ensure only critical points are contained).

Cell membrane – fluid mosaic model

- Phospholipids (hydrophilic heads and hydrophobic tails) + “mosaic” of proteins



- Membrane fluidity – saturated = no kinks, decrease in fluidity; unsaturated = kinks, increase in fluidity
- Cholesterol at body temp (37 Celsius) decreases fluidity
- Note: fluidity is opposite of viscosity so an increase in fluidity is a decrease in viscosity and vice versa

Membrane proteins

- include: integral proteins (hydrophobic interior) and peripheral proteins (not embedded in bilayer)
- 6 main functions of proteins: transport, enzyme activity, intercellular joining, cell-cell recognition, attachment to cytoskeleton and signal transduction

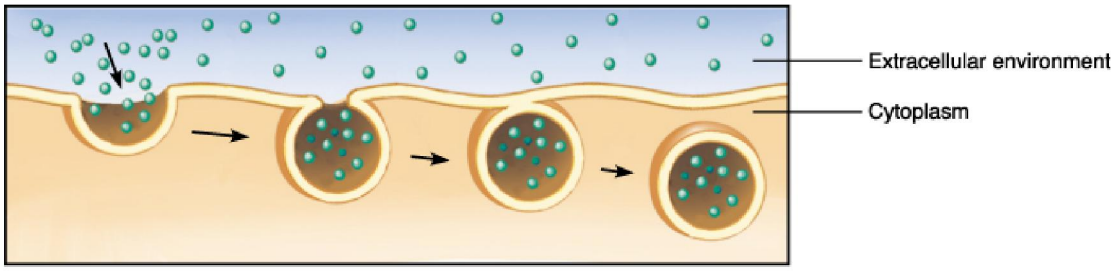
Permeability of phospholipid bilayer

- non polar, small and/or hydrophobic such as $CO_2$, $O_2$ and hydrocarbons
- Glucose and water do not cross easily
- Hydrophilic substances avoid contact with bilayer using transport proteins
- 2 classes of transport proteins: channel proteins (specialised channel proteins for water – aquaporins) and carrier proteins
- Carrier proteins bind to the molecule, changes shape then shuttles across bilayer
- Channel proteins discussed further below
- A concentration gradient occurs when there are separated areas of high and low concentration
- Substances generally diffuse down their concentration gradient meaning diffusing from high to low concentration
- Passive transport – no energy, therefore goes down gradient and includes diffusion and facilitated diffusion (transport proteins)
- Osmosis is movement of water across a selectively permeable membrane
- Hypertonic solution is outside concentration > inside concentration (cell loses water – crenation)
- Hypotonic is opposite of hypertonic (cell gains water – lysing)
- Isotonic is outside concentration = inside concentration
- Active transport means going against the concentration gradient (from low to high concentration)
- Active transport requires ATP and can also utilise carrier proteins
- Cotransport is where 2 substances are transported simulatenously across the membrane by 1 channel protein without ATP

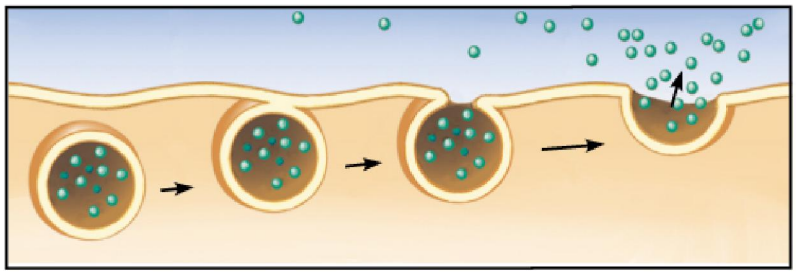
Bulk Transport (big molecules) occurs by 2 main mechanisms

- Exocytosis where the intracellular vesicle moves to plasma membrane and fuses together with the plasma membrane to release the big molecules

- Endocytosis where the cell transports molecules into another cell by engulfing them




(a) Endocytosis



(b) Exocytosis

with the use of ATP

- Phagocytosis and pinocytosis are special examples of endocytosis and are the cell "eating" and "drinking", respectively

Cell signalling

- In both local and long distance signalling, specific target cells that recognise given signalling molecule will respond to it
- Types of signalling include local (paracrine and synaptic – where nerve cells release neurotransmitters into synapse stimulating target cells) and long distance (specialised edoncrine cells secrete hormones into bodily fluids most often blood where hormones reach most body cells)

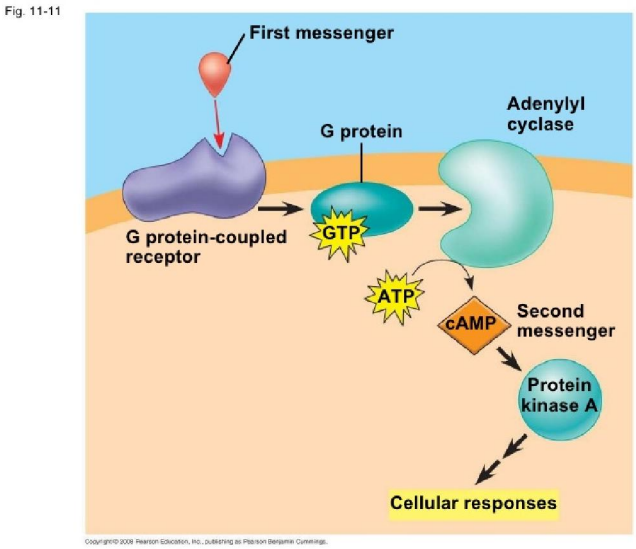
Stages of Cell signalling

- Reception: signalling molecule binds to receptor protein causing it to change shape (also called a conformational change)
- Transduction: cascades of molecular interactions relay signals from receptors to target molecules in the cell
- Response: cell signalling leads to regulation of transcription or cytoplasmic activity

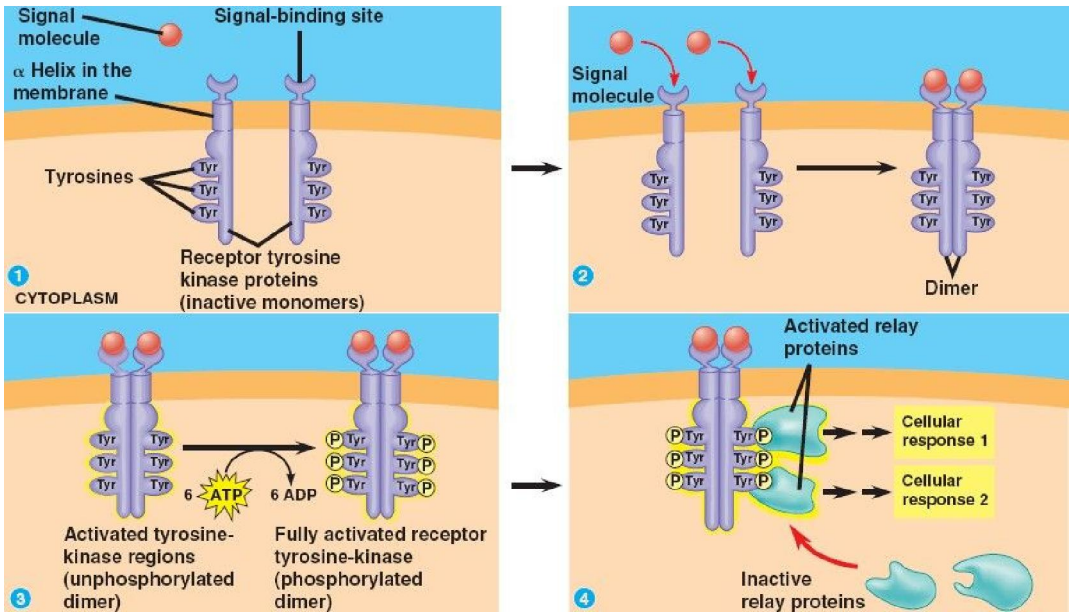
Types of receptors

- G-coupled protein receptors:

- First messenger (ligand) binds to receptor activating specific G-protein with GTP displacing GDP
- G-protein activates adenyle cyclase which catalyses conversion of ATP to cAMP
- cAMP is second messenger that activates phosphorylation cascade then followed by a response such as gene regulation

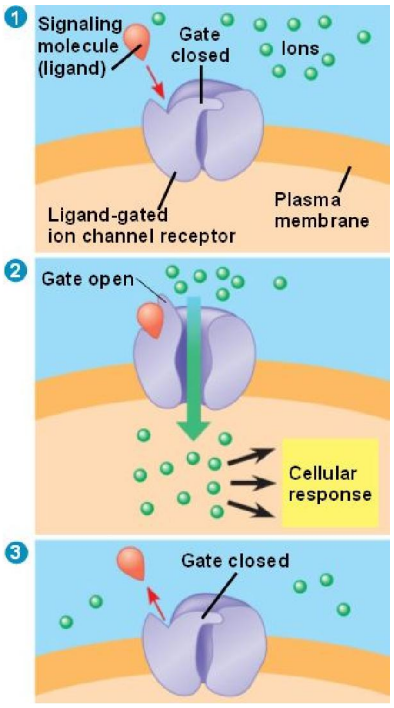



- Tyrosine Kinase receptors:
  - Ligand binds causing 2 receptor monomers to get close to each other (dimer)
  - Dimerisation activates tyrosine kinase region of each monomer, adds phosphate from ATP to molecule to a tyrosine on tail of other monomer
  - When receptor is fully activated, specific relay proteins recognise and bind to specific phosphorylated tyrosine
  - Phosphorylation cascade proceeds leading to the response

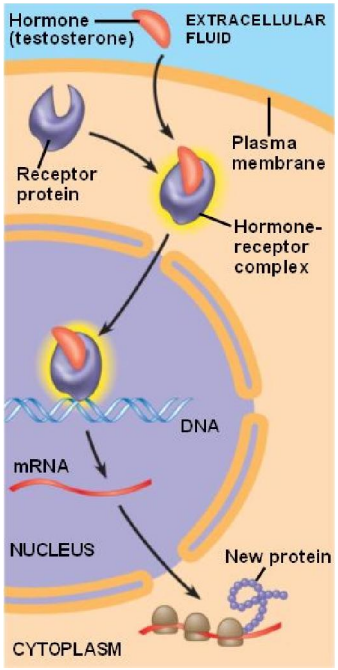



- Ion Channel receptors

- Ligand binds to receptor and gate opens allowing particular ions to flow through channel
- When ligand dissociates from receptor, gate closes




- Intracellular receptors
  - Steroid hormone passes through plasma membrane
  - Hormone binds to receptor protein in cytoplasm activating it
  - Hormone-receptor complex enters nucleus and binds to specific genes
  - This regulates gene transcription



- Signal amplification occurs when some molecules in pathway transmit signal to numerous molecules at next step in a series leading to a large number of activated molecules at end of pathway
- Second messengers
    - Small, non-protein and water soluble
    - Participate in pathways of G-coupled protein receptors and tyrosine kinase receptors
    - Common ones include cAMP and Calcium ions

## Key concepts you need to know for Module 1 EOS Exam

- Membrane fluidity and what factors affect it
- Membrane proteins and their functions
- Transport in cells (passive diffusion, facilitated diffusion and active transport)
- Type of cell receptors and their processes
- Second messengers