SCIE1106 Condensed Summary

Theme 1: Basics

Structure of Eukaryotic & Prokaryotic Cells 1

Criteria that describe living "things".

Can reproduce.
Can respond to stimuli.
Can grow and develop.
Can transform matter and energy.
Display homeostasis = maintain a relatively constant internal environment.
Are highly organised.
Show adaptations to their environment.
Are made up of cells.

Cells are the basic unit of life.

Membrane-enclosed units = separation of cellular contents from the environment.
Contain cytoplasm.

Basic chemistry shared by all cells.

All store their genetic material as DNA.
Same basic genetic mechanisms
- Genetic material is replicated and passed on via cell division.
- Information flow uses the same chemical machinery.

All contain the same 20 amino acids.

Why cells are so similar in chemistry and composition

Same common ancestor (3.5 billion years ago)
3 major divisions = eubacteria, archaea, eukaryotes.

Characteristics of prokaryotic and eukaryotic cells.

Prokaryotes
- Lack a nucleus and intracellular organelles.
- Most diverse group with many growth forms.
- Circular DNA in nucleoid in cytosol.
- Quick reproduction.
- **Use many energy sources**
  - Organotrophic = organic molecules.
  - Lithotrophic = inorganic molecules
  - Phototrophic = light
- **Eubacteria** = common environments.
- **Archaea bacteria** = hostile environments.

Eukaryotes
- Have a nucleus and intracellular organelles.
- Animals, plants, and fungi.

Roles of cellular structures found in prokaryotic and eukaryotic cells.

Cytoplasm and cytosol

- **Cytoplasm** = entire content within the cell membrane excluding the nucleus.
- **Cytosol** = molecules crowded together forming water-based gel.
- **Eukaryotes** = cytosol is the fluid part of the cytoplasm. Organelles are excluded.
- **Prokaryotes** = cytoplasm = cytosol.
- Many chemical reactions occur.

Ribosomes

- Protein synthesis.
- Eukaryotes are larger *(80S)* than prokaryotes *(70S).*
- **Cytosolic** = free or attached to endoplasmic reticulum *(80S).*
- **In mitochondria/chloroplasts** = bacterial size *(70S).*

Cytoskeleton

- Provide structure and organise internal space.
- Made up of proteins forming filamentous structures.
- **In eukaryotes:**
  - **Actin filaments (7nm)**
    - Respond to stimuli.
    - Reorganize and change shape of cell.
    - Allows movement.
  - **Intermediate filaments (10nm)**
    - Support nuclear envelope.
    - Attachment for chromosomes.
    - Distribute force to cytosol preventing tearing.
  - **Microtubules (25nm)**
    - Organise cytoplasm.
    - Intracellular transport.
    - Maintain structure.
    - Form mitotic spindle.
    - Backbone of cilia and flagella.

Composition and roles of cellular membranes.

Cell signalling.
Transport of solutes via transport proteins.
Movement and cell growth.
Double membranes = nucleus, mitochondria, chloroplasts.
Selectively permeable:

- Small nonpolar molecules can cross freely.
- Only some small uncharged polar molecules can cross freely.
- Large uncharged polar molecules can hardly cross.
- Charged molecules and ions cannot cross except through transport proteins.

Integral proteins = embedded in the bilayer.
Peripheral proteins = attached to the bilayer.