Session 1
09/03/2025

1. Define Biochemistry.
The chemistry of life
The study of chemical properties/composition/structure & function of living organisms.

2. What is the fluid mosaic model?
Fluid refers to the phospholipid bilayer
Matrix = number of proteins/molecules
“mosaic” is used because the molecules can freely move

3. What is a membrane made of?
- Phospholipids
- Hydrophilic head
- Hydrophobic tail (face inward)

4. What type of organisms have a cell wall and what are composed made of?
Fungi - Chitin
Plants – Cellulose
Prokaryotes - Peptidoglycan

5. Describe and state the functions of the following cell structures. Identify which structure is present in Prokaryotic cells, Eukaryotic cells, or both. Describe any differences in functions if present in both.

a) Cell Wall

Eukaryotic and Prokaryotic

Prokaryotic – Rigid, static, and strong structure. Its function is for protection against

internal osmotic pressure. Made of peptidoglycan.

Eukaryotic – Most things (small) can easily move through. Its function is also for osmotic

Pressure.

b) Cell Membrane

Eukaryotic and Prokaryotic (function is the same)

Prokaryotic – Composed of phospholipids and proteins & is selectively permeable.

Separates living cell & outside world.

Eukaryotic – Composed of phospholipids and proteins & is selectively permeable.

Separates living cell & outside world.

c) Nucleoid/Nuclear Region

Prokaryotic

- Transcription and translation occur here.

d) Flagellum/Flagella

Eukaryotic and Prokaryotic

Prokaryotic – Functions for mobility. Rotates like a propeller.

Eukaryotic – Functions for mobility. Has a “whip-like” motion.

e) Pili & Sex Pili

Prokaryotic

Pili – Used for attachment to surfaces

Sex Pili – DNA is being moved from one cell to another

Do these rotate? -- NO

f) Cytoplasm & Cytosol

Eukaryotic and Prokaryotic

Prokaryotic – Cytoplasm is highly concentrated

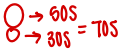
Eukaryotic – Cytoplasm contains organelles. It is everything between the nuclear to the cell membrane. Cytosol does NOT contain organelles. It is everything between nuclear envelop to the cell membrane.

g) Ribosomes

Eukaryotic and Prokaryotic

- Both make proteins

Prokaryotic:



Eukaryotic:

h) Nucleus

Eukaryotic

- Where DNA and RNA is created/stored. This organelle is enclosed by the Nuclear envelope (double membrane)

i) Nucleolus

Eukaryotic

- Distinguishable area located by the nucleus that has no

membrane. This is where rRNA is made (proteins and ribosomes are created). Transcription occurs here.

j) Endoplasmic reticulum (Single membrane)
Eukaryotic
Smooth ER – Function: Makes lipids. Smooth due to no ribosomes present on cytosolic side of the cell.

Rough ER – Function: protein modification. Ribosomes are present on the cytosolic side (the outside).
There are ribosomes found in here that are usually exported out of the cell.

k) Mitochondria (Double membrane)
Eukaryotic
- Selectively permeable membranes and can also change shape. Mitochondrial matric is inside the inner membrane. InTER membrane space: between the inner and outer membranes. ATP production occurs here.

l) Cytoskeleton
Eukaryotic
- Function: Needed for cell shape, structure & support. Examples include microtubules, microfilaments, intermediate filaments, flagella (long) and cilia (short).

m) Vacuoles (Single Membrane)
Eukaryotic
- Storage of some type of molecule…usually waste.

n) Lysosomes (Single membrane)
Eukaryotic
- Contains degradative enzymes.
  Examples include lipase (lipid break down), proteases (protein break down), and nuclease (nucleic acid break down)

o) Chloroplasts (double membrane)
Eukaryotic
- Contains thylakoid discs (one disk in a stack)
- Chlorophyl is the molecule found in the thylakoid membrane of the chloroplasts.
- A stack of thylakoid discs is called a granum.

p) Golgi apparatus
Eukaryotic
- Deals with newly made proteins that need modification. Glycosylation occurs here—sugars have been added to the proteins. These proteins are sent outside of the cell via exocytosis.

7. What are microbodies?
- Single membrane organelles that contain enzymes.
Peroxisomes: Break down oxides like peroxide
Glyoxisomes: Found in plants and microbes—converts fats into sugar

8. What is the hierarchy of biomolecules?
1. Low molecular weight. Molecules 20-100 daltons
- Water, O_2, N_2, PO^{3-}

2. Metabolic intermediate. 50-250 daltons.
- Pyruvate, alpha-keto acid, acetate

3. monomeric building blocks
- amino acids, fatty acids, monosaccharides, nucleotides

4. Biopolymers or macromolecule. 10^3-10^6 daltons.
- Proteins, lipids, polysaccharides, nucleic acids

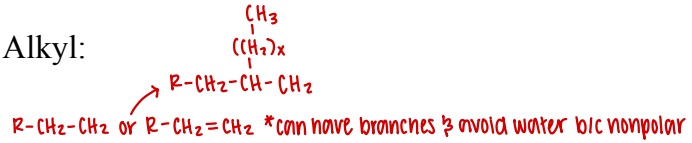
5. Macromolecular complexes. 10^6-10^{12} daltons.
- nucleoproteins, lipoproteins, glycoproteins

9. Name a handful of essential ions.
Calcium (Ca^{2+})
Potassium (K^{+})
Sodium (Na^{+})
Chloride (Cl^{-})
Magnesium (Mg^{2+})
Iron ($Fe^{2+/3+}$)

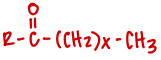
10. Name the 6 essential elements.
Carbon: 4 covalent bonds
Hydrogen: 1 covalent bond
Oxygen: 2 covalent bonds (possibly 1)
Nitrogen: 3 covalent bonds (possibly 4)
Phosphorous: 5 covalent bonds
[redacted] 2 covalent bonds
SULFUR!!

11. Draw the following functional groups.

- Alkyl:



- Acyl:

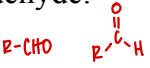


- Aromatic:

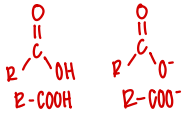
- Carbonyl:

- Ketone:

- Aldehyde:



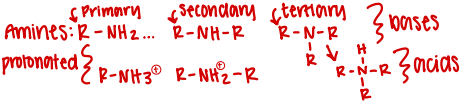
- [redacted] carboxyl group



- Ester:

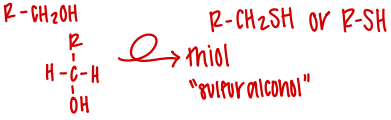
- Ether:

- Amide:



- Amine:

- Alcohol:

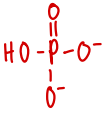


- Disulfide:

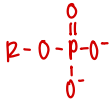
[redacted]

13. List and draw the phosphate molecules you should know. Include their shorthand version.

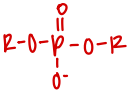
- inorganic phosphate: Pi



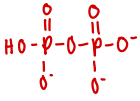
monophosphate: R-Ⓟ



phosphodiester: R-Ⓟ-R



- pyrophosphate: PPi



diphosphate: R-Ⓟ-Ⓟ