BIO 1305 – Modern Concepts in Bioscience I – Campbell Textbook
Week 4 – Chapter 5 & 6

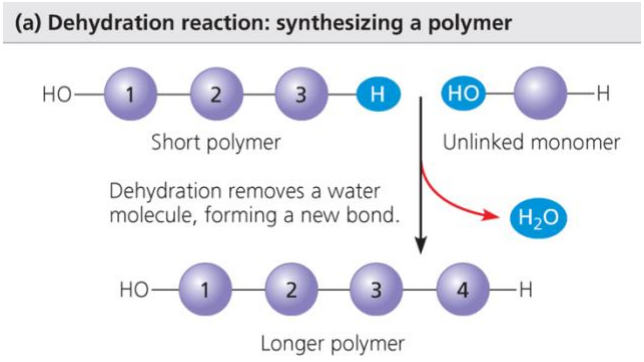
Hi everyone! My name is Jaycie Moore and I am one of the Master Tutors for Biology 1305 this semester. I am a sophomore Cell and Molecular Biology major on the pre-med track. Gabriel Andino is the other Biology 1305 Master Tutor, and we are both super excited to guide you through this semester and provide helpful resources for your studying. We think biology is the best and hope that you think so too after you conquer this course! Gabriel and I hold **weekly group tutoring sessions on Thursdays from 5-6 pm**. Sign up to join us here: **https://baylor.edu/tutoring.** We would love to see you there!

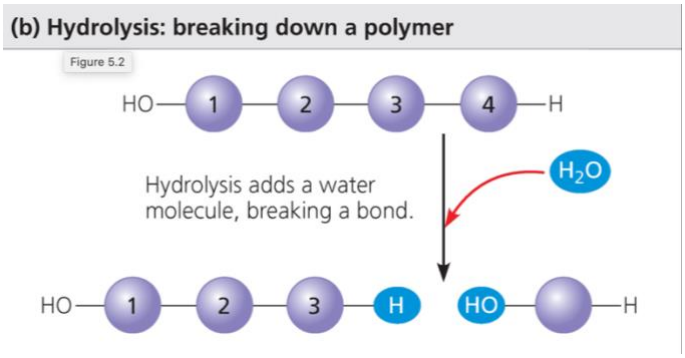
Keywords for this week: Monomers, Polymers, Macromolecules, Organelles

Throughout this resource, I have sprinkled helpful videos for you watch as you read. Click the links to refresh what you just learned!

Chapter 5: The Structure and Function of Large Biological Molecules

Before we jump into the main biological molecules that make up living things, here are some important things to remember about how macromolecules are generally structured: Macromolecules are large molecules called **polymers**. Polymers are made of smaller "building blocks" called **monomers**. Monomers are connected to form polymers by a **dehydration reaction** (when two monomers join together, and a water molecule is lost as a result). The opposite process, where a polymer is broken down into monomers, is called **hydrolysis**. The key to this process is in the word: "hydro" = water and "lysis" = to break.





Video: **Monomers and Polymers**

Now we can talk about the four classes of large biological molecules that make up all living things:

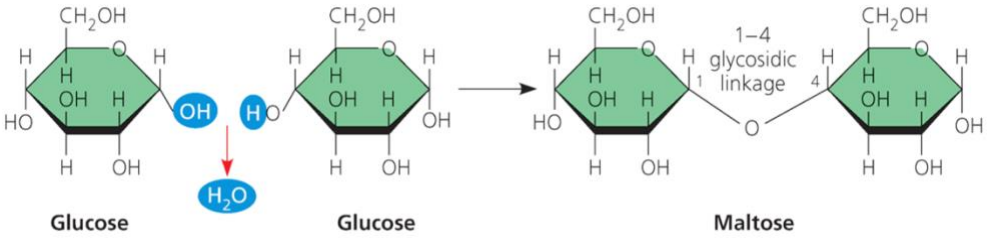
- Carbohydrates, lipids, proteins, nucleic acids

Carbohydrates

When you think of carbohydrates, think **FUEL** and **BUILDING MATERIAL**. Carbohydrate macromolecules are called **polysaccharides**. The monomers that make up polysaccharides are

called **monosaccharides**, which are simple sugars. Glucose is an example of a monosaccharide. **Glycosidic linkages** are the types of bonds that join these sugar monomers into long polymers.

**remember that a glycosidic linkage is a result of a dehydration reaction!

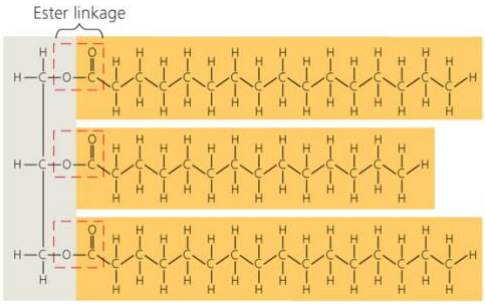


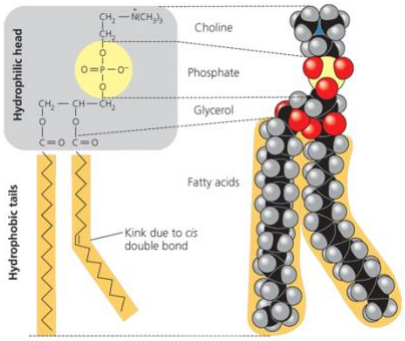
Video: **Carbohydrates** , **Polysaccharides**

Lipids

These macromolecules are primarily **hydrophobic**, meaning they do NOT like water! This drives a lot of their functions! Lipids are known for their large **hydrocarbon regions**. Fun fact about lipids: they don't technically have a true monomer! Let's look at some of the important lipids in biology…

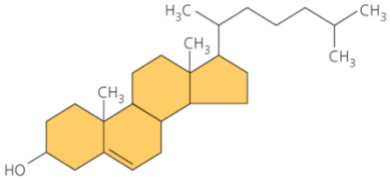
Fats: glycerol backbone with three fatty acid tails, which are long chains of carbon and hydrogen. These hydrocarbon tails make lipids hydrophobic and can be either saturated (no double bonds) or unsaturated (has double bonds) To the right is an important example of a fat molecule.





Phospholipids: these are VERY important because cells could not even exist without them! These resemble fats but just have two fatty acid tails. There is also a phosphate group connected to the glycerol, creating a polar head and making the molecule have both hydrophobic and hydrophilic regions. To the left is the structure of a phospholipid.

Steroids: known for their four fused rings. One example is cholesterol (on the right) which has many important functions in animal cells.



Video: **Lipids**, **Phospholipids** **Steroids**

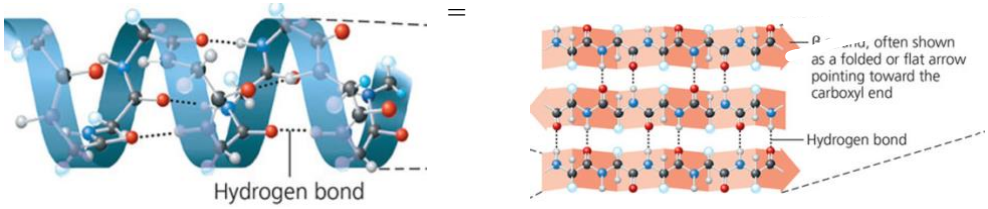
Proteins

These macromolecules carry out almost **ALL FUNCTIONS** in cells! Proteins come in many shapes and sizes, and their structures are important to all activities that occur in the cell! **Amino**

acids are the monomers that create **polypeptides**, the polymers. The monomers are joined by **peptide bonds** (which is also a result of dehydration!)

There are different levels to how proteins are structured. The specific way that a protein folds and assembles is key to how it acts!!! You will likely hear this in all bio classes you take: FORM EQUALS FUNCTION. Let's talk about the four levels of protein structure…

Primary structure — sequence of amino acids that forms a polypeptide
Secondary structure – interactions between parts of the amino acid sequence to form either an α helix (left pic) or β pleated sheet (right pic)

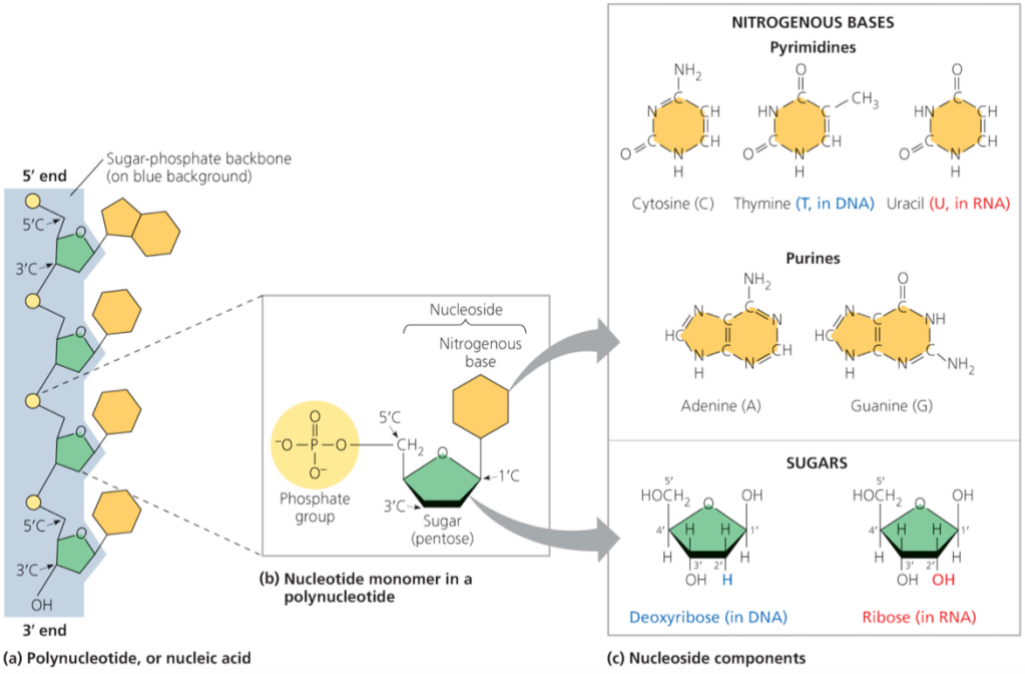


Tertiary structure – three-dimensional structure formed by interactions between side chains
Quaternary structure – two or more polypeptides interact with each other

Video: **Proteins**, **Protein Structure**, **Protein Folding and Denaturation**

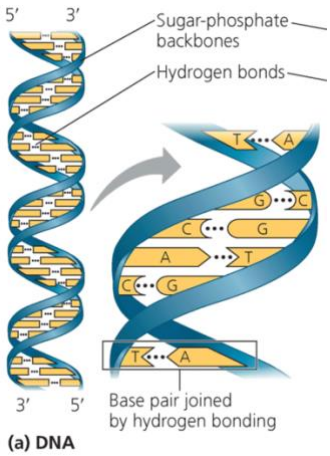
Nucleic Acids

When you think about nucleic acids, think about **DNA and RNA**! These polymers are made up of monomers called **nucleotides**. The polymers are called **polynucleotides**. A nucleotide is made of a pentose (5 carbon) sugar, nitrogenous base, and a phosphate group. Without the phosphate group, it is called a **nucleoside**. The picture on the next page breaks everything up nicely!



All pictures, figures, and diagrams came from Pearson Campbell Biology 12th Edition.

Something important to note about DNA is that the two strands run **antiparallel** and are **complementary**. This means that one of the strands runs 5' → 3' while the other strand runs 3'→ 5'. The nitrogenous bases are complementary, meaning the A matches with the T while the C matches with the G.



(a) DNA

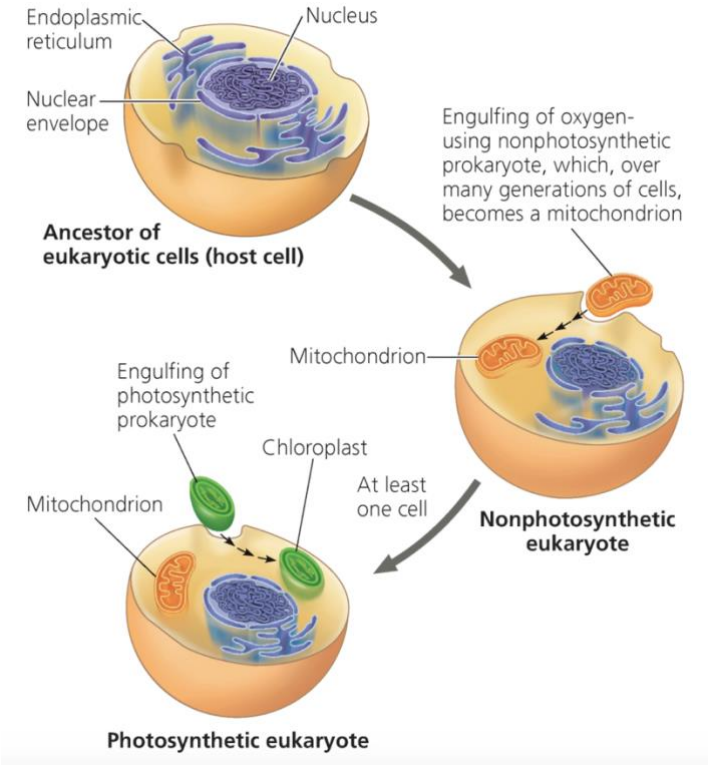
Chapter 6: A Tour of the Cell

Cells are the basic units of life. There are two types: **prokaryotic and eukaryotic.**

There are great picture/diagrams in your Campbell biology book about the different organelles and their functions, but these videos sum up most of what you should be familiar with:

The Nucleus, **Ribosomes**, **Endomembrane System**, **Mitochondria**, **Chloroplasts**, **Peroxisomes**, **The Cytoskeleton**, **The Extracellular Matrix**, **Cell Junctions**

An important topic in cell biology is the **endosymbiotic theory.** This idea explains how mitochondria and chloroplasts came to be part of eukaryotic cells, and can be explained by this photo:



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