**Module 1**

**Chapter 1 – The microbial world and you**

**Microbes in our liv**es

Overall theme of this course is to discuss microbes and how they are involved in the lives of humans. Microbes make the biggest news when they are causing harm

* Microbiology – The study of \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Microbes are organisms \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to be seen with the \_\_\_\_\_\_\_\_\_\_\_\_
  + aka, Microorganisms, germs, bugs
  + Includes bacteria, fungus, protists, algae, viruses
  + Huge diversity in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – only common theme is that \_\_\_\_\_\_\_\_\_
* Microbes are everywhere
  + Most famous, or infamous, microbes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - TB, AIDS, food spoilage
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_ are microbes that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of microbes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Most microbes are \_\_\_\_\_\_\_\_\_\_\_\_\_
  + Directly beneficial
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (bread, yogurt, beer), make \_\_\_\_\_\_\_\_\_\_\_\_\_ in intestine
  + Indirectly beneficial
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organic matter in soil, clean up sewage, part of food chain

**Naming and classifying microorganisms**

* Nomenclature 🡪 system of naming for organisms
* Carolus Linnaeus established the system of scientific nomenclature
* Based on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 🡪 language of scholars
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_ names 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ system
* The **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, which are *italicized* or underlined
* The genus is \_\_\_\_\_\_\_\_\_\_\_\_\_\_, species is in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* *Staphylococcus aureus*, *Escherichia coli*
* After the first use, scientific names may be abbreviated with the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:
  + *Escherichia coli* and *Staphylococcus aureus* are found in the human body
  + *E. coli* is found in the large intestine, and *S. aureus* is on skin

**Types of Microorganisms**

* Diverse variety of microbes
* Microbes are classified into groups that share \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Microbes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ groups can also be diverse
  + Helps \_\_\_\_\_\_\_\_\_\_\_\_\_\_ a very diverse group of organisms
* Bacteria (bacterium)
  + Single celled
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – no \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** cell walls
  + Diverse metabolism
    - Organic chemicals, inorganic chemicals, or light as food
* Archaea
  + \_\_\_\_\_\_\_\_\_\_\_\_\_ celled
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in cell wall
  + Archaea of interest:
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – produce methane
    - Extreme \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – live in \_\_\_\_\_\_\_\_\_\_\_\_ environments
    - Extreme \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – live in \_\_\_\_\_\_\_\_\_\_\_\_ environments
* Fungus (pl, fungi)
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – contain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cell walls
  + Use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for energy
  + \_\_\_\_\_\_\_\_\_\_\_ are \_\_\_\_\_\_\_\_\_\_\_cellular
    - Mushrooms, molds
  + Some are single celled
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Protozoan (pl, protozoa)
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ celled, **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** cells
  + Absorb or ingest organic chemicals
  + May be motile via pseudopods, cilia, or flagella
* Alga (pl, algae)
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cell walls
  + Use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ producers”
    - Produce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_ that other organisms consume
* Viruses
  + Extremely \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ particles - \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Consist of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ core
  + Core is surrounded by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ coat
  + Coat may be enclosed in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Are replicated only when they are in a living host cell
    - Obligate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Multicellular animal parasites
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + Multicellular \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Parasitic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are called *helminths*
  + Microscopic stages in life cycles

**Modern Developments in Microbiology**

* Bacteriology
  + Study of \_\_\_\_\_\_\_\_\_\_\_\_
* Mycology
  + Study of \_\_\_\_\_\_\_\_\_\_\_\_\_
* Parasitology
  + Study of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ worms
* Virology
  + Study of \_\_\_\_\_\_\_\_\_\_\_\_\_
* Immunology
  + Study of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **Microbial genetics**: the study of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **Molecular biology**: the study of how \_\_\_\_\_\_\_ directs \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **Genomics**: the study of an organism’s \_\_\_\_\_\_\_\_\_\_\_\_\_; has provided new tools for classifying microorganisms
* **Recombinant DNA**: DNA made from two \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + In the 1960s, Paul Berg inserted animal DNA into bacterial DNA, and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**, the use of microbes to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, is centuries old
* **Recombinant DNA technology,** a new technique for biotechnology, enables bacteria and fungi to produce a variety of proteins, including vaccines and enzymes
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in human cells can be replaced in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Recombinant DNA technology can be used to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from pests or make them resistant to harsh environments

**Microbial Ecology**

* Bacteria \_\_\_\_\_\_\_\_\_ carbon, nutrients, sulfur, and phosphorus that can be used by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Bioremediation**

* Use of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ chemical \_\_\_\_\_\_\_\_\_\_\_\_\_ in environment
* Bacteria degrade organic matter in sewage
* Bacteria degrade or detoxify pollutants such as oil and mercury

**Biological Insecticides**

* Microbes that are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are alternatives to chemical \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in preventing insect damage to agricultural crops and disease transmission
* *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* infections are fatal in many insects but \_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, including humans, and to plants

**Microbes and Human Disease**

* Microbes normally \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the human body are called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* Normal microbiota \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of pathogens
* Normal microbiota produce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, such as folic acid and vitamin K
* Only a small proportion of microbes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Many more microbes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* When a pathogen \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the host’s resistance, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (EIDs)**: \_\_\_\_\_\_\_\_\_\_\_\_\_ diseases and diseases \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Avian Flu
  + West Nile
  + MRSA
  + AIDS
  + Ebola

**Chapter 2 – Chemical Principles**

* **Chemistry** is the study of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ between atoms and molecules
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of microorganisms involve complex \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Nutrients are broken down by microbes to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and to make \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The Structure of Atoms**

* Atoms – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of matter
* Consist of:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charge, have no discernable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Molecules – combination of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ atoms
  + Sometimes called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Ion – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ atom
  + Can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charged

**Chemical bonds**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_ are held together by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Three kinds of chemical bonds

* Ionic bonds
  + Attraction between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to each other
    - “Opposites \_\_\_\_\_\_\_\_\_\_\_\_\_\_”
  + Ions held together by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ interaction
    - Form an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Covalent bonds
  + Bonds formed when \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ interaction
  + Bonds can form between 2 \_\_\_\_\_\_\_\_\_\_ atoms, or 2 \_\_\_\_\_\_\_\_\_\_\_\_\_ atoms
  + Strongest chemical bond
* Hydrogen bonds
  + Form between:
    - A hydrogen atom covalently bonded to an \_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_ atom and;
    - Another \_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_ atom
* Order of bond strength:

\_\_\_\_\_\_\_\_\_\_\_\_\_ > \_\_\_\_\_\_\_\_\_\_\_\_\_\_ > \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Stronger ionic bonds not biologically relevant
  + Only \_\_\_\_\_\_\_\_\_\_\_\_ ionic bonds are biologically important
* Covalent bonds require \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to form, break
  + Energy can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when covalent bonds \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when they are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bonds are biologically important
  + \_\_\_\_\_\_\_\_\_\_\_ bond, can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Can \_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2 molecules, or parts of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecule
  + Maintains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ structure of many molecules

**Important biological molecules**

* Organic compounds always \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Inorganic compounds typically \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Inorganic molecules**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and structurally \_\_\_\_\_\_\_\_\_\_\_\_
* Typically lack \_\_\_\_\_\_\_\_\_\_\_\_ atoms
* Water
  + Most important \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecule for supporting life
    - Hydrogen bonds between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ make it a good \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – a liquid with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – the dissolving \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The ability of water to form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ makes it an excellent solvent
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ many molecules
* Dissolving molecules helps with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Atoms and molecules in solution can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Organic compounds**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and structurally \_\_\_\_\_\_\_\_\_\_\_\_\_
* Contain \_\_\_\_\_\_\_\_\_\_\_ atoms
  + Carbon can bond with \_\_\_\_ atoms, including \_\_\_\_\_\_\_\_\_
  + Can form chains, branches, rings
* Organic molecules can combine to form large \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (“big molecules”)
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ formed by covalent bonding of many repeating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – small molecules that make up \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Polymers are formed from monomers via \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_ is removed during the reaction (molecule is dehydrated)
* Polymers are broken down into monomers via \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Water is added to break (or \_\_\_\_\_\_\_\_\_\_\_) the polymer

**Carbohydrates**

* Group of organic compounds that include \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_
* Important functions:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (cell walls, DNA)
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; fuel and storage
* Made up of C, H, O
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are building blocks (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) of carbohydrates
* Monosaccharides \_\_\_\_\_\_\_\_\_\_\_\_ sugar
  + Usually \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in water
* Grouped by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in ring
  + Triose (3 C), Tetrose (4 C), Heptose (7 C)
* Disaccharides
  + Molecule of \_\_\_\_ monosaccharides
  + Formed from two monosaccharides by?
  + Broken into 2 monosaccharides by?
* Polysaccharides
  + Consist of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ monosaccharides
    - Often number in the 100s
  + Some important polysaccharides
    - Glycogen – energy reserve in \_\_\_\_\_\_\_\_\_\_\_
    - Cellulose – main component of \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_ cell walls
    - Starch – energy reserve in \_\_\_\_\_\_\_\_, eaten as food by animals

**Lipids**

* Diverse group with one common property:
  + Hydro\_\_\_\_\_\_\_\_\_\_\_\_\_\_ - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Primary functions:
* Simple lipids
  + \_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Contain:
    - Glycerol – 3 carbon \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - 3 Fatty acids – long chain of \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_
  + Type of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ determine \_\_\_\_\_\_\_\_\_\_\_\_\_ of triglyceride
  + Saturated fatty acids have the \_\_\_\_\_\_\_\_\_ number of \_\_\_\_\_\_\_\_ (2) per carbon
    - Saturated fatty acids are relatively \_\_\_\_\_\_\_\_, can pack closer together
    - Usually \_\_\_\_\_\_\_\_\_\_ at room temperature
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fats (butter) tend to be high in saturated fatty acids
  + Unsaturated fatty acids have \_\_\_\_\_\_\_\_\_\_\_\_\_ double bonds between 2 carbons
    - Creates \_\_\_\_\_\_\_\_\_\_\_, or \_\_\_\_\_\_\_\_\_\_\_\_, in chains
    - Keeps chains \_\_\_\_\_\_\_\_\_\_\_
    - Usually \_\_\_\_\_\_\_\_\_\_\_\_ at room temperature
* Complex lipids
  + Contain \_\_\_\_\_\_\_\_\_\_\_\_ attached to glycerol in addition to the fatty acids
    - Phosphorous, oxygen, nitrogen, sulfur
  + Phospholipids made up of glycerol, \_\_\_ fatty acids, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ group
    - Essential lipids that build \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - Phospholipids have hydrophobic and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (water loving) regions that allows for formation of cell membranes
* Steroids
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from other lipids
    - Interconnected carbon \_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + A steroid, \_\_\_\_\_\_\_\_\_\_\_\_\_, important part of some \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Proteins**

* Most \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organic molecule in a cell
* Perform \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ functions; cellular tools
  + Enzymes – proteins that speed up biochemical reactions
  + Transport – transport chemicals into and out of cells
  + Toxins – harm living organisms
  + Structure – in cell membranes, cell components
  + Movement – muscles, movement of cells
* Amino acids - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of proteins
* Consist of:
  + One carbon
  + A \_\_\_\_\_\_\_\_\_\_\_\_\_\_ group (-COOH)
  + An \_\_\_\_\_\_\_\_\_\_\_\_\_ group (-NH2)
  + A hydrogen
  + A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or \_\_\_\_\_-group
* \_\_\_\_\_ different amino acids
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ determines the property of the amino acid
  + Can be large or small, hydrophobic or hydrophilic
* Amino acids are joined by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Two amino acids joined together are called a \_\_\_\_\_\_\_\_\_\_\_\_\_; three are called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are 10+ amino acids joined together
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a protein is vital for its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Loss of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = loss of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Proteins require a specific environment to function properly
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (high temperature, high salt, etc …) will cause protein to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Nucleic acids**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ material of organisms
  + Deoxyribonucleic acid (\_\_\_\_\_\_\_) – makes up \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Ribonucleic acid (\_\_\_\_\_\_) – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of DNA
* The monomers of nucleic acids are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ consist of:
  + A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ base
  + A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (5 carbon) sugar; either deoxyribose or ribose
  + A \_\_\_\_\_\_\_\_\_\_\_\_\_\_ group
* Nucleotides are named after the nitrogen containing bases:
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nucleotide, A
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nucleotide, T
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nucleotide, C
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nucleotide, G
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nucleotide, U
* DNA
  + Has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sugar
  + \_\_\_\_\_\_\_\_\_\_ nucleic acid molecules form a double helix
    - Sugar and phosphate form “backbone”
    - Bases meet in the middle
  + A always pairs with \_\_\_\_\_, C always pairs with \_\_\_\_\_\_
    - These bases are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to each other
    - “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_ bases are held together by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Order of bases is specific
  + Determines the genetic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* RNA
  + Has \_\_\_\_\_\_\_\_\_\_\_\_\_ sugar
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_ stranded nucleic acid molecule
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, instead of \_\_\_\_\_\_\_\_\_\_\_\_\_\_
    - **A** to **U**
    - **C** to **G**
  + Major role in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Adenosine triphosphate, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Principal \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecule of all cells
  + Stores chemical energy released by some \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Provides chemical energy for other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + Consists of:
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_ base
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_ sugar
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_ groups
  + Energy is released when \_\_\_\_\_\_\_\_\_\_\_\_\_ phosphate group is released
    - Forms adenosine \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, ADP
  + ATP is created by adding \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to ADP
    - Requires \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, usually from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_