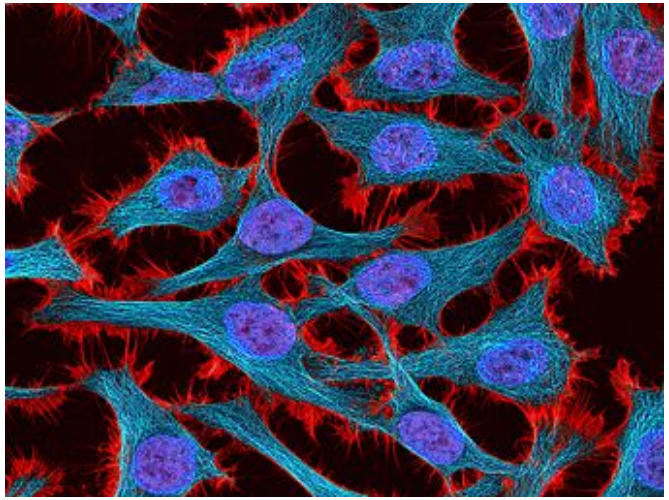
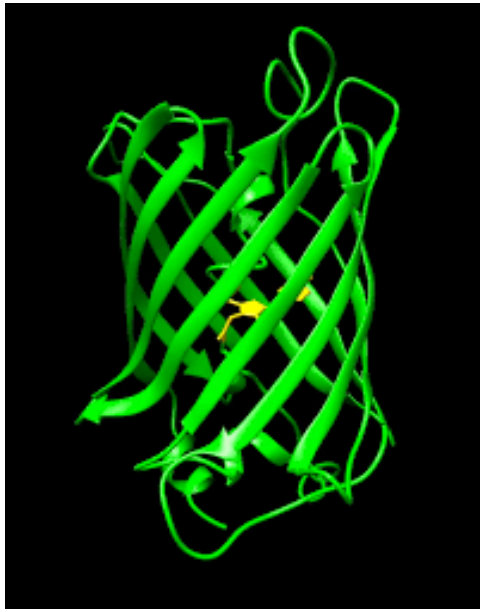
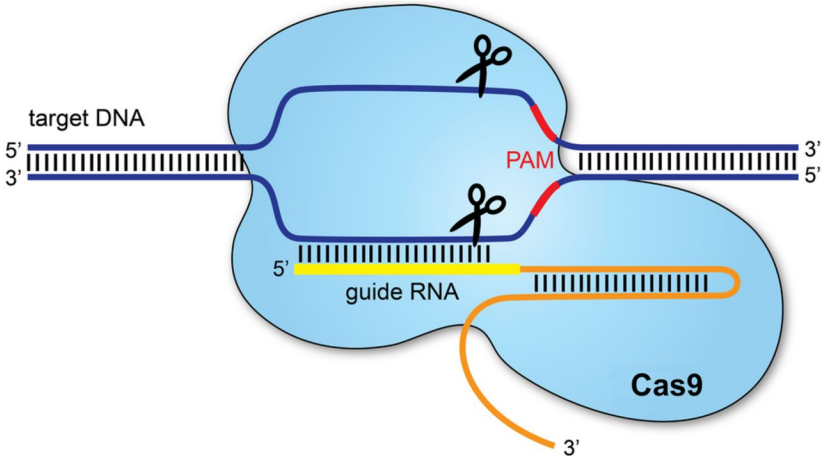




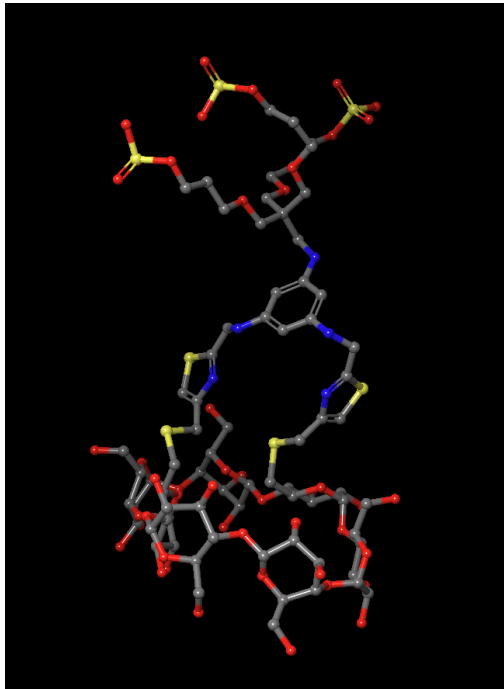
# Introduction to Biochemistry

Miguel Aguilar




# About me


- Originally from El Salvador.
- Rising junior studying Chemistry and Biology (5-7)
- Working during the summer in the Anderson lab (Koch Institute for Integrative Cancer Research) developing molecular sensors for glucose to create long-release platforms for insulin delivery.



# What is Biochemistry?




# What is Biochemistry?

*The study of cellular processes and life at the molecular level.*

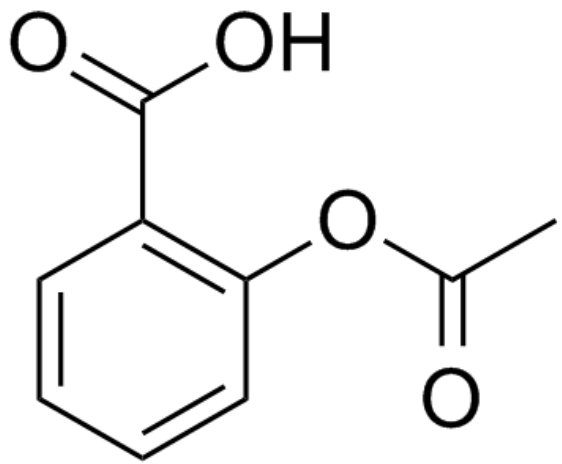
# Why Biochemistry?


# Why Biochemistry?

- *Life must be studied at a molecular level to truly understand it.*
- *Molecular features help to explain mechanisms of human disease and therapeutics.*
- *Experimental design is critical for outcome*

# Tentative Syllabus

- Introduction
- Carbohydrates
- Lipids
- Proteins
- Nucleic Acids
- Translation, Transcription and Replication
- Enzymes
- Energy and Metabolism
- Extra Topics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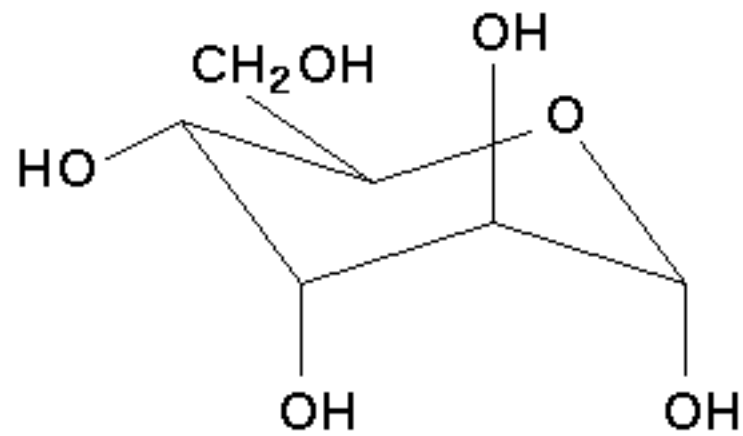
OH
O
O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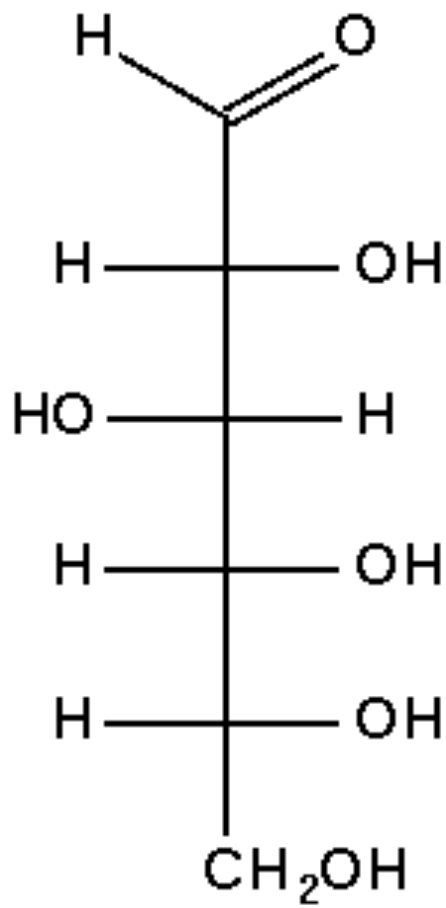
OH
HO
O
OH
OH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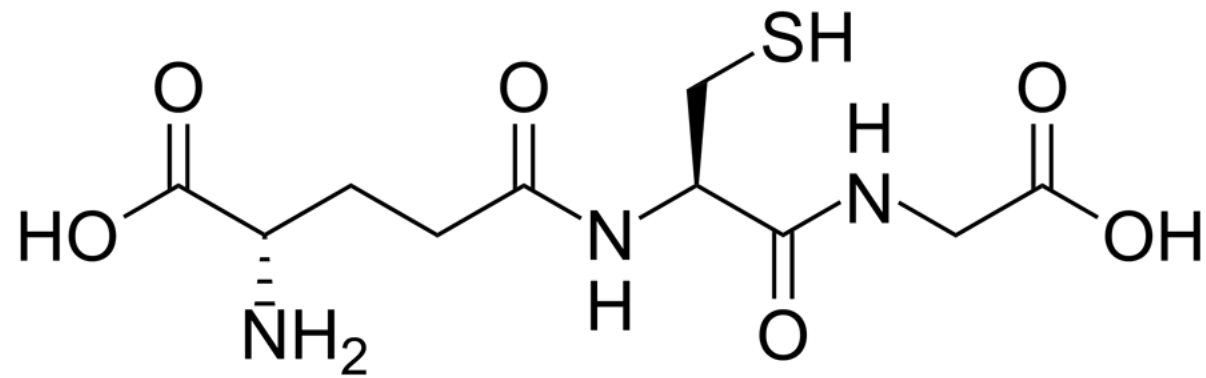
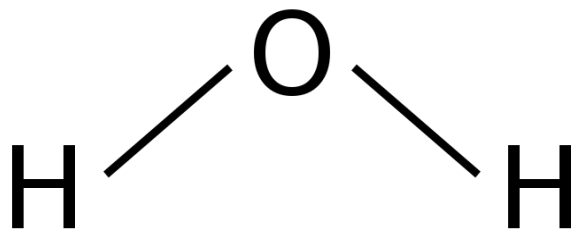
O
H
OH
HO
H
H
OH
H
OH
CH2OH


SH
O
O
H
O
HO
N
N
OH
NH2
H
O

# What's inside a cell?


*E. coli* cell

# What’s inside a cell?




Water!

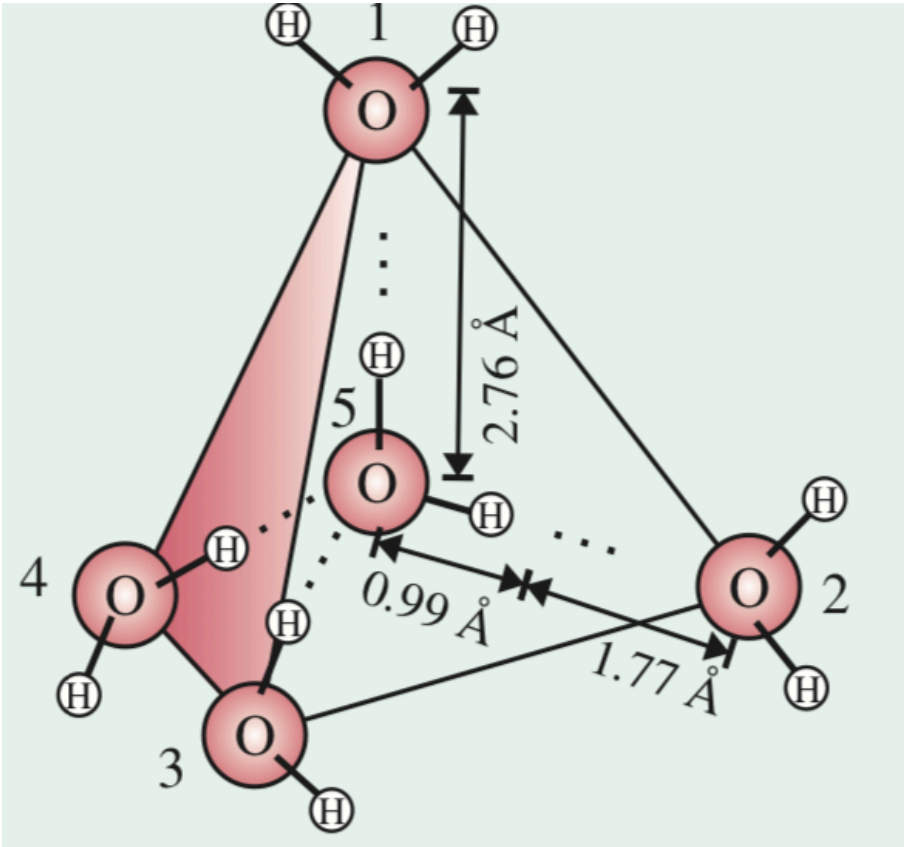
# Water in a biological context.

- The human body is 70% water by weight.
- Chemical reactions in biological processes evolved in water.
- Water does not tend to autoionize, but its ionization products play an important role in influencing biomolecules.
- Water its required to transport substances all across the body.

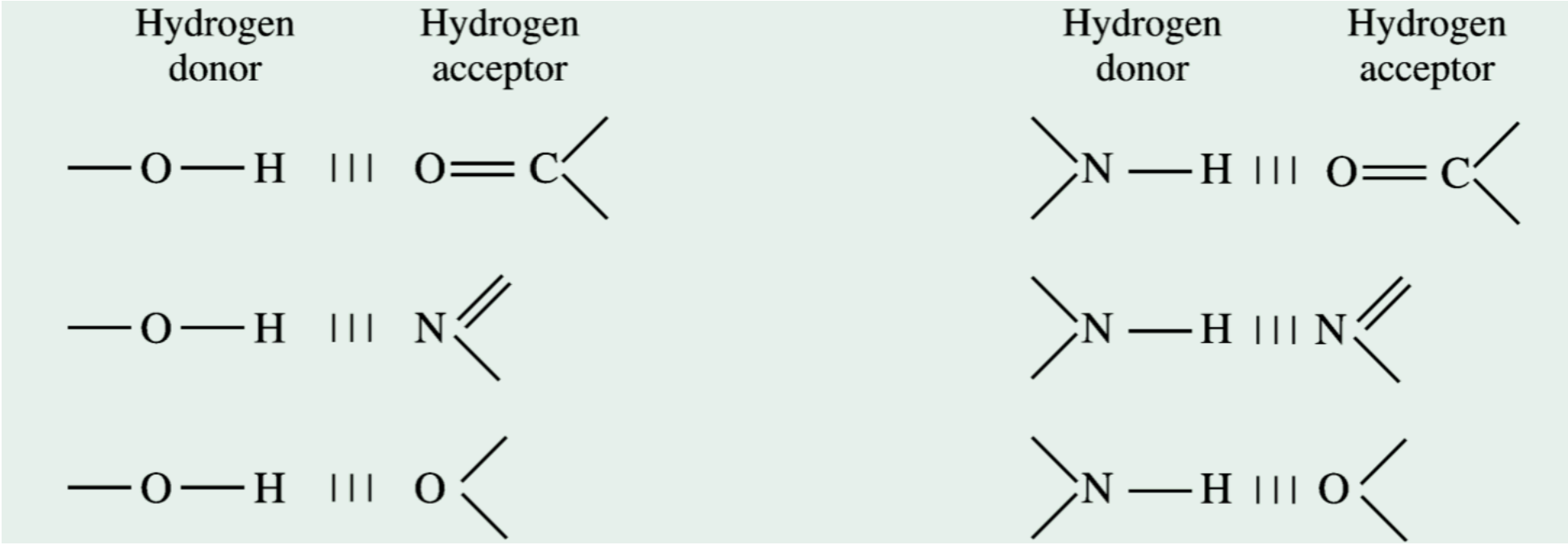
# Water in a physical context.

- Water has strong interactions with itself, resulting in its particular solvent properties.
- Water is the most abundant substance on Earth.
- Water’s solid form is less dense than its liquid form at normal conditions.
- Water resists changes of state, thus moderating Earth’s temperature.

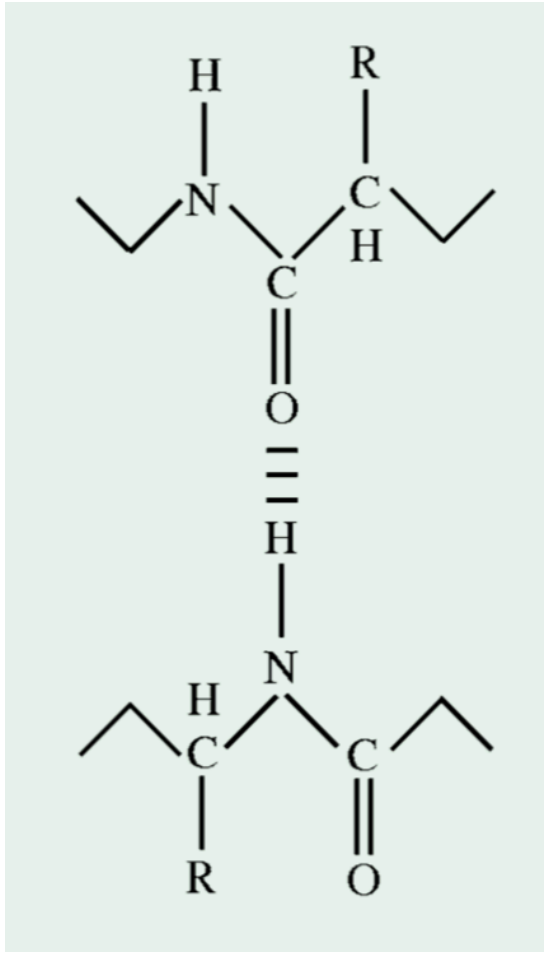
# Hydrogen Bonding between Waters

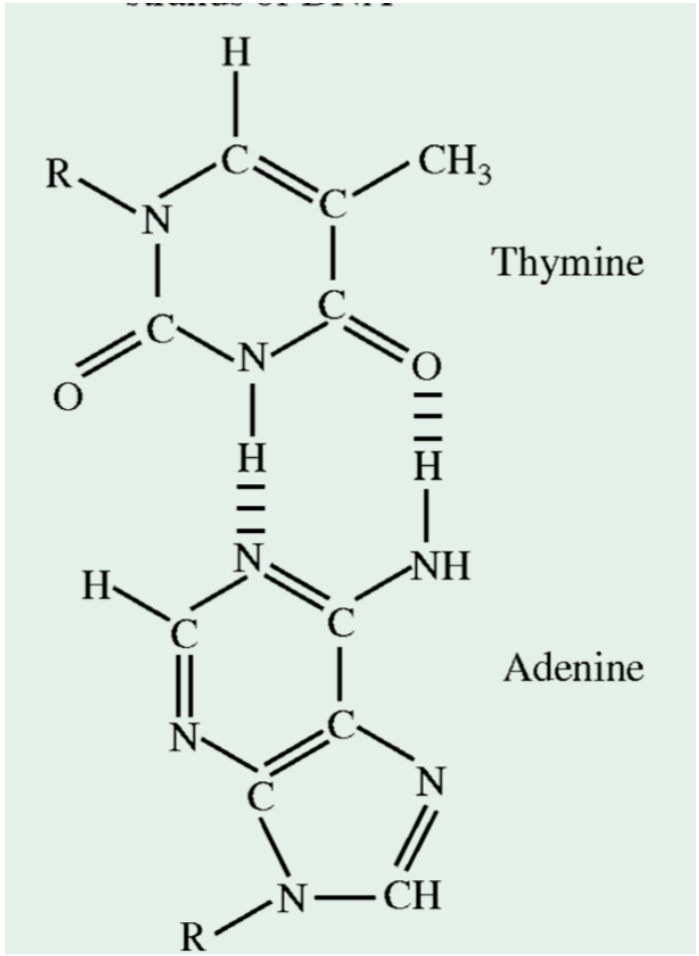


# Hydrogen Bonds in Biological Molecules



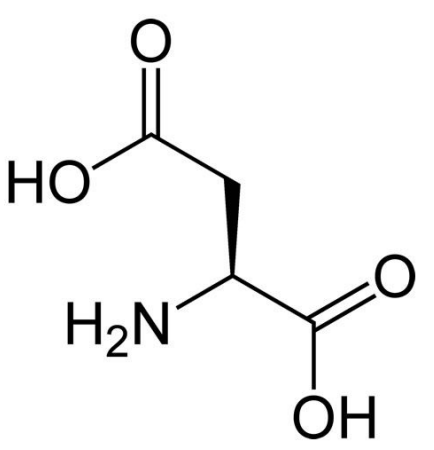
# Hydrogen Bonds in Biological Molecules



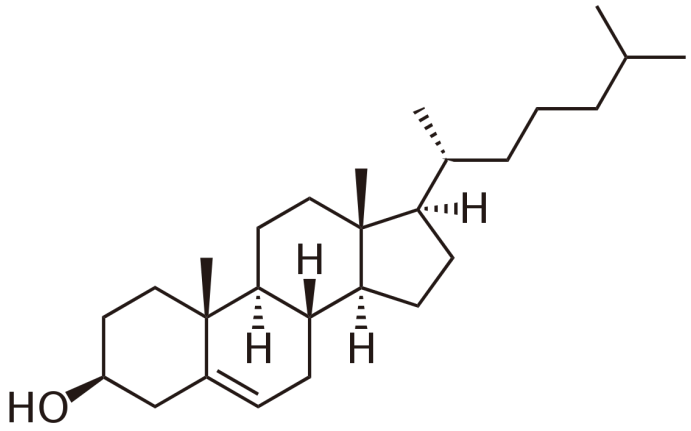


# Water and Solutes

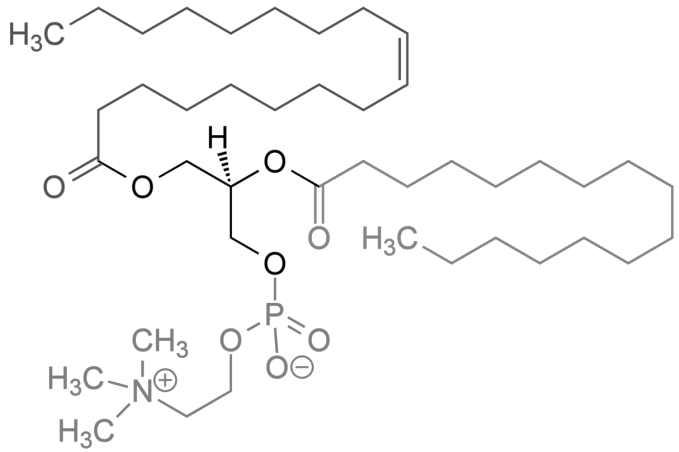
## Hydrophilic




## Hydrophobic

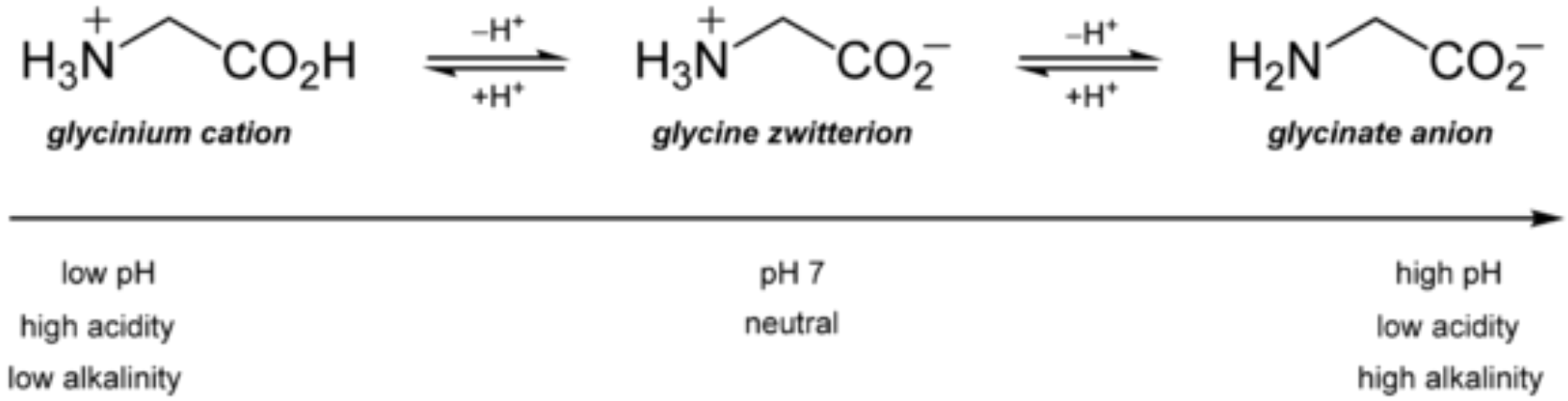



## Amphipathic

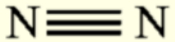
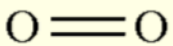
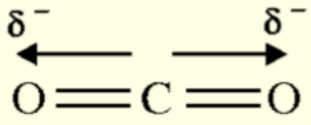
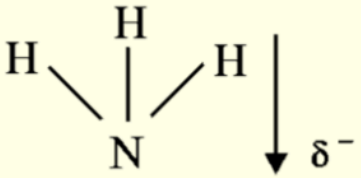
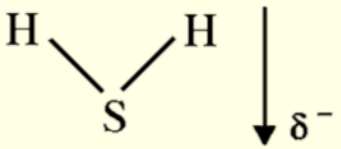


# pKa (in water)

- If pH > pKa, compound loses a proton.
- If pH < pKa, compound gains a proton



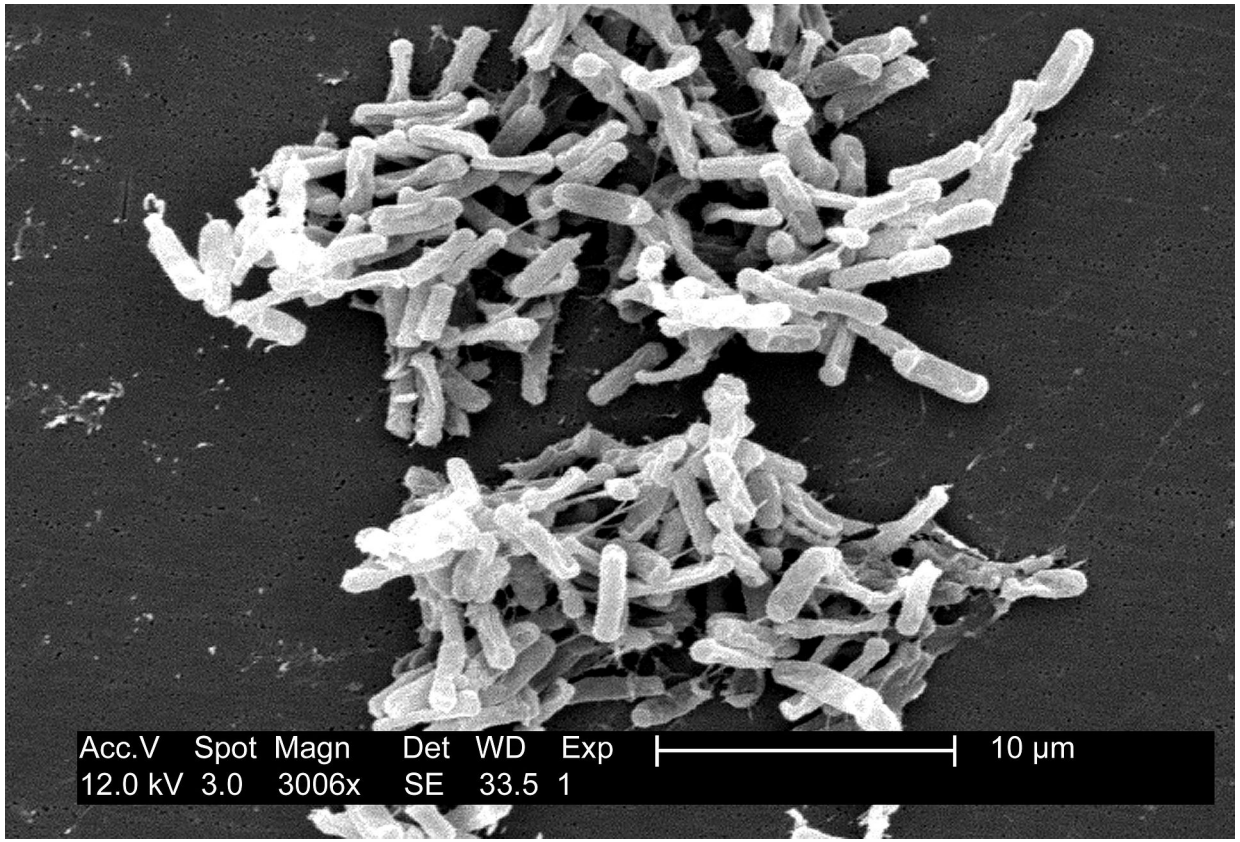
# Gases in Water

| *Gas* | *Structure** | *Polarity* | *Solubility in water (g/L)* | *Temperature (°C)* |
|---|---|---|---|---|
| Nitrogen |  | Nonpolar | 0.018 | 40 |
| Oxygen |  | Nonpolar | 0.035 | 50 |
| Carbon dioxide |  | Nonpolar | 0.970 | 45 |
| Ammonia |  | Polar | 900 | 10 |
| Hydrogen sulfide |  | Polar | 1,860 | 40 |

# Oxygen

- Required for aerobic respiration as the final electron acceptor.
- Used to break down food in order to produce energy.
- Normally carried around the body as hemoglobin-$O_2$.
- However, uncarried oxygen in our body can be quite dangerous as it is highly reactive and can result in tissue damage

# Anaerobic Organisms




Clostridium

Spinoloricus