

CHEM 153A Week 1

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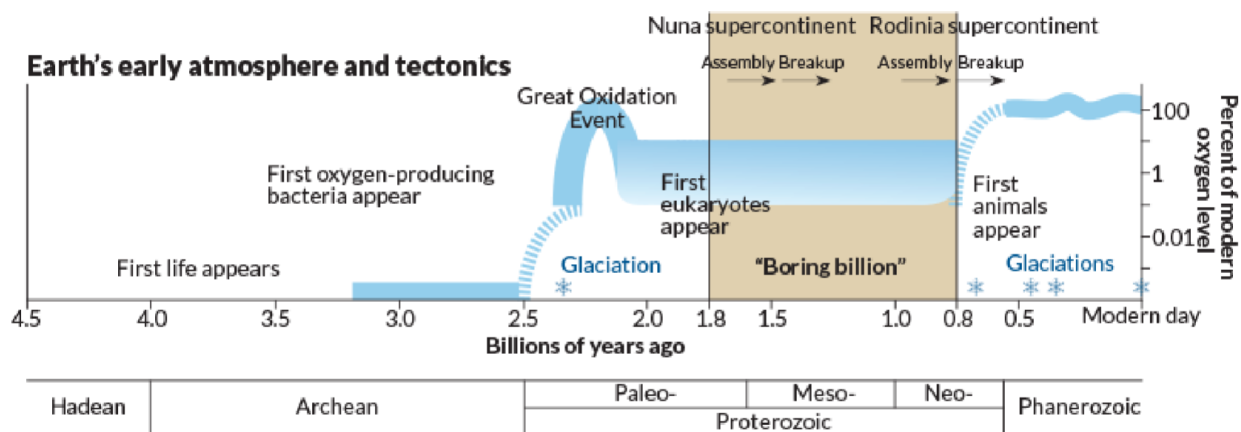
January 6, 2025

Biochemistry

- It describes in molecular terms the structures, mechanisms, and chemical processes shared by all organisms and **provides organization principles** that underlie life in all its diverse forms.

How Molecular Processes Evolved

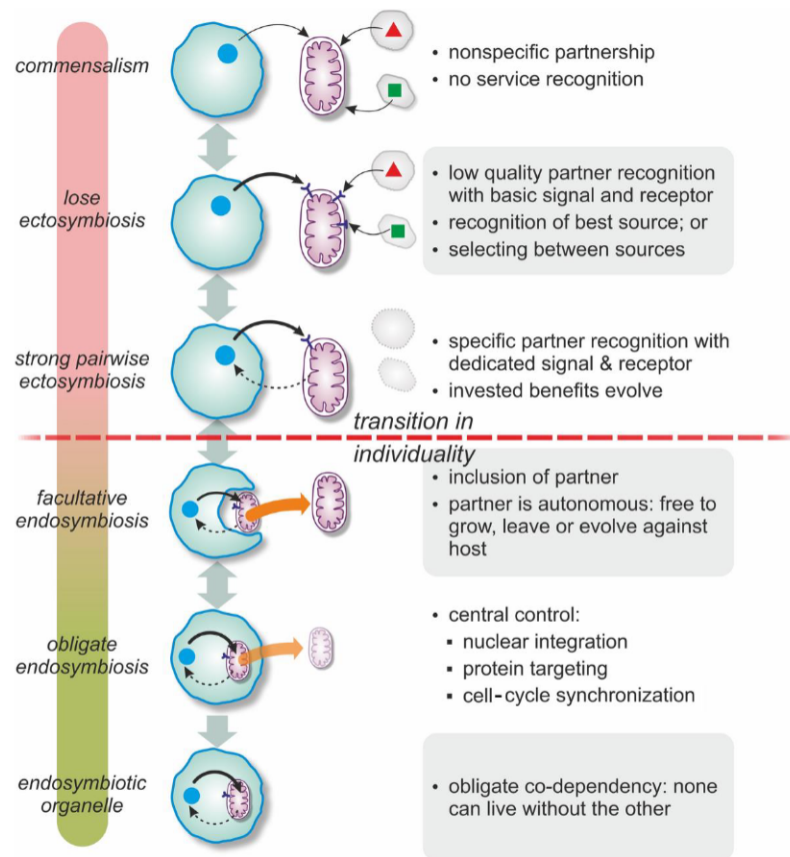
The Great Oxidation Event (2.4-2.1B years ago)



During this event, a few things happened:

- Lots of species went extinct because of the change in atmosphere
- Animals can now exist, since aerobic respiration became possible
- Mitochondria began appearing.

Endosymbiotic Theory

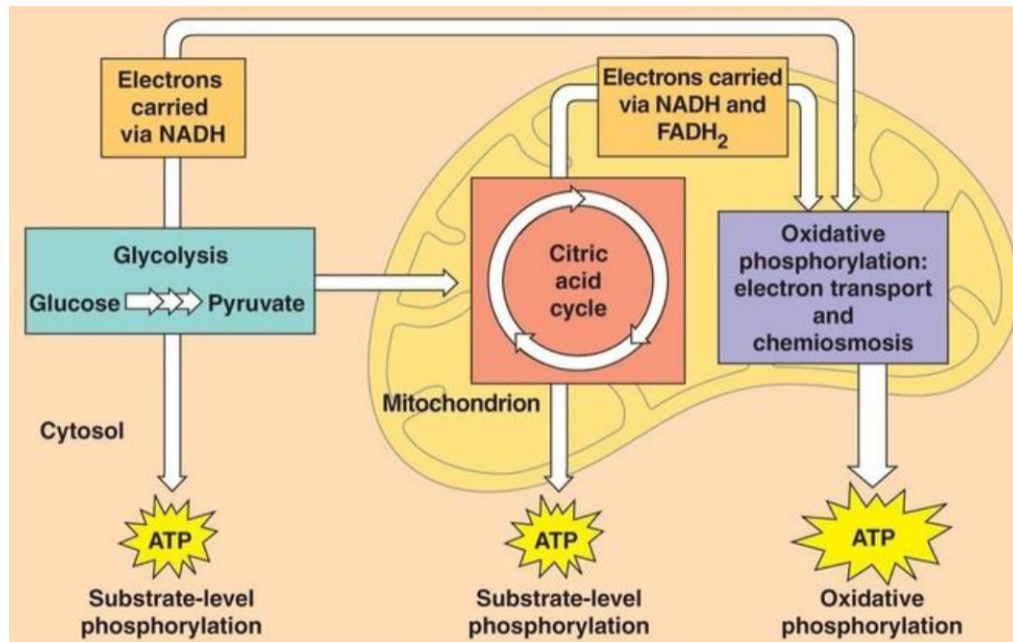


Zachar & Boza, 2020

<https://doi.org/10.1007/s00018-020-03462-6>

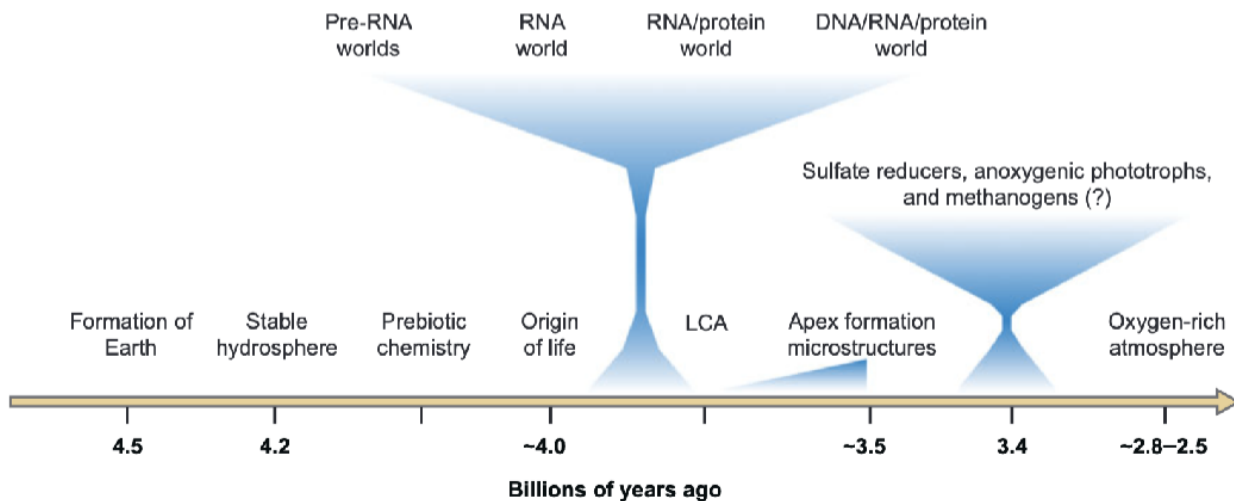
- Mitochondria used to be separate cells, rather than an organelle.
- At some point, one cell engulfed the other, and evolution occurred.

Mitochondria



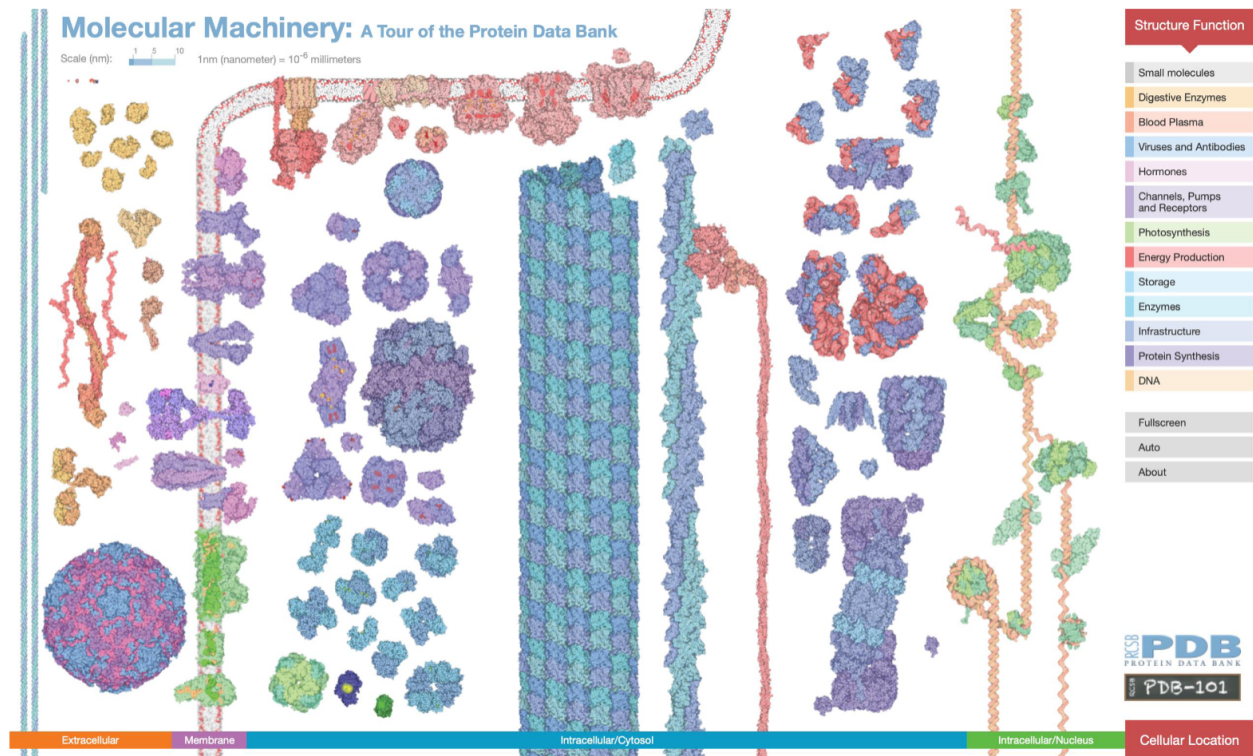
Evolution of Metabolism

- This example alone demonstrates the transformative impact of oxygen in life
- **Biochemistry can be divided into two eras: one before oxygen, and one after**
- Modern processes depend on oxygen, while older, more ancient pathways functioned in its absence.



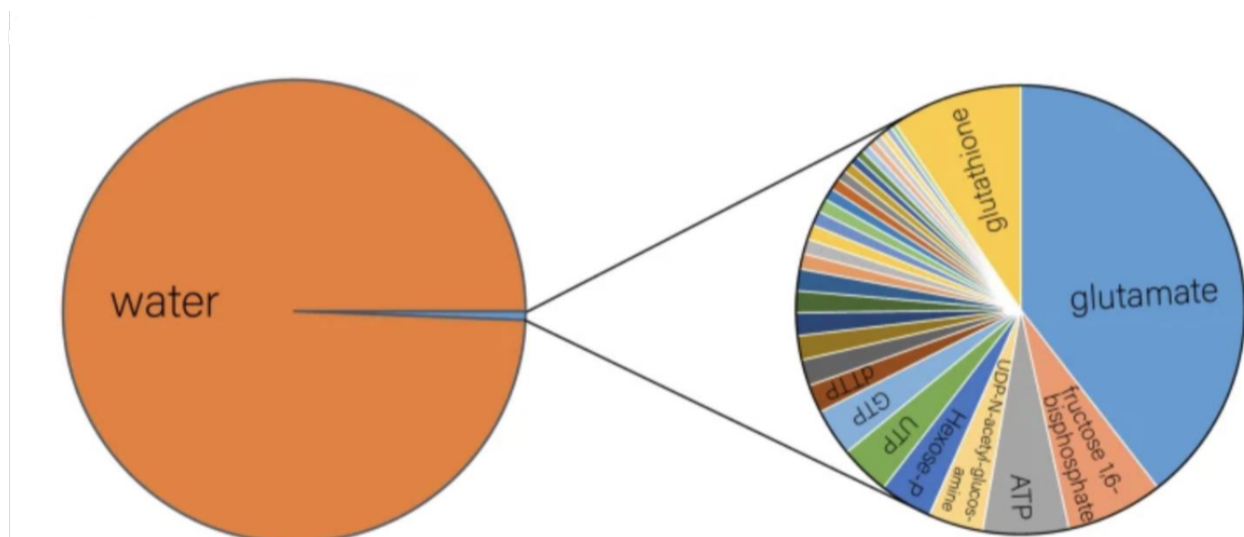
Becerra et al., 2007

Proteins



- The above diagram shows proteins, an important part of cells and metabolism.
- This class aims to study the metabolic pathways in cells, many of which are catalyzed by proteins (specifically enzymes).
- RNA can also be a catalyst. (RNA is not a protein)

Water



- Water is a dominant metabolite in biochemistry, accounting for 99.4% by molarity of metabolites within an *E. coli* bacteria. Water in an *E. coli* cell is around 40 M. The sum of the concentrations of all

other metabolites is 240 mM.

Proteins Exist in Aqueous Environments

- Our first major topic in this class is **protein synthesis and structure**
 - The **amino acids** of proteins are affected by the **pH** of aqueous environments (protonation state!)
 - These amino acids often form different **intermolecular interactions** amongst themselves and with their environment
 - The folding of proteins is a **thermodynamic** problem

Importance of Water

- Physical and chemical properties of water influence every biochemical interaction
 - The medium for most biochemical reactions
 - Participates directly in many biochemical reactions
 - Affects folding (structure) of biomolecules