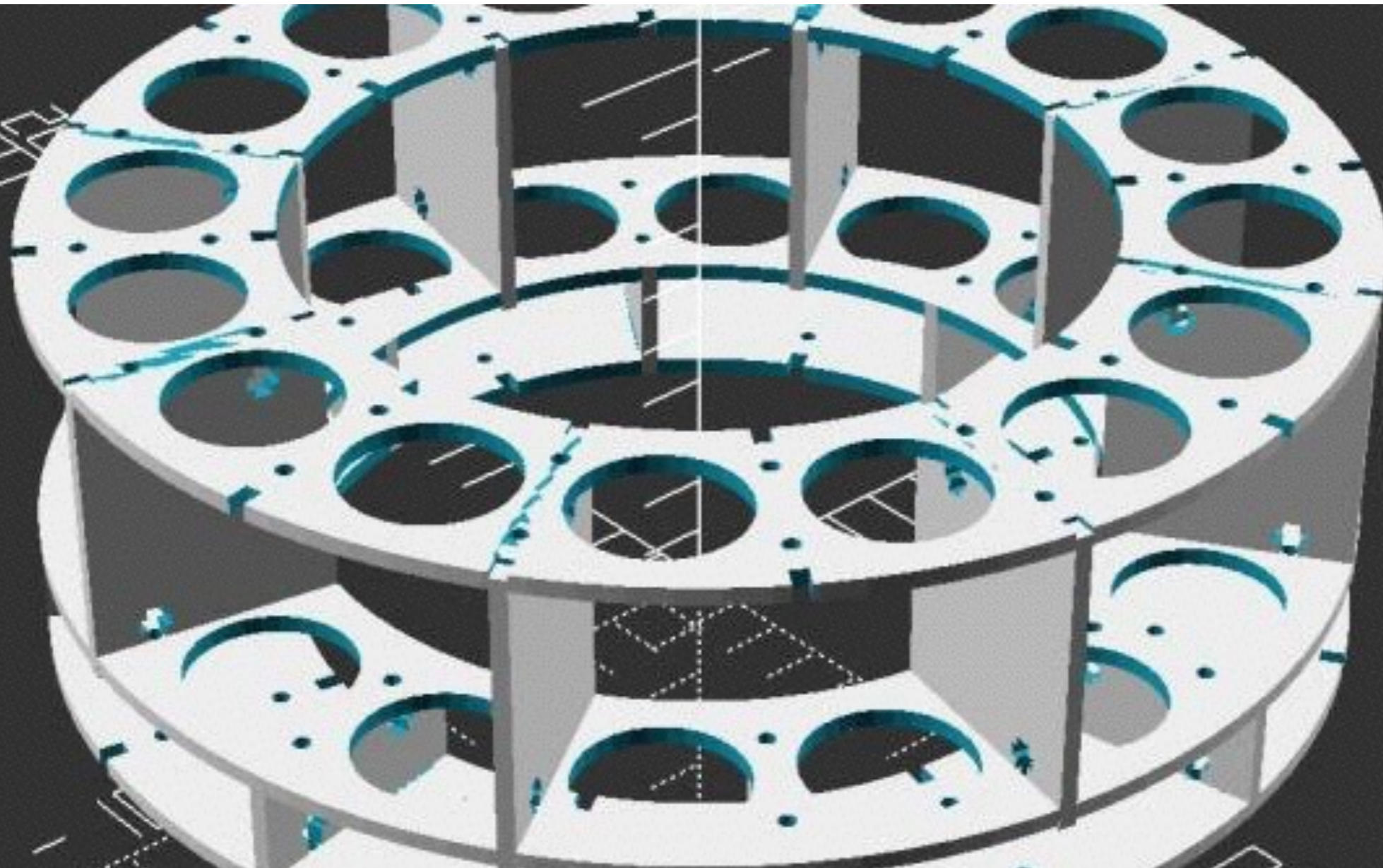




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picture by Erwin




# BioHack Academy Materials in Life



# BioFactory canvas



  
input

\_\_\_\_\_ C

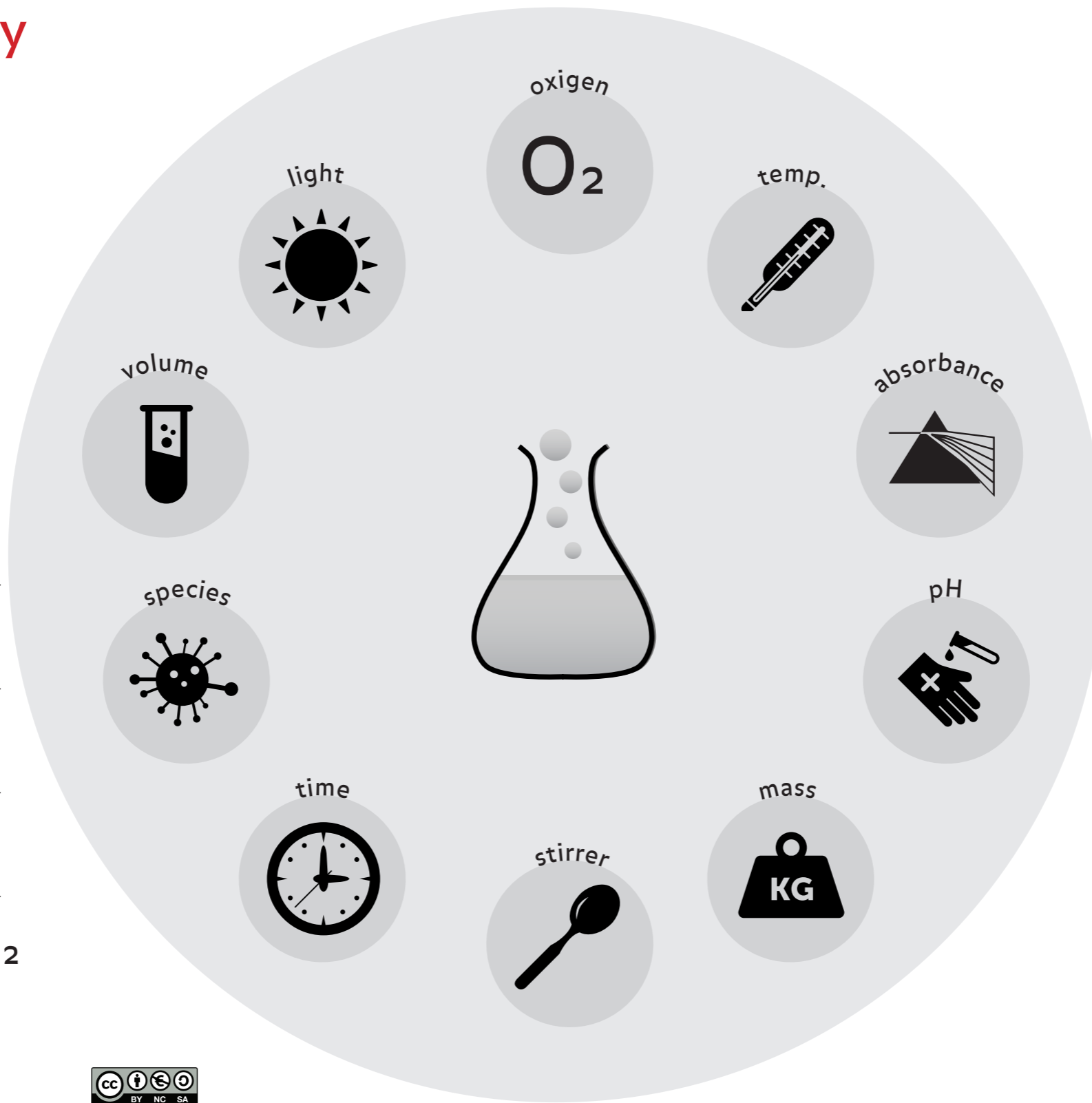
\_\_\_\_\_ N

\_\_\_\_\_ P

\_\_\_\_\_ O<sub>2</sub>

\_\_\_\_\_ S

\_\_\_\_\_



## observations

day #	
day #	
day #	
day #	
day #	



## material

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



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# The Cell





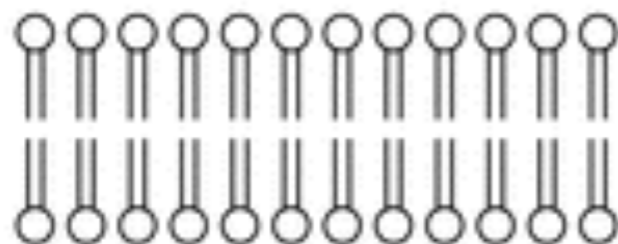
# Lipid bilayer cell



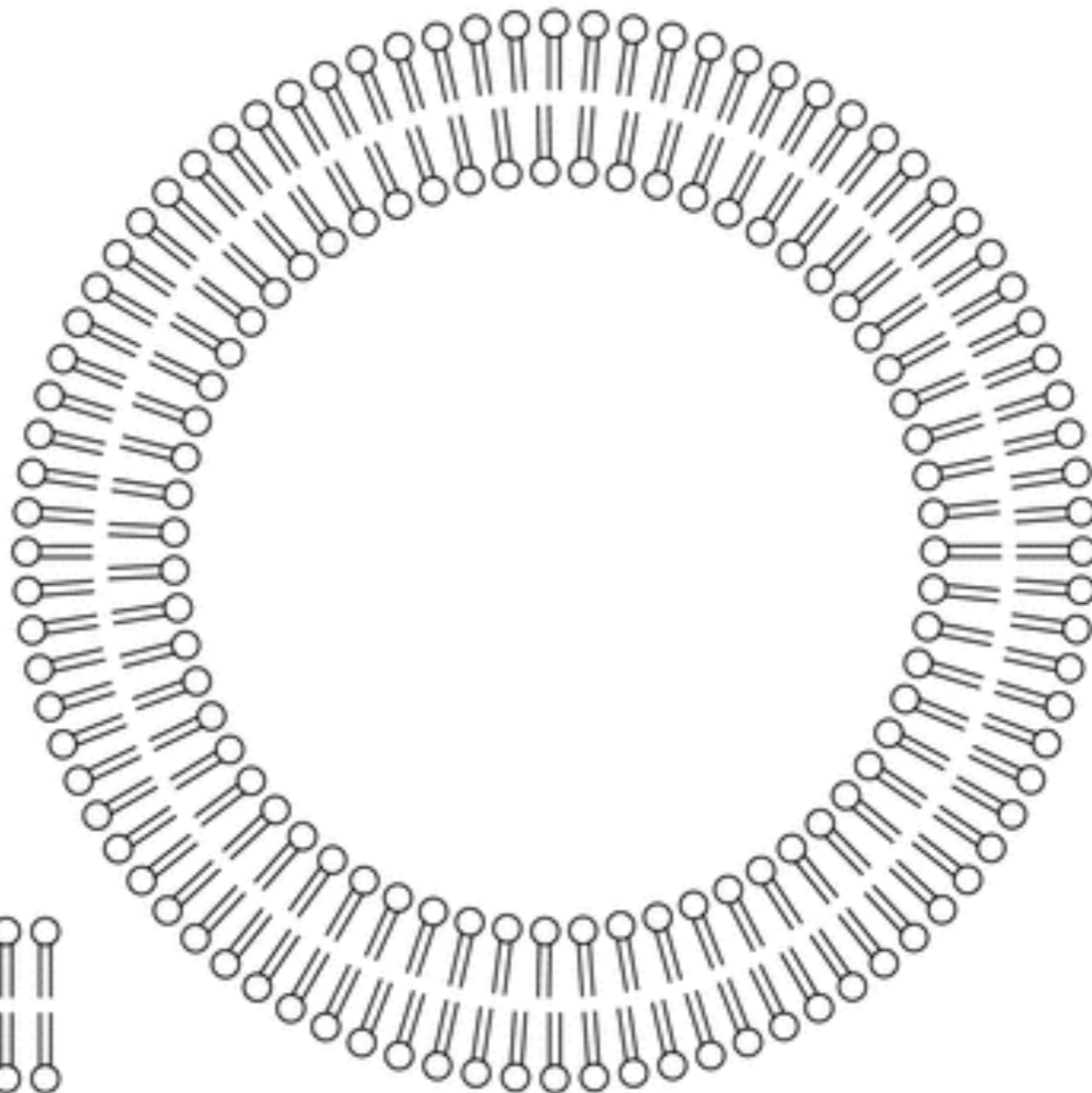
Micelle



Inverted micelle



Lipid bilayer

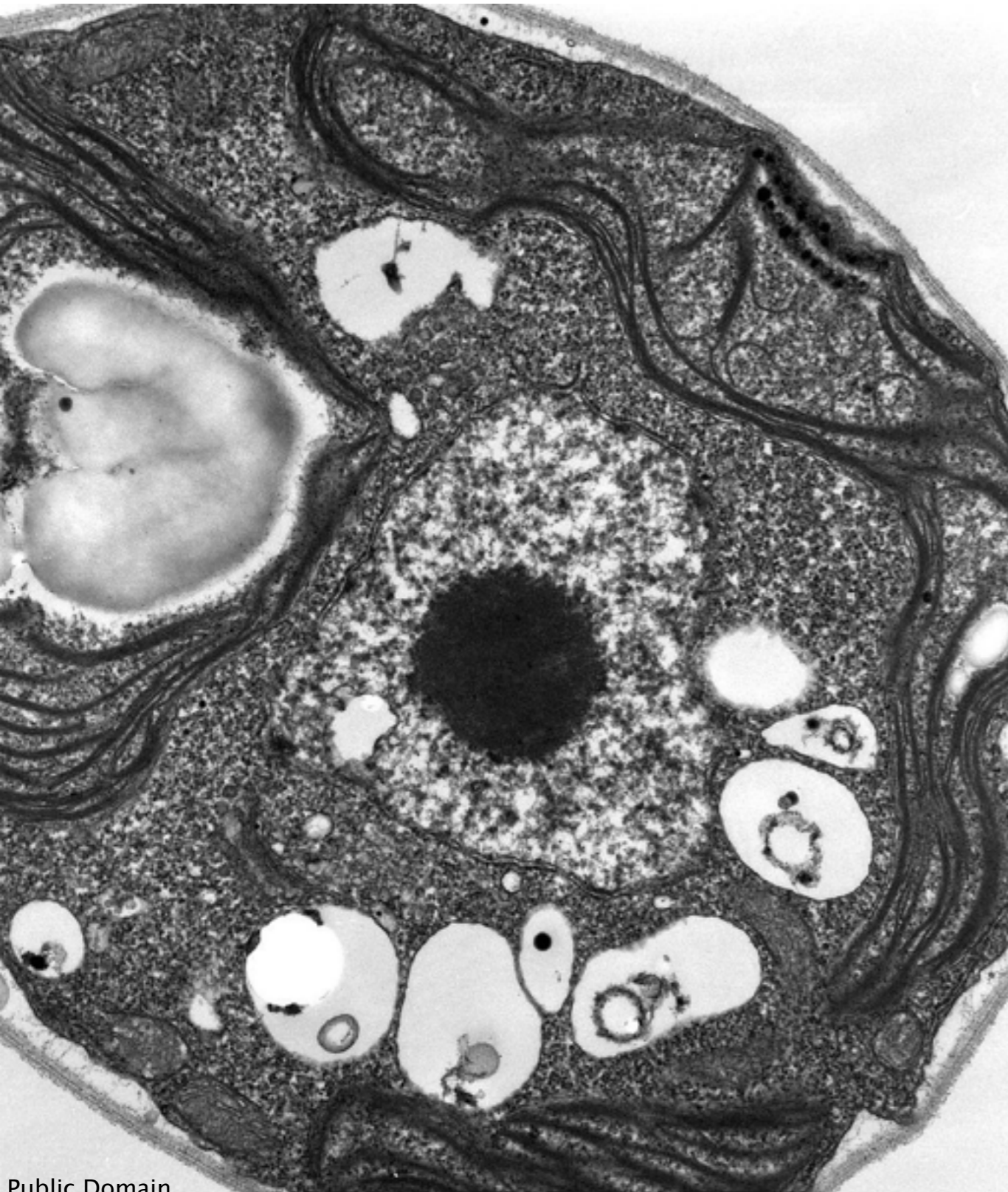


Vesicle

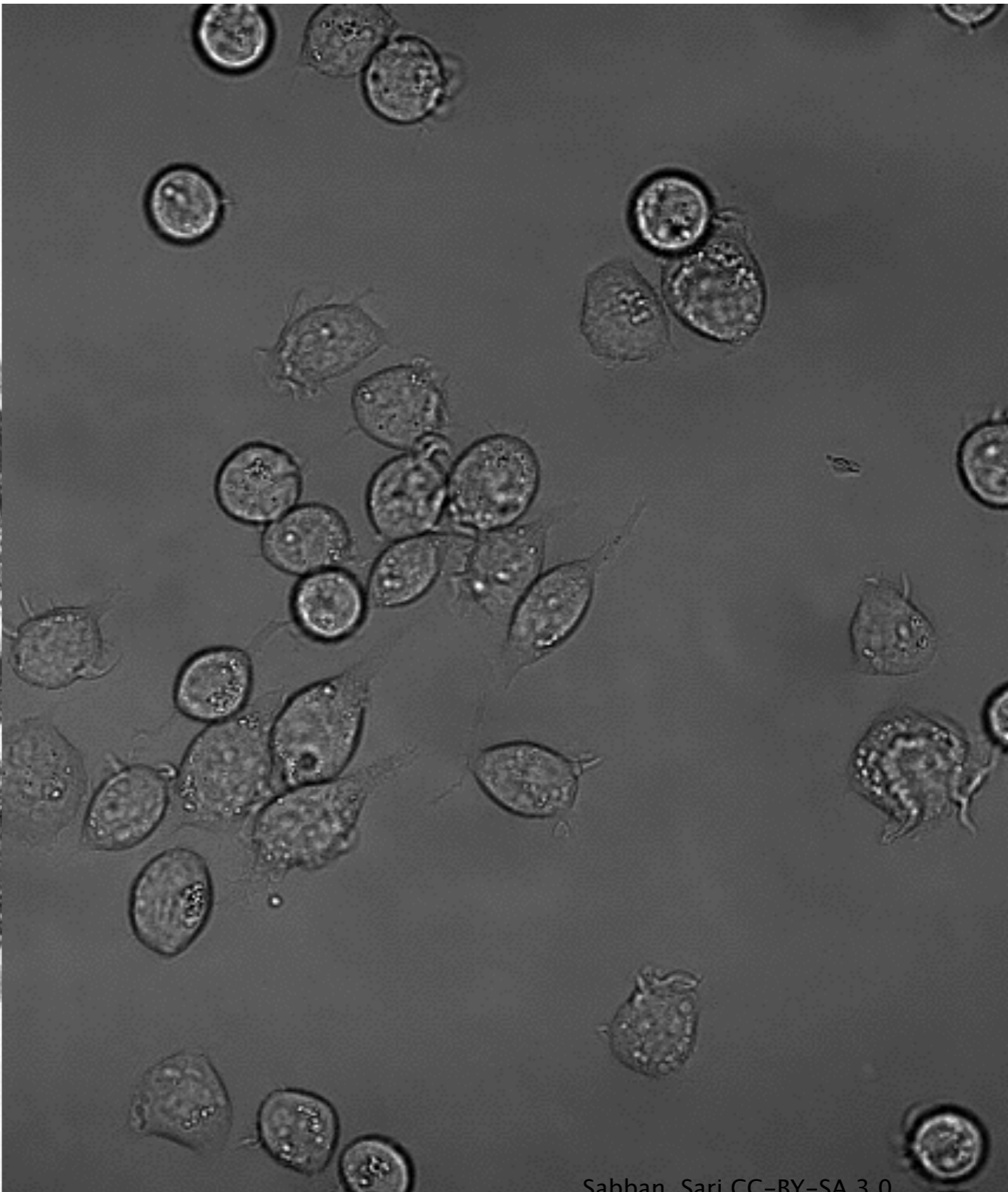




# Life is made out of cells



Public Domain



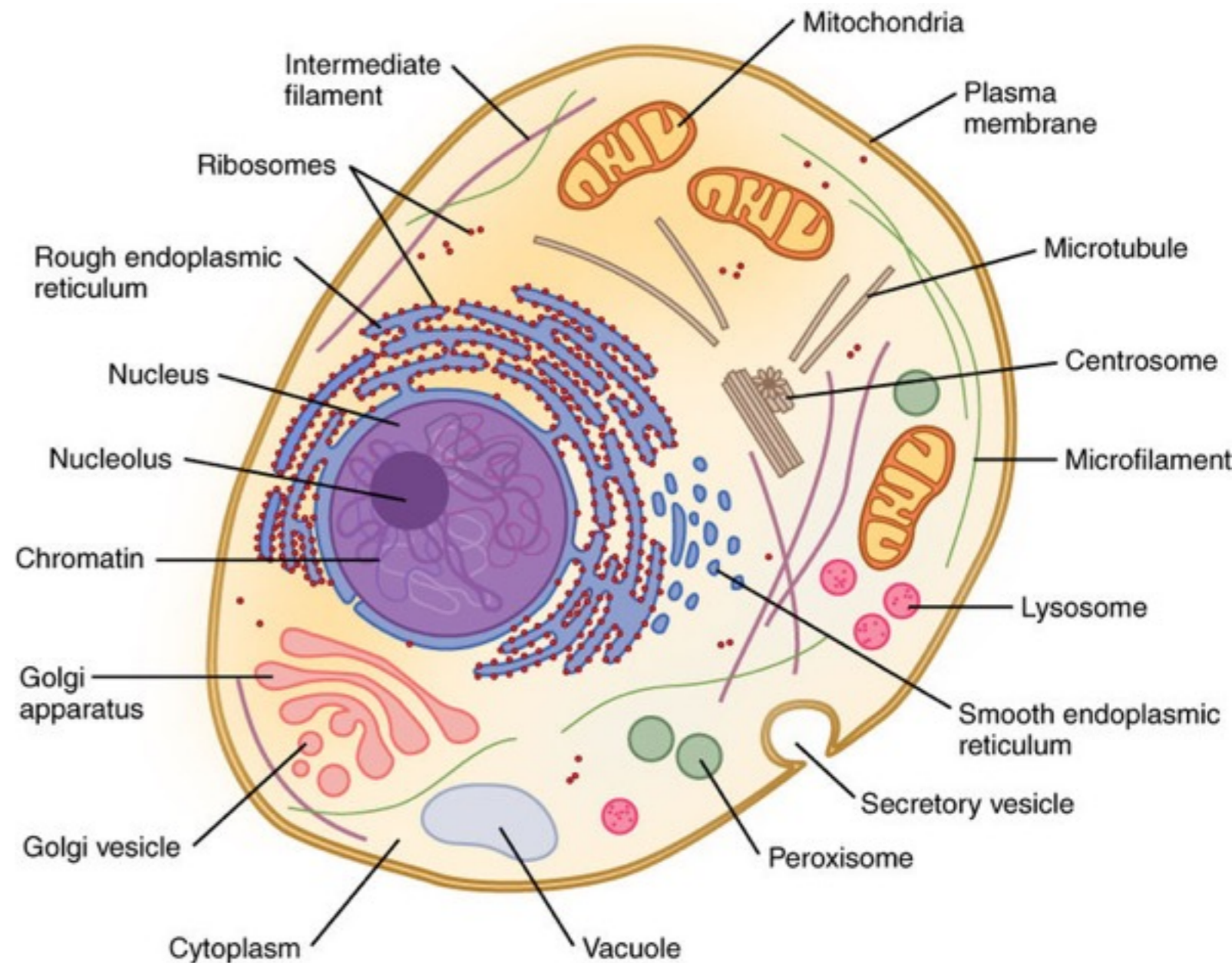
Sabban, Sari CC-BY-SA 3.0





## What's a cell made of:

- Lipids
- Proteins
- DNA
- RNA
- Metabolites
- Ions





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# Energy





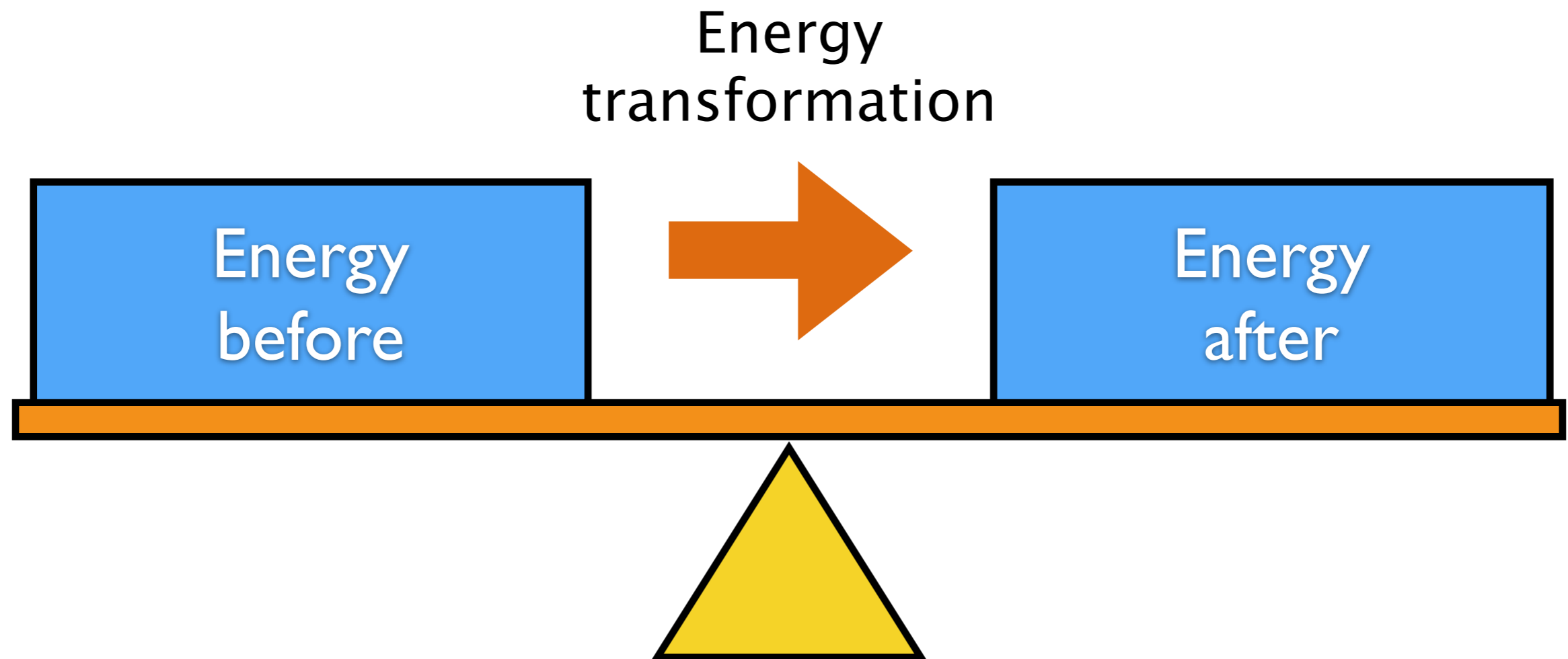
# Bio energy





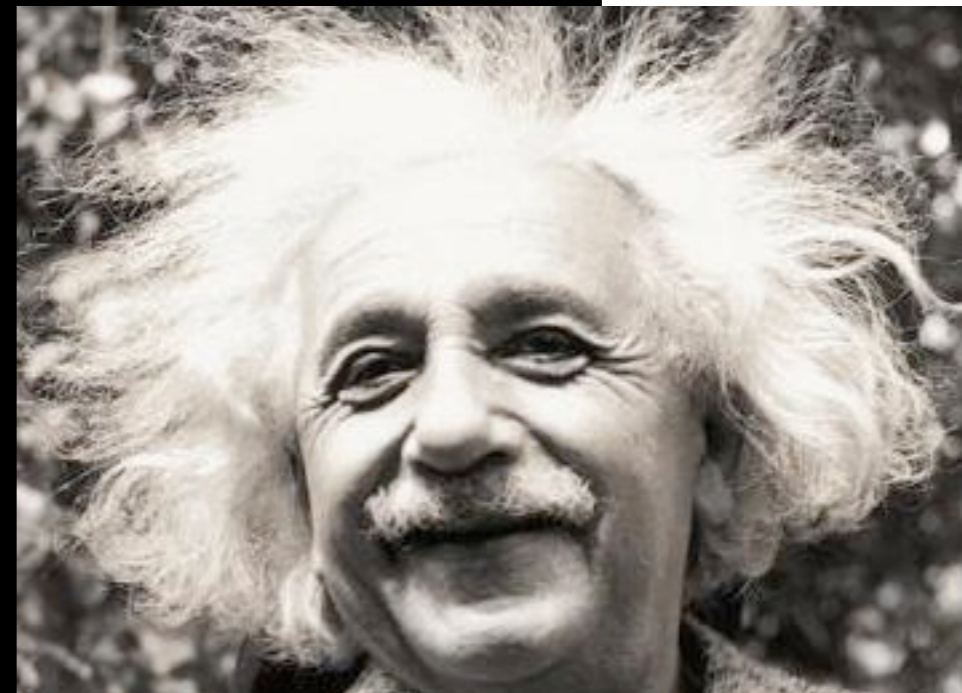


# First law of thermodynamics





$$E = mc^2$$







## Second law of thermodynamics

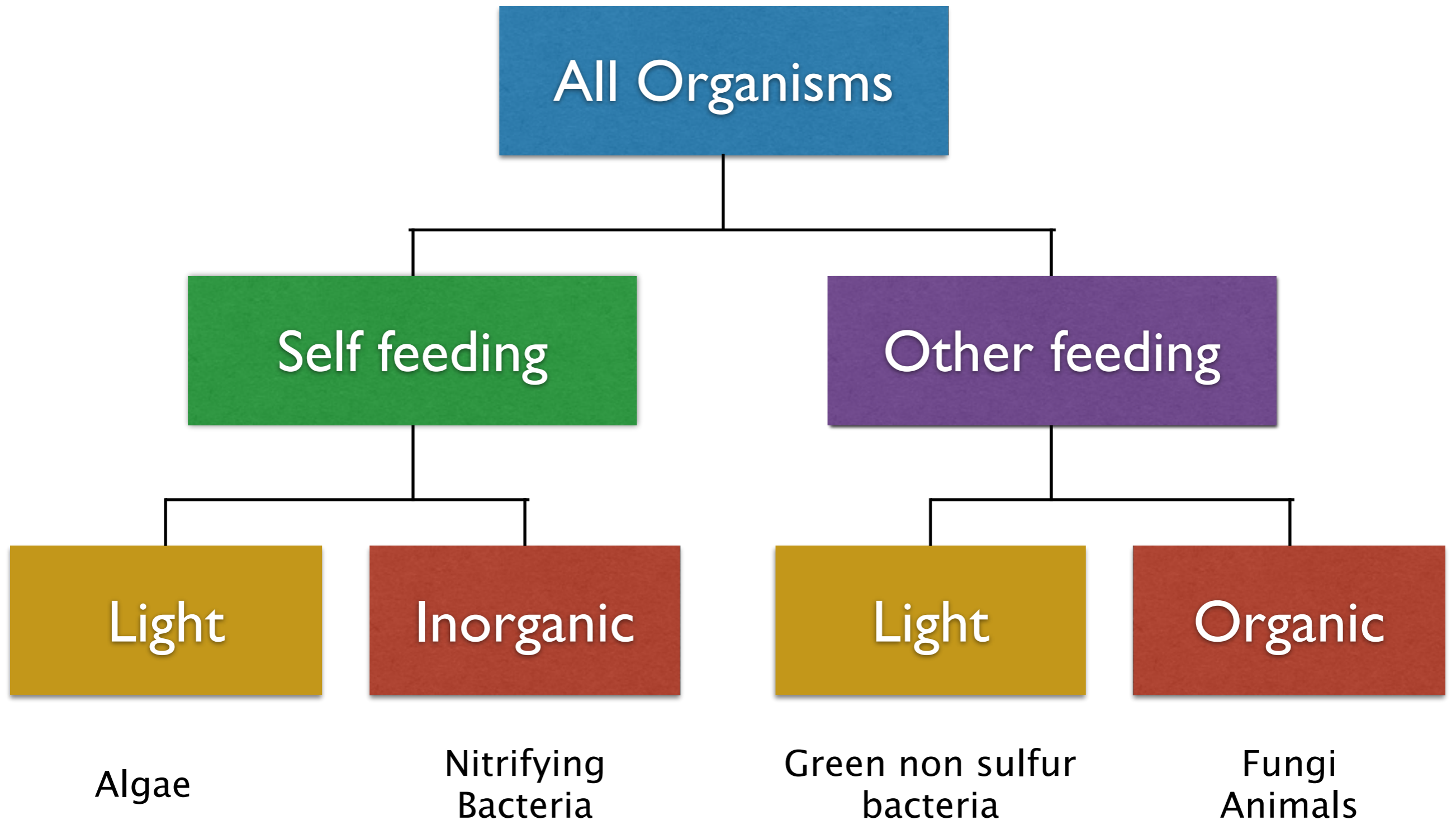
Nothing will happen spontaneously unless it increases the **entropy** of the universe

**Entropy** is a measure of disorder





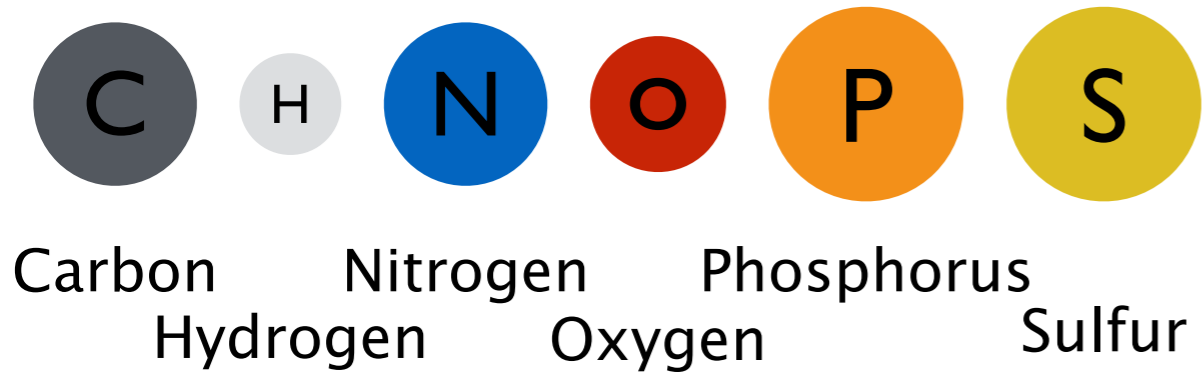
# Diversity in Metabolism



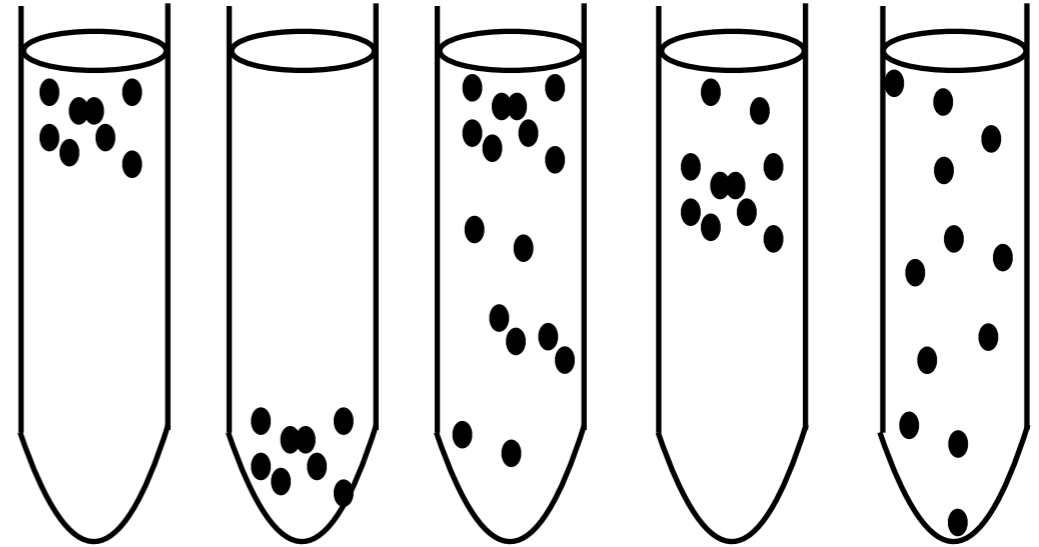


# Diversity in growth conditions

## Nutrients



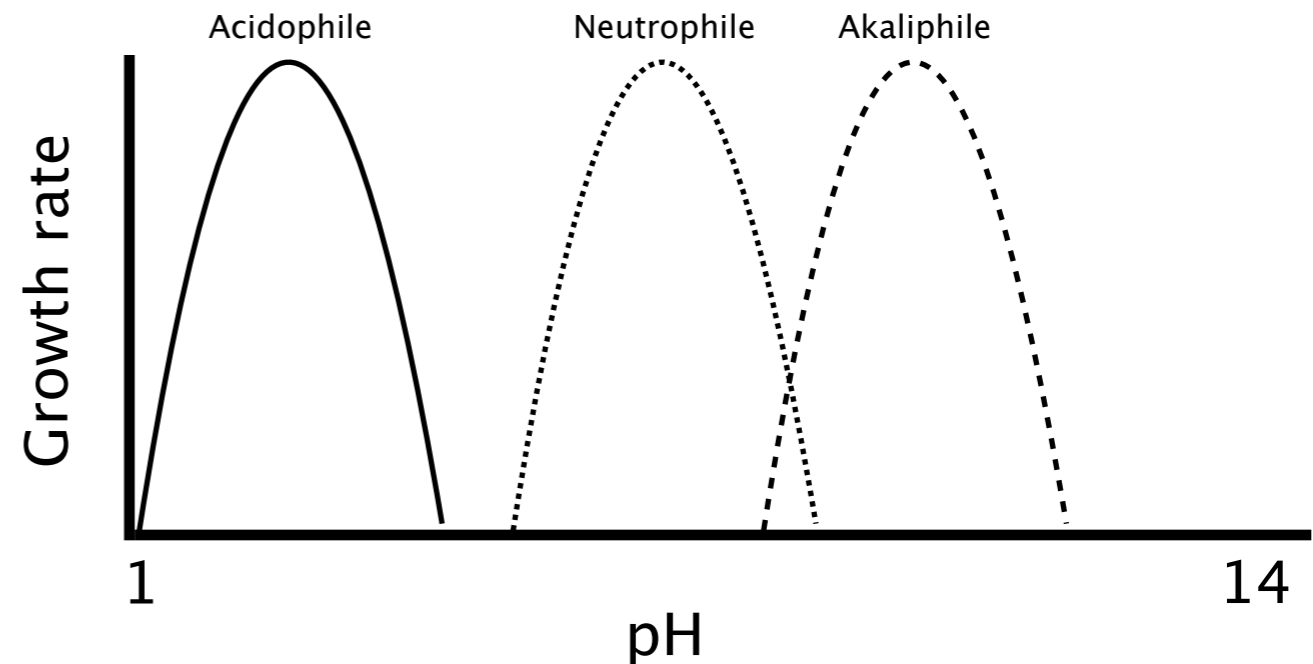
## Atmosphere



## Temperature



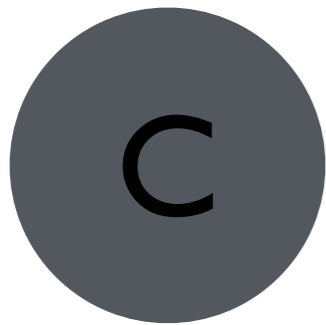
## pH







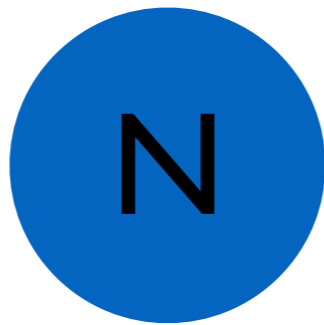
# Elements of Life



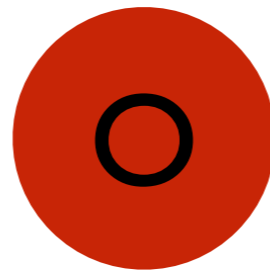
Carbon



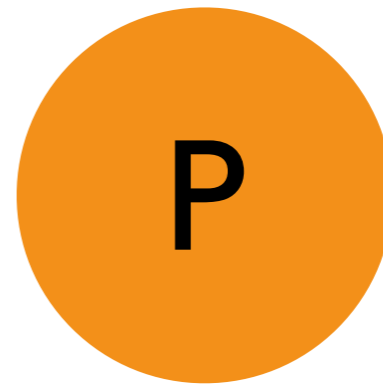
Hydrogen



Nitrogen



Oxygen



Phosphorus

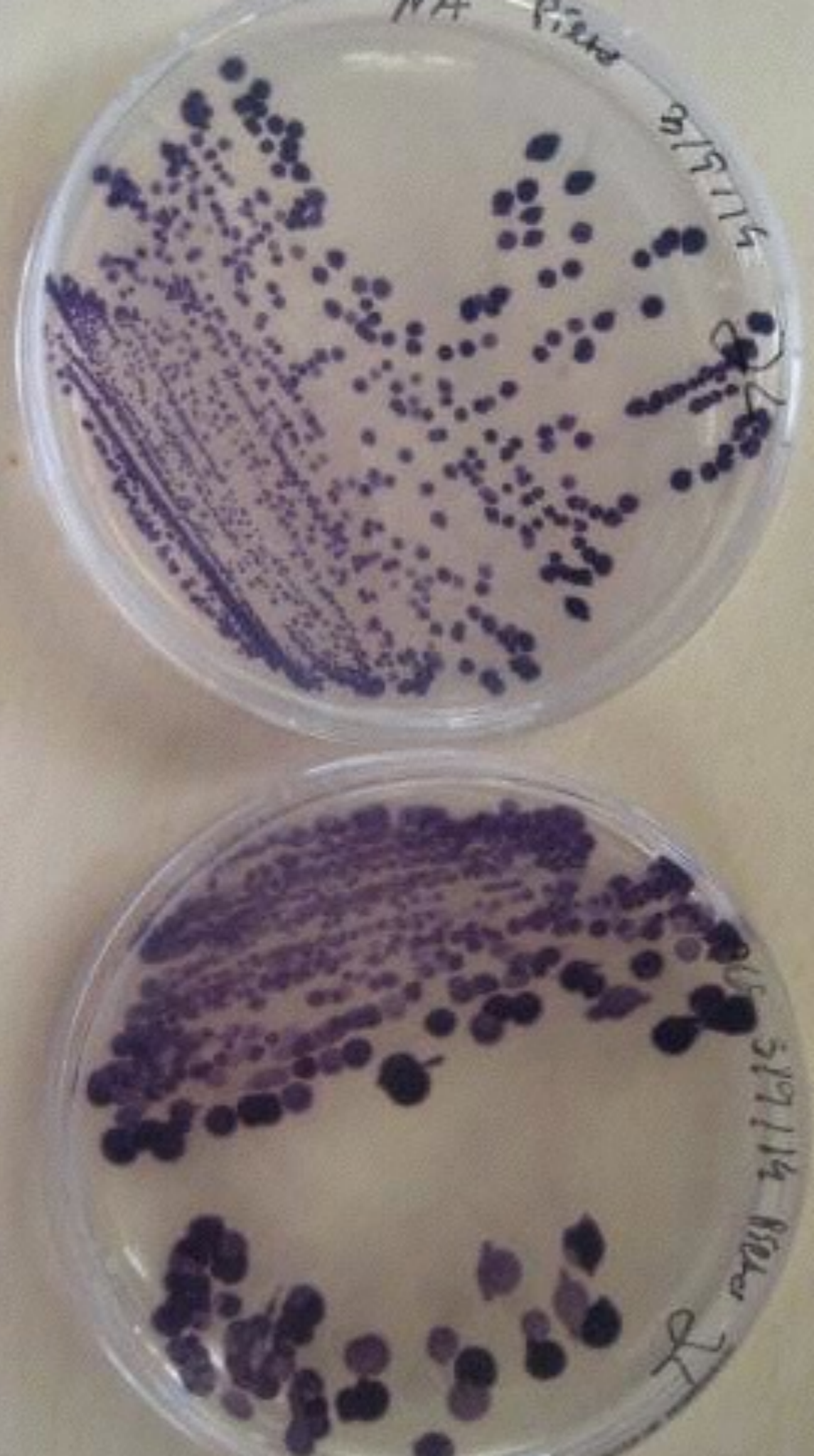


Sulfur



# Non selective

- Plate count agar
- Nutrient agar







# Slightly selective

- Malt agar
- MRS agar
  
- Kombucha medium







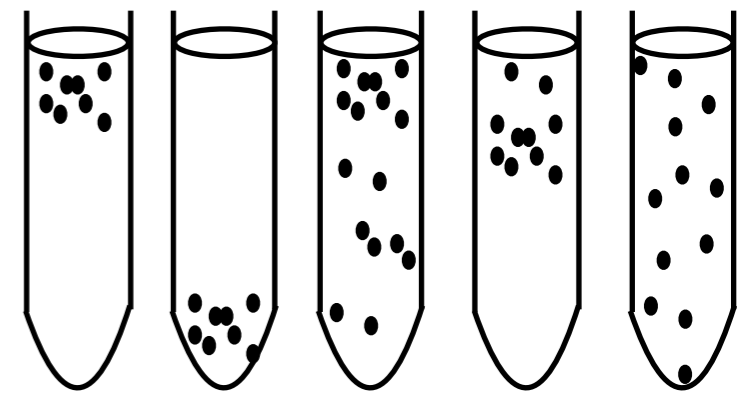
# Selective

- Spirulina medium





# Diversity in Atmosphere



Term	Property	Example
Strict aerobe	Requires oxygen	<i>Pseudomonas aeruginosa</i>
Stric anaerobe	Does not tolerate oxygen	<i>Bacteroides fragilis</i>
Facultative anaerobe	Aerobe, but can also grow anaerobically	<i>Escherichia coli</i>
Aerotolerant	Anaerobe, but can tolerate oxygen	<i>Clostridium perfringens</i>
Micro-aerophilic	Prefers reduced level of oxygen	<i>Helicobacter</i> spp.
Capnophilic	Prefers increase level of oxygen	<i>Neisseria</i> spp.



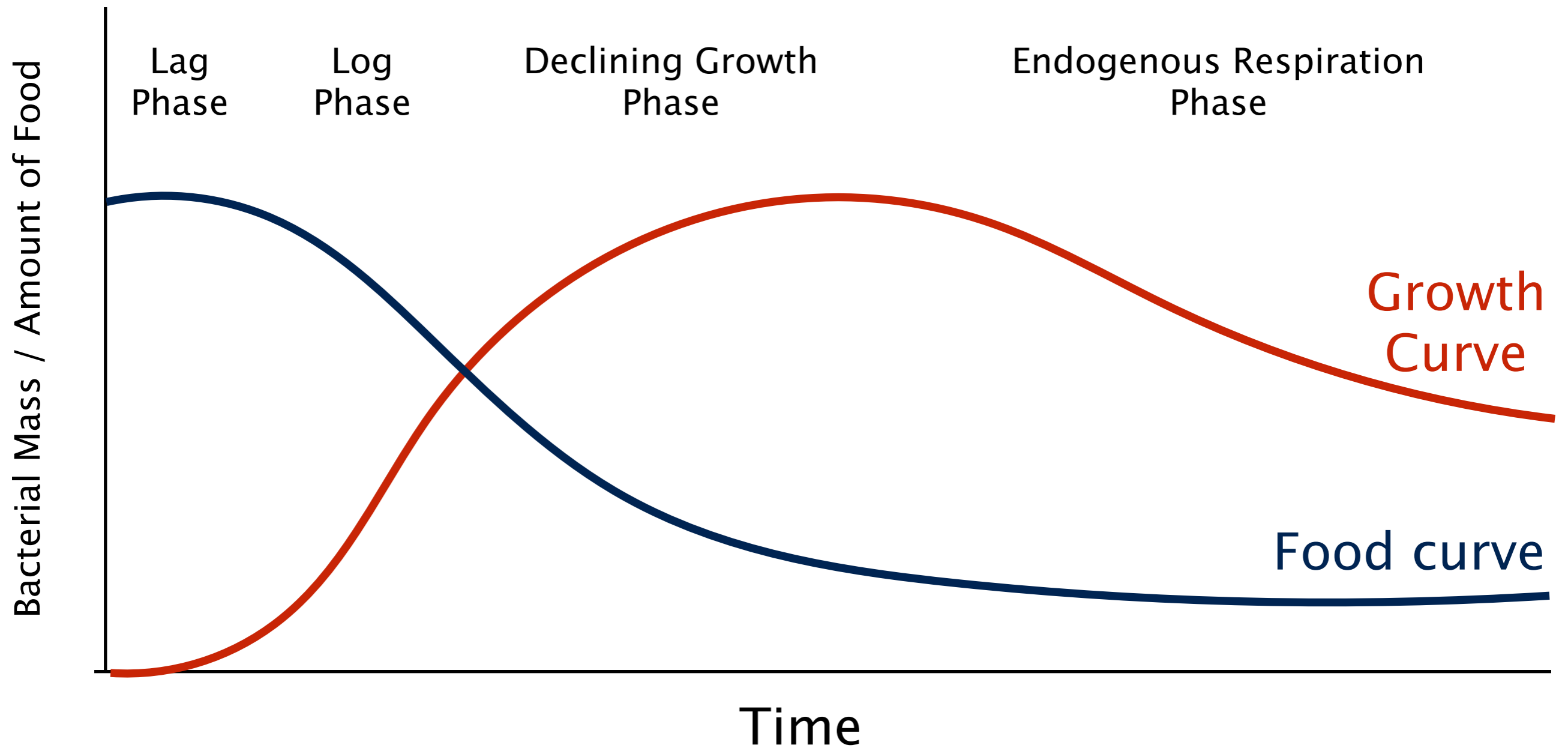
# Diversity in Temperature

Term	Property	Example
Psychrophilic	Temp < 10 C	Flavobacterium spp
Thermophilic	Temp > 60 C	B. stearothermophilus
Mesophilic	20 - 40 C	Most pathogens



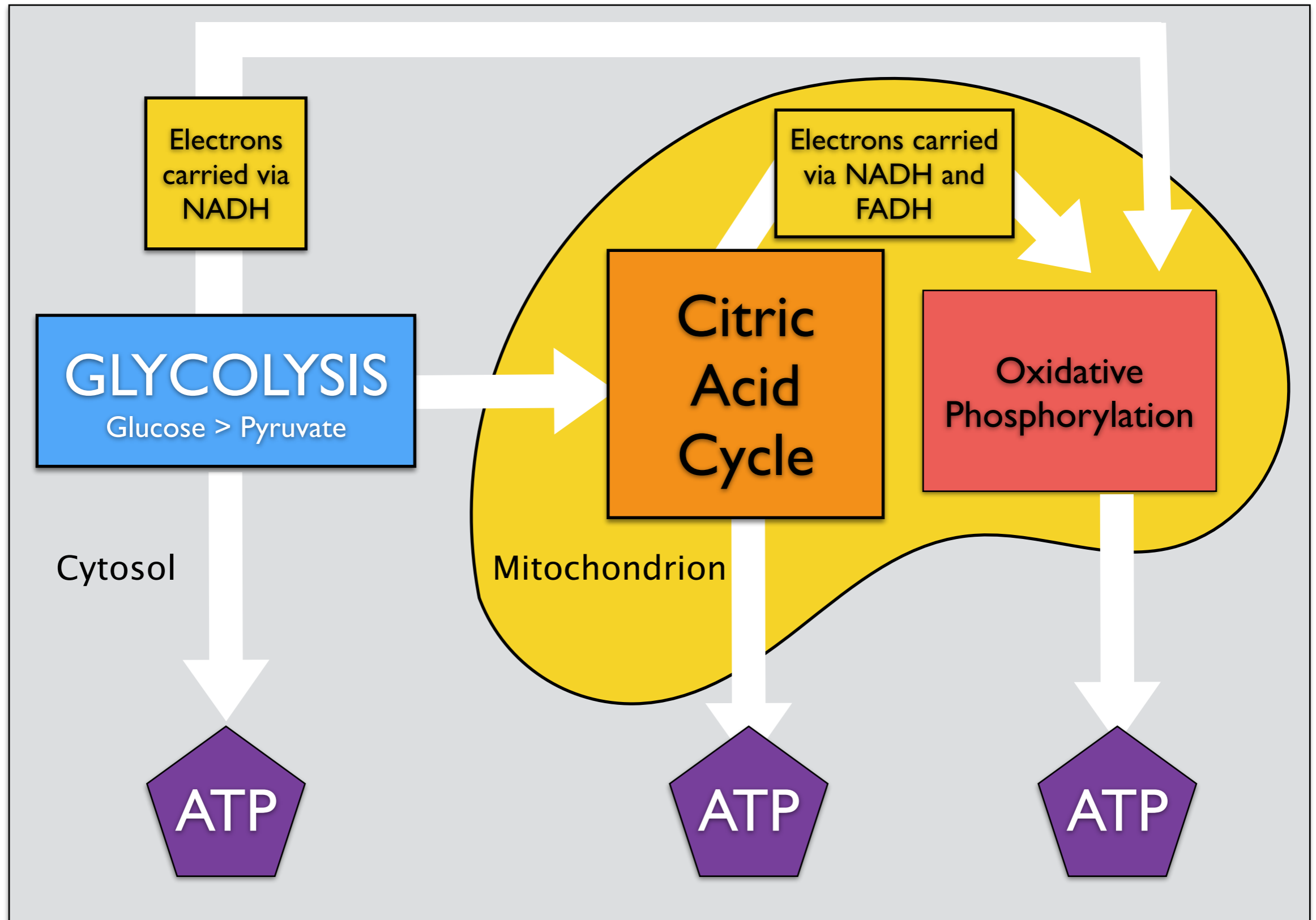


# Bacterial growth curve



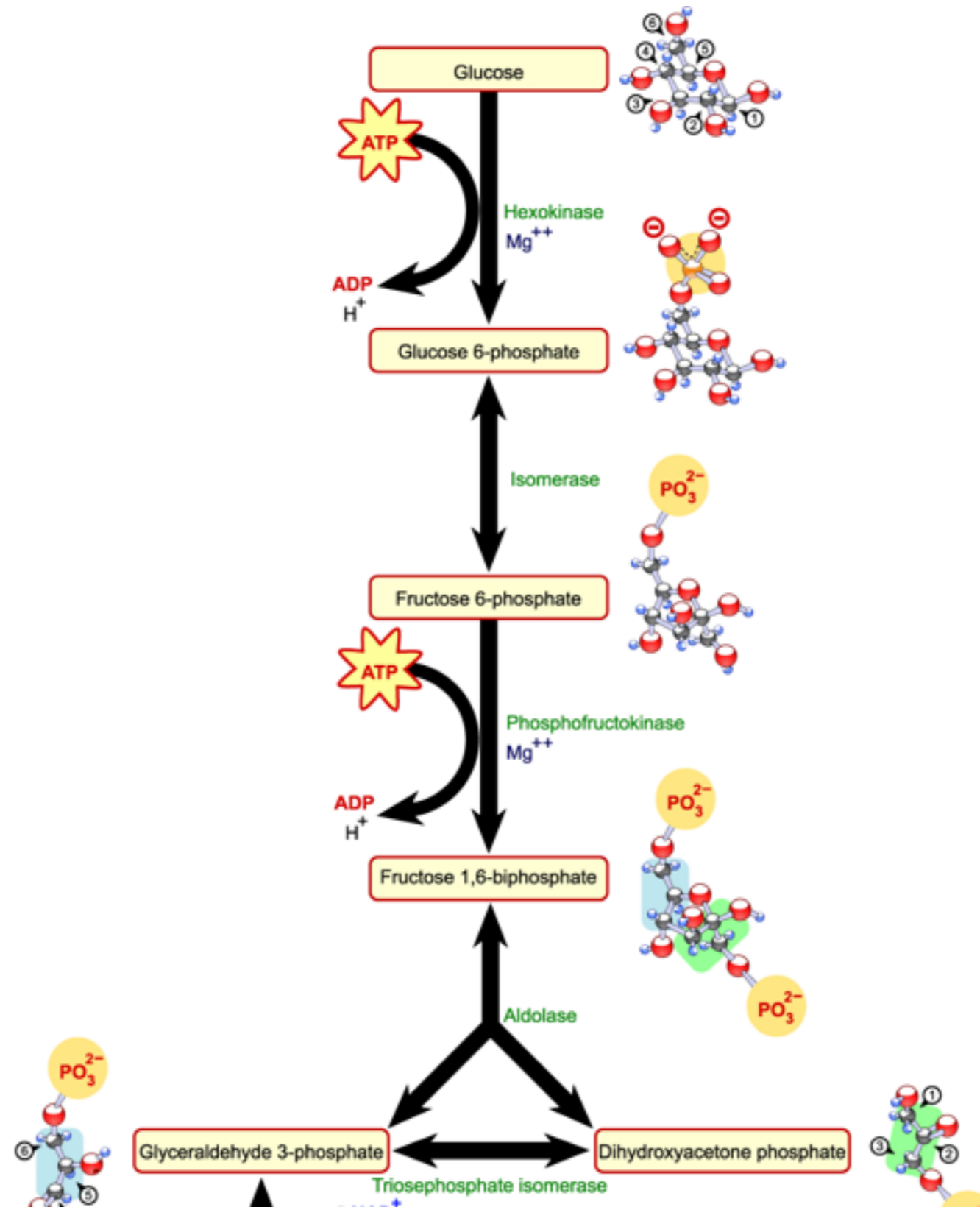


# Respiration





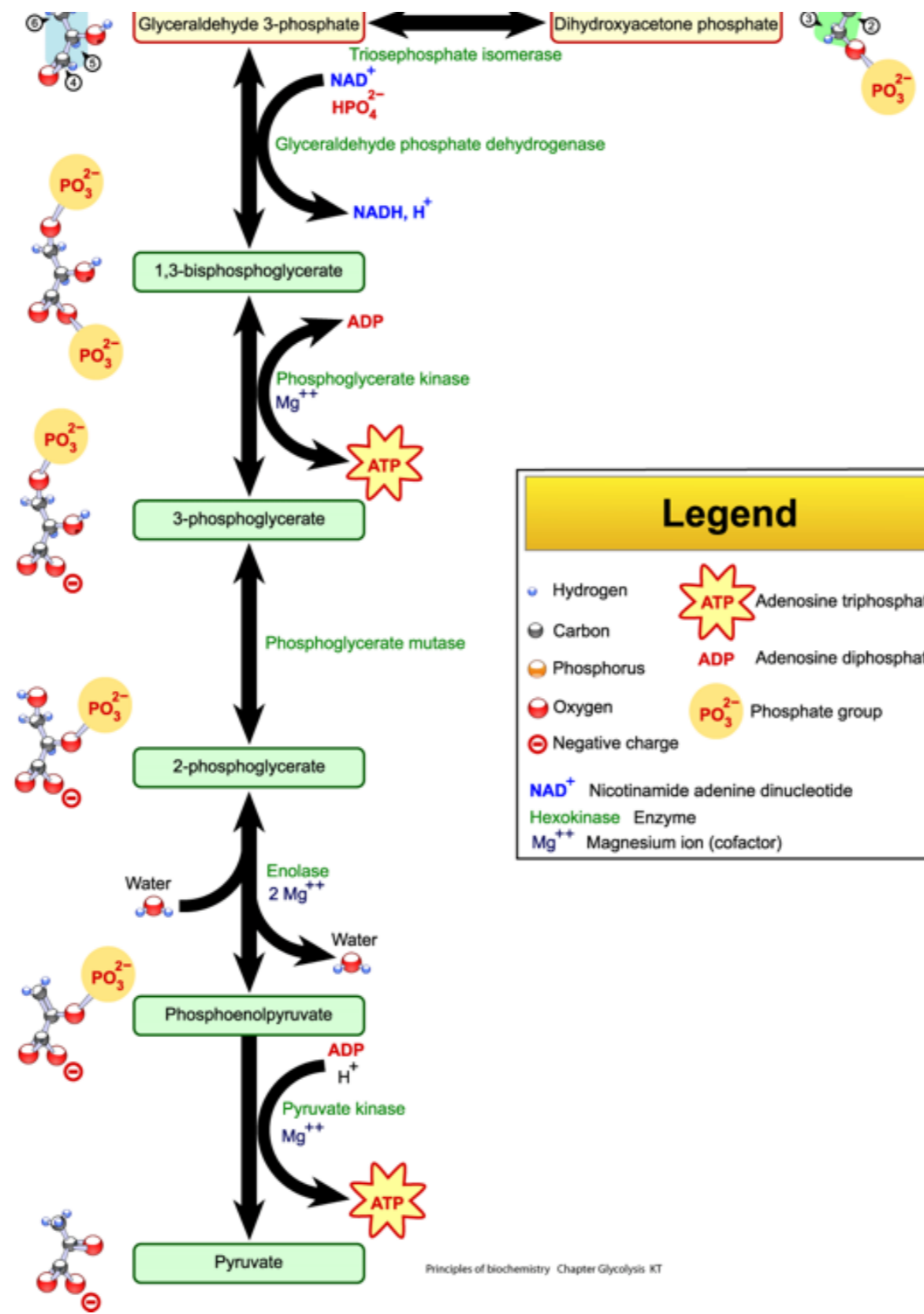
# Glycolysis part 1





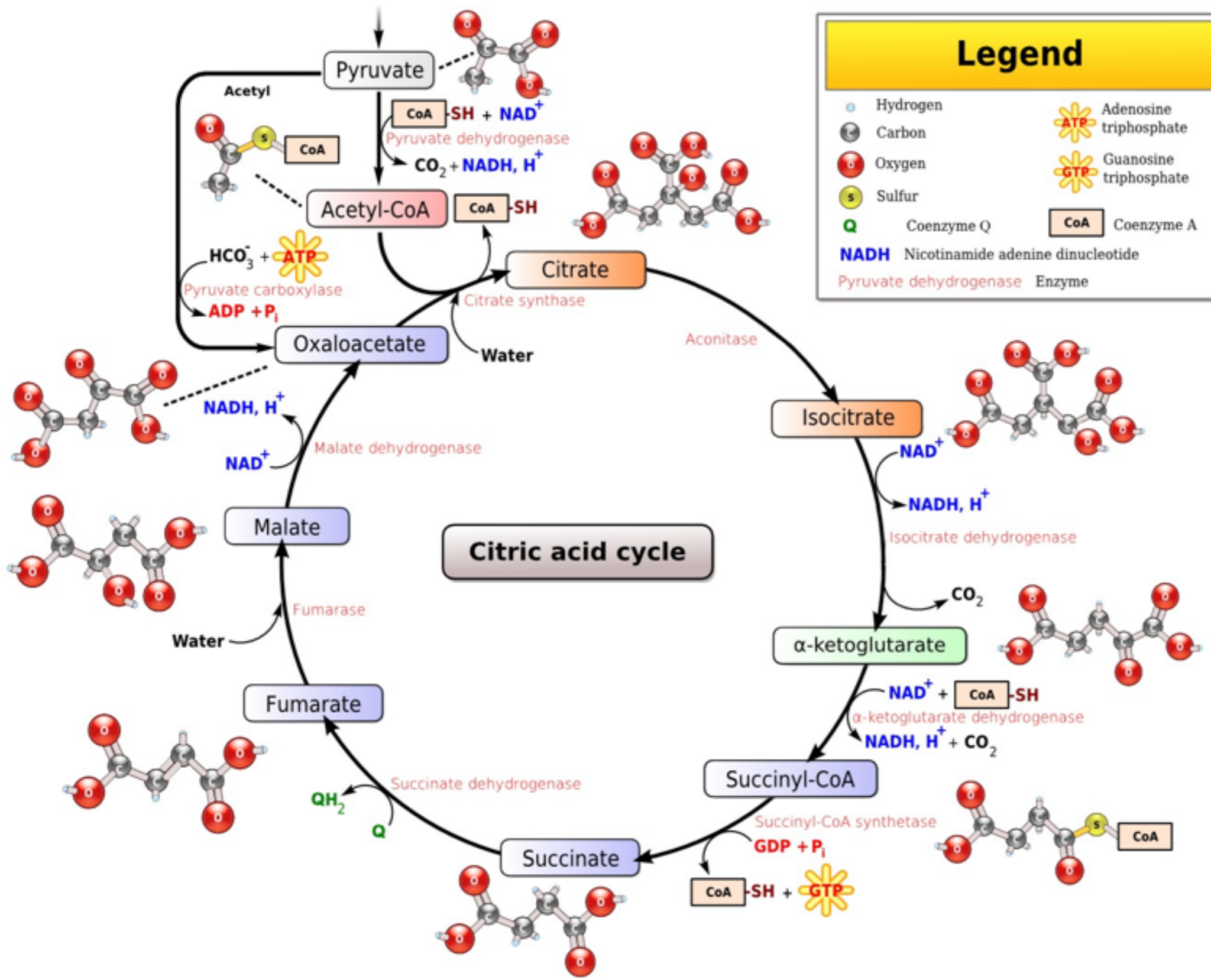


# Glycolysis part 2



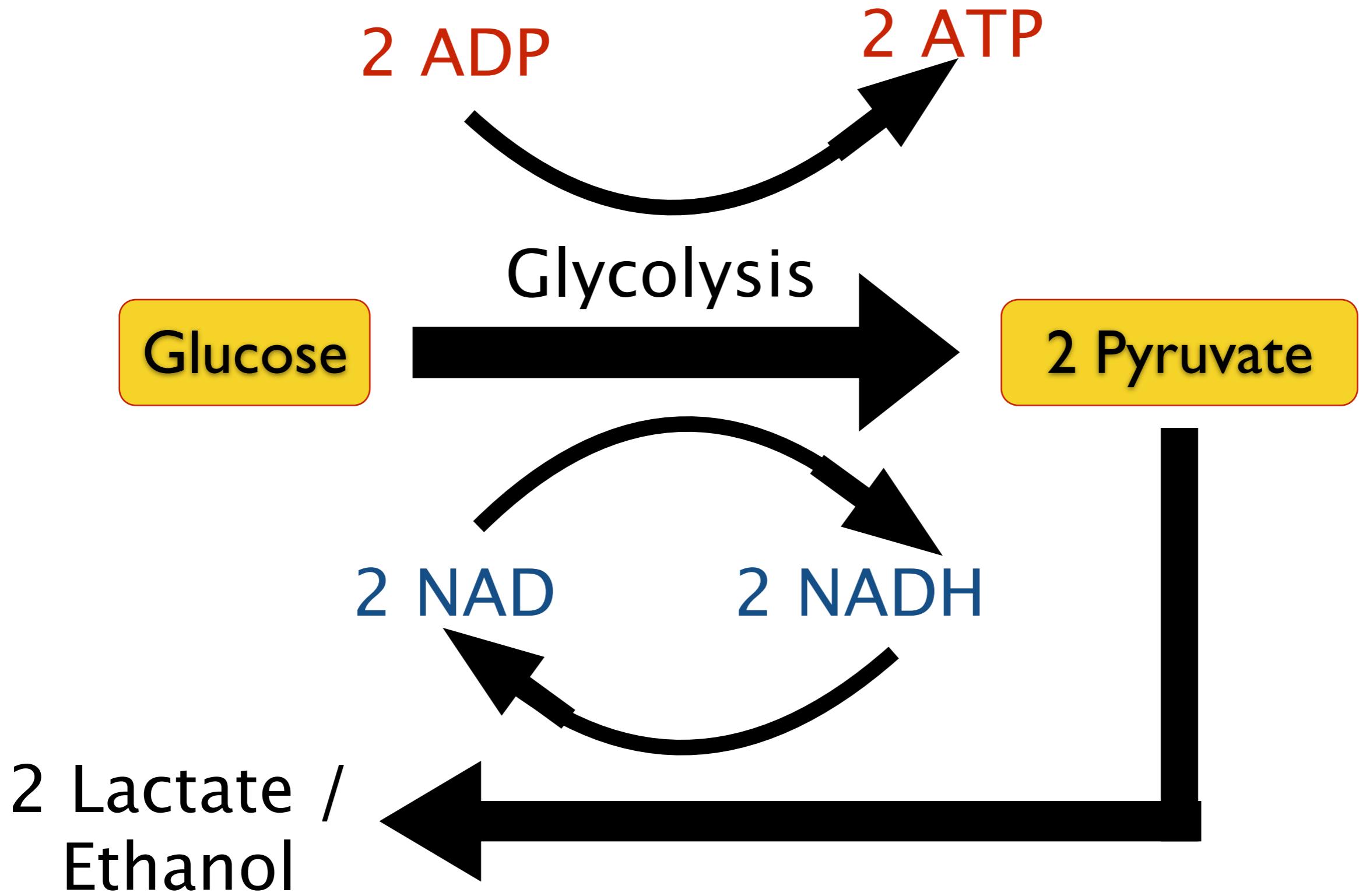


# Citric Acid Cycle





# Fermentation







# Assimilation

- Amylase
- Glucomylase
- Protease
- Invertase
- Peptidase
- Lipase
- Lactase
- Cellulase



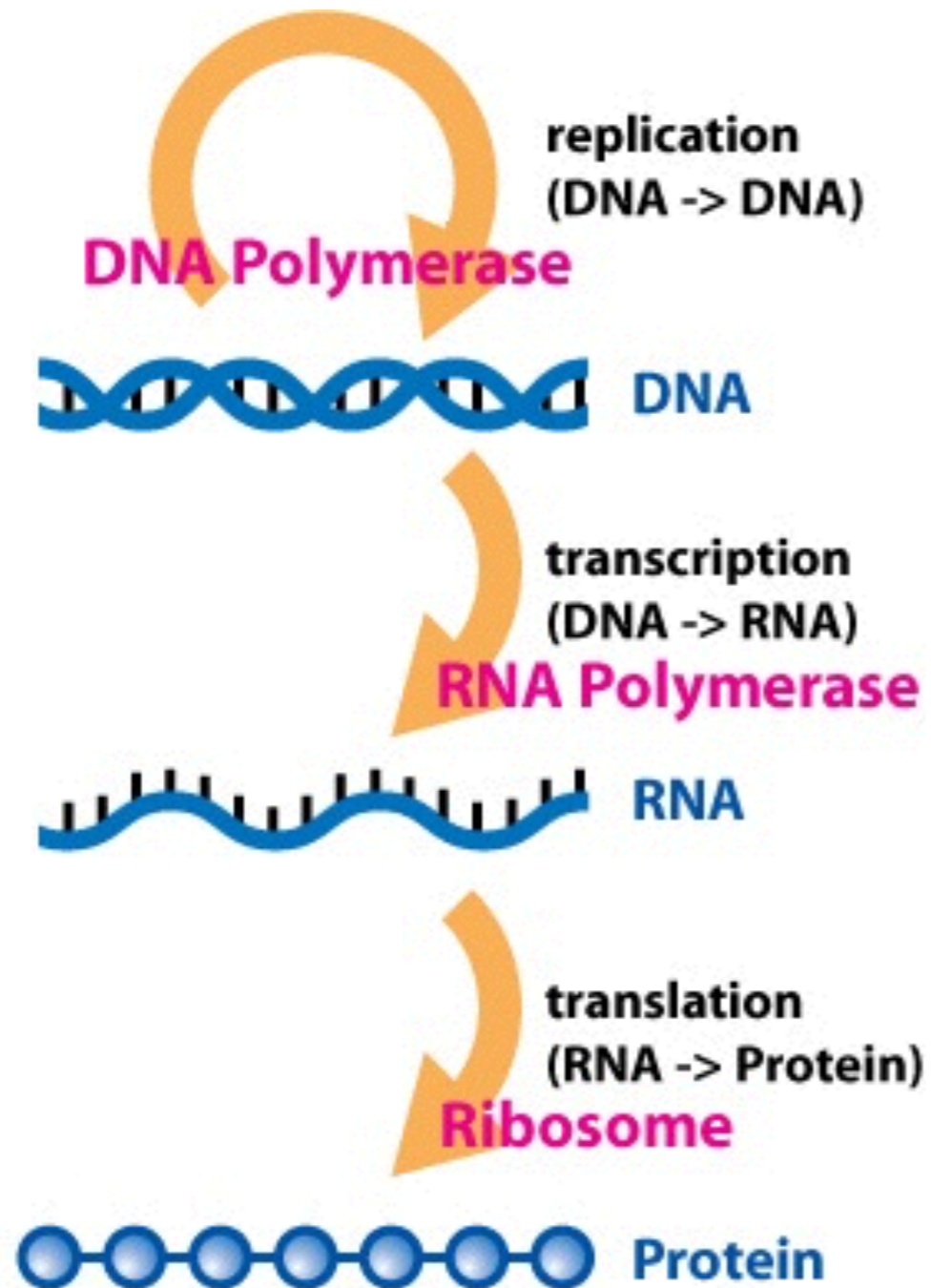
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# DNA & Chromosomes



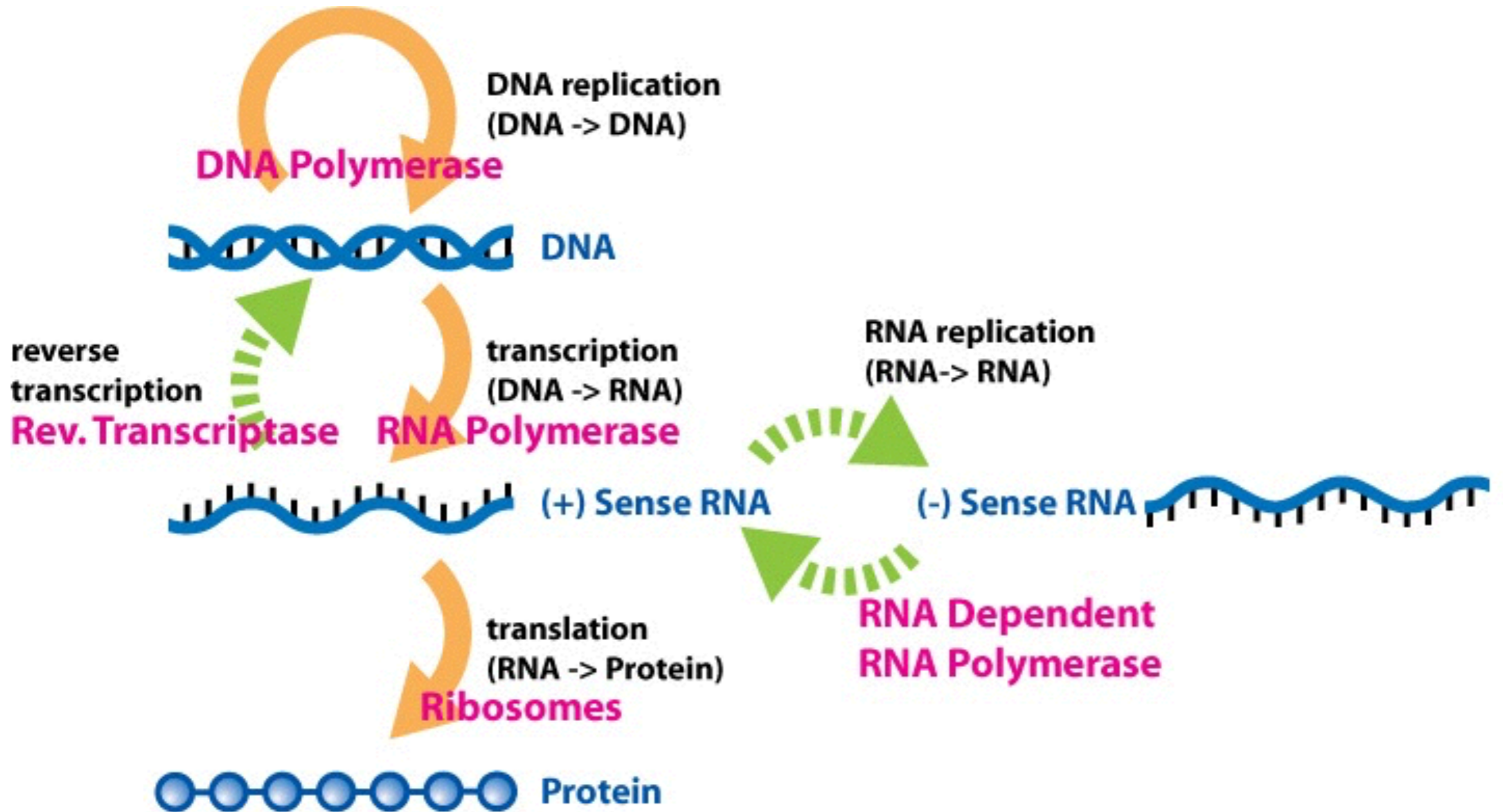
# Central Dogma







# Central Dogma

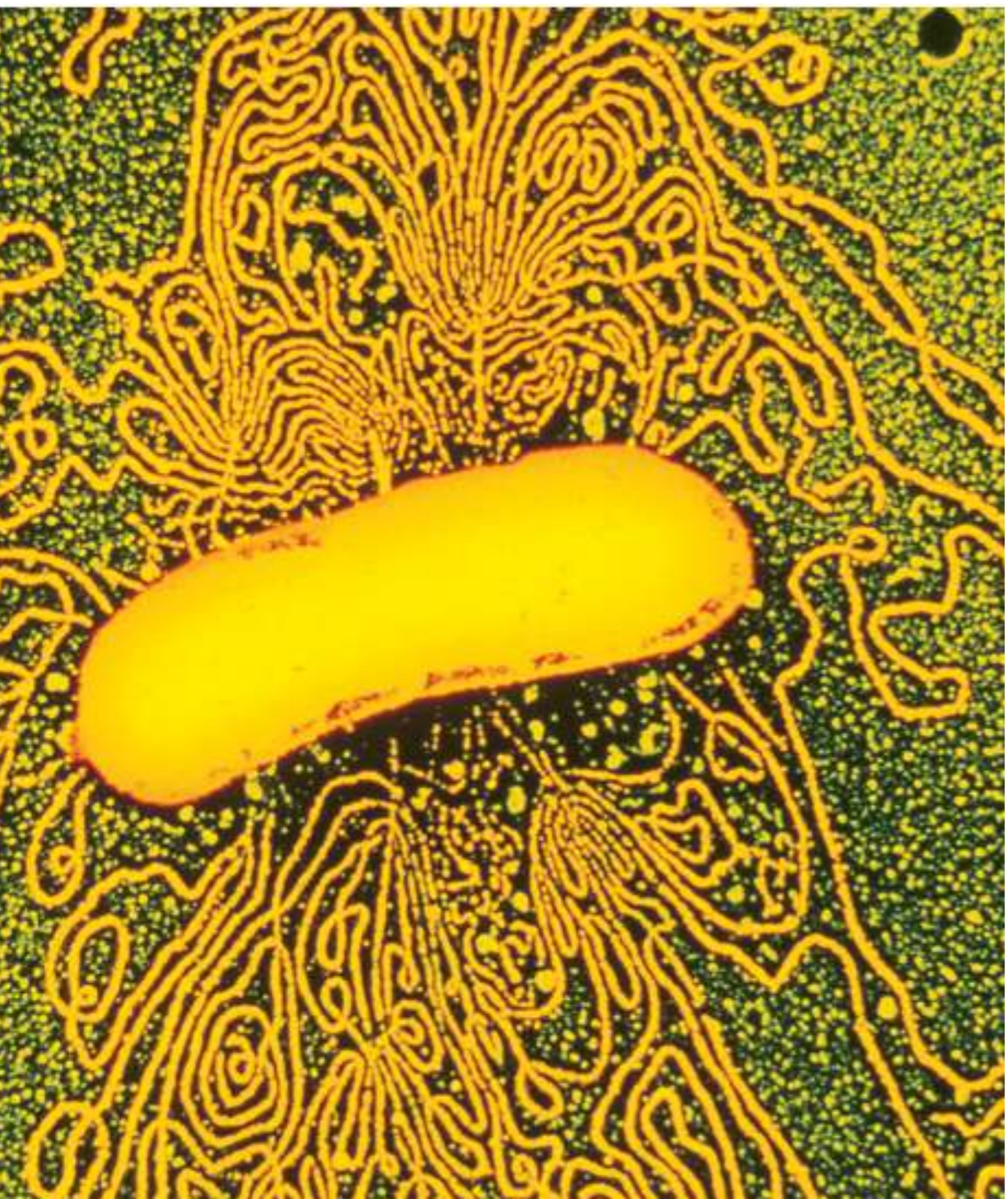








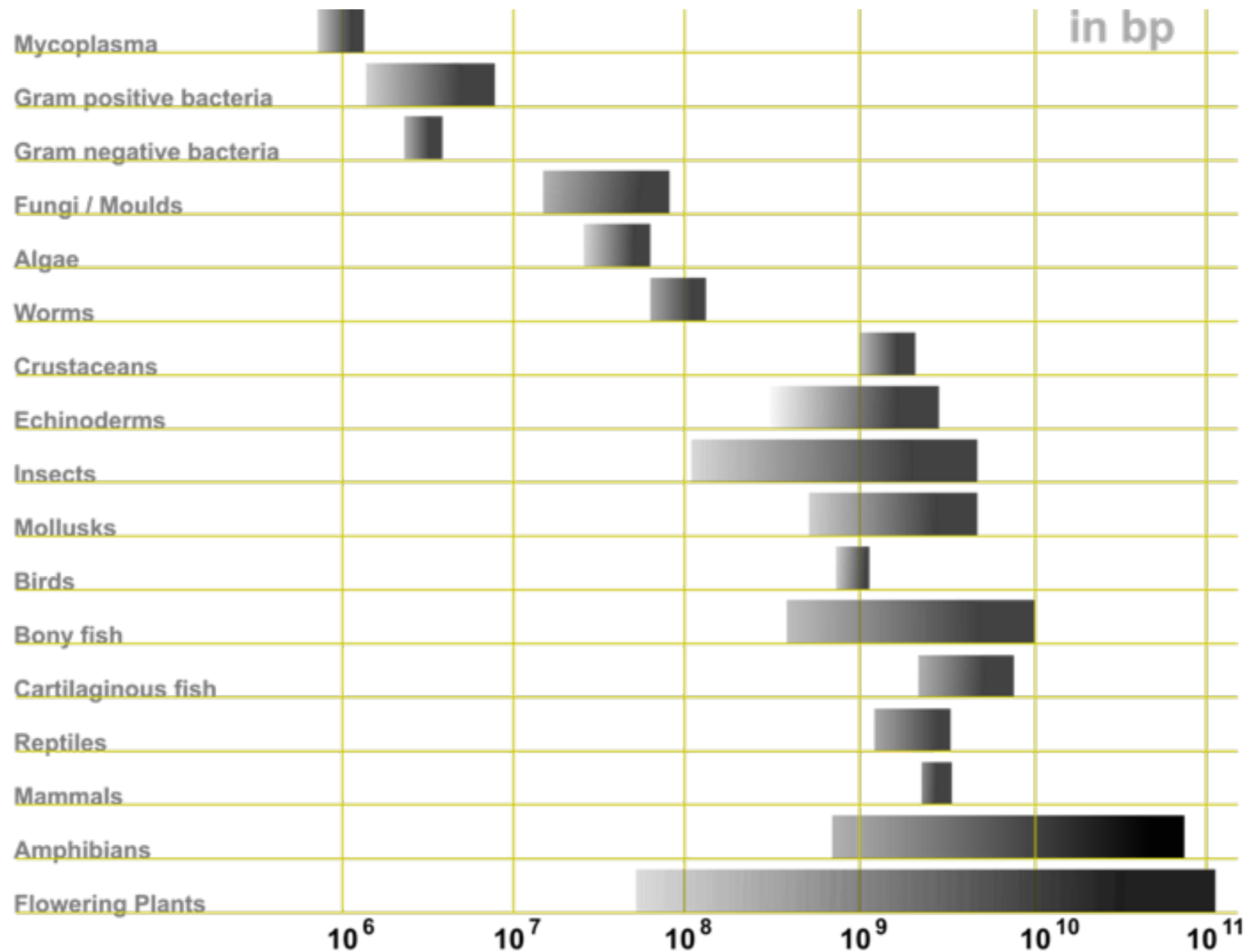
# 5,000 vs 25,000 genes





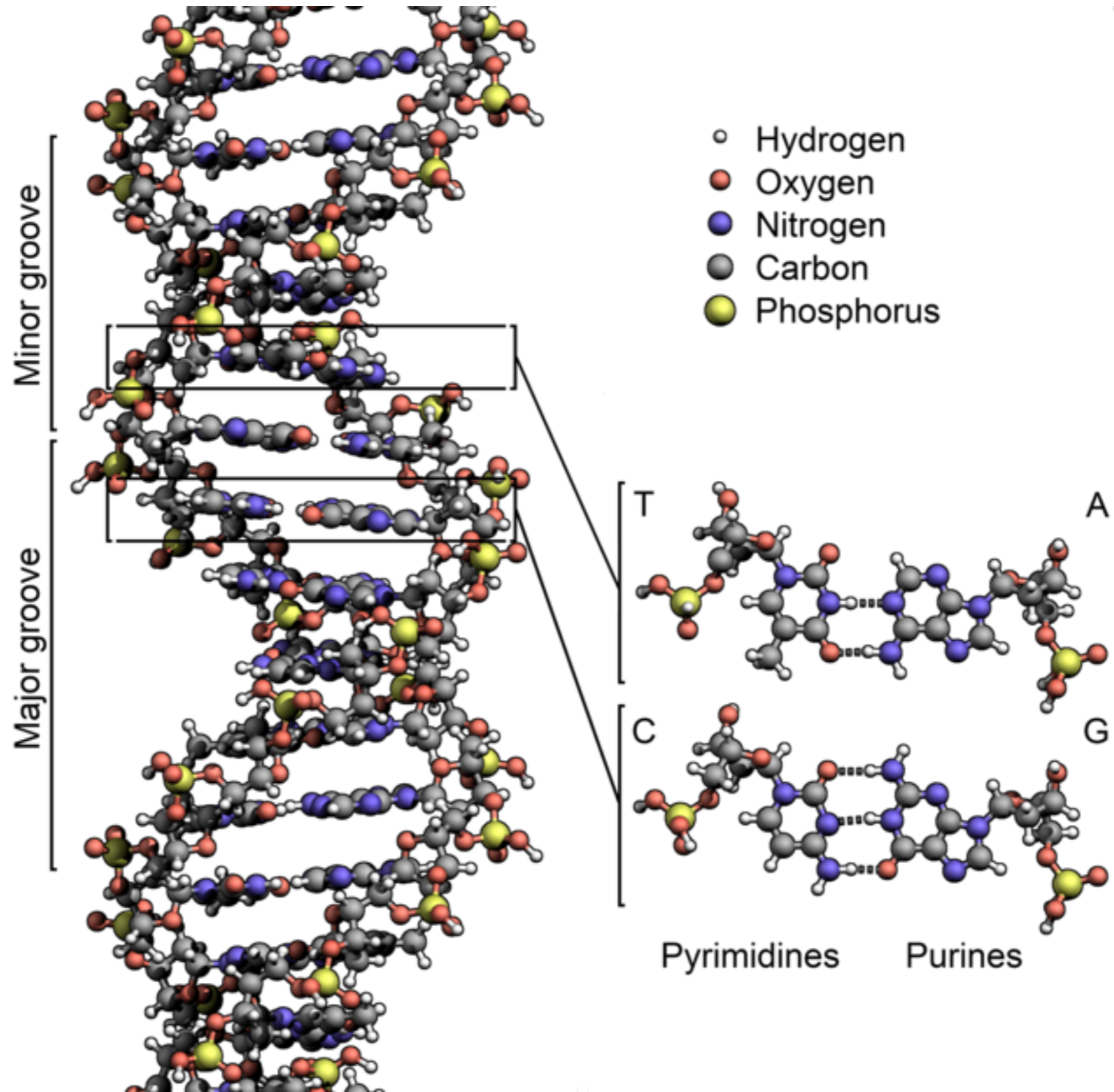


# Genome size compared





# DNA Molecule





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# Proteins





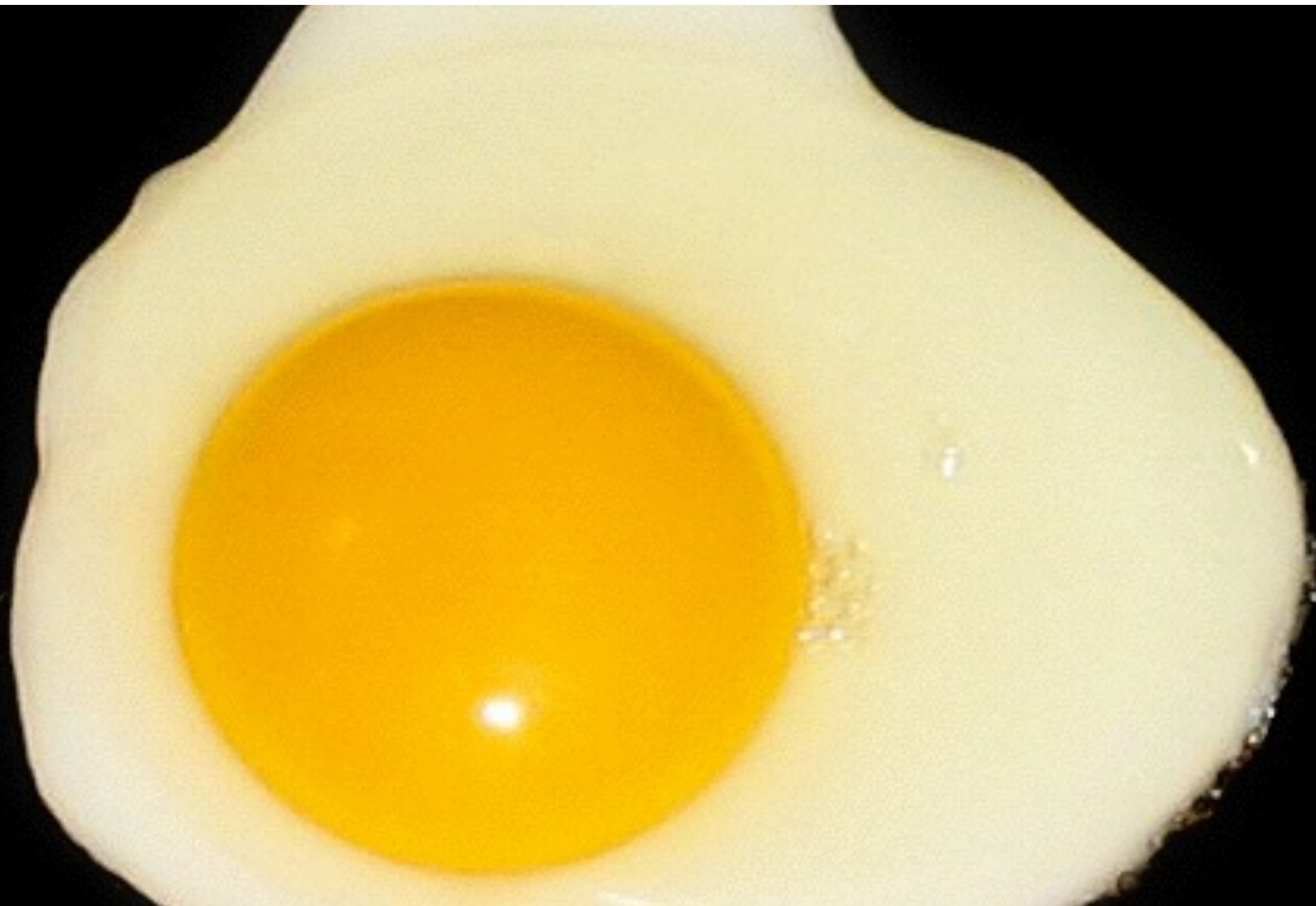
# Proteins





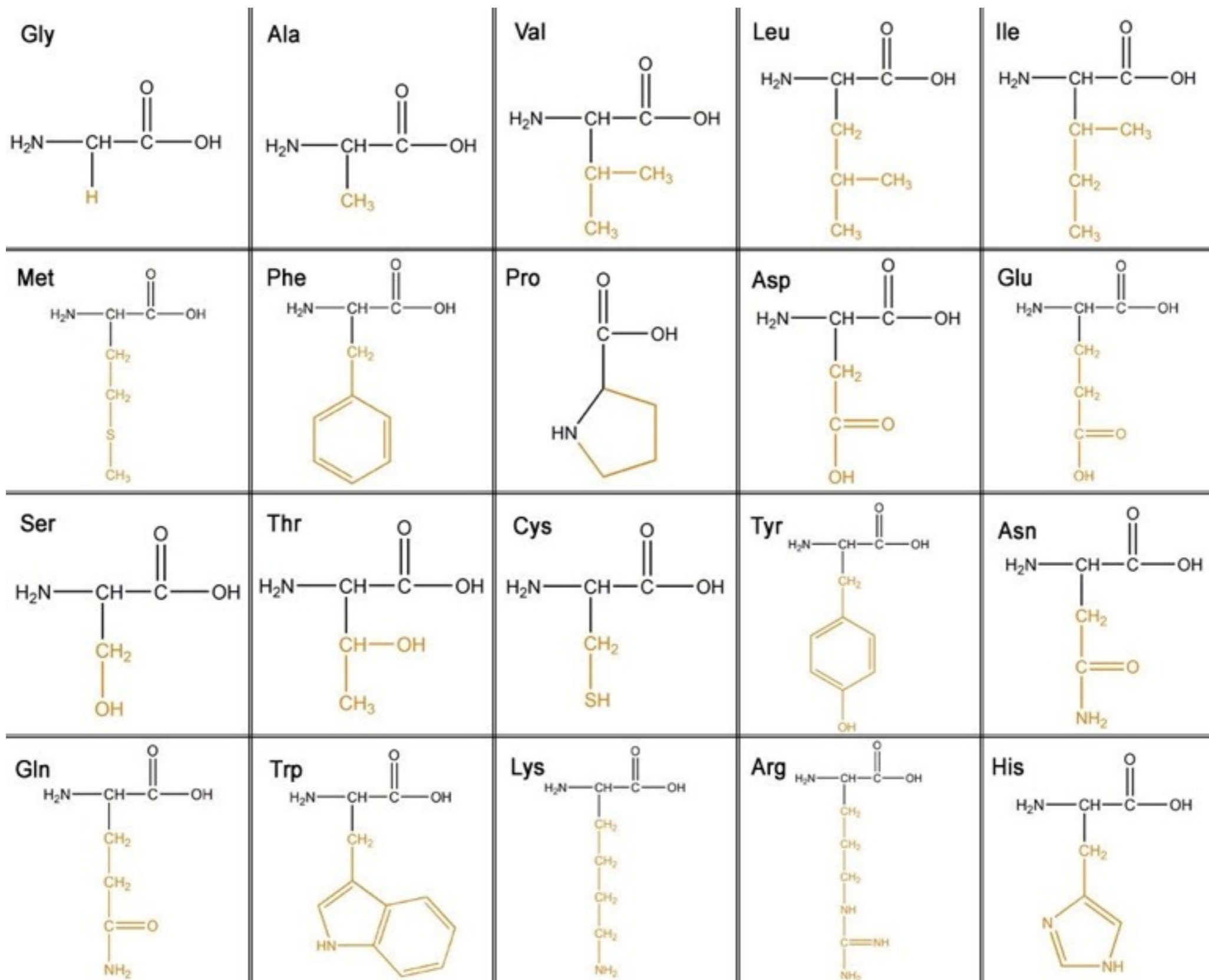


Egg white



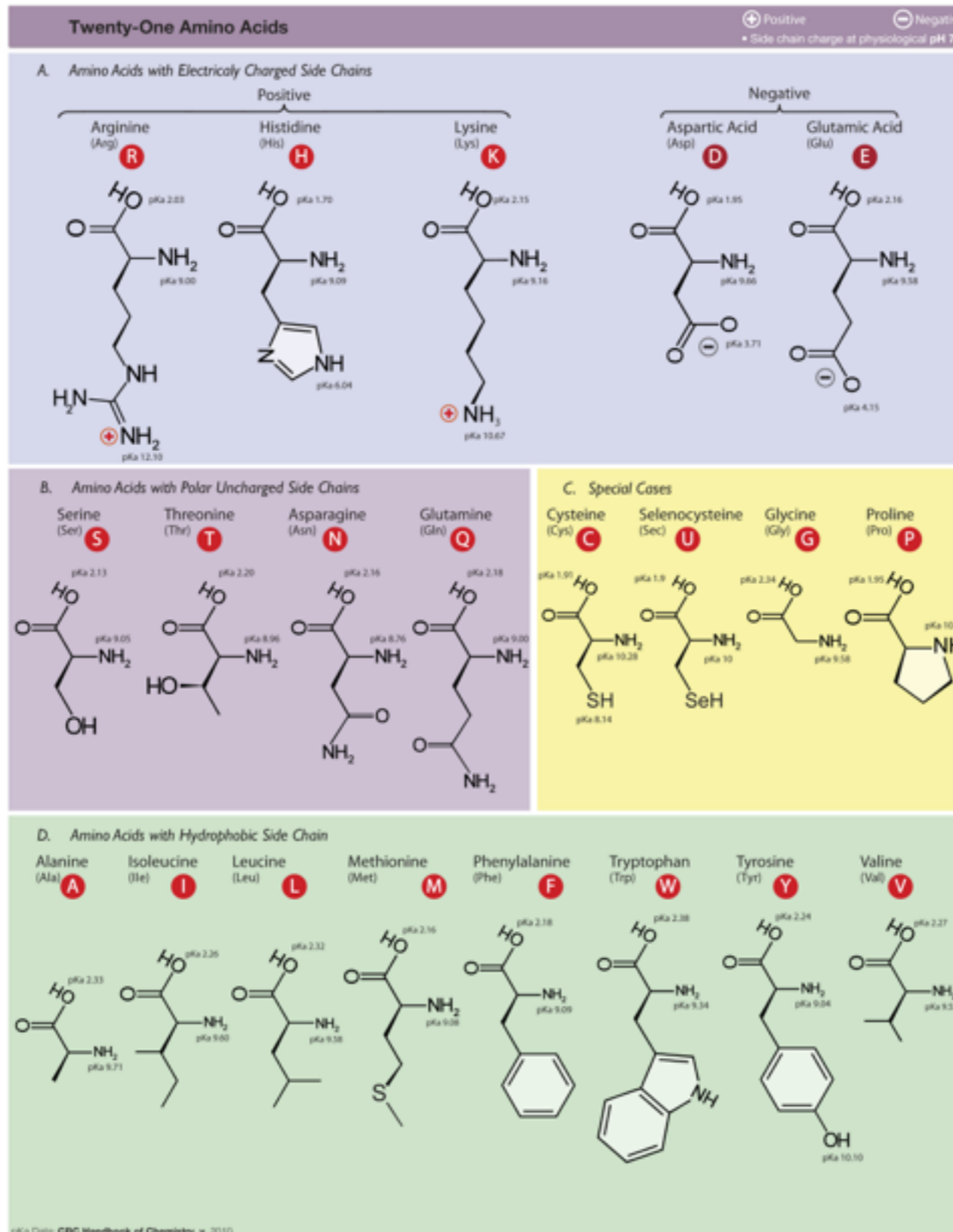


# Amino acids, the building blocks



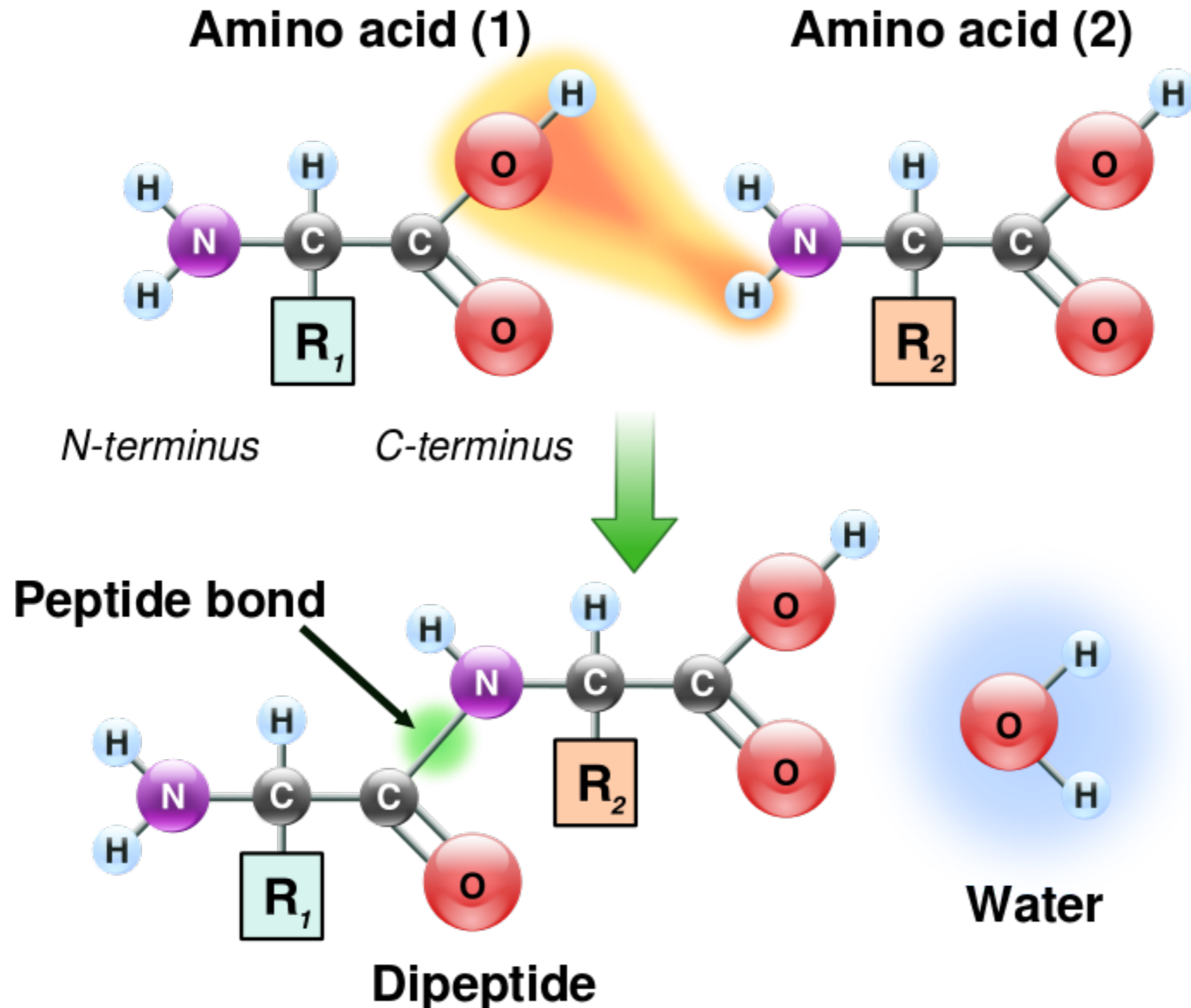


# Amino acid groups





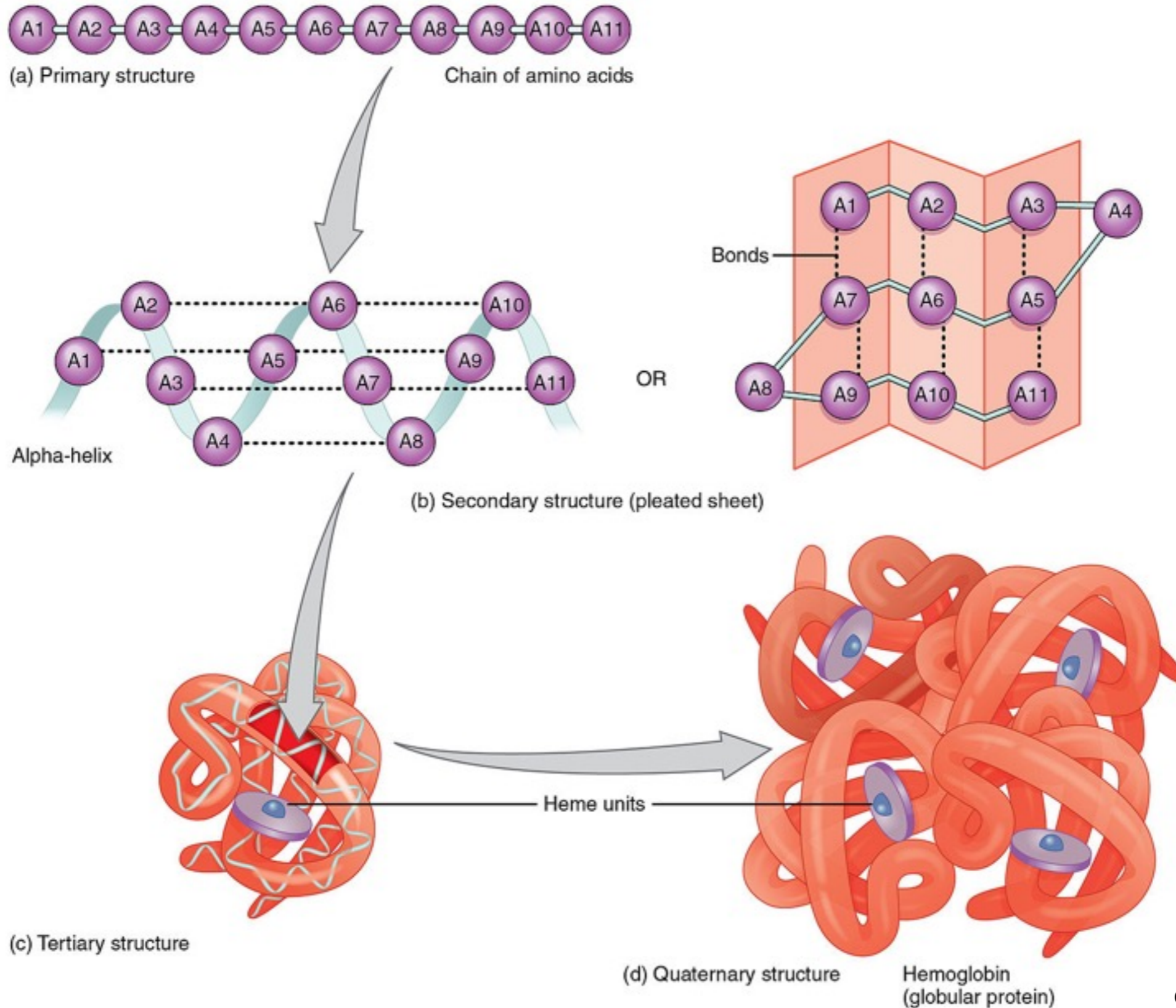
# Peptide bond formation





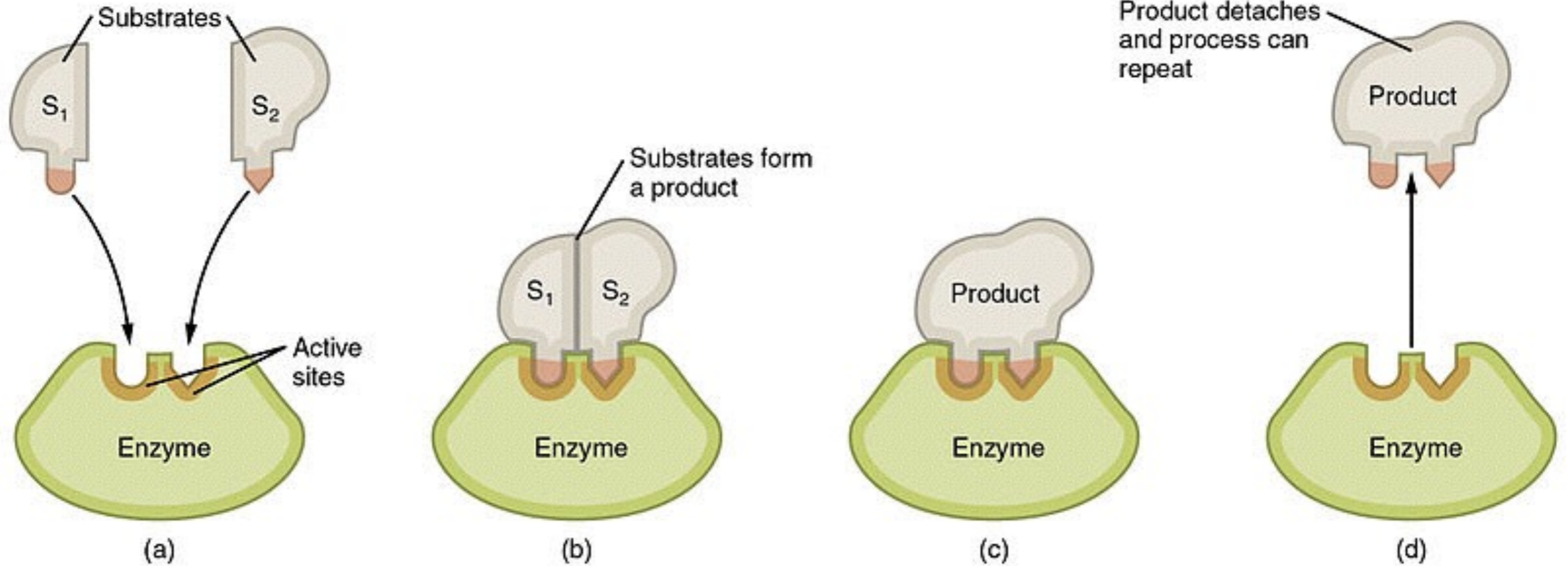


# Protein folding



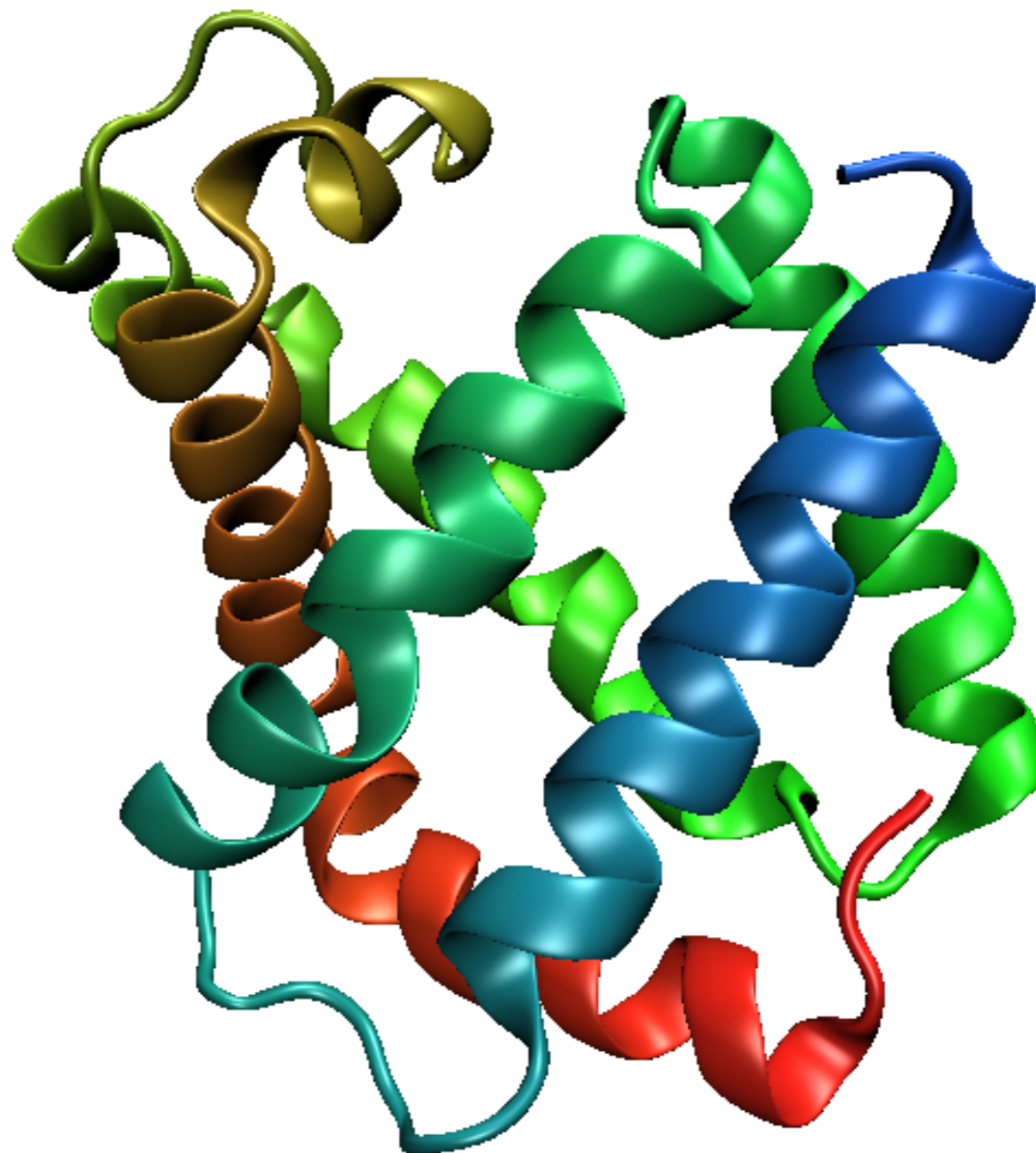


# Enzymatic reactions





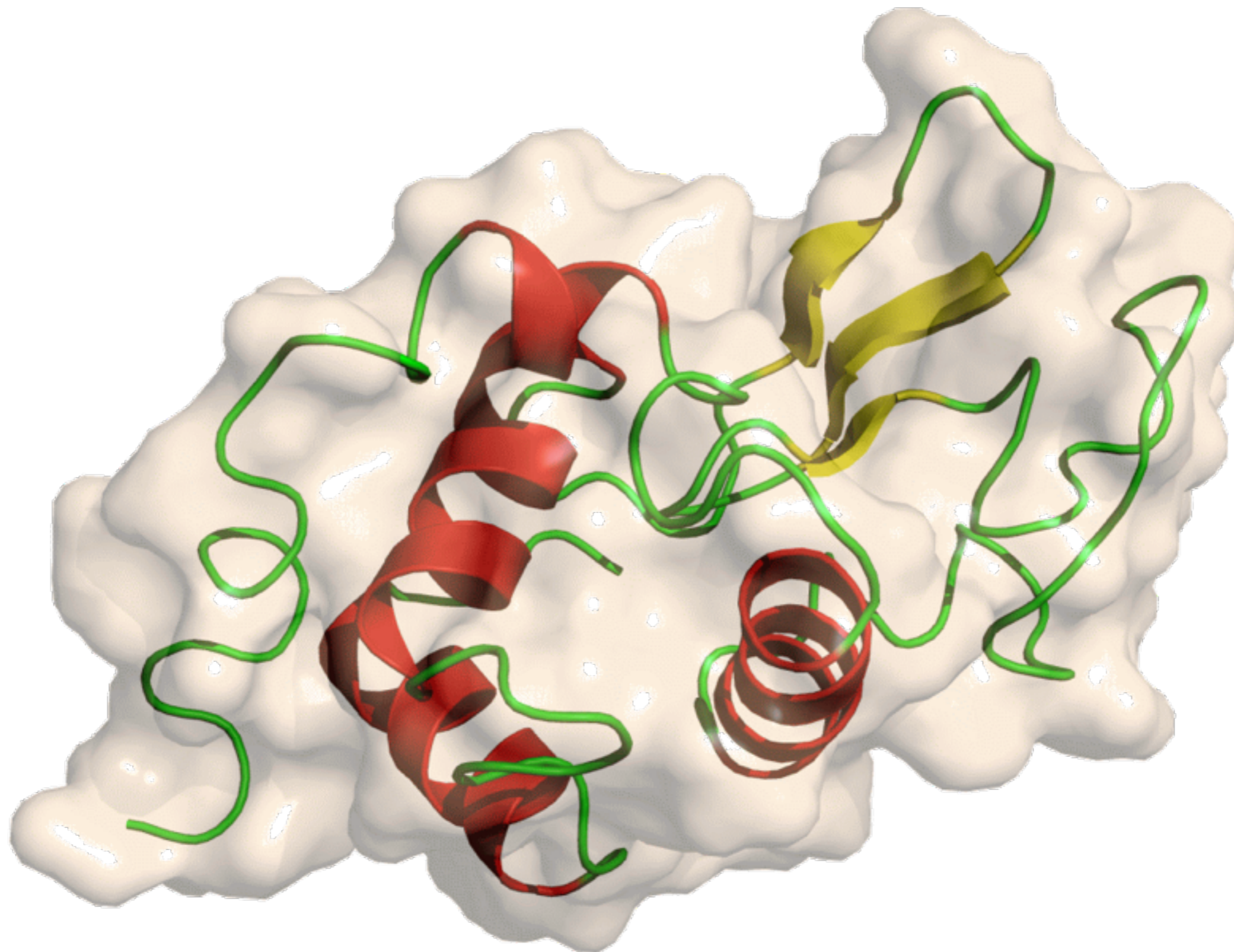
# Myoglobin







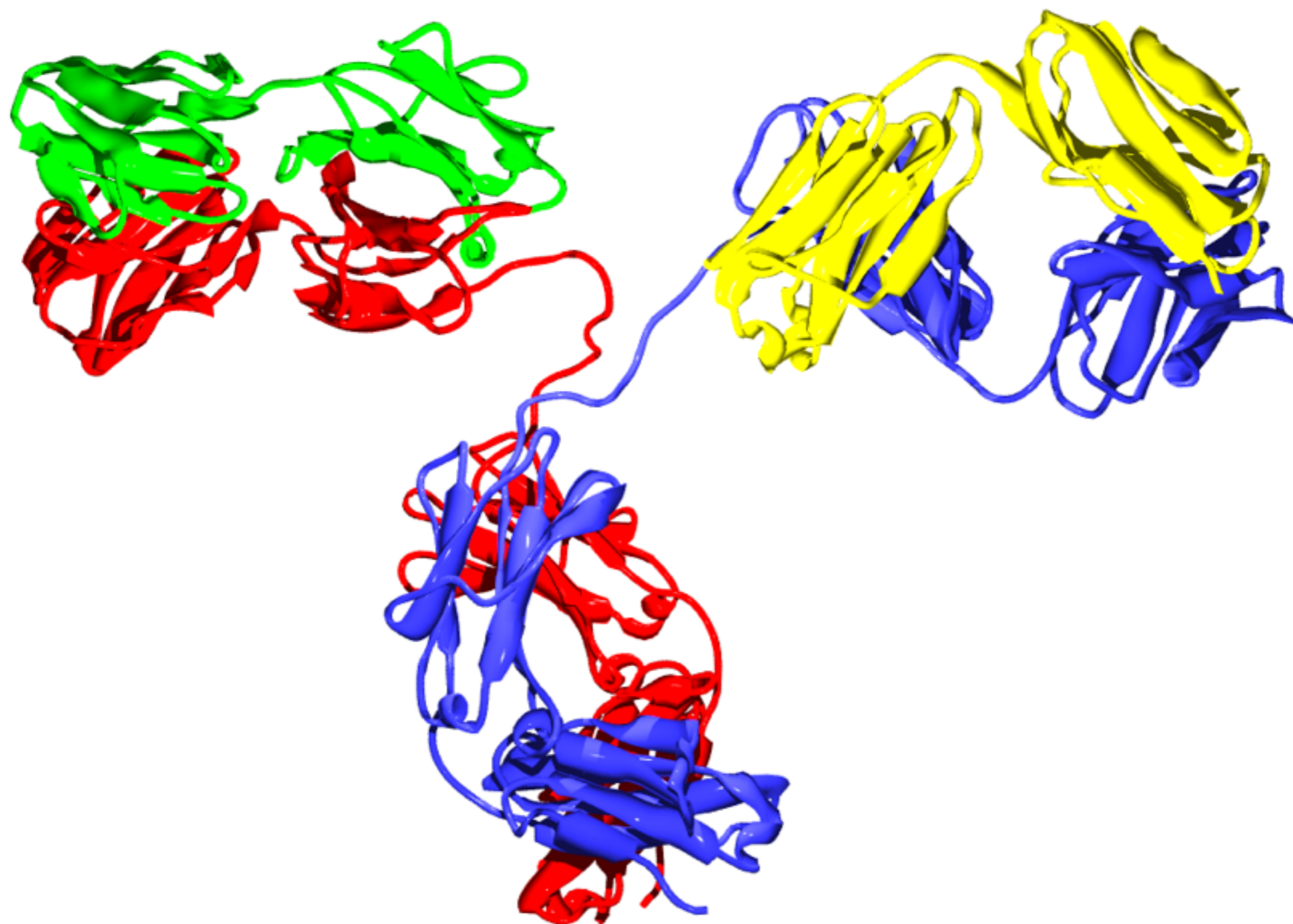
# Lysozyme





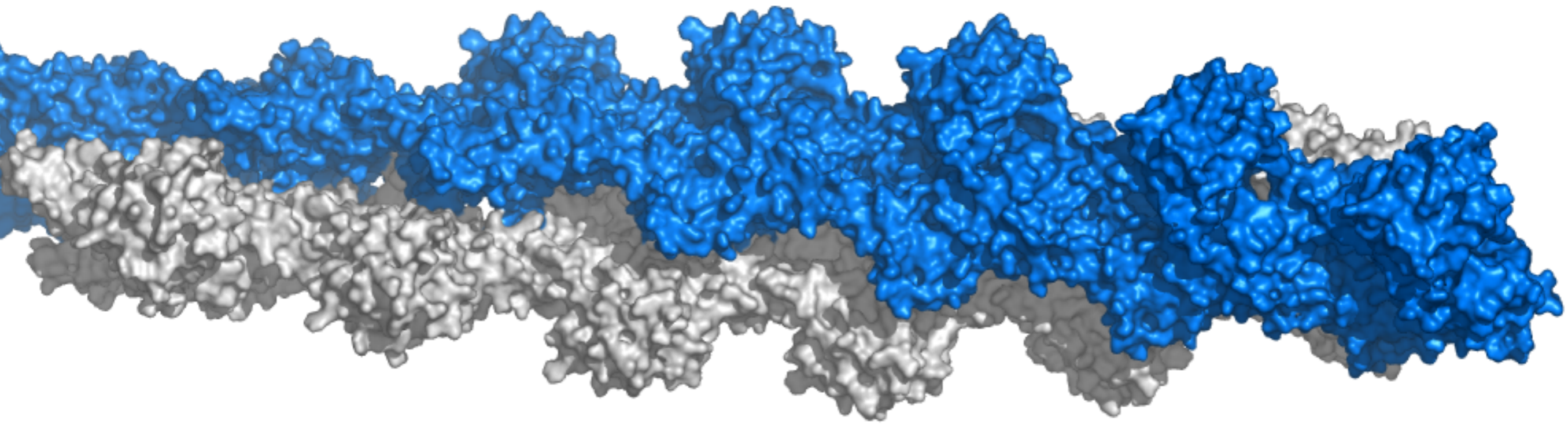


# Antibody





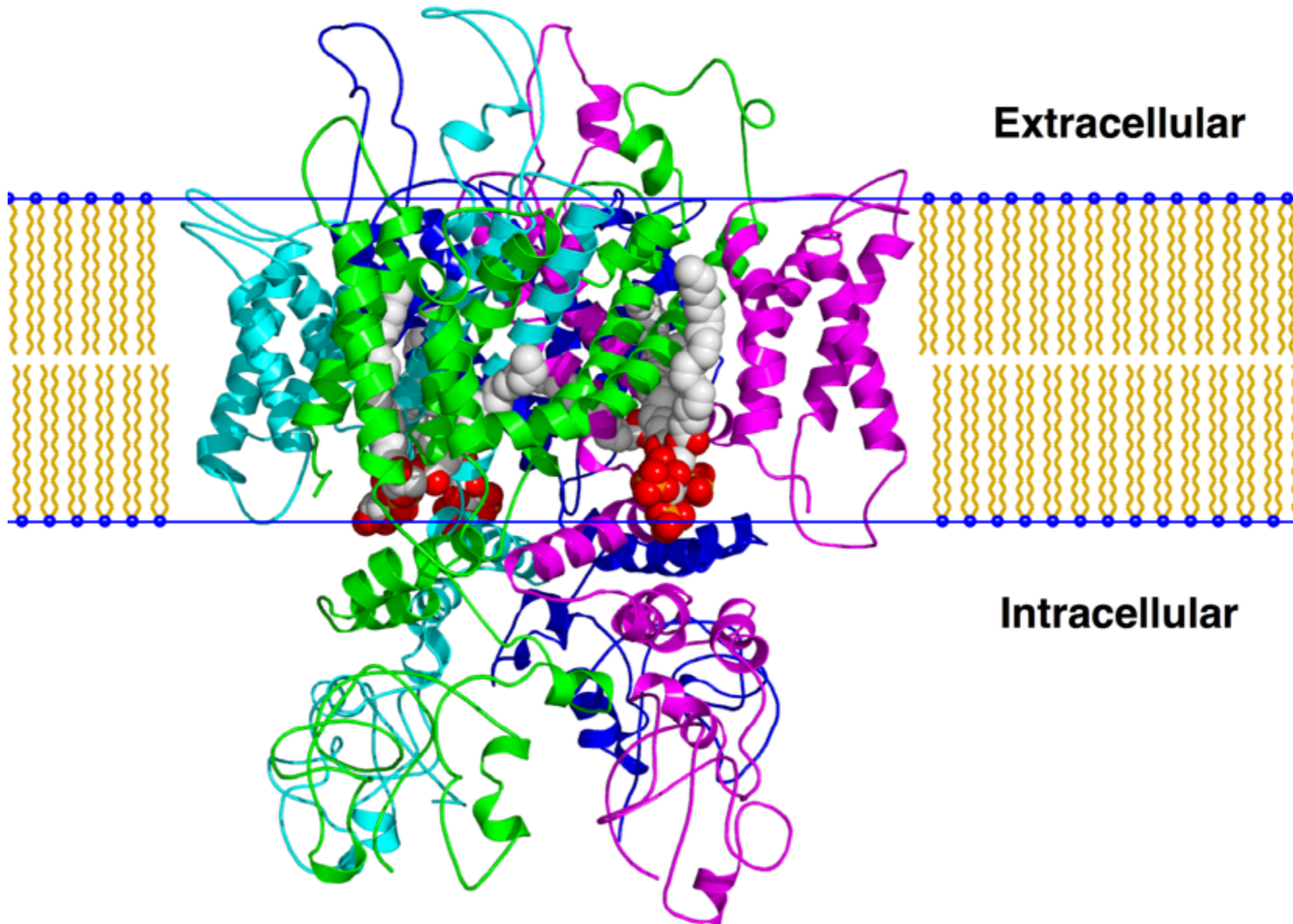
# Structural proteins: Actin







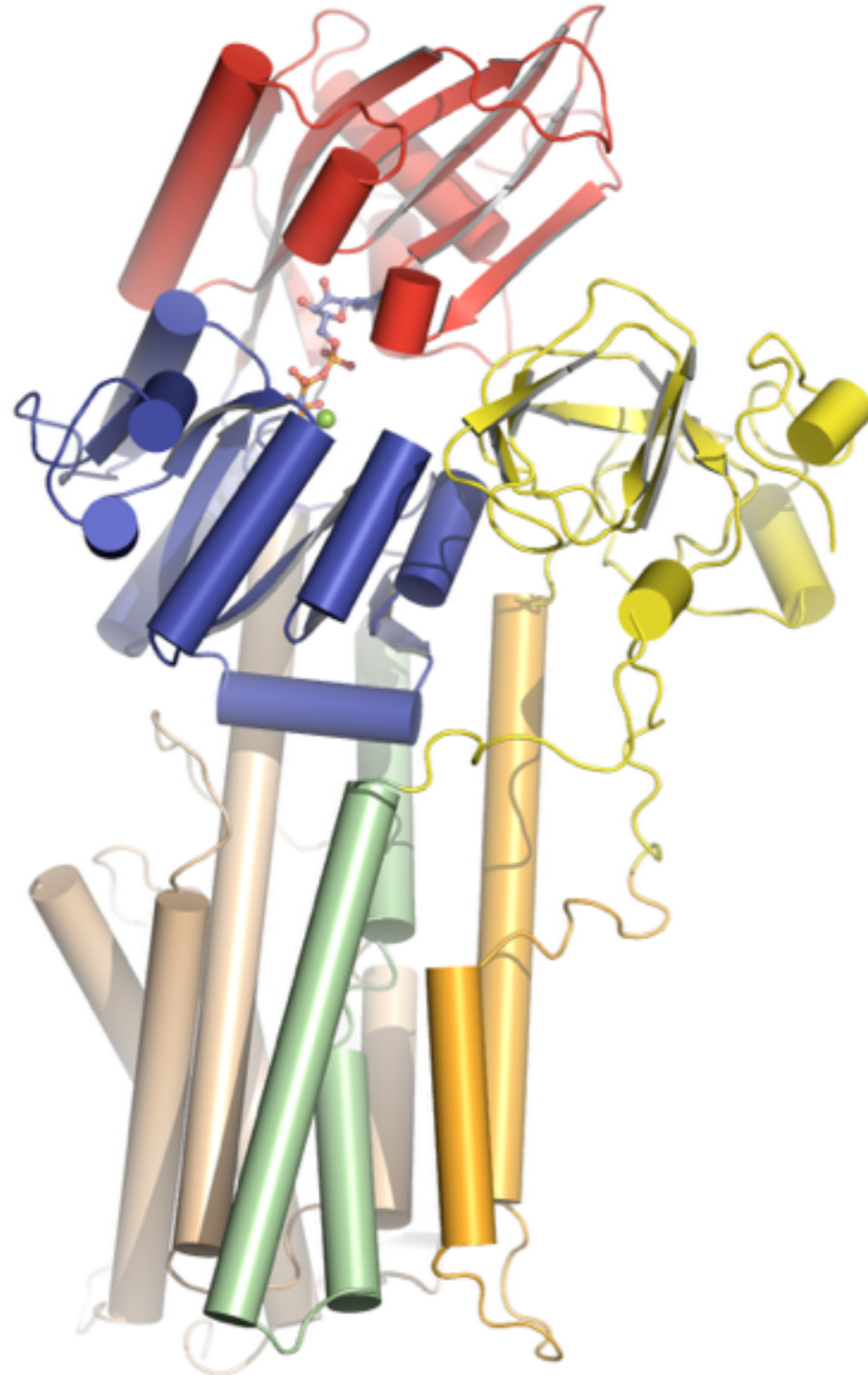
# Receptor proteins







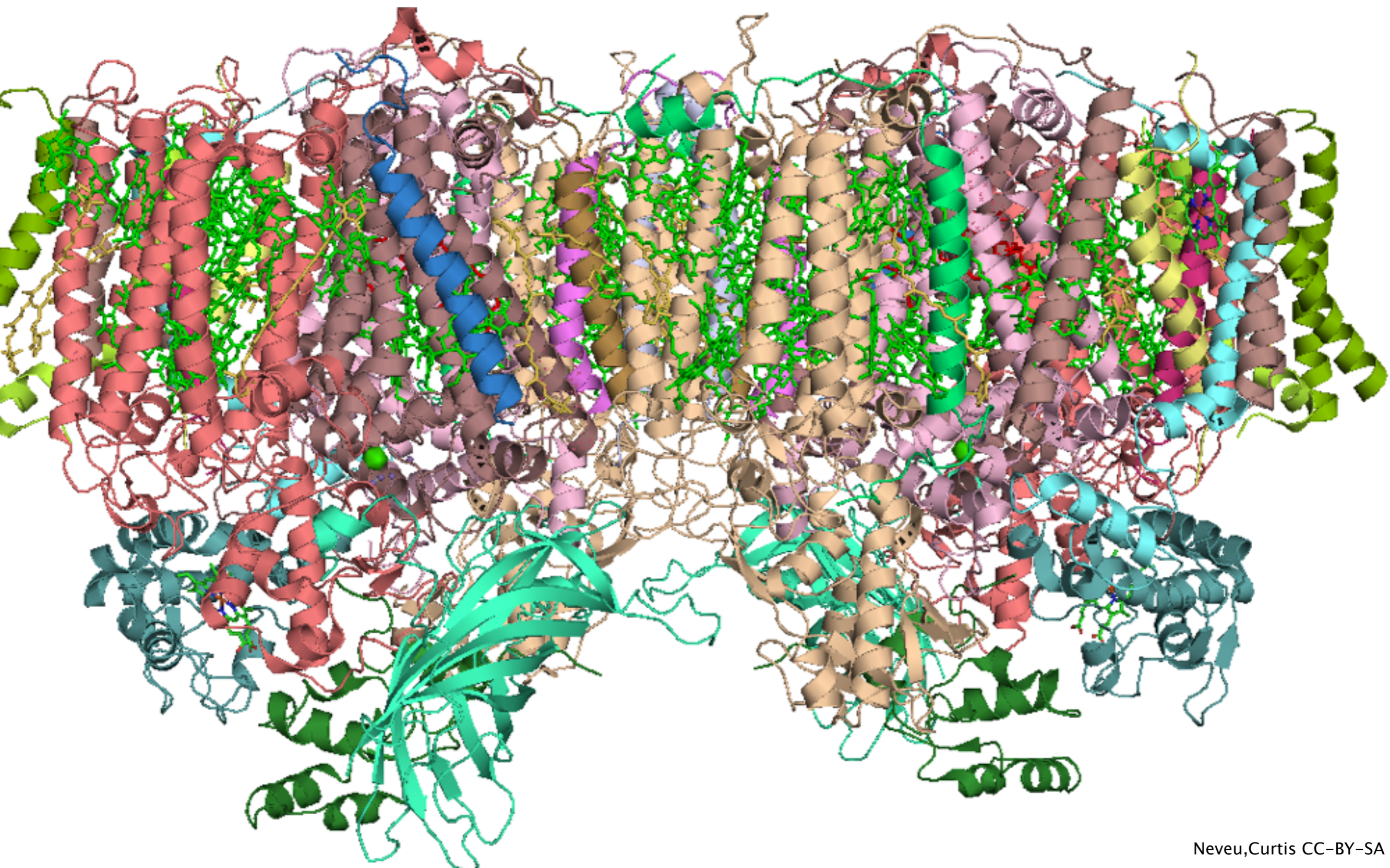
# ATPase







# Photosystem II







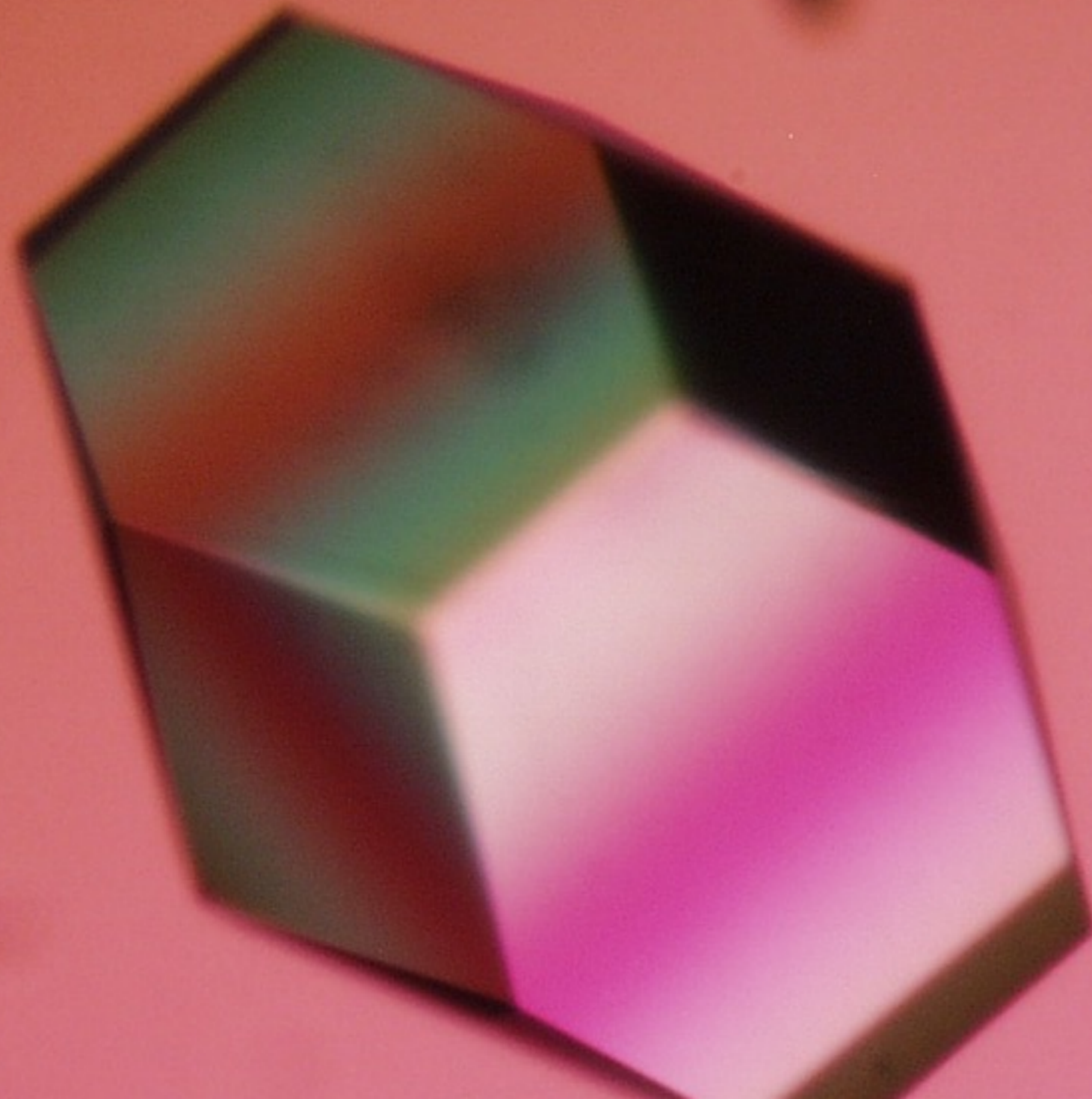
# Synchrotron EMBL Grenoble





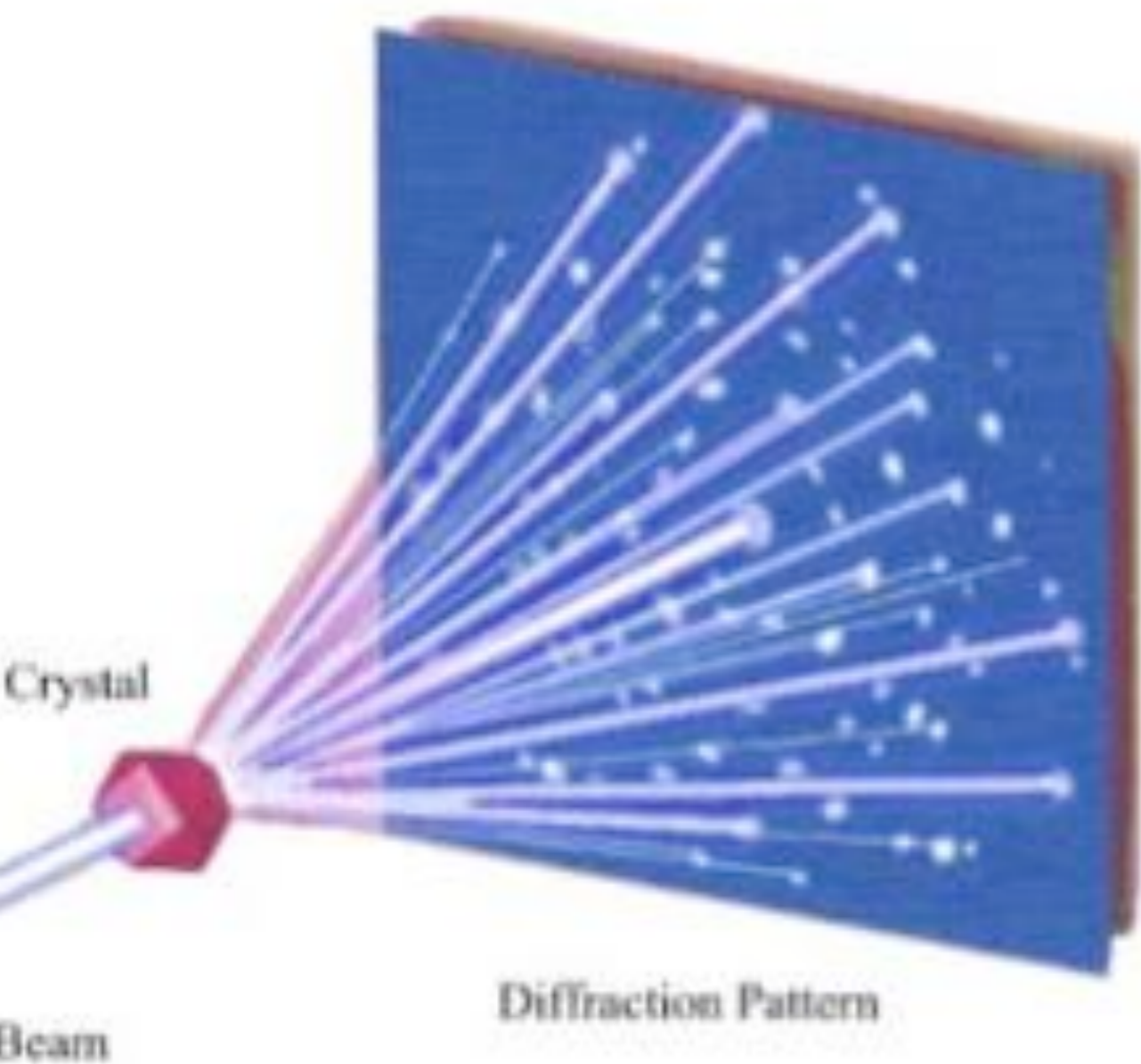


# Lysozyme crystal

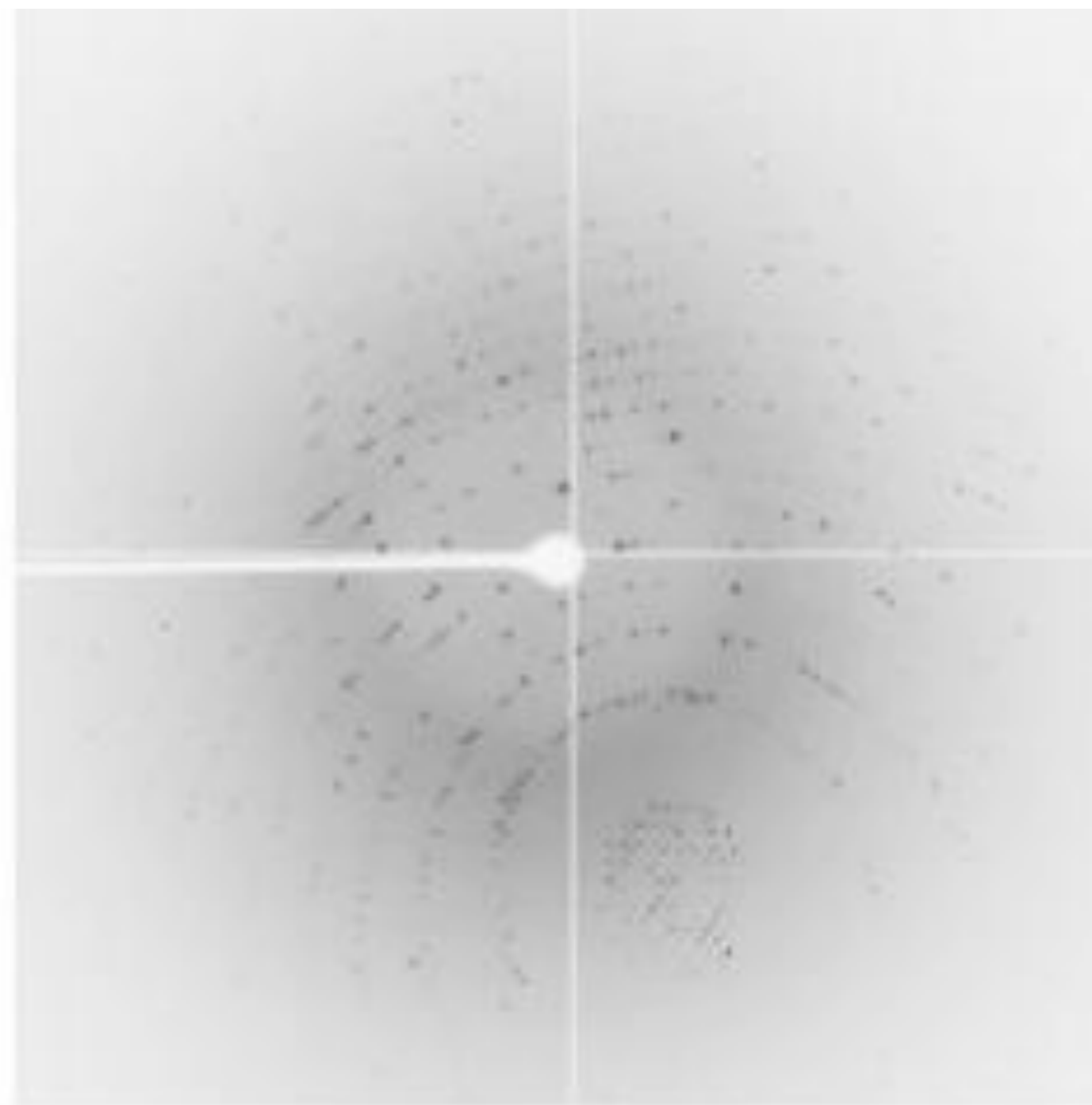




# Protein crystal diffraction



Diffraction Process



Diffraction Pattern from NSLS





**some**

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