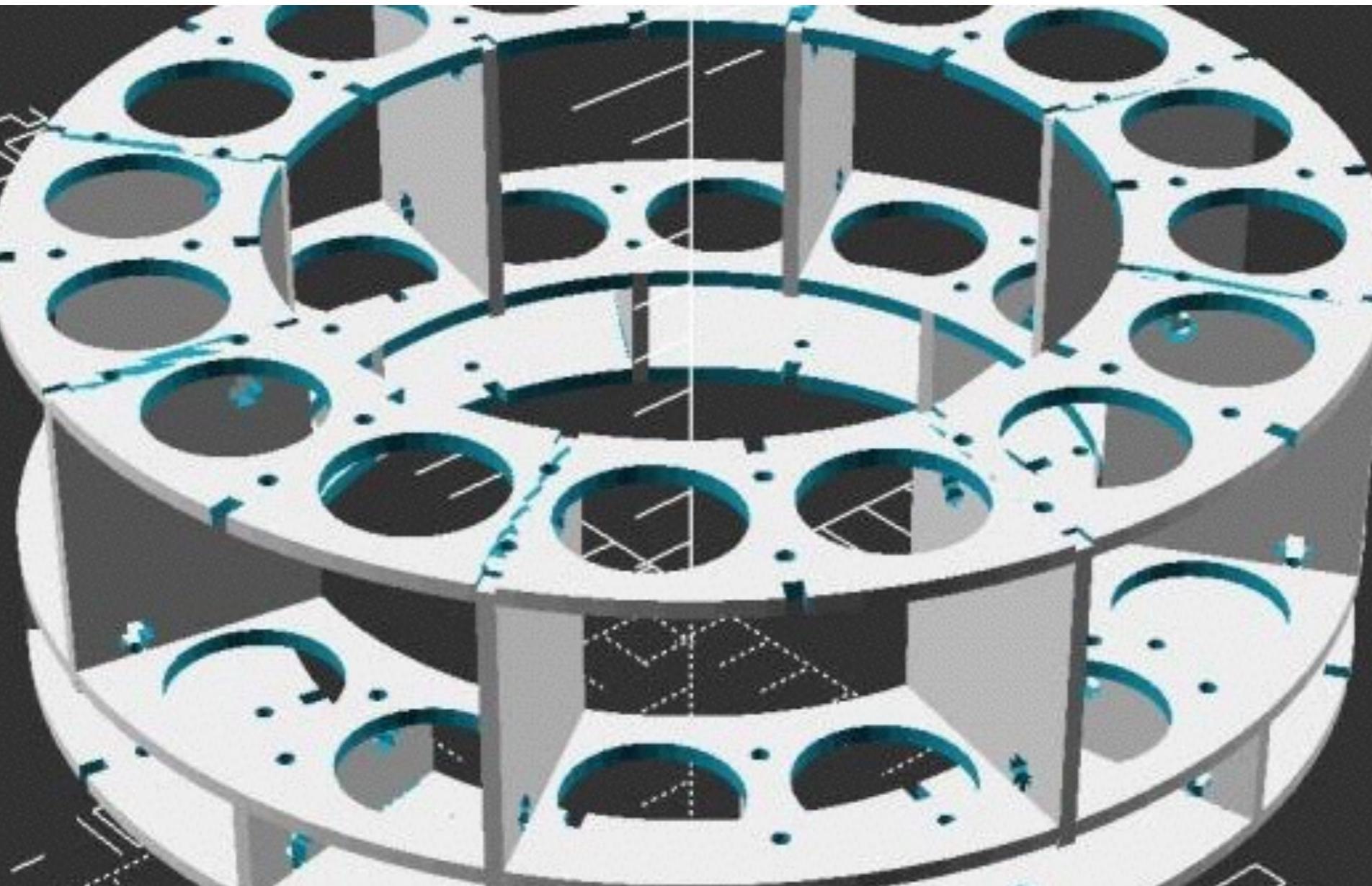




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picture by Erwin



BioHack Academy
Materials in Life



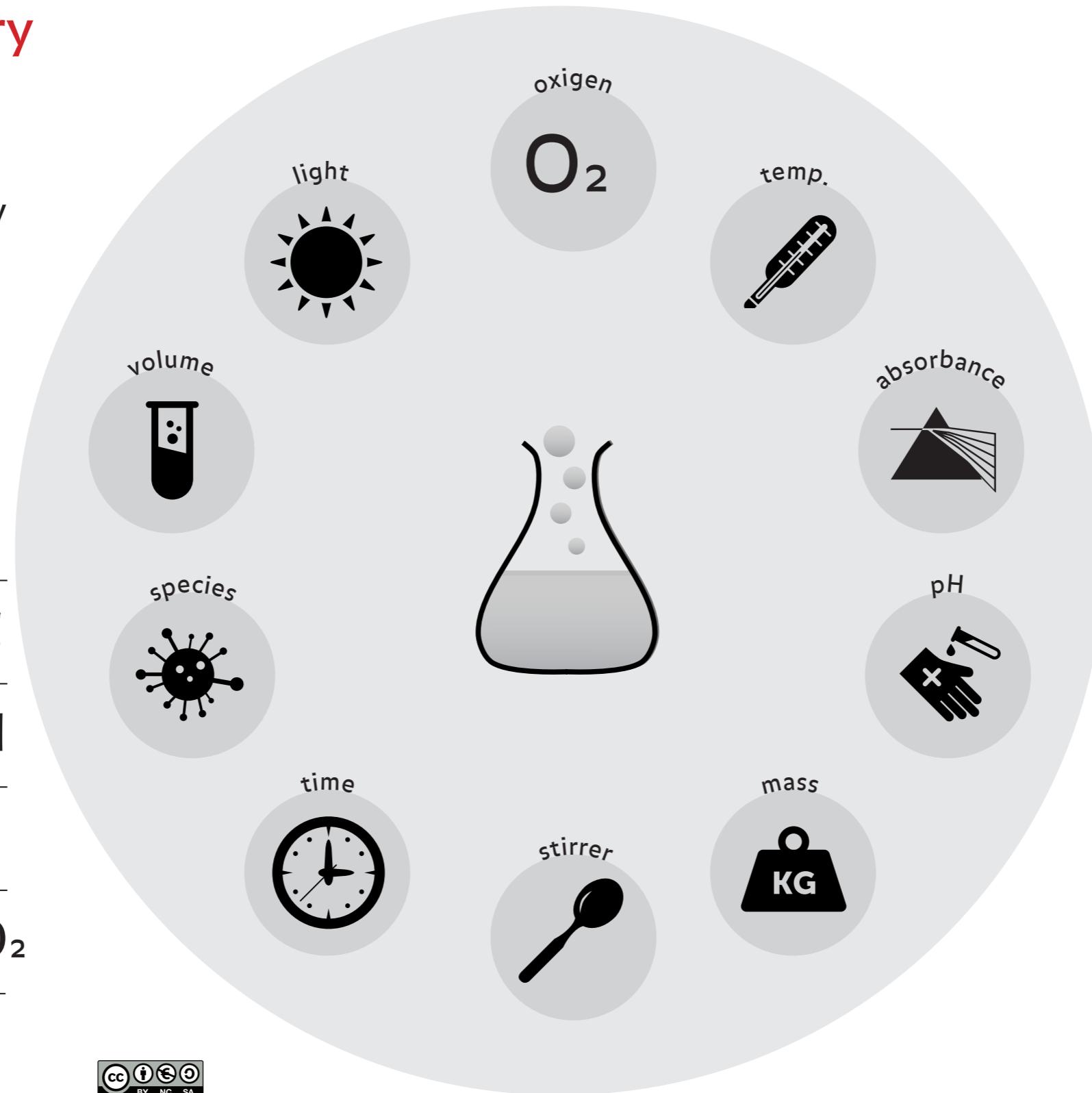
BioFactory

canvas



!!!
input

C
N
P
 O_2
S



observations

day #	



material



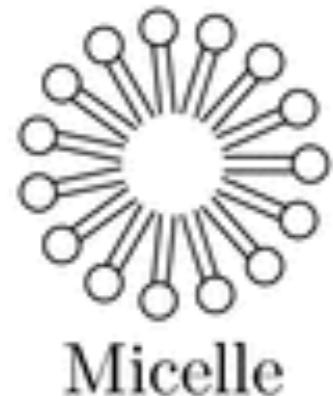
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The Cell



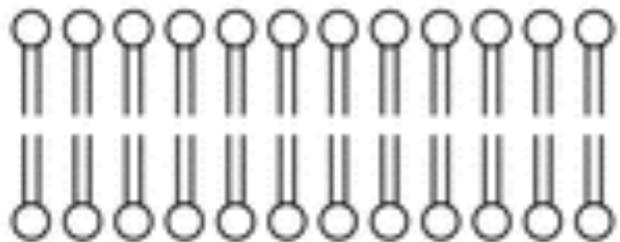
Lipid bilayer cell



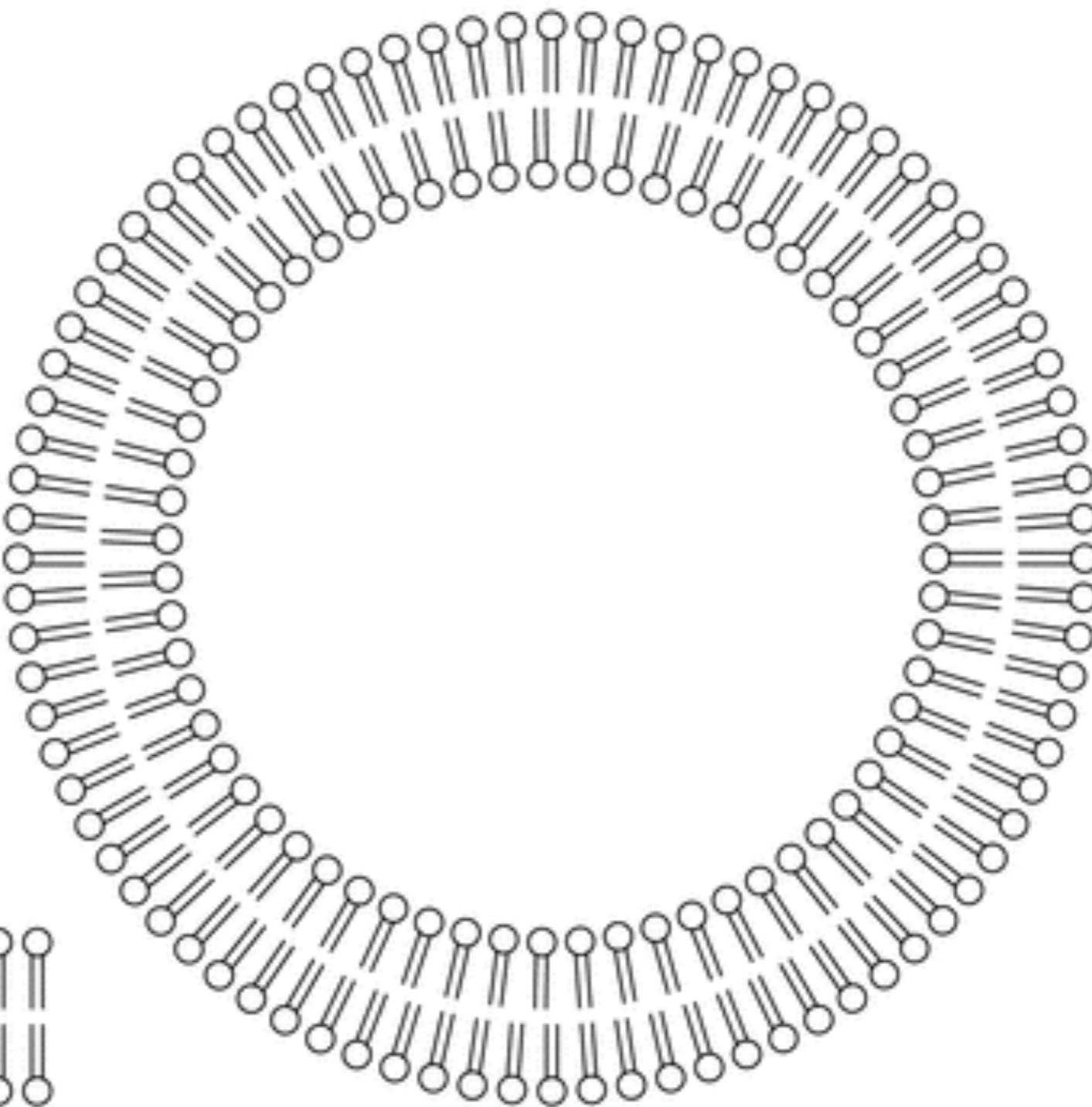
Micelle



Inverted micelle



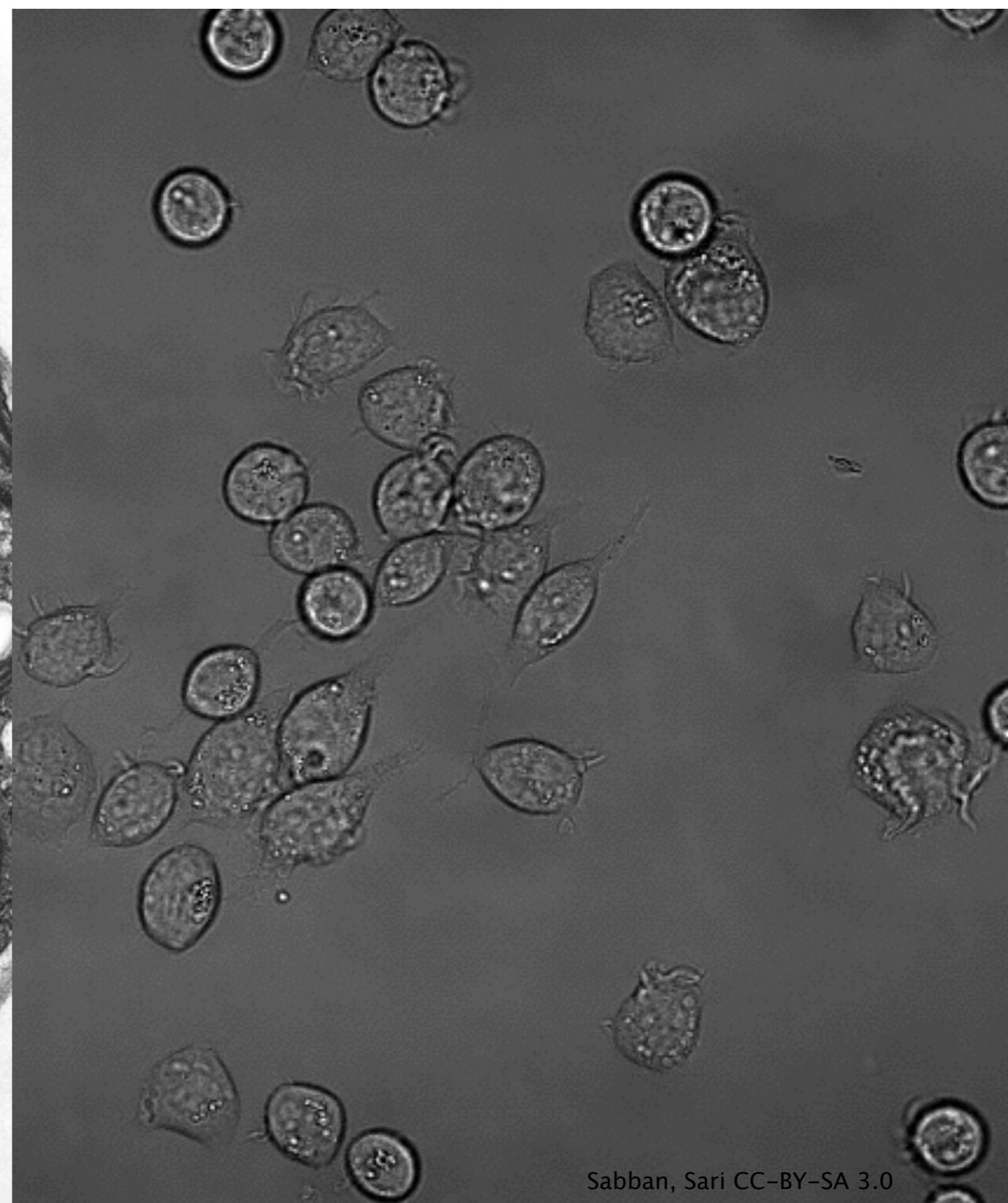
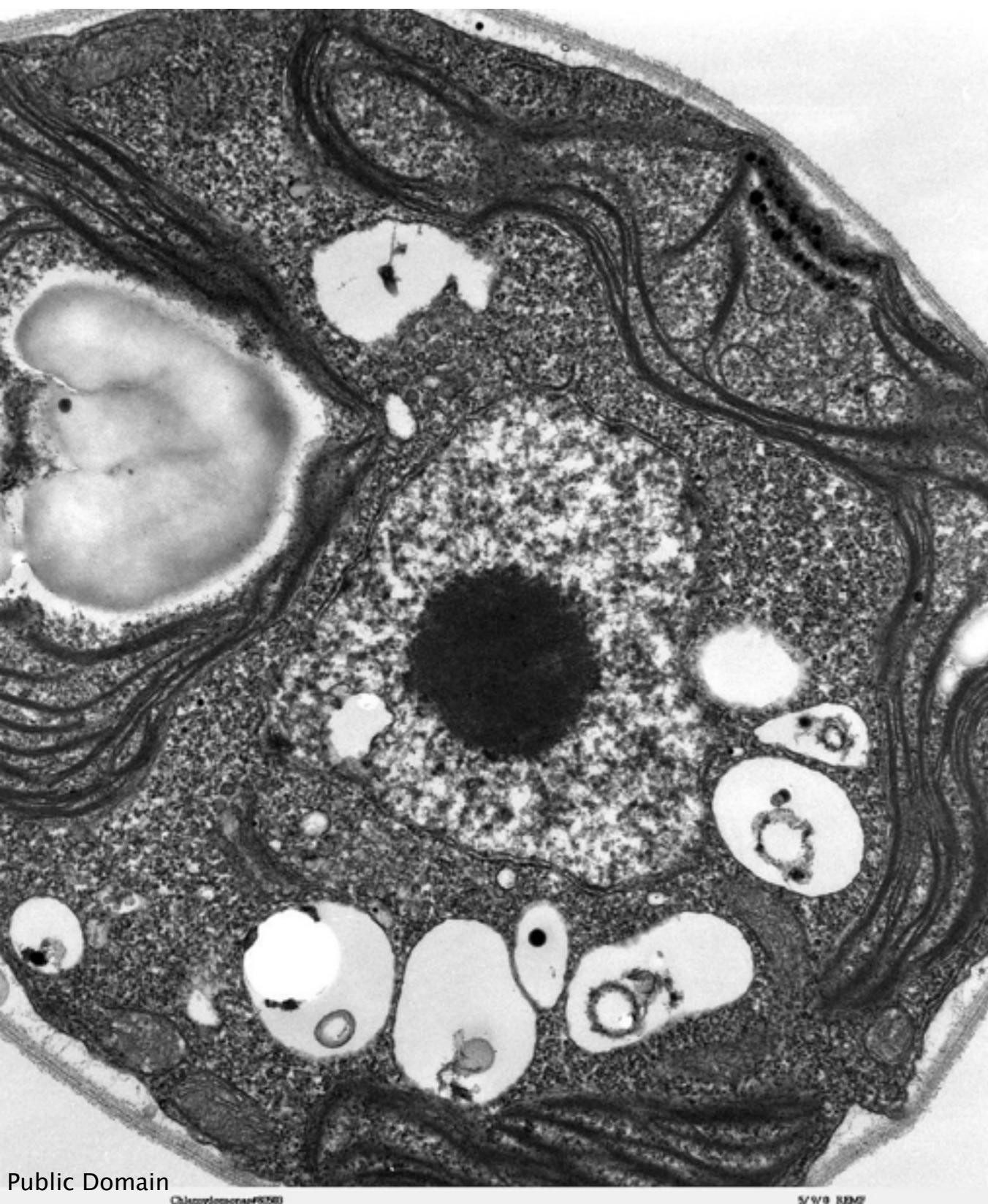
Lipid bilayer



Vesicle



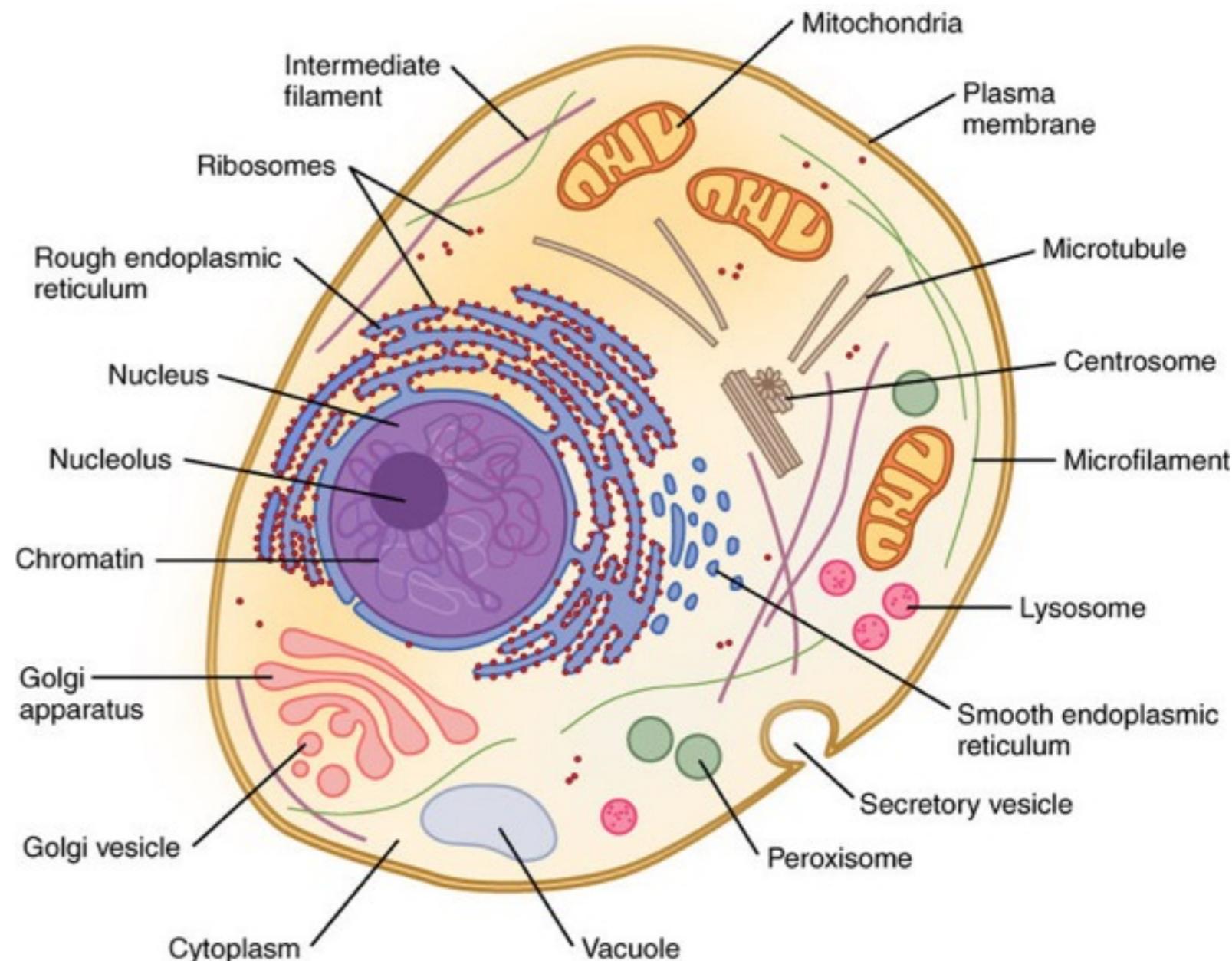
Life is made out of cells





What's a cell made of:

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





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Energy

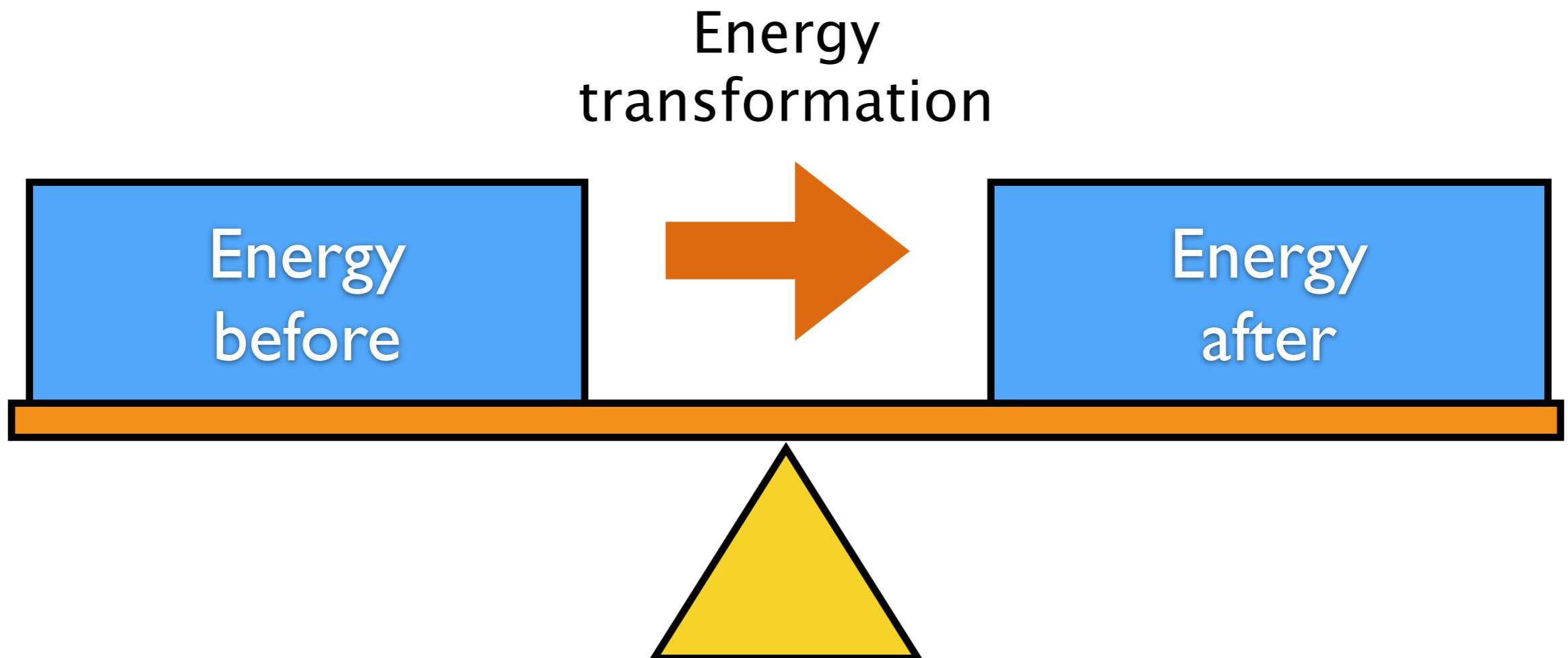


Bio energy



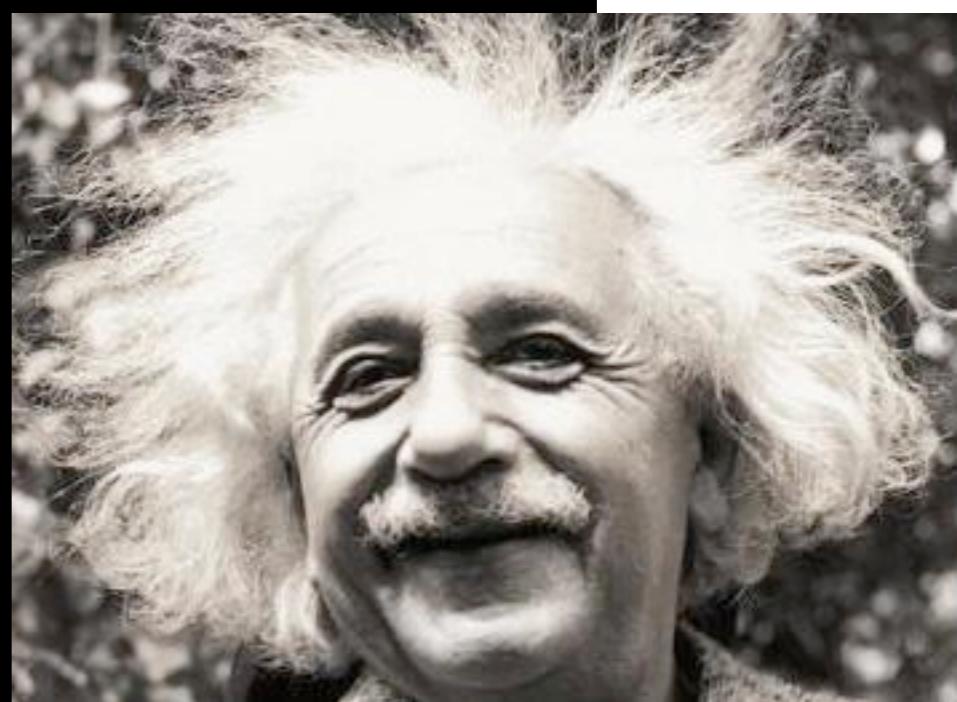


First law of thermodynamics





$$E = mc^2$$





Second law of thermodynamics

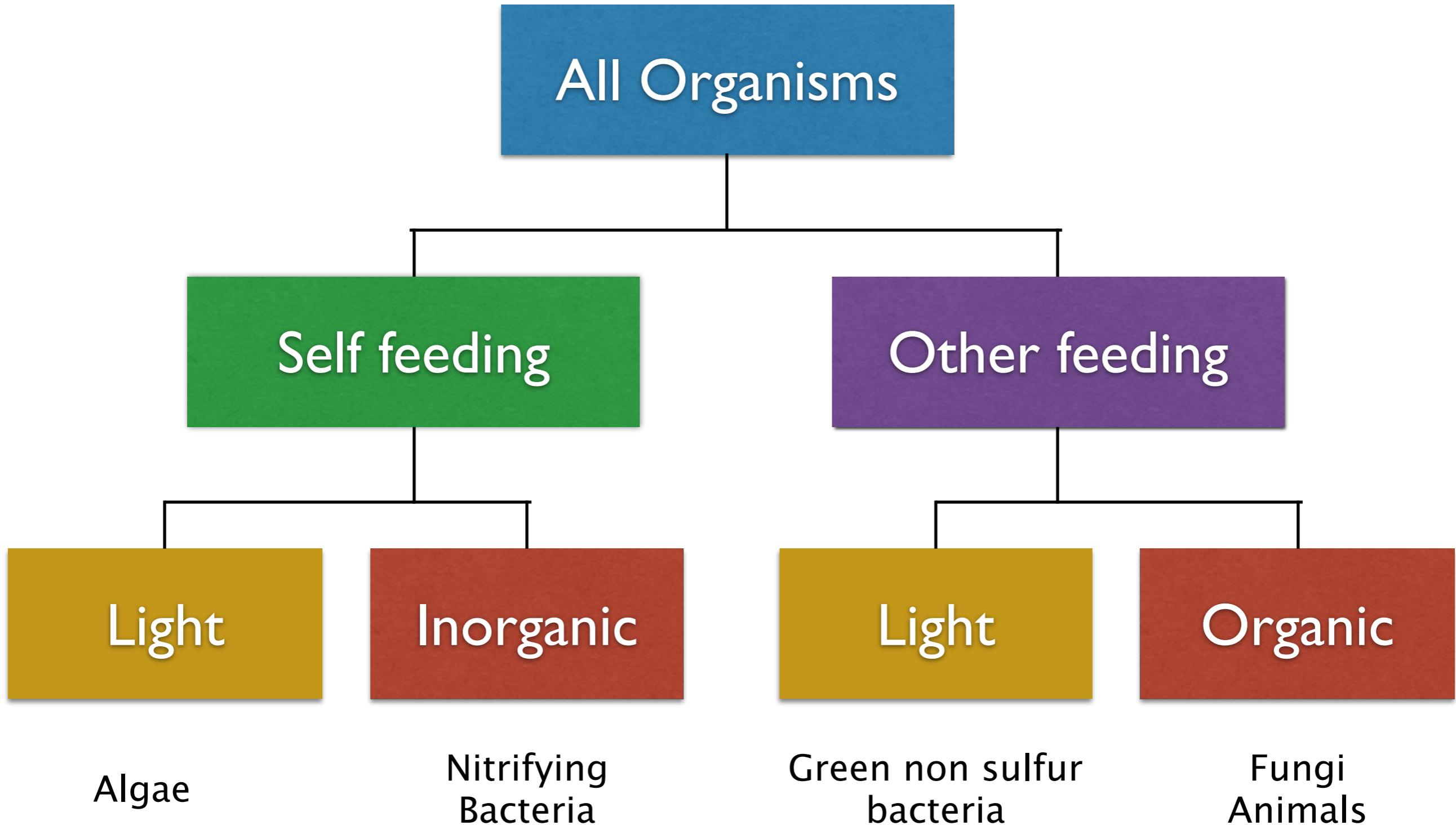
Nothing will happen spontaneously unless it increases the **entropy** of the universe

Entropy is a measure of disorder





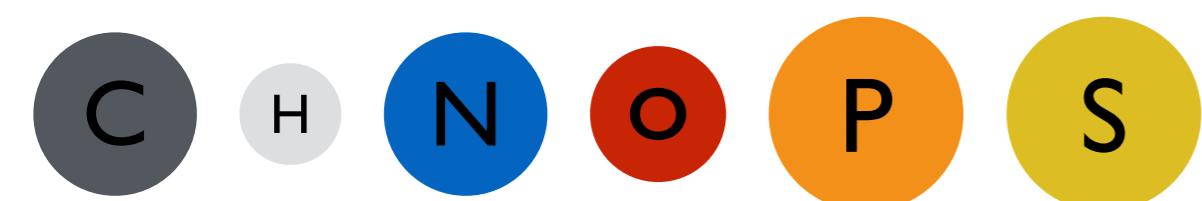
Diversity in Metabolism





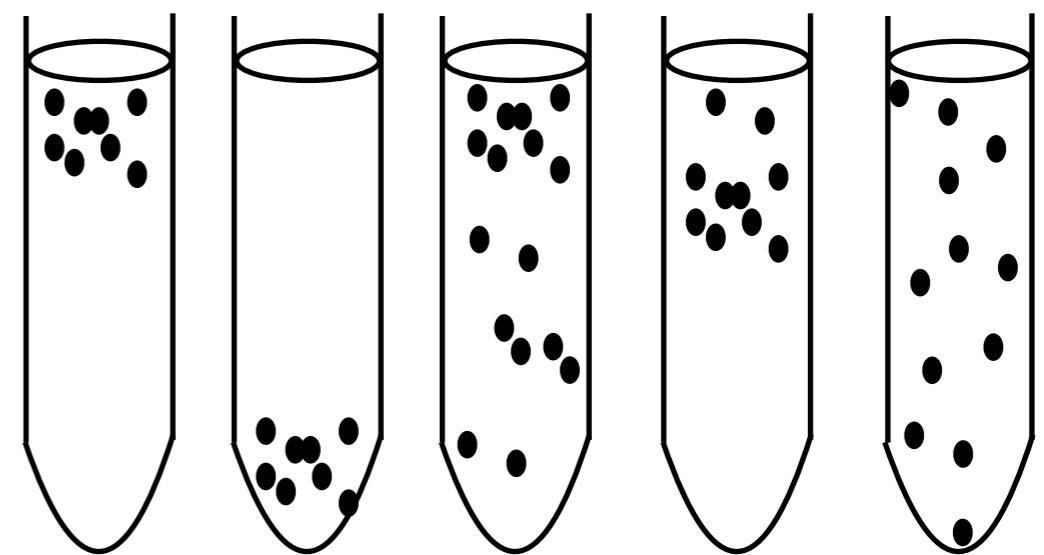
Diversity in growth conditions

Nutrients



Carbon Nitrogen Phosphorus
Hydrogen Oxygen Sulfur

Atmosphere

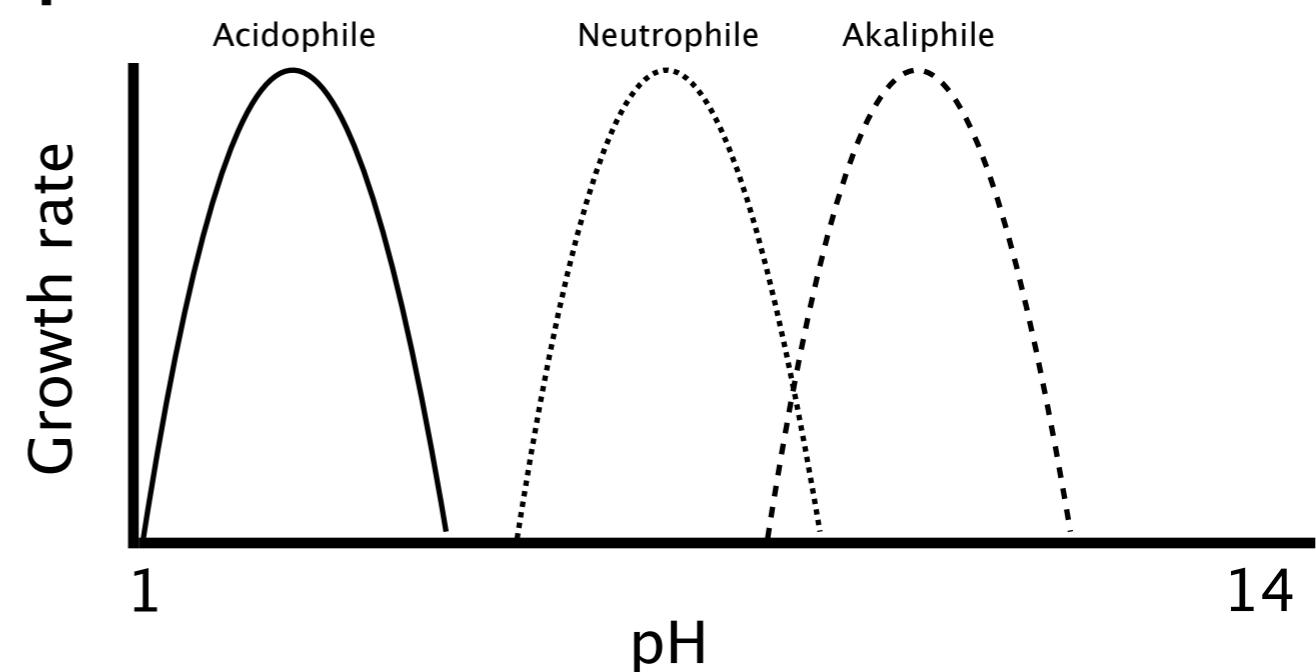


Temperature



Pixabay - CC0

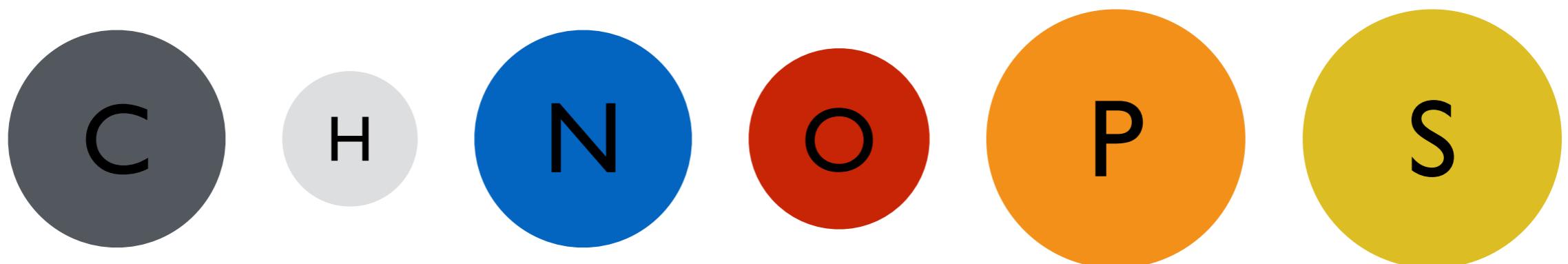
pH



14



Elements of Life



Carbon

Nitrogen

Phosphorus

Hydrogen

Oxygen

Sulfur



Non selective

- Plate count agar
- Nutrient agar





Slightly selective

- Malt agar
- MRS agar
- Kombucha medium





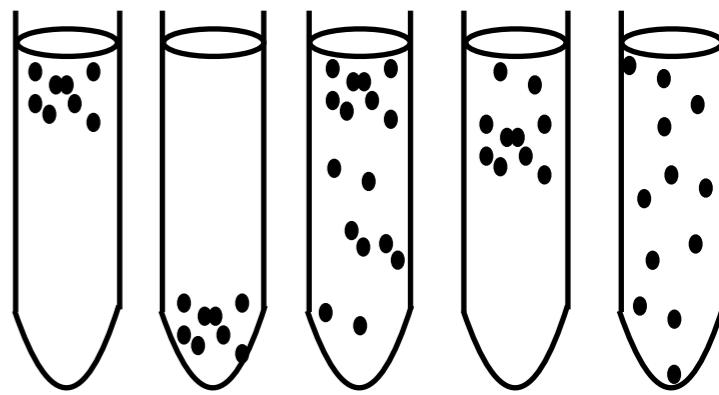
Selective

- 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.

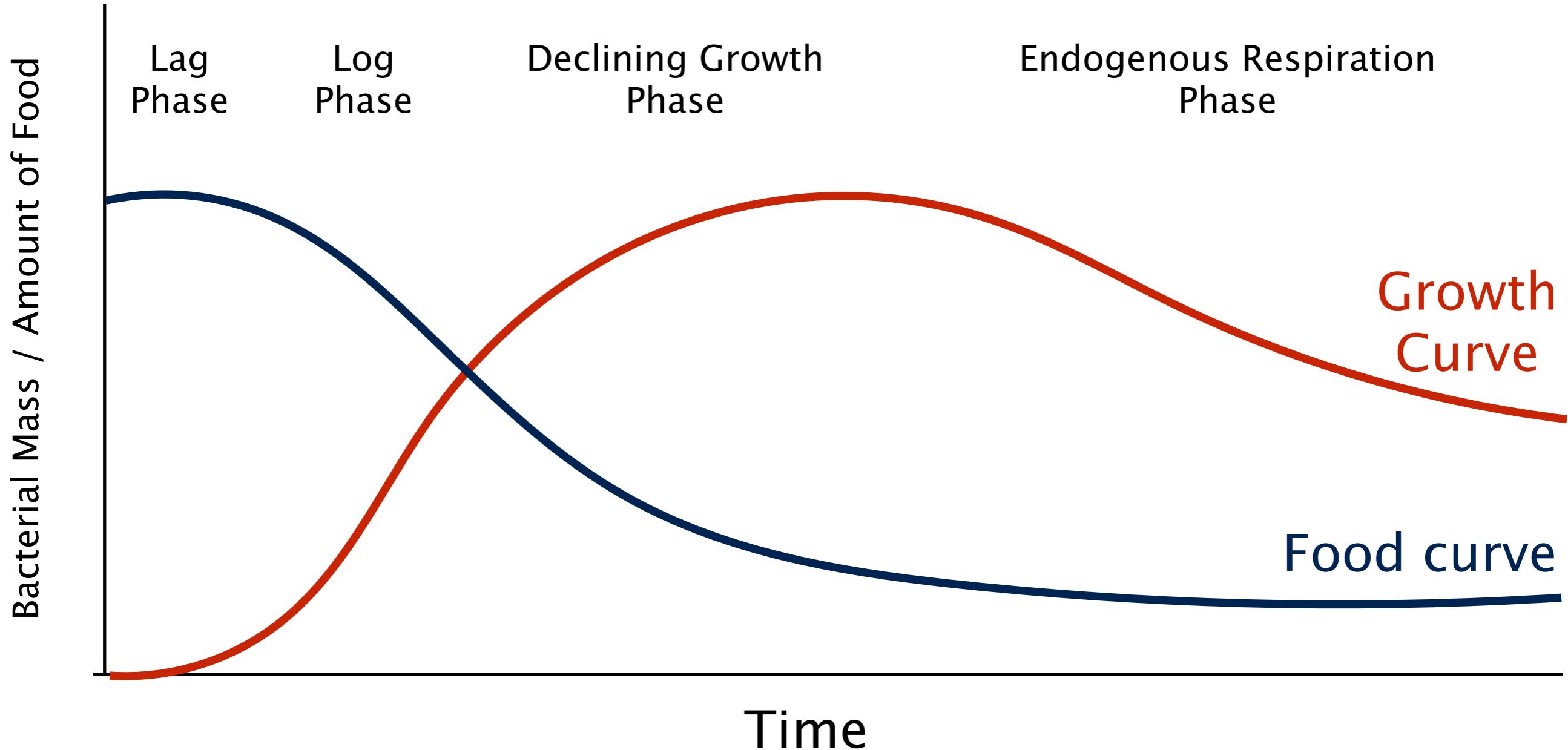


Diversity in Temperature

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

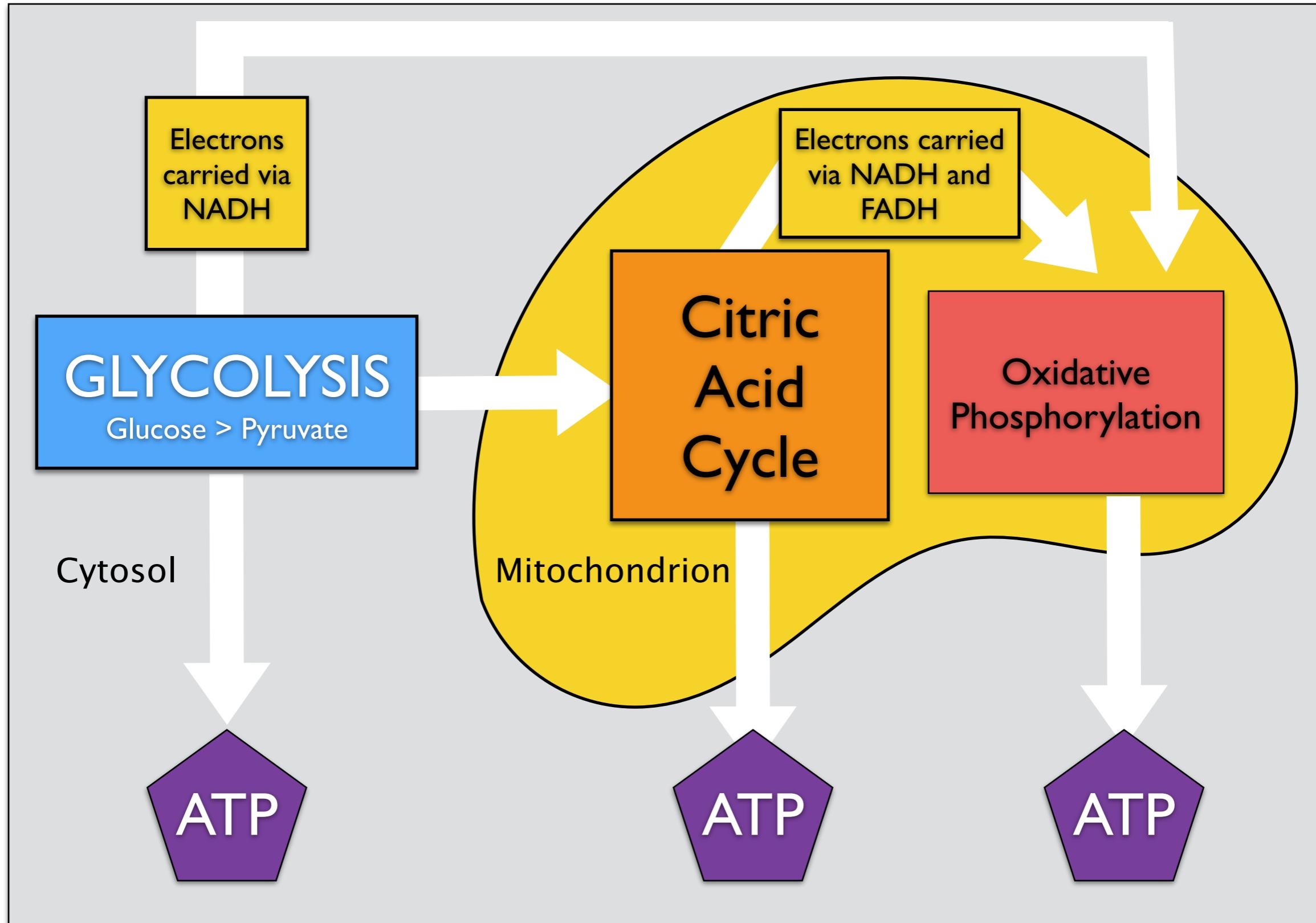


Bacterial growth curve



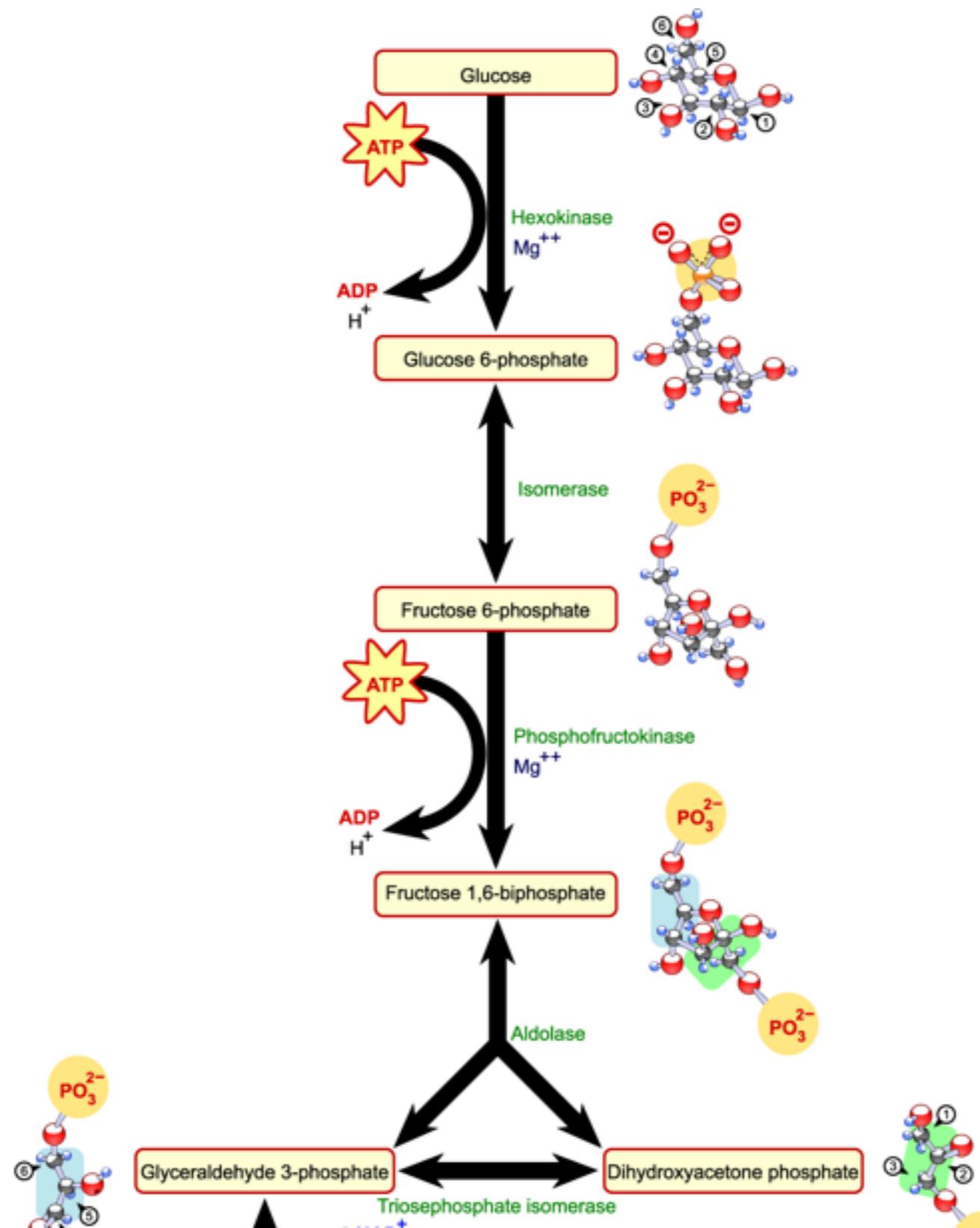


Respiration



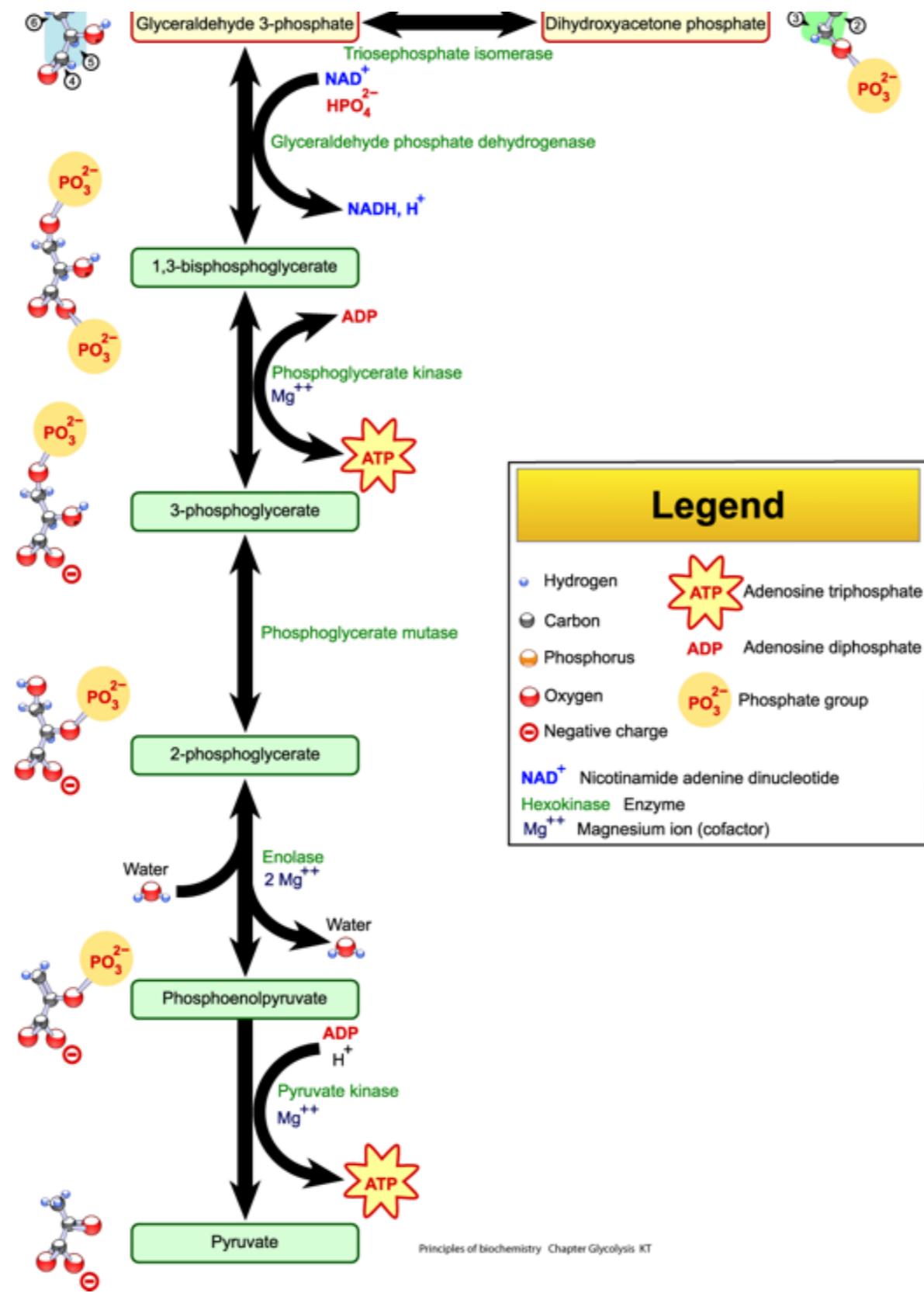


Glycolysis part 1



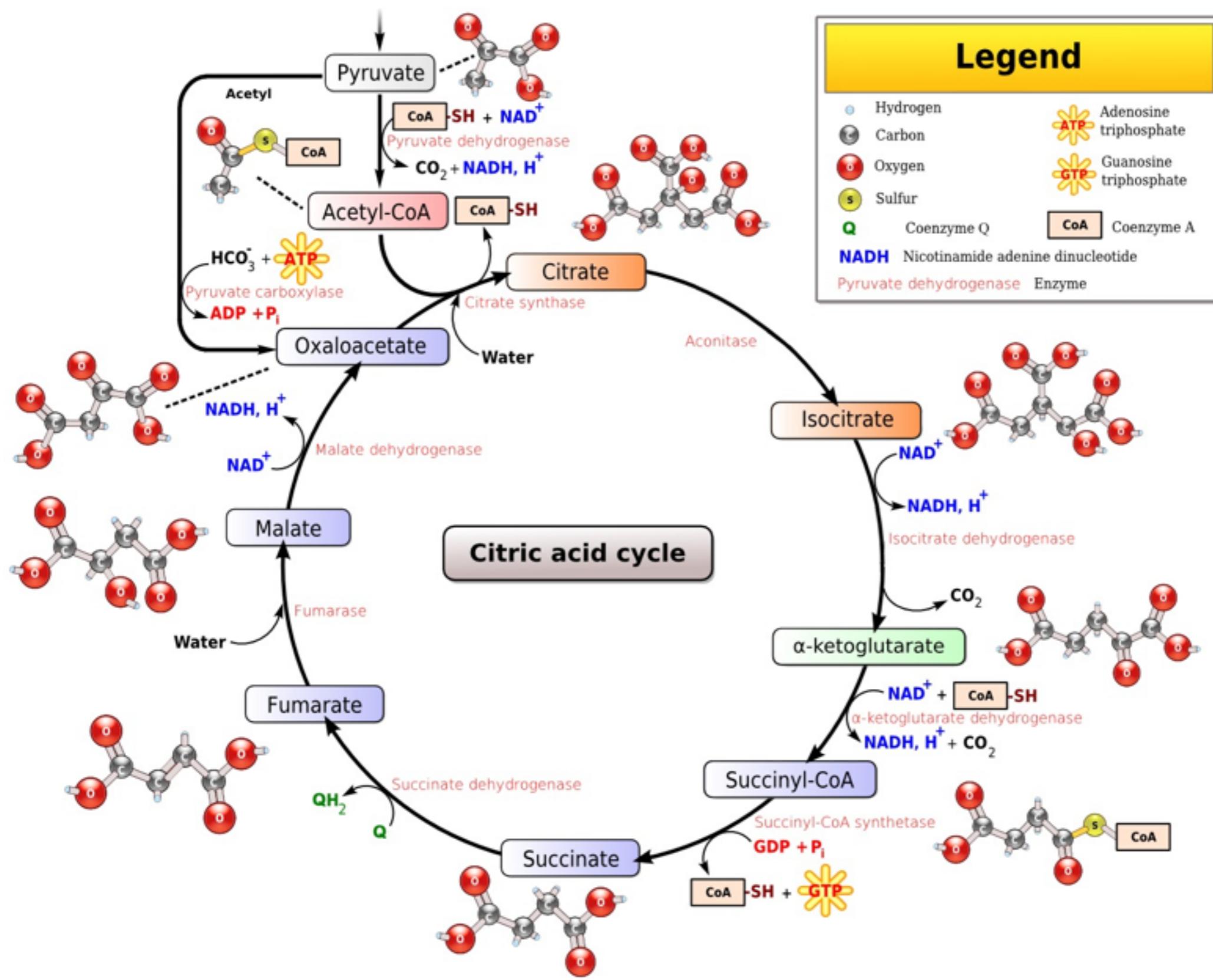


Glycolysis part 2



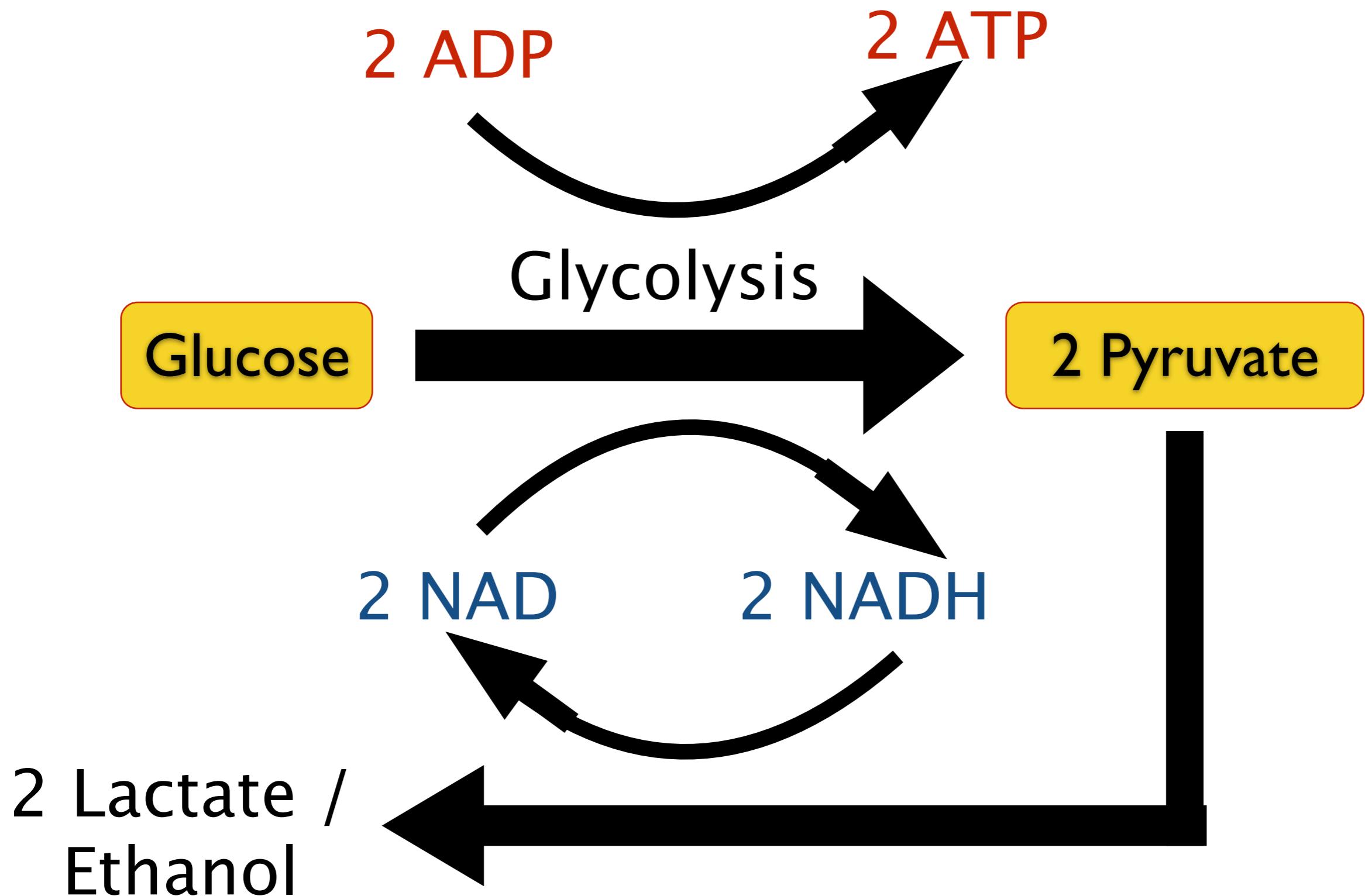


Citric Acid Cycle





Fermentation





Assimilation

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



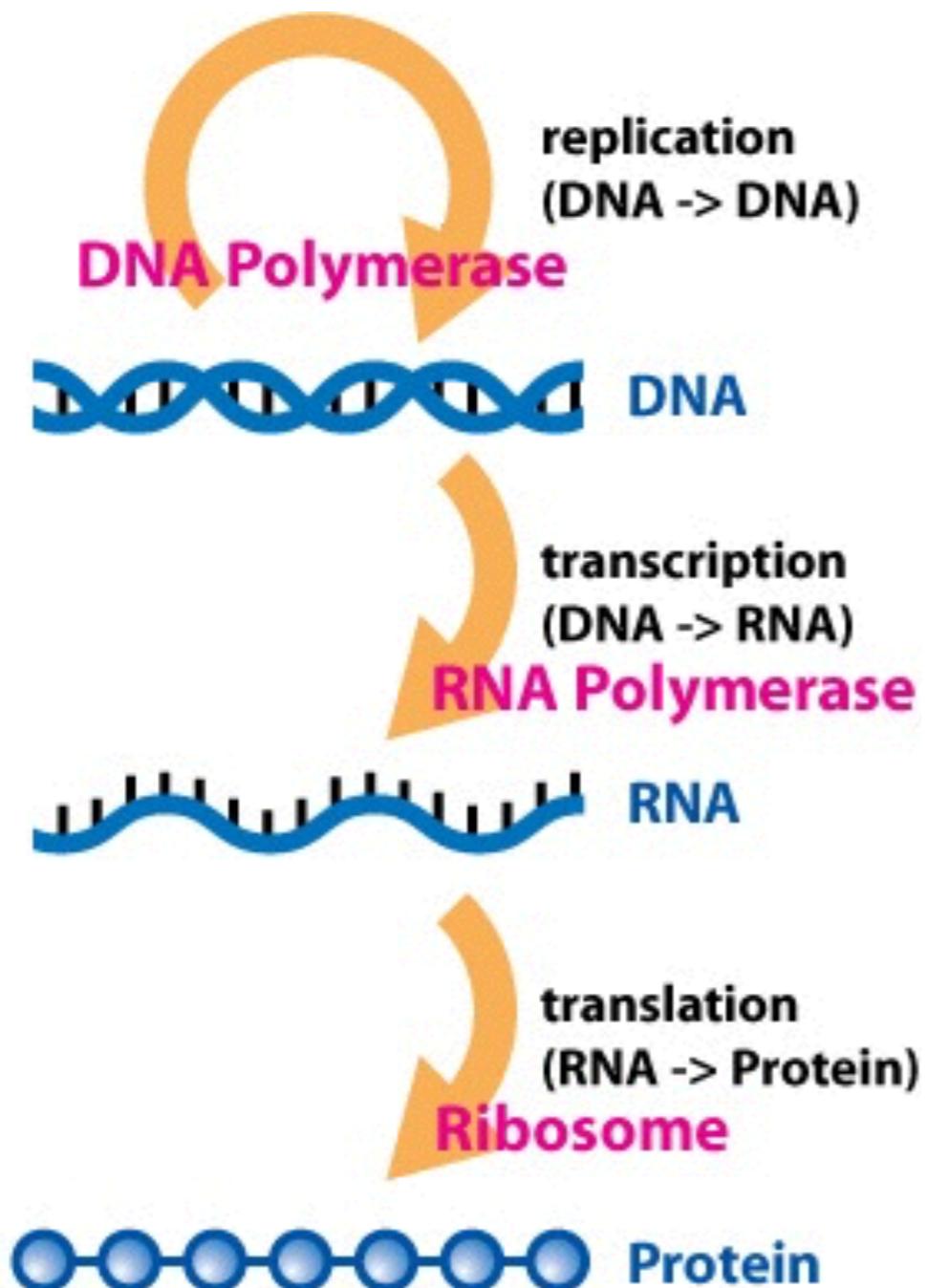
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DNA & Chromosomes

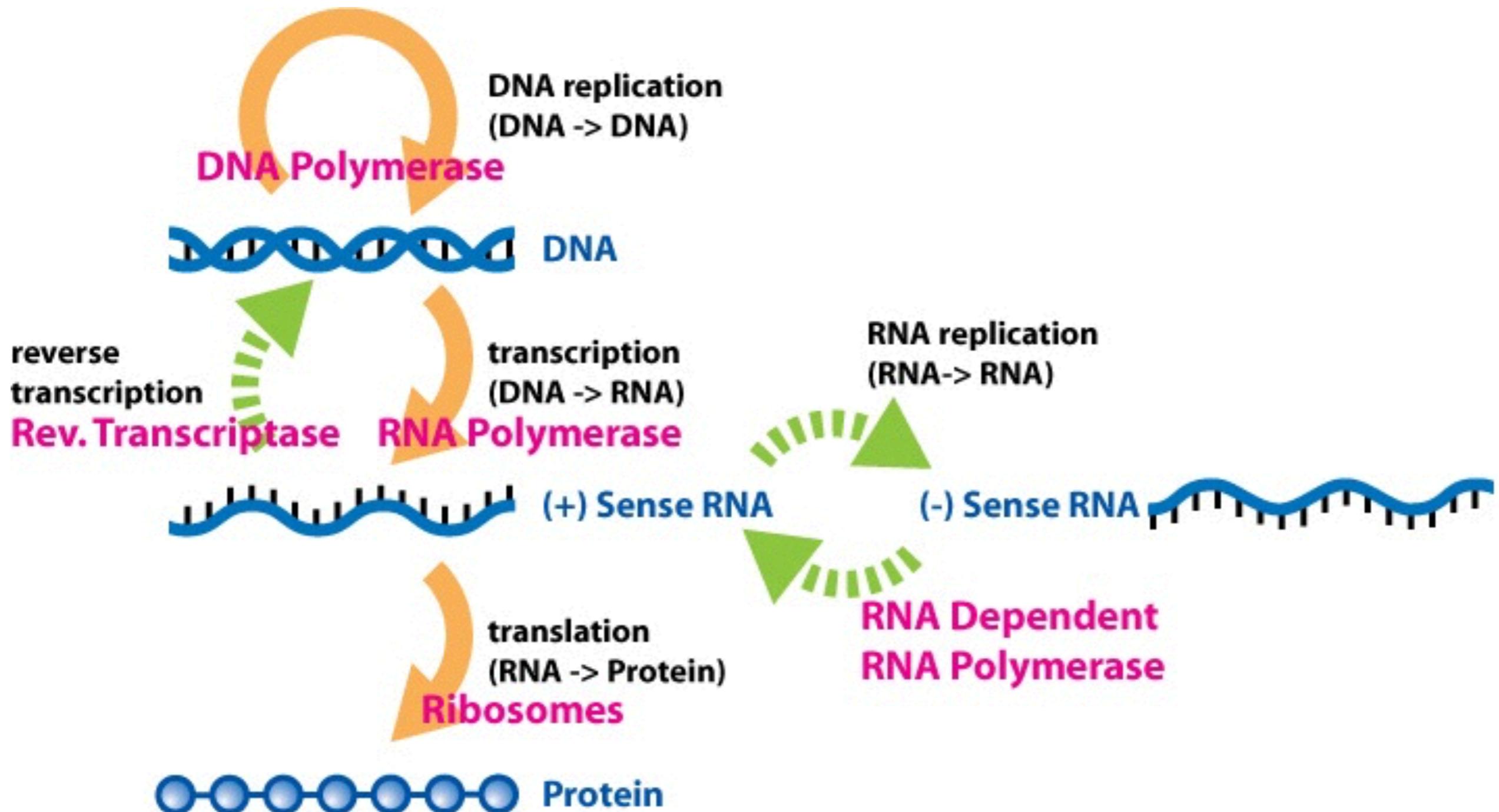


Central Dogma



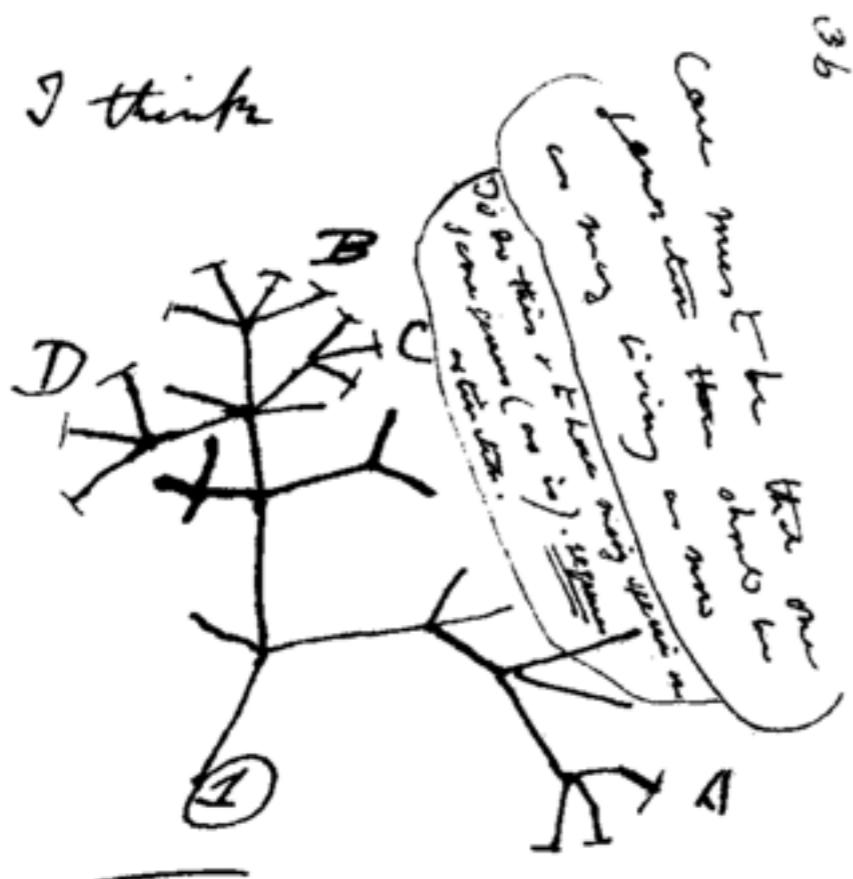


Central Dogma





Origin of Species

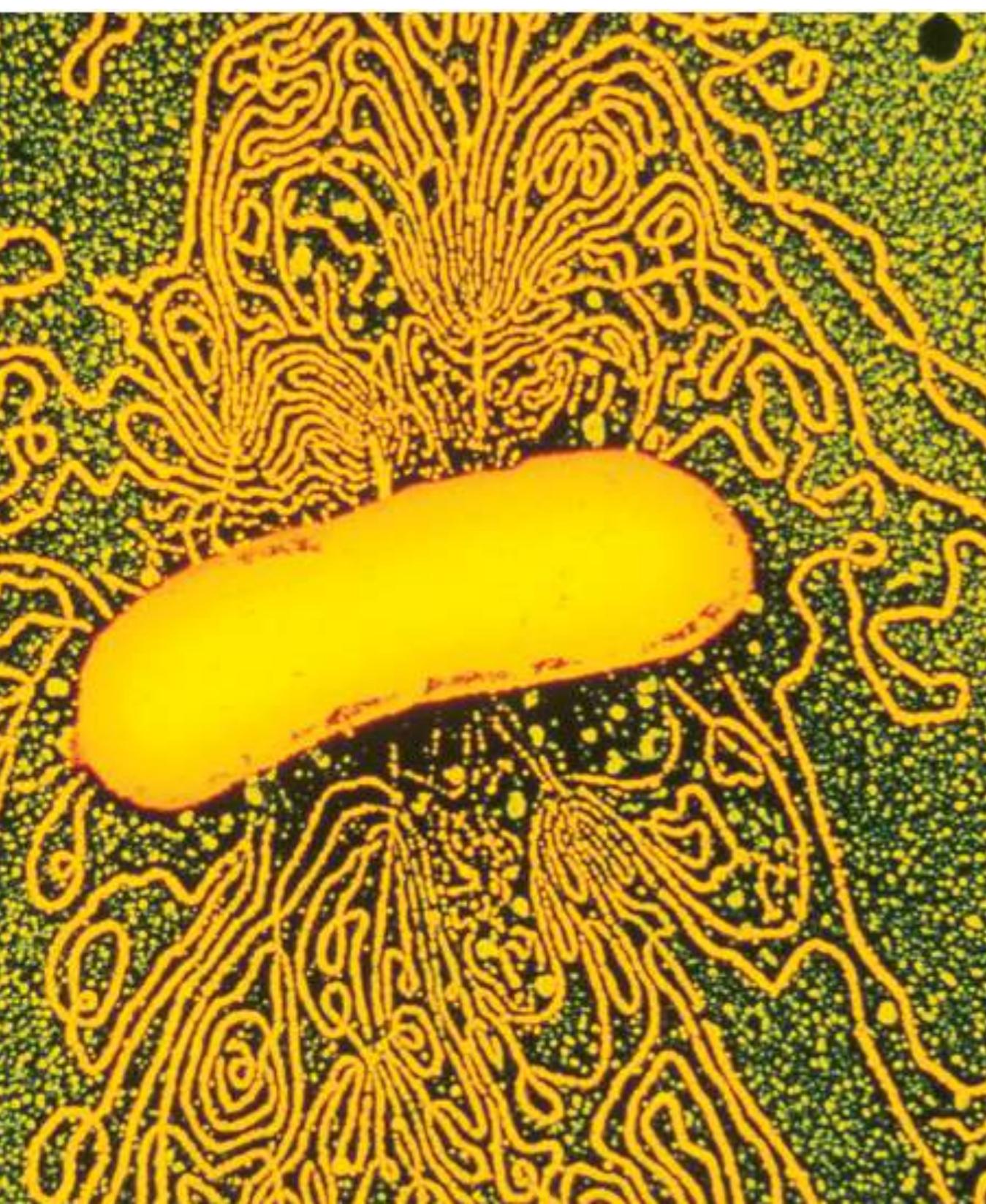


Thus between A & B. arises
less of relation. C & B. the
finer gradation, B & D
rather greater distinction
Thus genera would be
formed. - binary relation



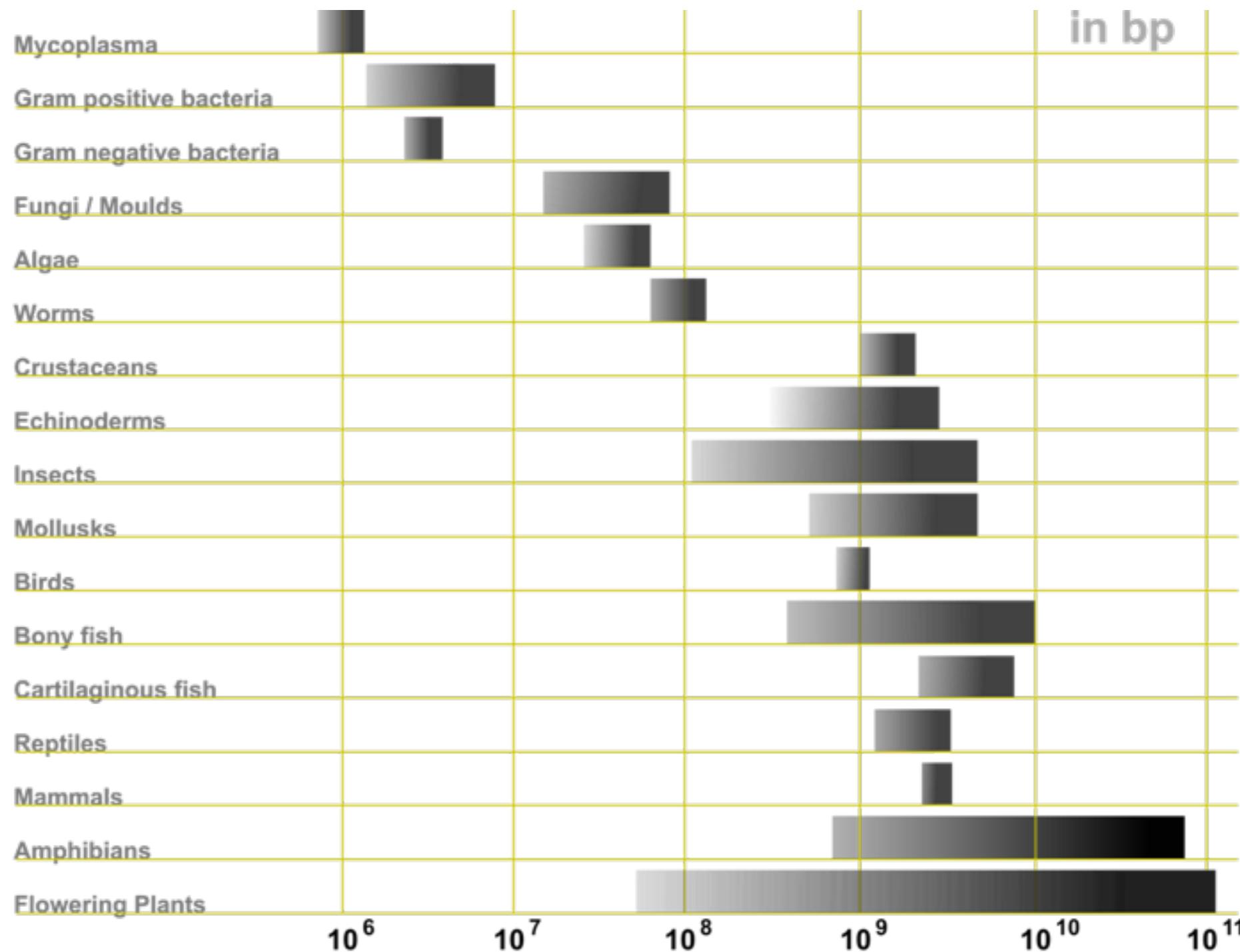


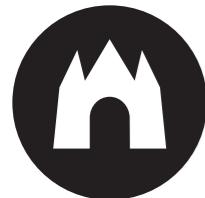
5,000 vs 25,000 genes



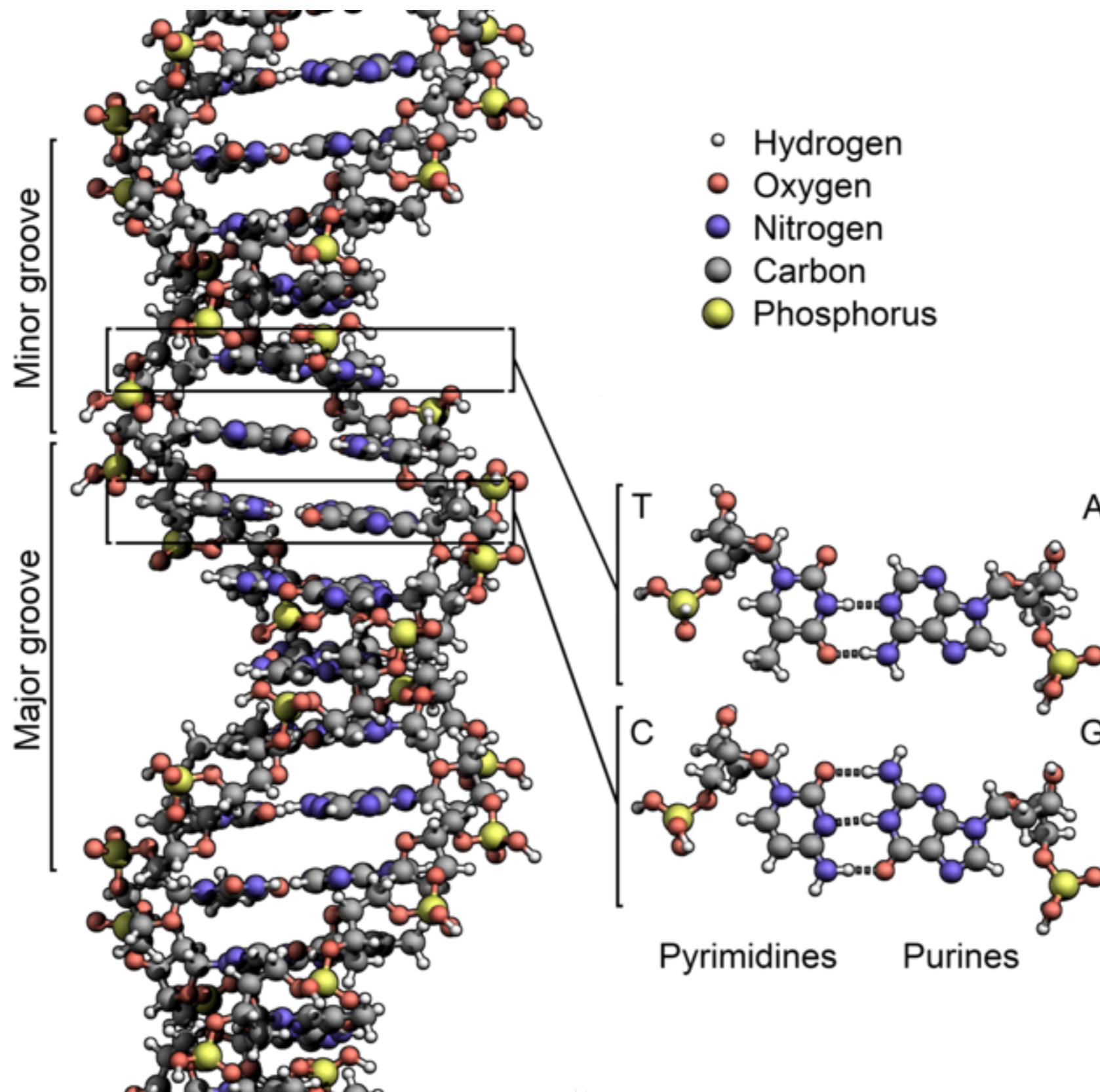


Genome size compared





DNA Molecule





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Proteins

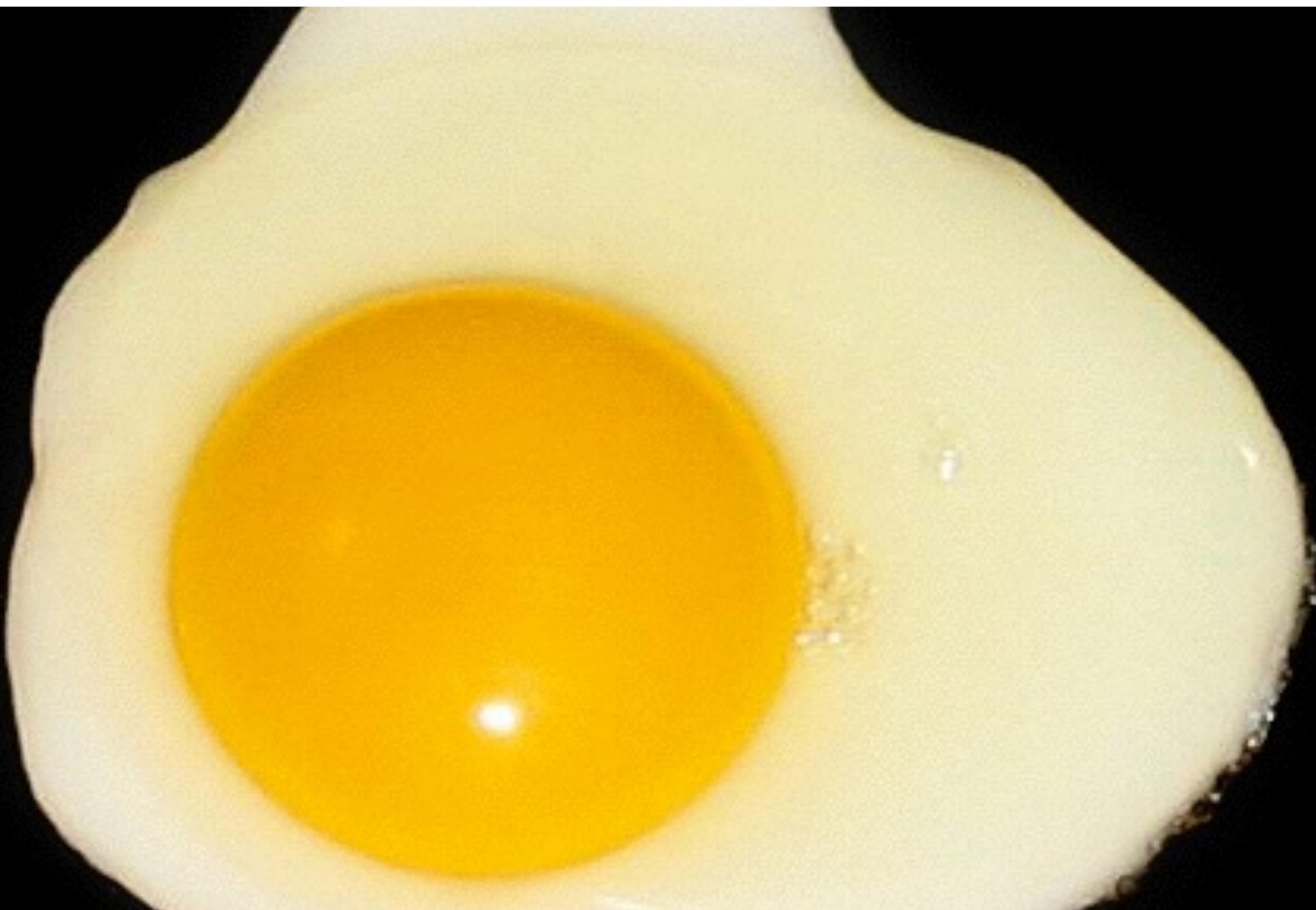


Proteins



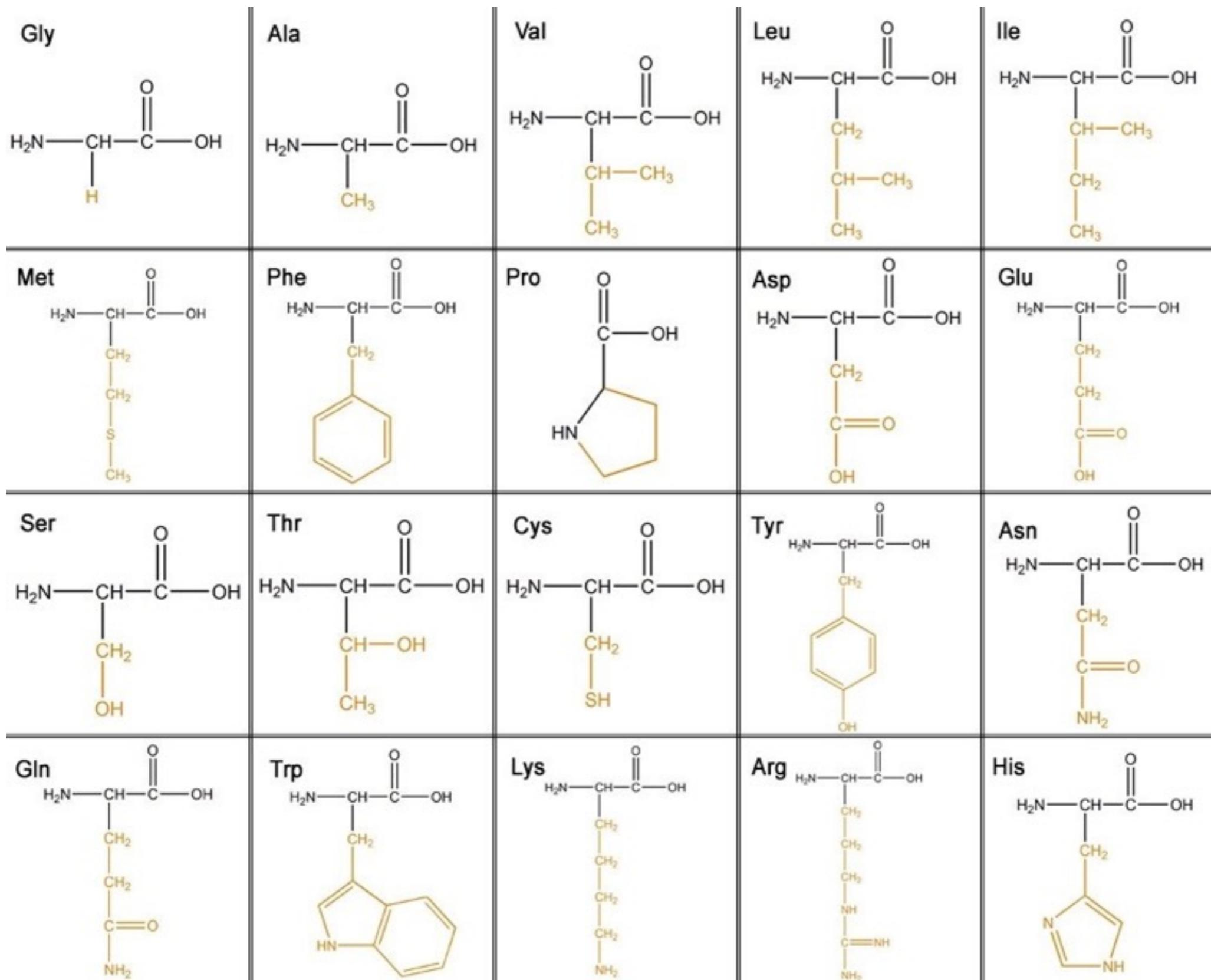


Egg white



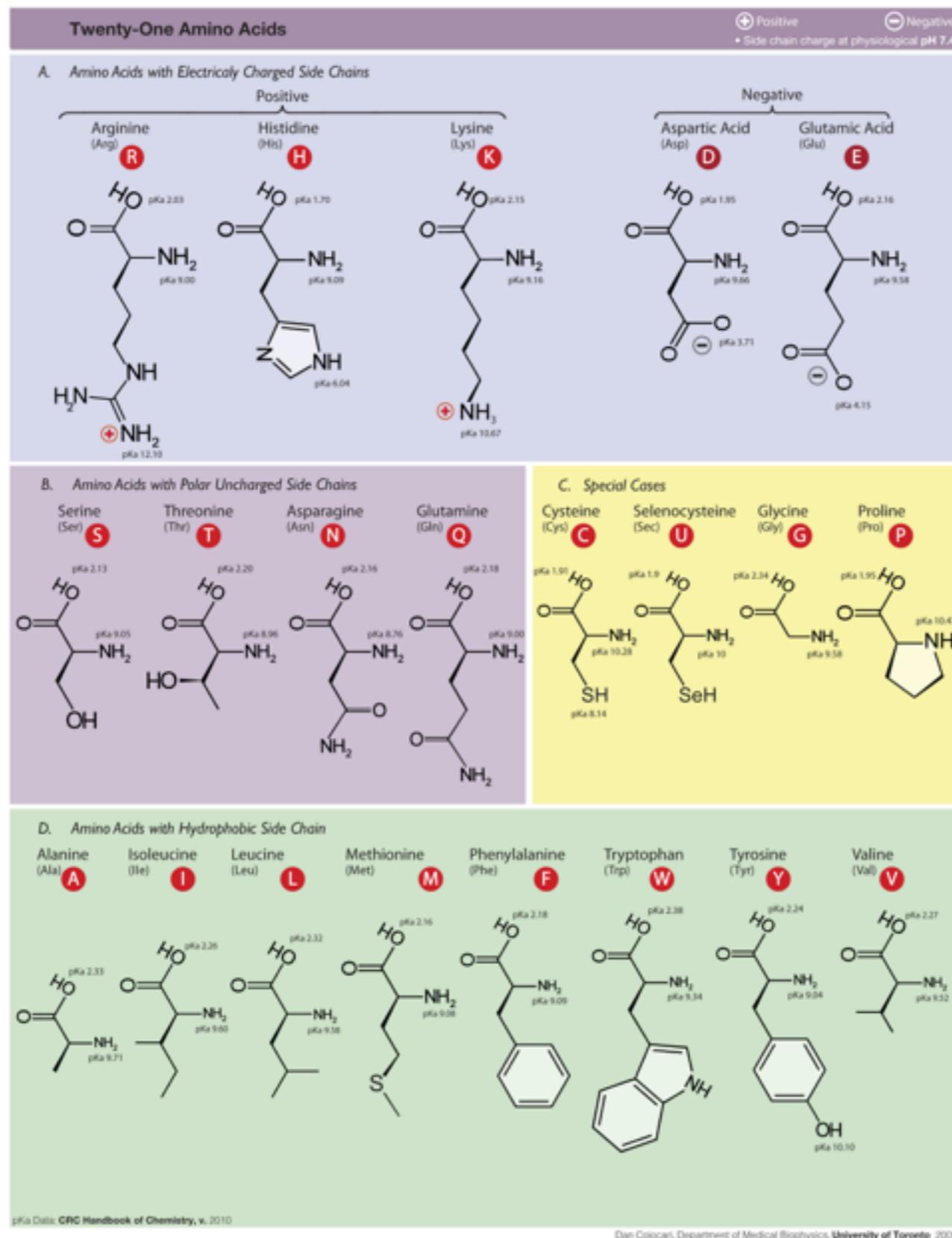


Amino acids, the building blocks



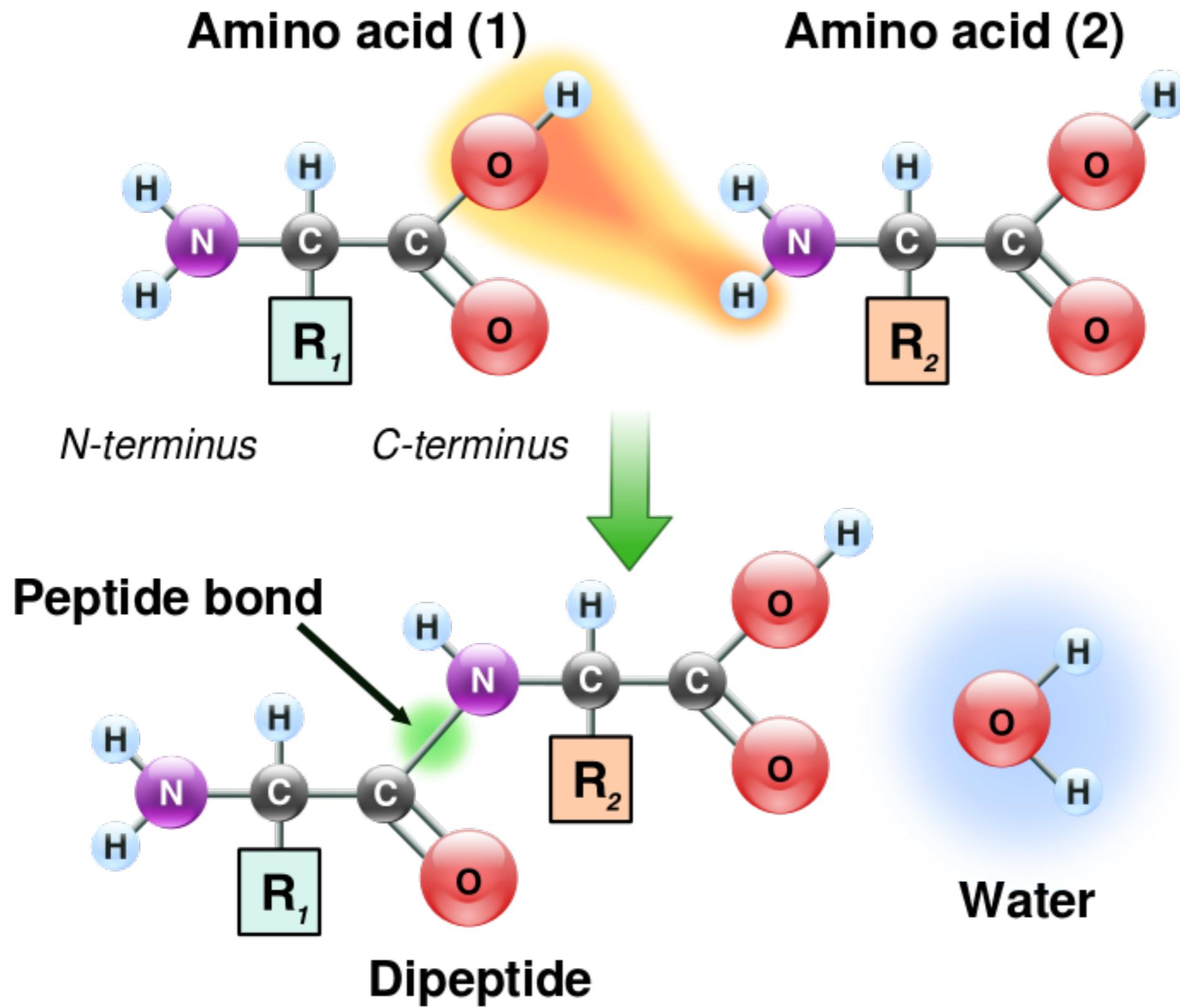


Amino acid groups



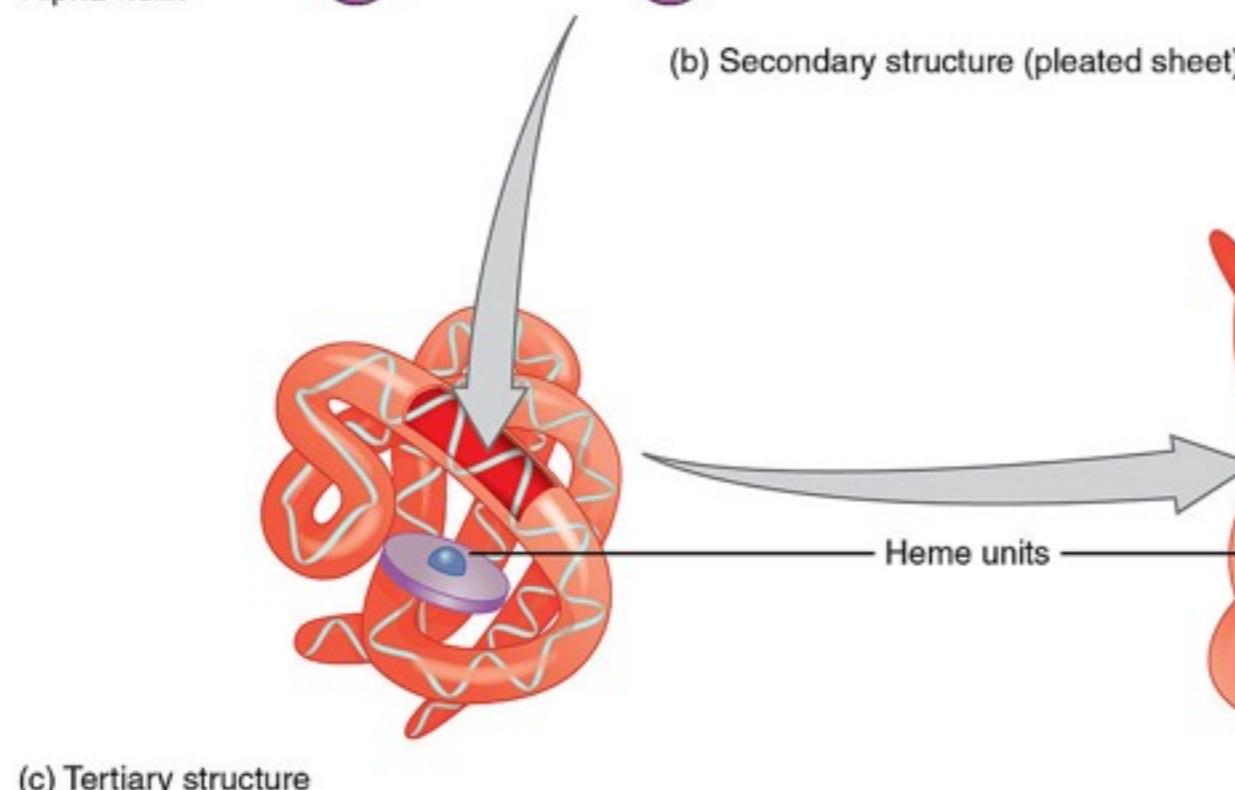
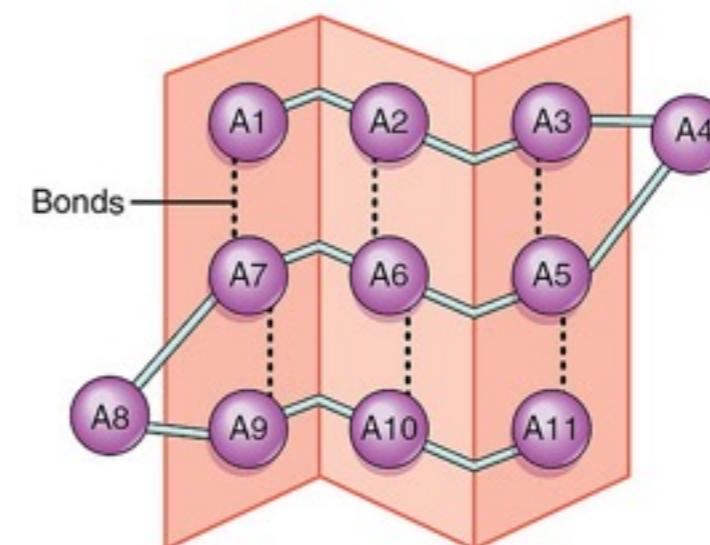
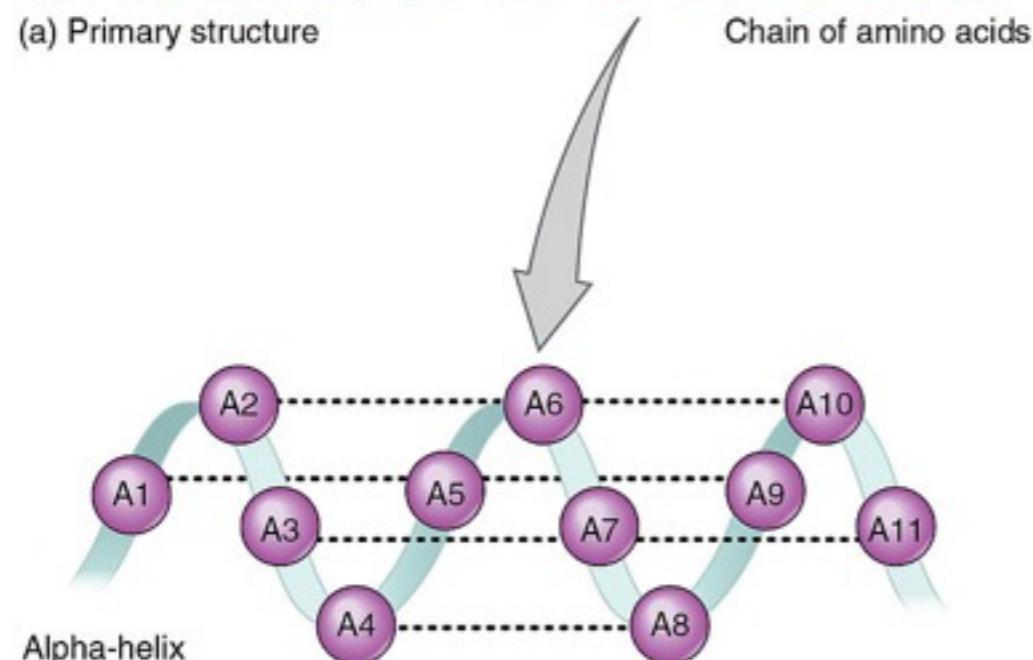
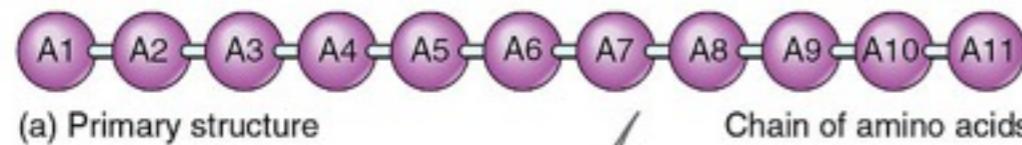


Peptide bond formation





Protein folding

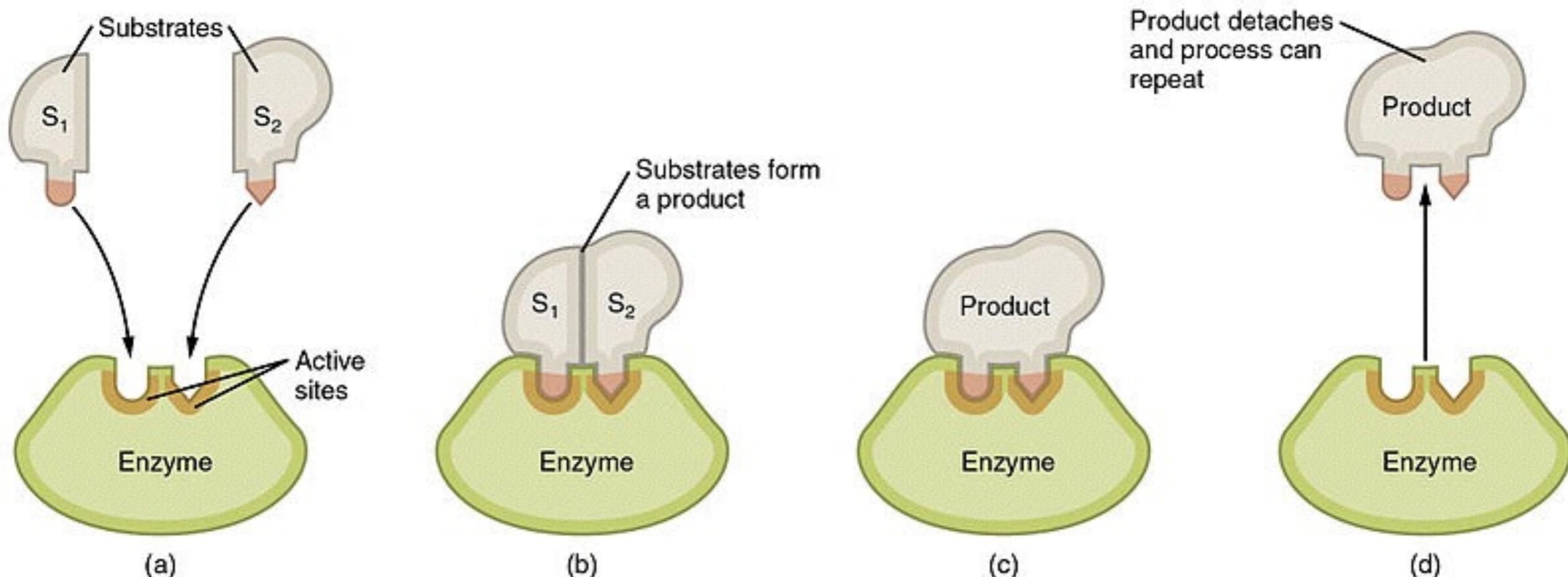


(d) Quaternary structure

Hemoglobin
(globular protein)

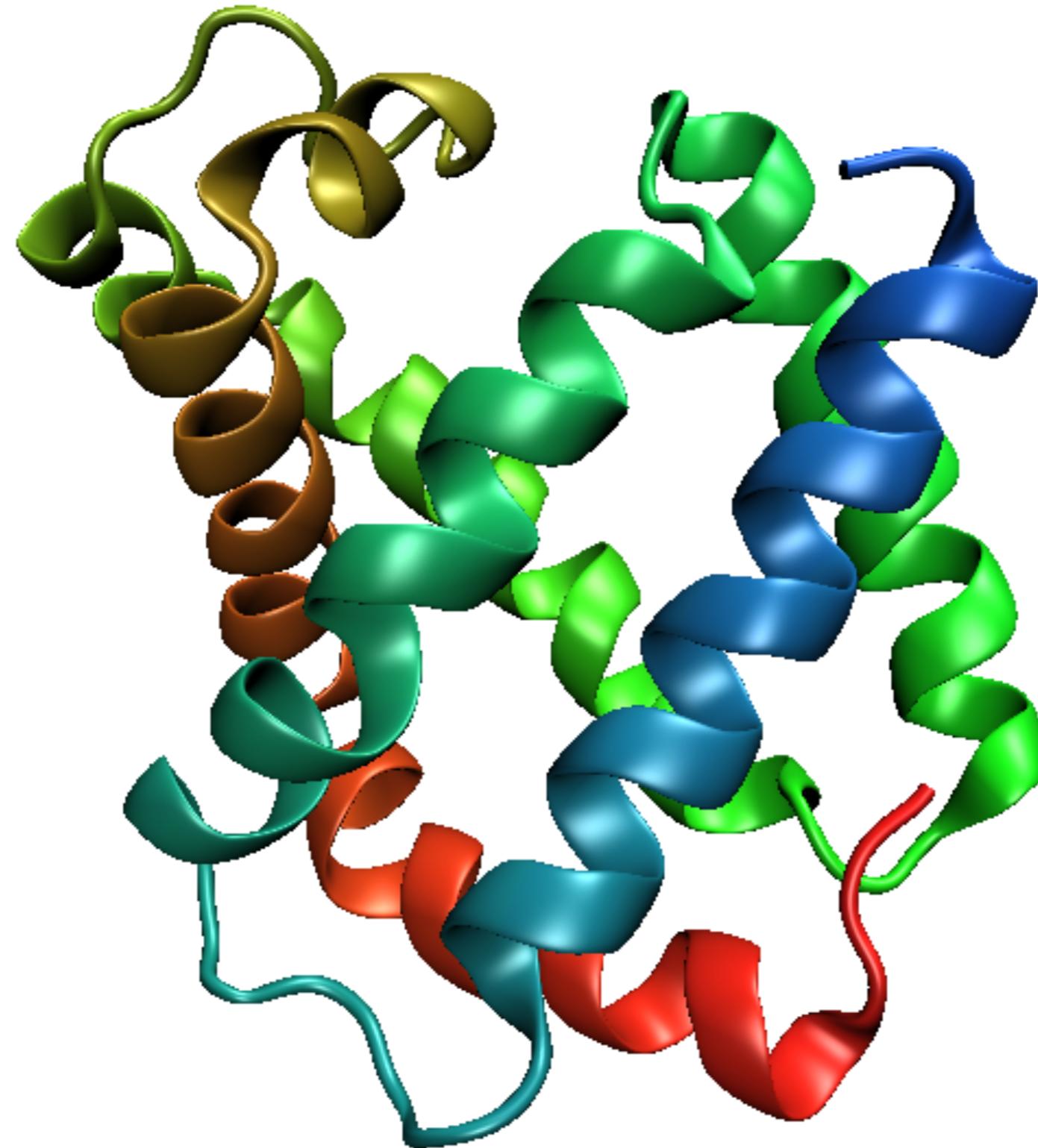


Enzymatic reactions



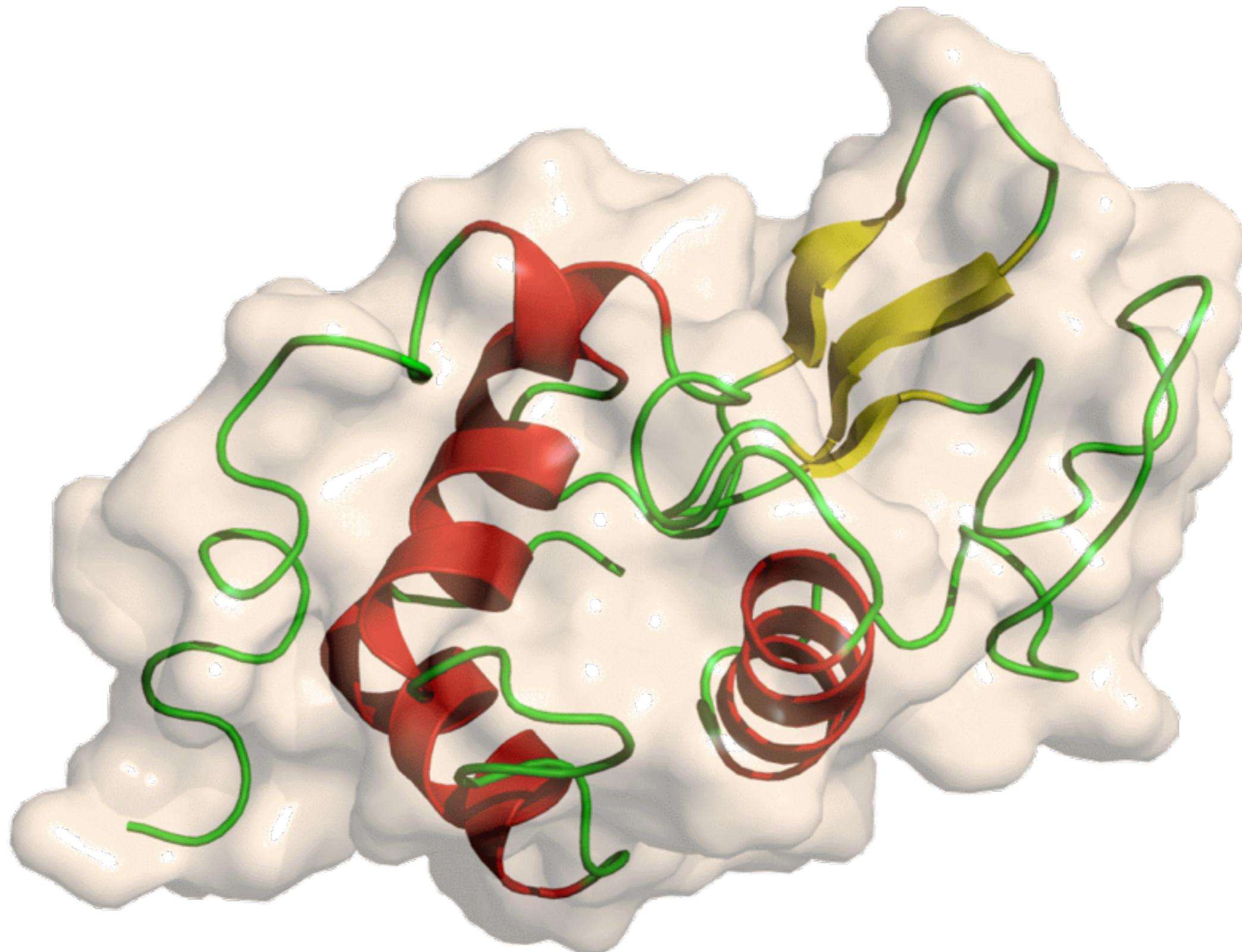


Myoglobin



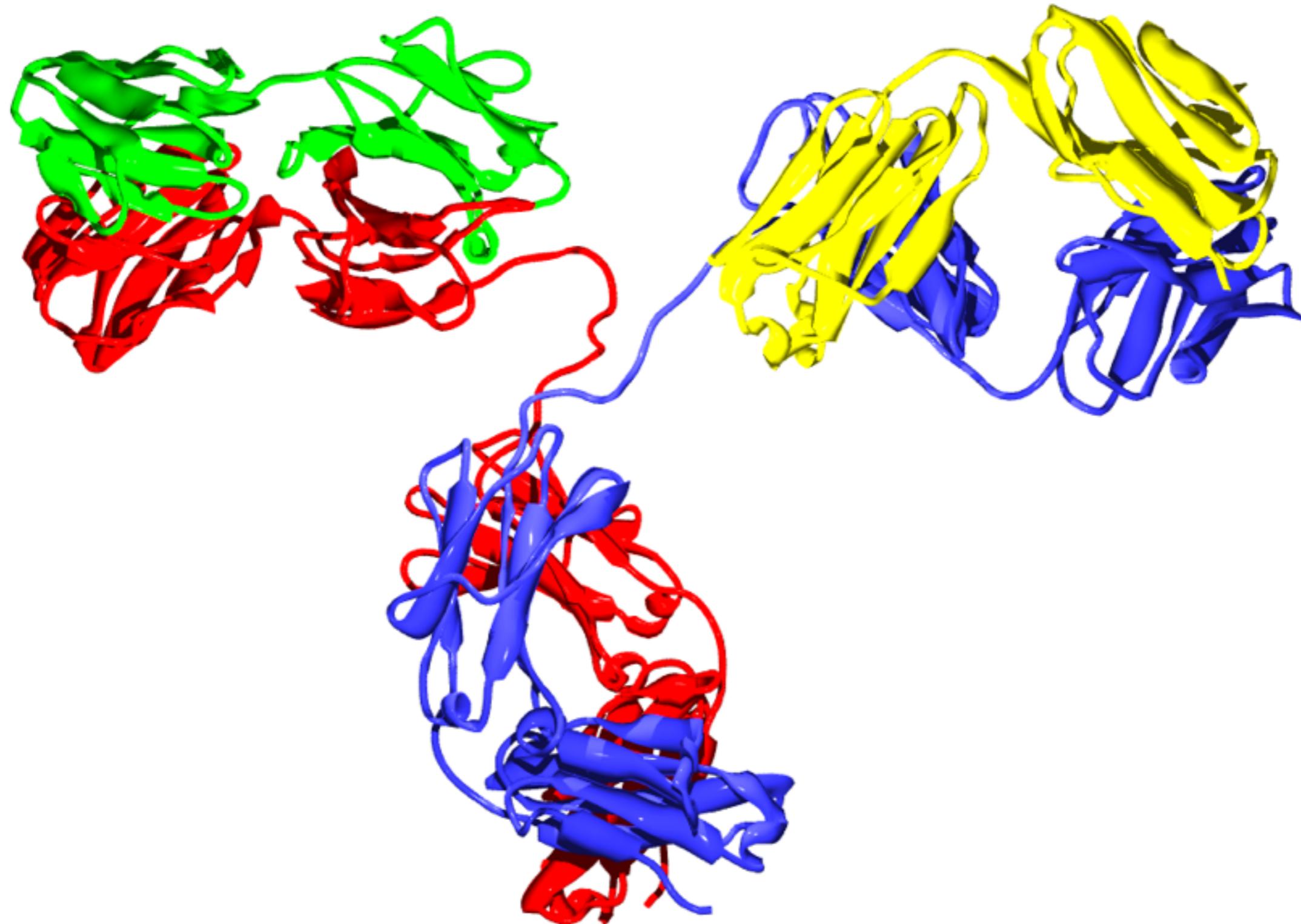


Lysozyme



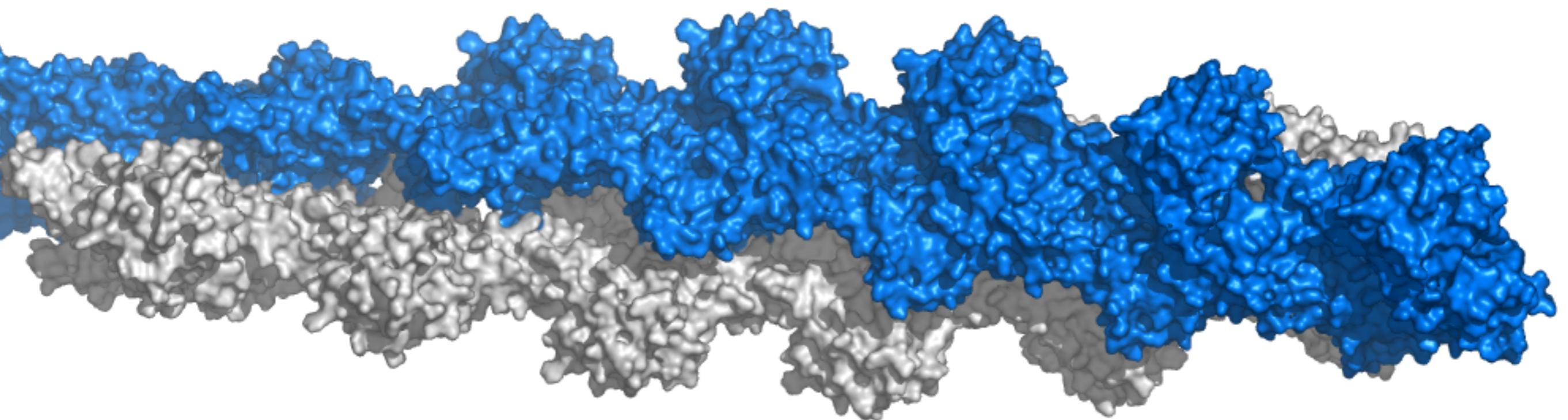


Antibody



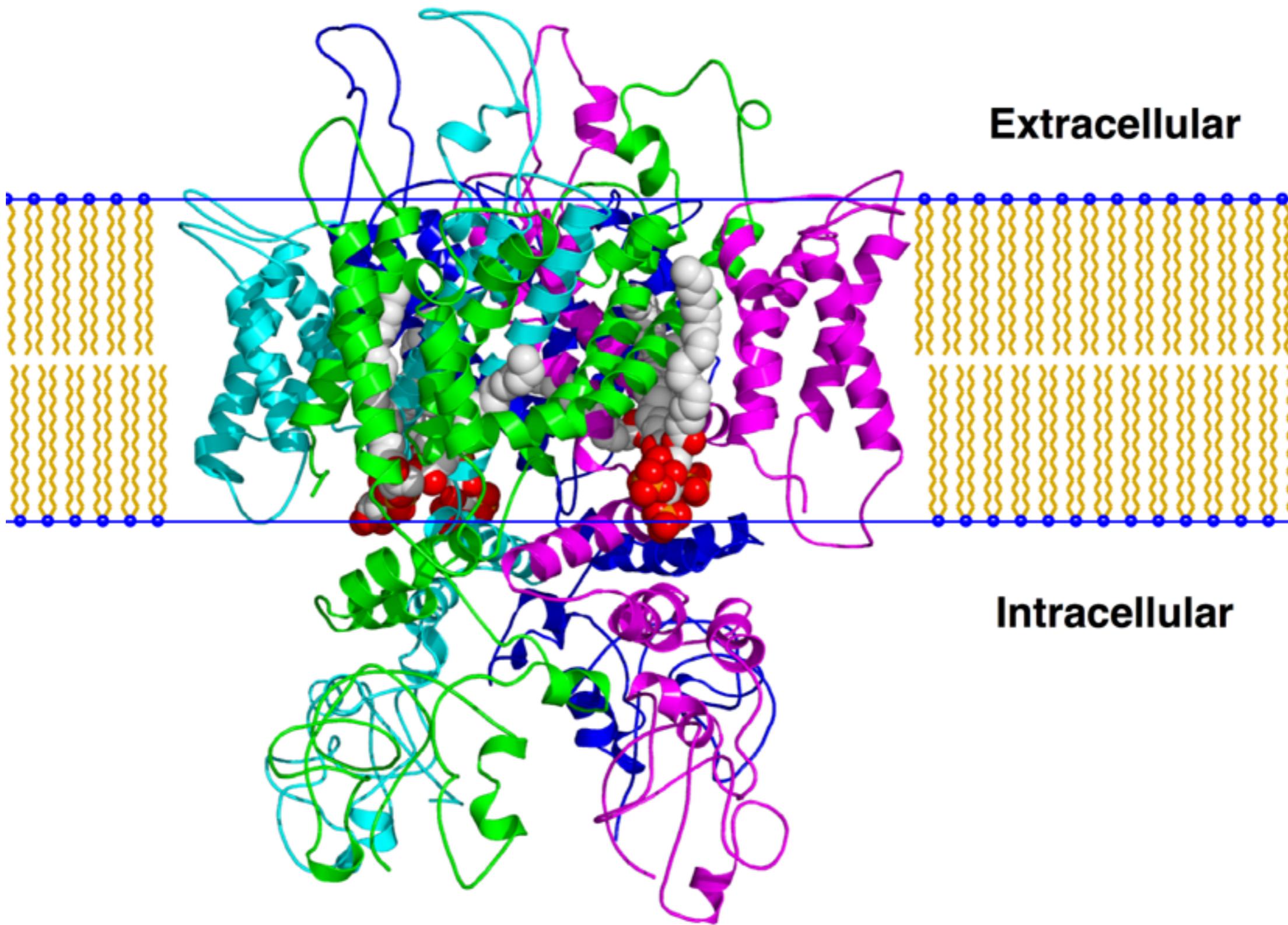


Structural proteins: Actin



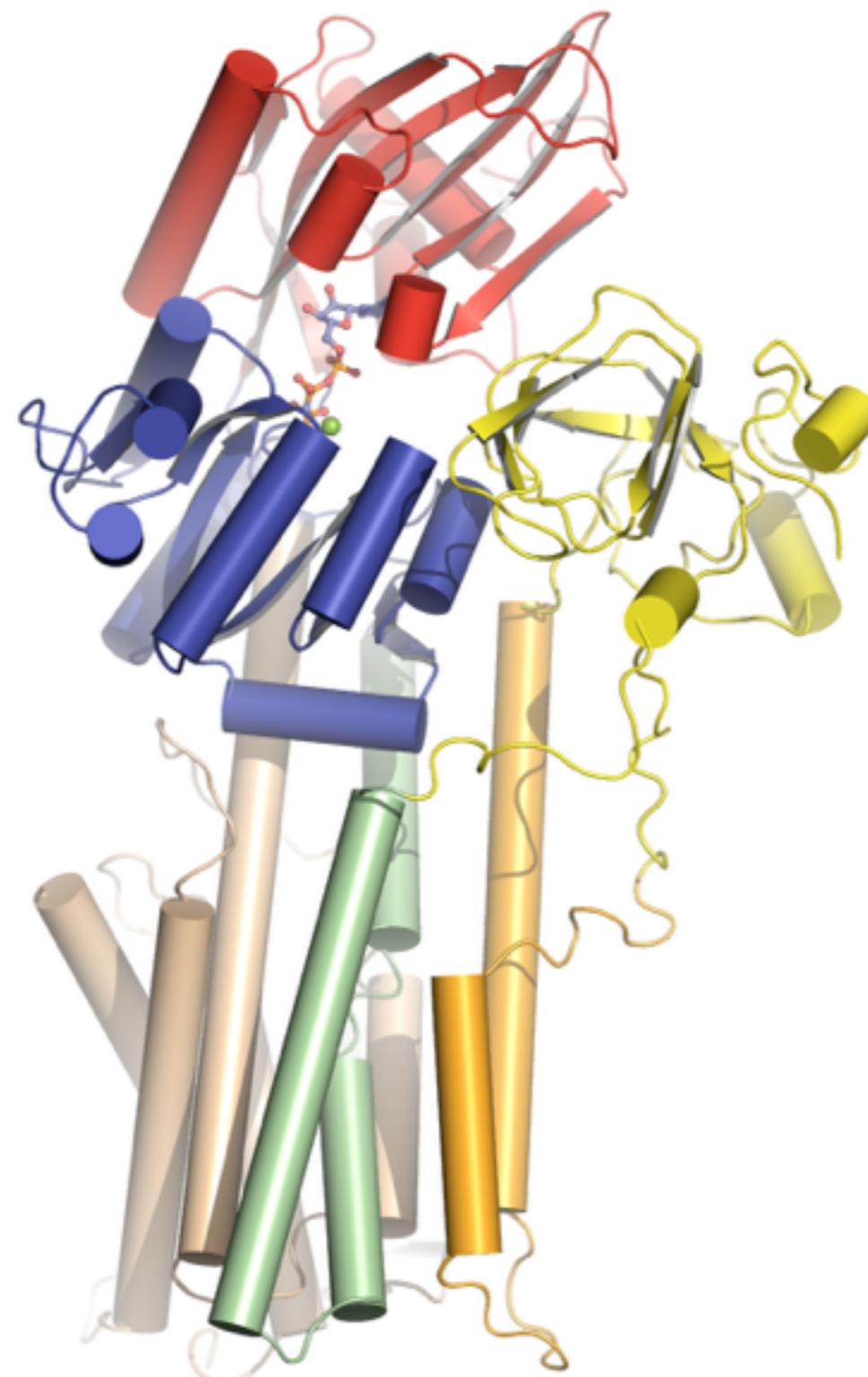


Receptor proteins



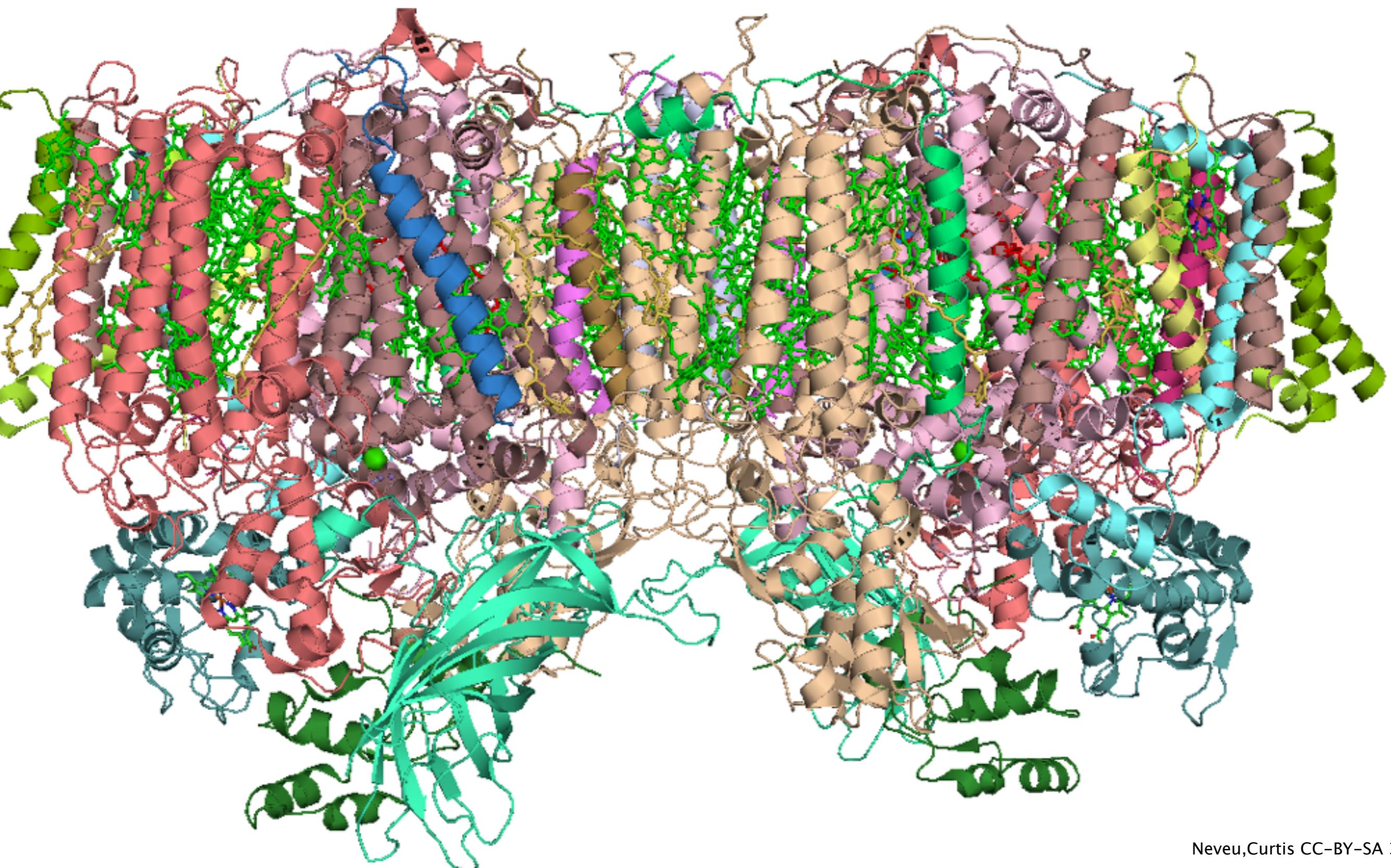


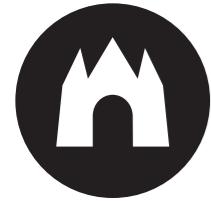
ATPase





Photosystem II



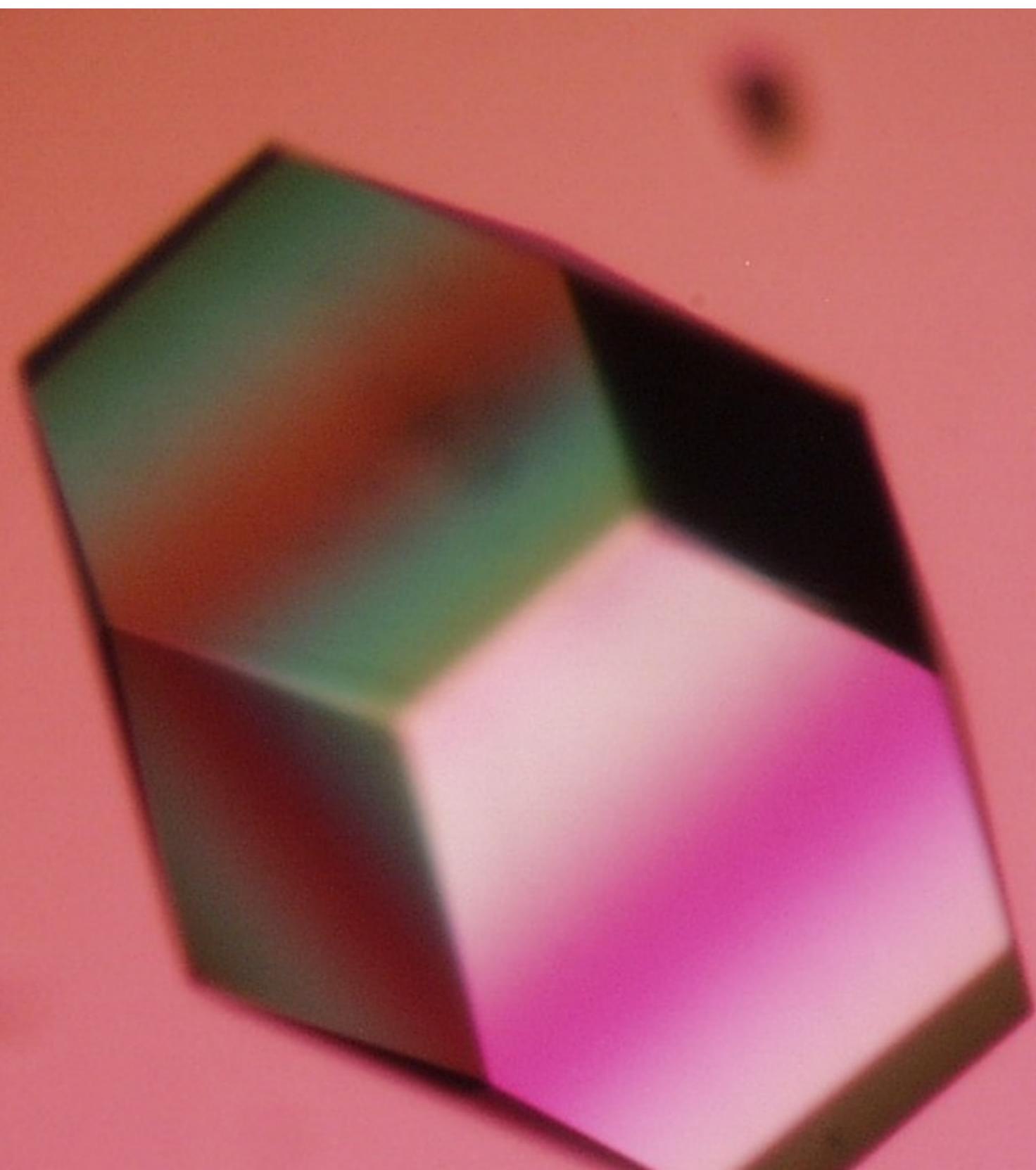


Synchrotron EMBL Grenoble



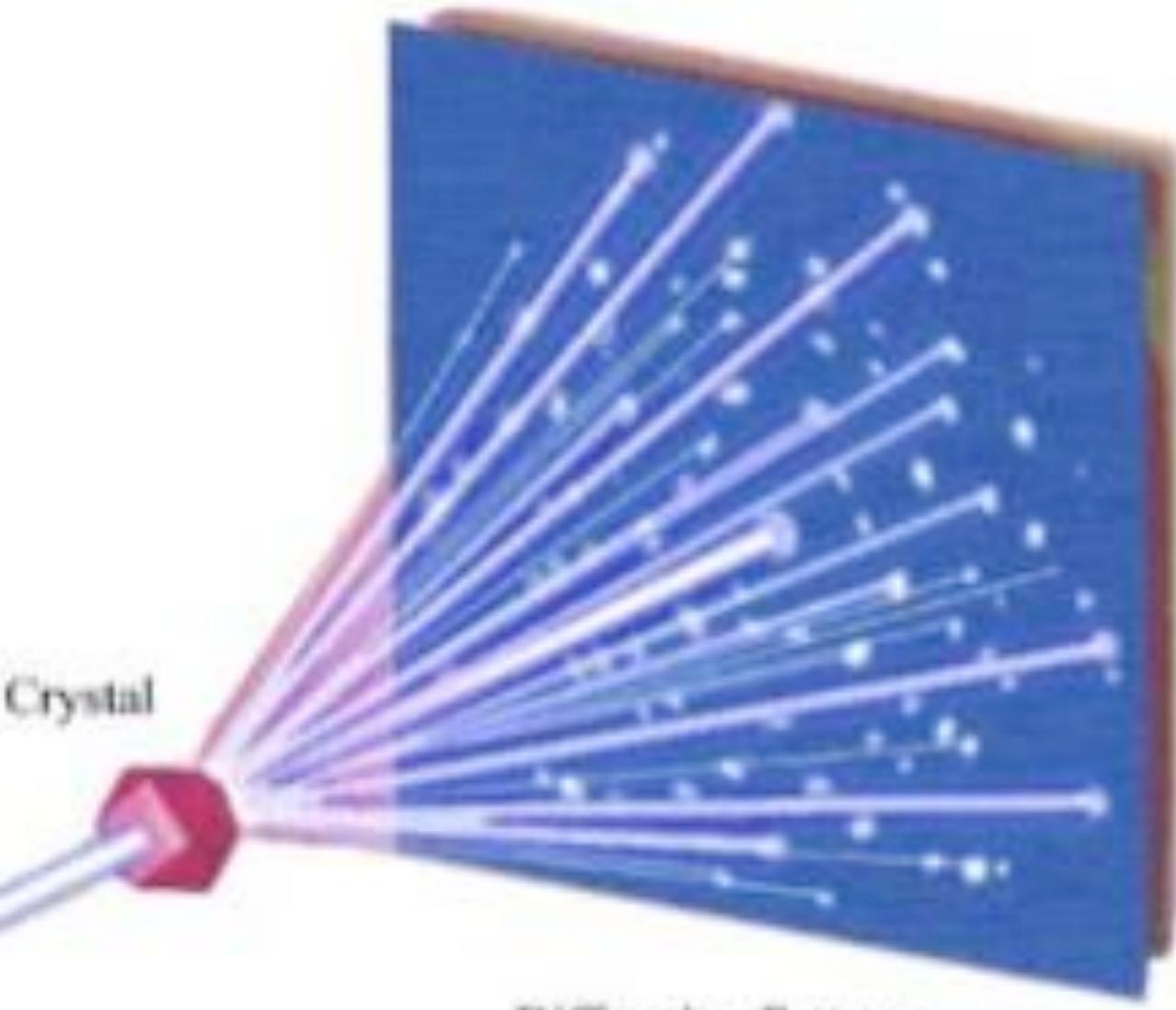


Lysozyme crystal





Protein crystal diffraction

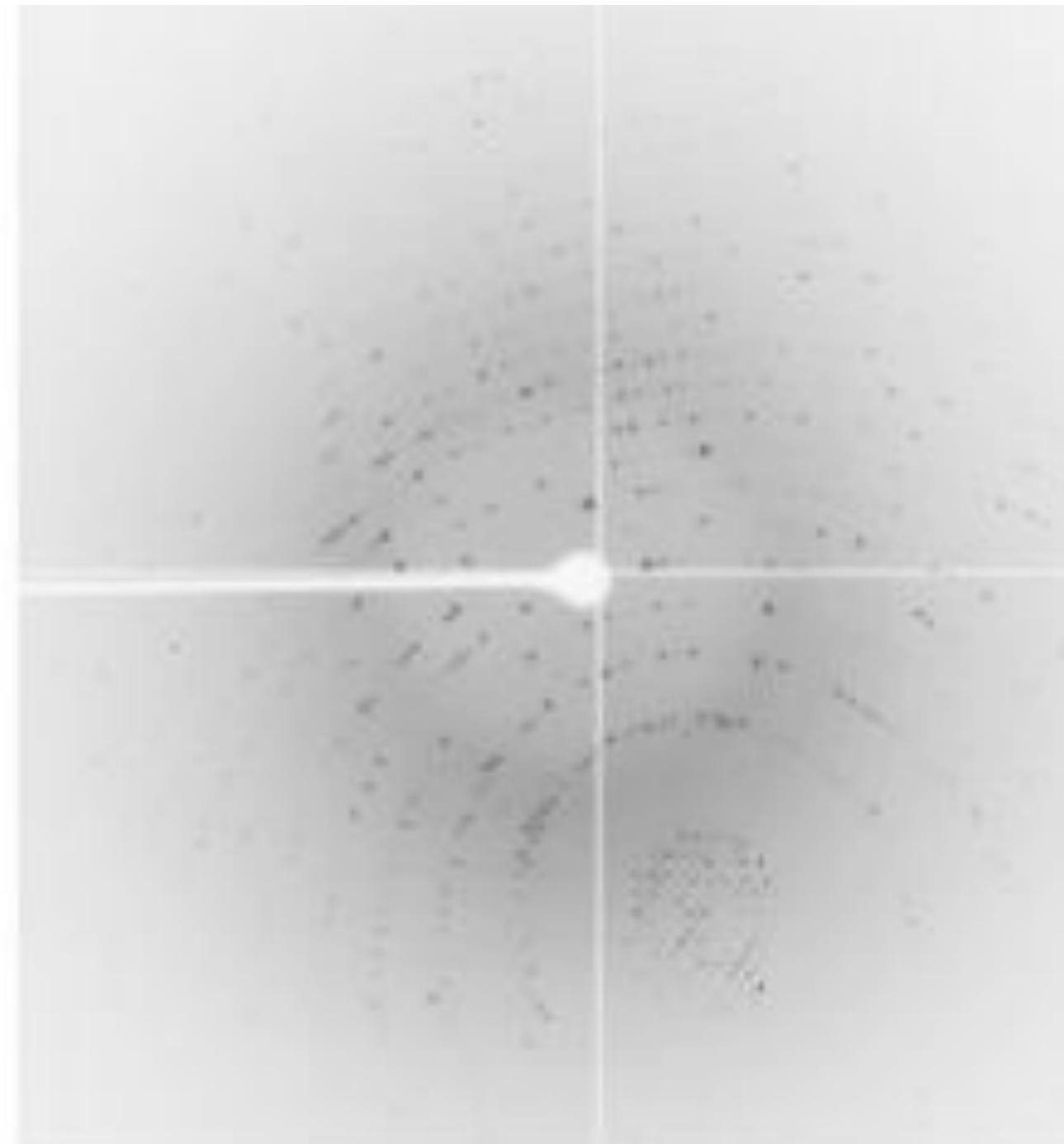


Crystal

Diffraction Pattern

Beam

Diffraction Process



Diffraction Pattern from NSLS



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