

# Introduction to Botany. Lecture 6

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  - History of photosynthesis studies



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# Questions and answers

## Quiz



# Final question (1 point)

What is a molecular weight of sulfuric acid,  $\text{H}_2\text{SO}_4$ ?



# Final question (1 point)

What is a molecular weight of sulfuric acid,  $\text{H}_2\text{SO}_4$ ?

98



# Basics of life

## Molecules of life





# Organic chemistry: chemistry of carbon

- Carbon skeleton
- And H, O, N, P, S



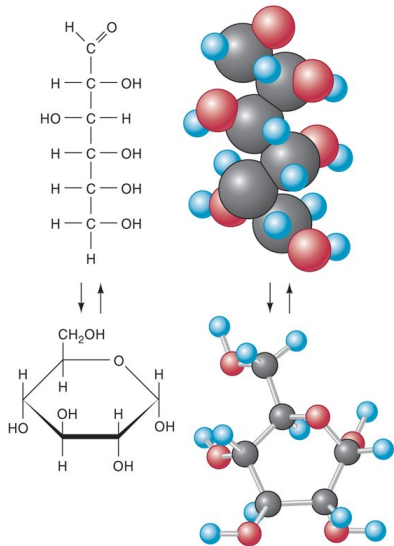
# Four types of biomolecules

- Lipids: hydrophobic
- Carbohydrates (sugars): multiple –OH groups
- Amino acids: N + C + O and hydrogen
- Nucleotides: cycle with nitrogen (heterocycle), sugar and phosphoric acid

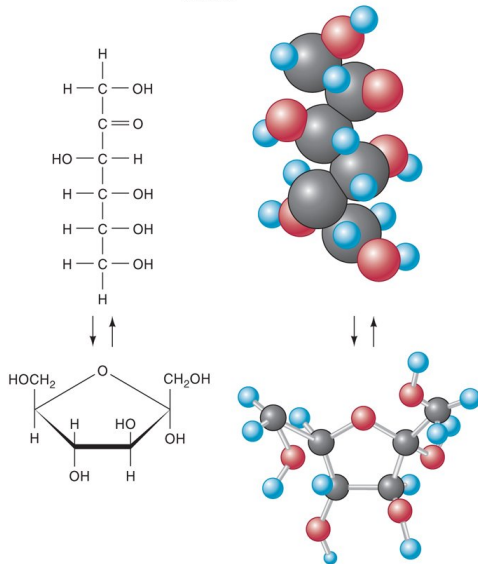


# Carbohydrates

glucose



fructose

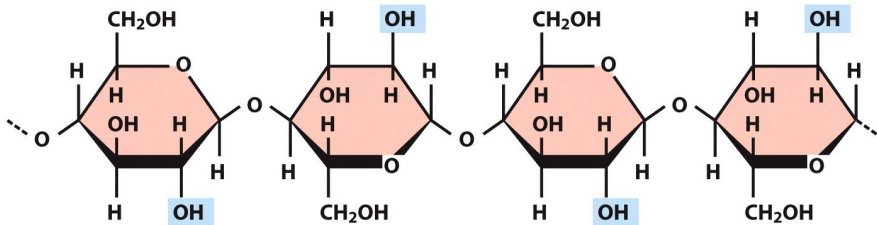


# Organic polymers

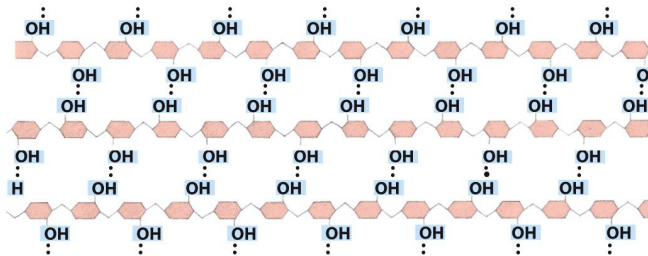
- Polymeric carbohydrates: polysaccharides (like cellulose and starch)
- Polymeric amino acids: proteins
- Polymeric nucleotides: nucleic acids (DNA and RNA)



# Cellulose



(a)



(b)



# Summary

- Most important bonds: polar and non-polar covalent (intramolecular) and hydrogen (intermolecular)
- Obligatory biogenic elements: C, H, O, N, P
- Most important monomers: lipids, carbohydrates, amino acids, nucleotides
- Most important polymers: polysaccharides, proteins, nucleic acids



# Photosynthesis

## History of photosynthesis studies



# van Helmont

- Johannes van Helmont (17th century) rejected the idea that plants take most of their biomass from soil
- Willow (*Salix* sp.) tree of 2.27 kg grew to 67.7 kg in five years, but weight of soil decreased only by 57 g
- van Helmont concluded that plants take most of their weight from water





# Pristley

- Famous Joseph Priestley in 1772, made series of experiments with mouse, candle and sprig of mint (*Mentha* sp.)
- Mouse behave similar to candle, they both “spent” air
- Plant revives the air for both candle and mouse



# Further history

- Jan Ingenhousz (1779–1796) and Jean Senebier (1780) found that:
  - Only in day time the air is reviving
  - CO<sub>2</sub> is assembled
- Antoin-Laurent Lavoiser (1783) found that the “revived air” is a separate gas, **oxygen**

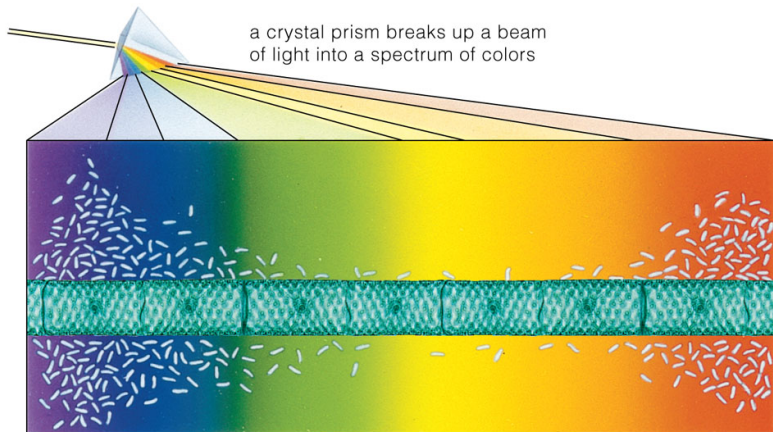


# Engelmann

- Thomas Engelmann in 1884 found that *Spirogyra* alga produce oxygen mostly in blue and red parts of spectrum
- Therefore, the key photosynthetic pigment should accept blue and red rays and reflect green rays
- Chlorophyll fits best to this description



# Experiment of Engelmann



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# Light and enzymatic (“dark”) reactions

- Light reactions depend on the light and water, they produce oxygen and energy (in form of ATP)
- Enzymatic reactions depend on carbon dioxide and water, they take energy from light reactions and result in production of carbohydrates



# Final question (2 points)



# Final question (2 points)

Why did Engelmann decide that photosynthetic pigment has a green color?



# Summary

- Main biogenic elements: C, H, O, N, P
- Most important monomers: lipids, carbohydrates, amino acids, nucleotides
- Most important polymers: polysaccharides, proteins, nucleic acids
- From 17th century, it constantly became clear that plants make their biomass from light, water and carbon dioxide





# For Further Reading



## A. Shipunov.

*Introduction to Botany* [Electronic resource]. newblock Mode of access:

[http://ashipunov.info/shipunov/school/biol\\_154](http://ashipunov.info/shipunov/school/biol_154)

