

## BIOGÉN ELEMÉK

### ÁLLANDÓ BIOGÉN ELEMÉK

### VÁLTOZÓ BIOGÉN ELEMÉK

#### MAKROELEMÉK

#### MIKROELEMÉK (NYOMELEMÉK) ( $< 0,005\%$ )

F, B, Si,  
Se, Sn,  
Cr, V

ELSŐDLEGES BIOGÉN  
ELEMÉK(kb. 95%)

MÁSODLAGOS BIOGÉN  
ELEMÉK ( $> 0,005\%$ )

I, Fe, Cu, Zn, Mn,  
Co, Mo

C, H, O, N

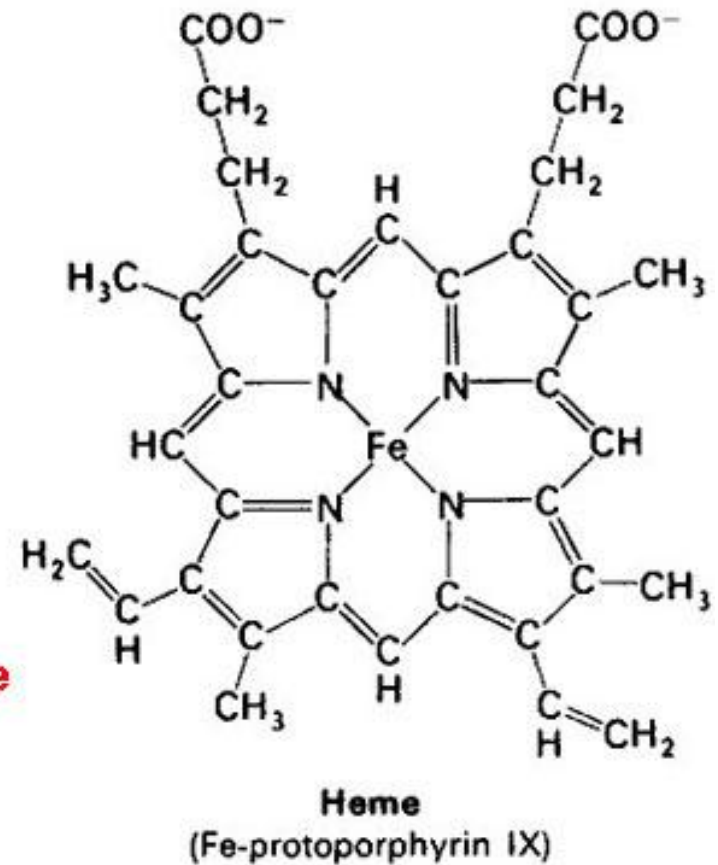
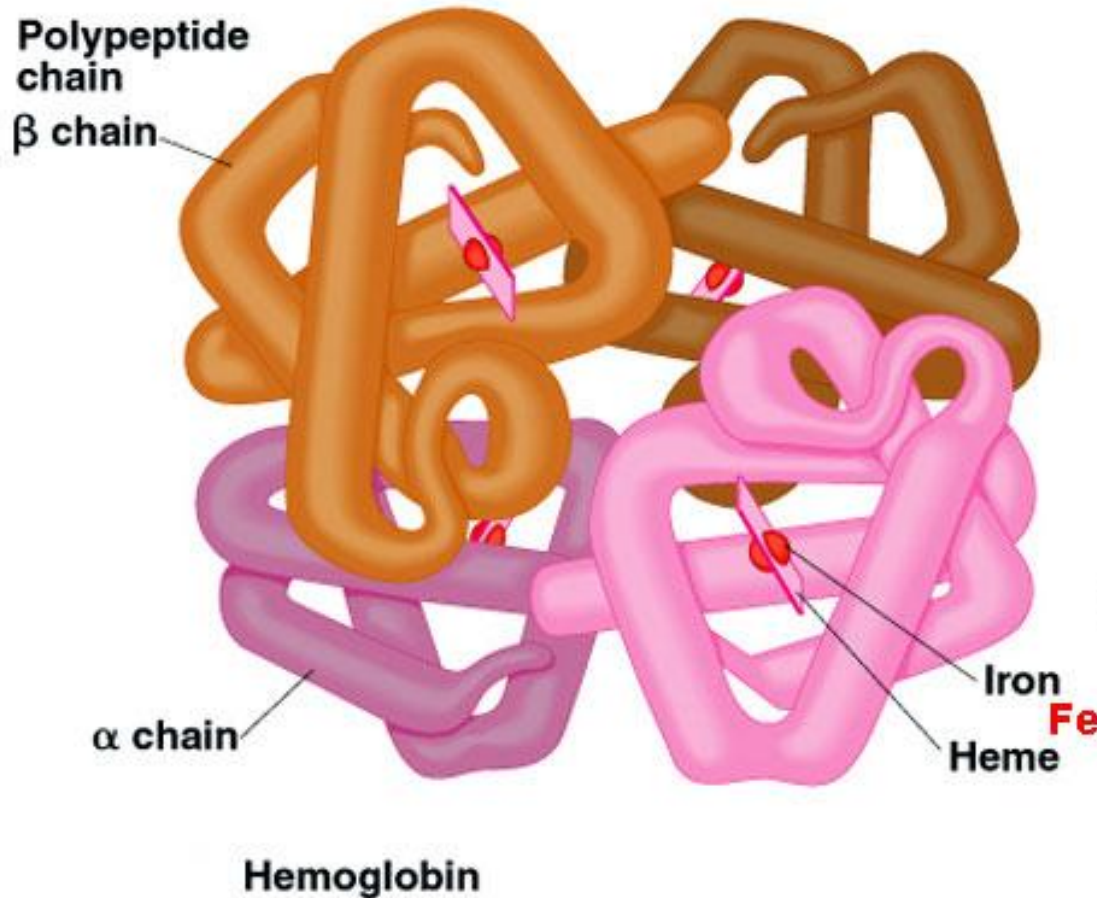
P, S, Cl, Na, K, Ca, Mg

# A biogén elemek főbb előfordulása és szerepe

- **P**: nukleinsavak (DNS, RNS) felépítése
- **S**: fehérjék felépítése
- **Na, K, Cl**: testnedvek elektrolitjai
- **Ca**: csontok felépítése, izomműködés
- **Mg**: izomműködés, klorofill
- **I**: pajzsmirigy tiroxin nevű hormonjában



# Fe: hemoglobin, elektronszállító fehérjék (színtest, mitokondrium)



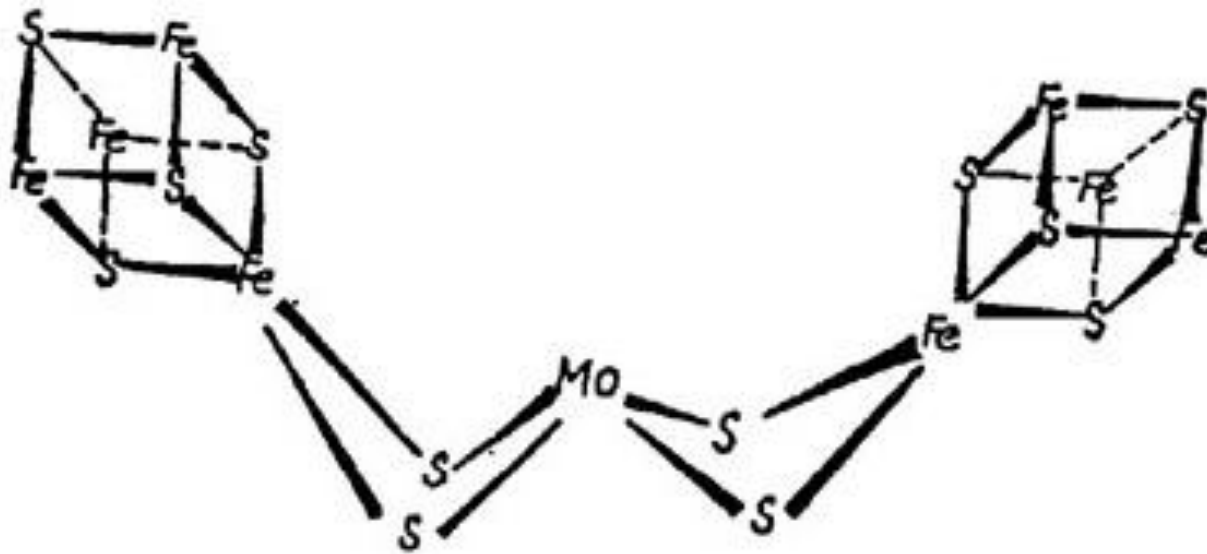
# Zn, Cu, Mn, Mo, Co

## Enzimalkotók

**A Zn pl. a májban az alkohol közömbösítését végző alkohol-dehidrogenáz komponense.**

- A Cu a vassal együtt a mitokondriumban működő terminális oxidáció utolsó enzimének, a citokróm-oxidáznak az alkotója (ez az az enzim, ami az elektronokat az oxigénhez továbbítja).**
- A Mn a glutamin nevű aminosavat előállító enzim (a glutamin-szintetáz) működéséhez kell.**
- A Mo vassal és kénatomokkal egy összetett konfigurációban a nitrogenáz enzim aktív centrumát képezi (ezzel az enzimmel képes néhány baktérium a levegő nitrogéntartalmát megkötni)**

# Nitrogenáz aktív centrum

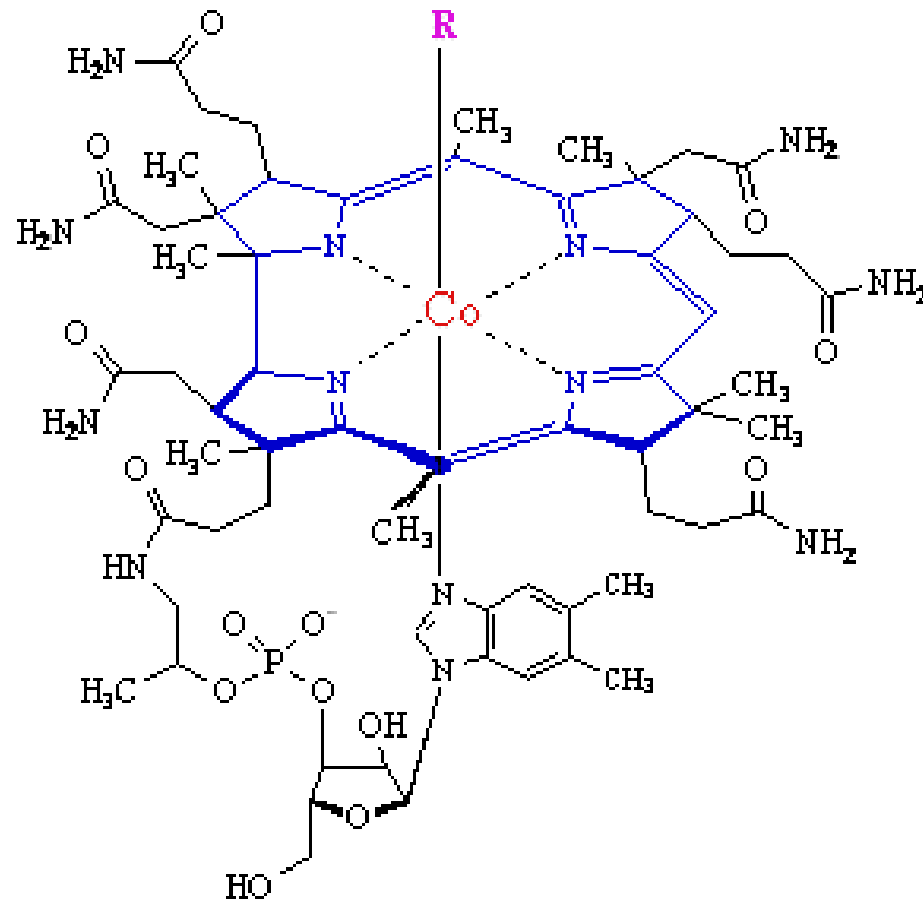


- **Co**

Birkák ún. bozótbetegsége: csak igen nagy mennyiségű Fe bejuttatásával volt kezelhető

- Gyanú: a vassal bevitt valamilyen szennyezőanyag okozta a tünetek enyhülését?
- A vasat mindig kísérő nyomelem, a kobalt az aktív hatóanyag.
- 1948-ban több tonna nyers májból sikerült izolálni azt a kobalttartalmú anyagot, ami a vérképzéshez a vas mellett elengedhetetlenül szükséges, és B12-vitaminnak nevezték el. Ez a vegyület igen hatásosnak bizonyult a bozótbetegség gyógyításában.

# B12 vitamin





# Változó biogén elemek

- **F**: emlősök fogzománca
- **B**: növények növekedése
- **Si**: kovamoszatok, kovaszivacsok, zsurlók
- **Se**: a máj egyik szabad gyököket semlegesítő, antioxidáns enzimének (a glutation-peroxidáznak) az alkotója
- **Cr**: az inzulint stabilizálja és néhány szénhidrát-anyagcsere enzim alkotórésze
- **V**: a foszfátnak a csontokba való beépüléséhez szükséges
- **Sn**: csak a patkányok szervezete igényli (?)

# Biológiai szempontból fontos makromolekulák

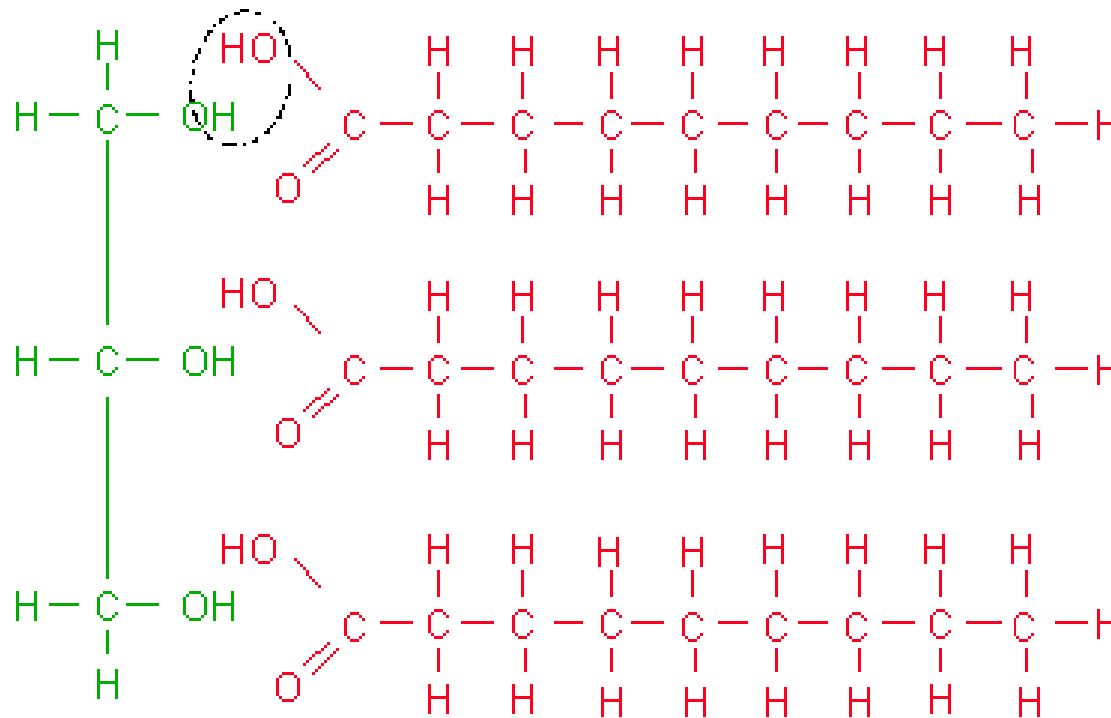
- LIPIDEK
- SZÉNHIDRÁTOK
- FEHÉRJÉK
- NUKLEINSAVAK

# LIPIDEK

- A sejtből apoláris oldószerekkel kivonható anyagok összessége
- Csoportosítás:
  - 1. Összetett lipidek:** lúgos hidrolízissel bonthatók (szappanosíthatók)
    - 1.1. Trigliceridek
    - 1.2. Foszfogliceridek
    - 1.3. Viaszok
  - 2. Egyszerű lipidek:** lúgos hidrolízissel nem bonthatók
    - 2.1. Terpének
    - 2.2. Szteroidok

# 1. Összetett lipidek:

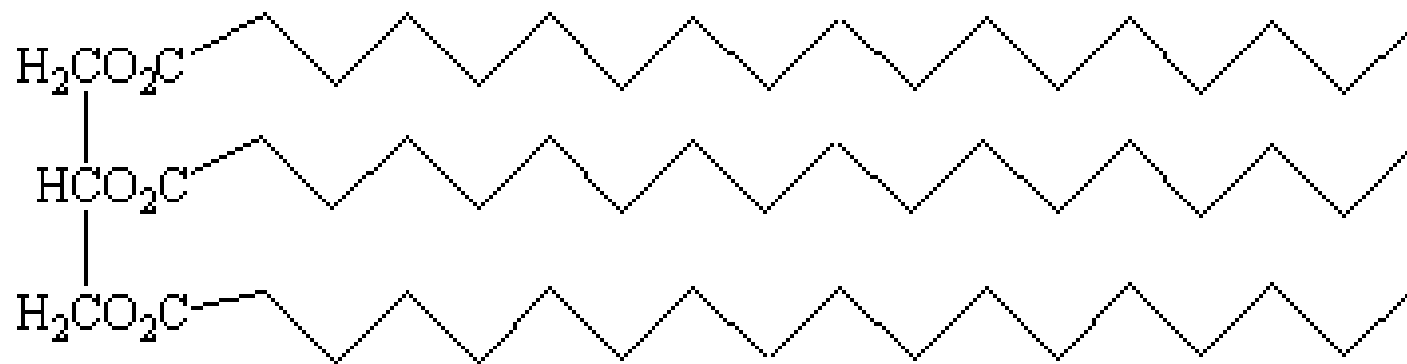
## 1.1. Neutrális zsírok és olajok (trigliceridek)



Glycerol

Fatty Acids

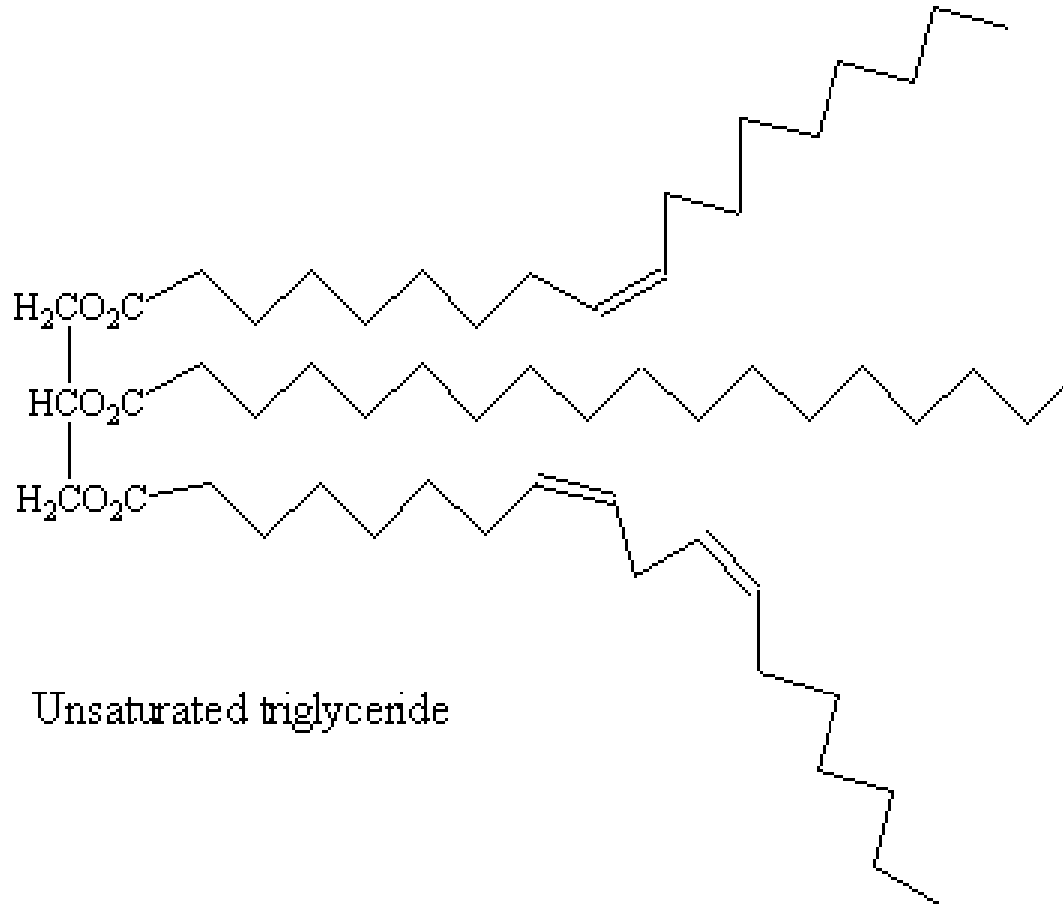




Saturated triglyceride

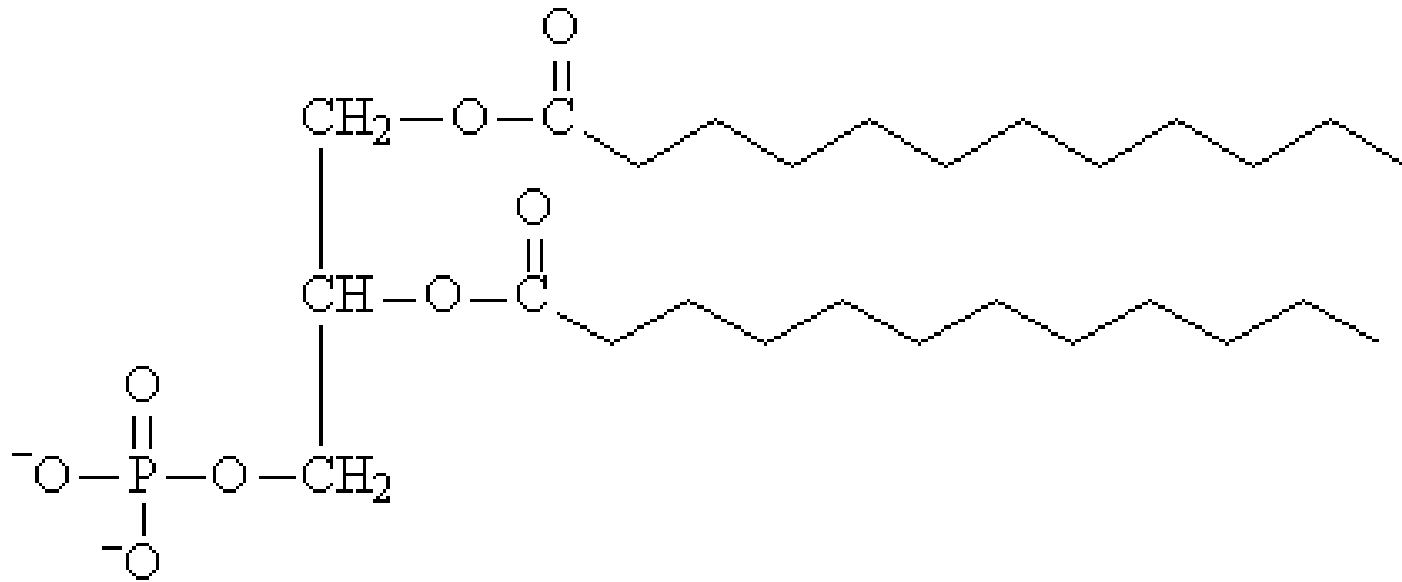
# Olajok:

- zömmel telítetlen zsírsavakat tartalmaznak
- szobahőmérsékleten folyadékok



Többszörösen telítetlen zsírsav: esszenciálisak (pl. linolsav, linolénsav)

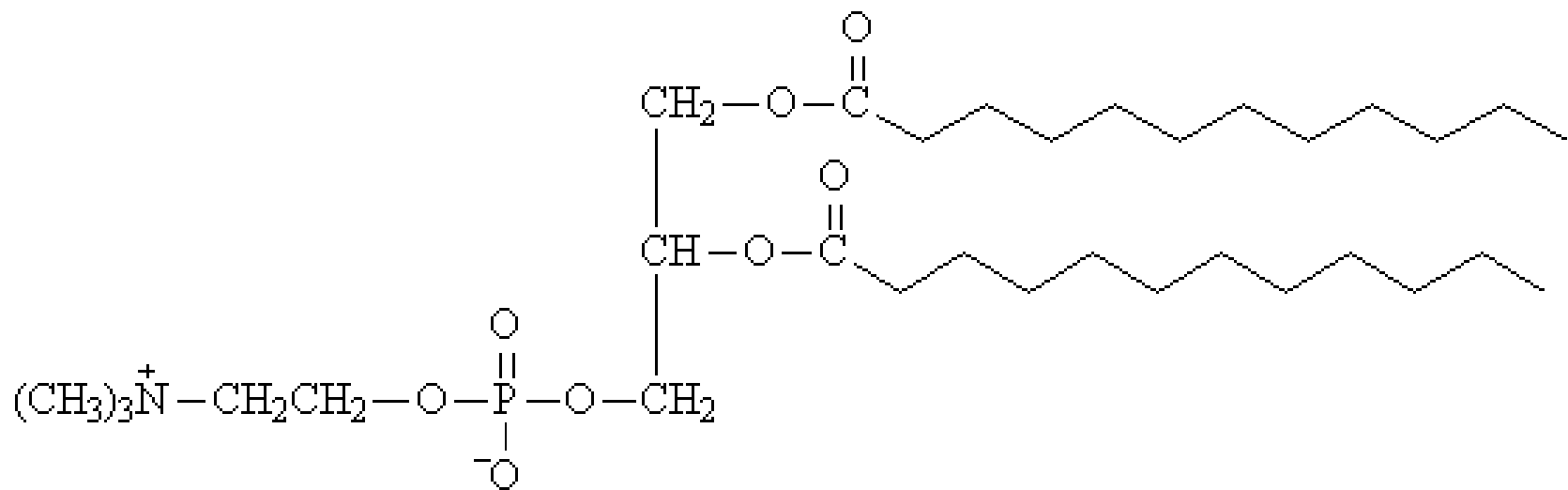
# 1.2. Foszfatidok (foszfogliceridek)



Phosphotidate

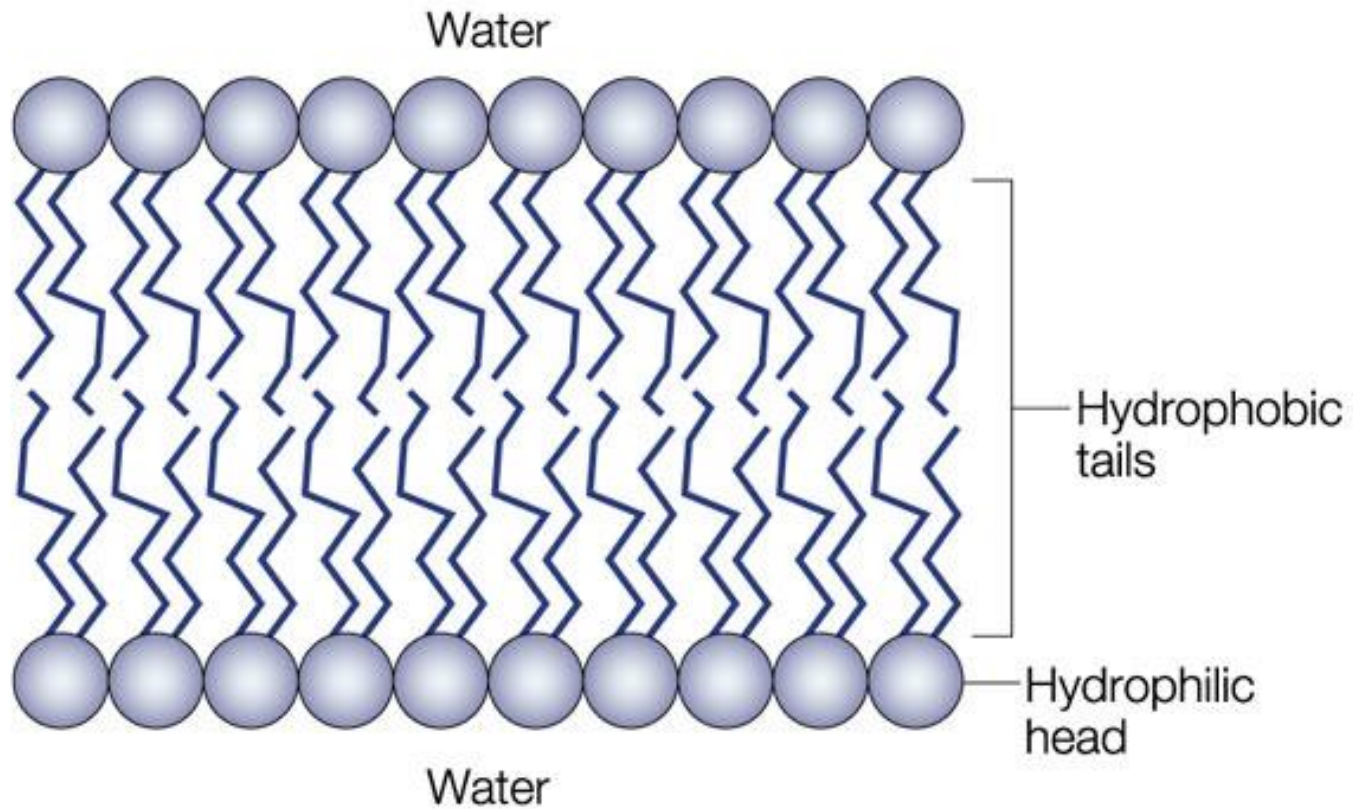
**foszfatidsav**





Phosphatidylcholine (lecithin)

# Jelentőség: biológiai membránok



# **1. Összetett lipidek:** lúgos hidrolízissel bonthatók (szappanosíthatók)

1.1. Trigliceridek

1.2. Foszfogliceridek

1.3. Viaszok

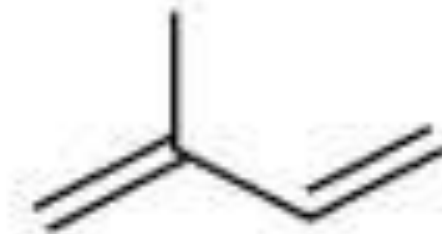
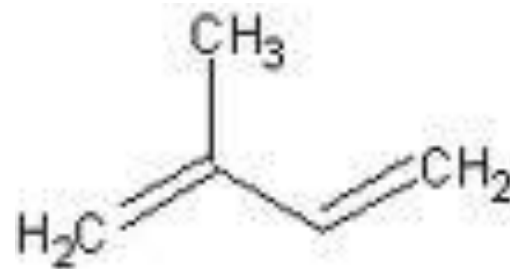
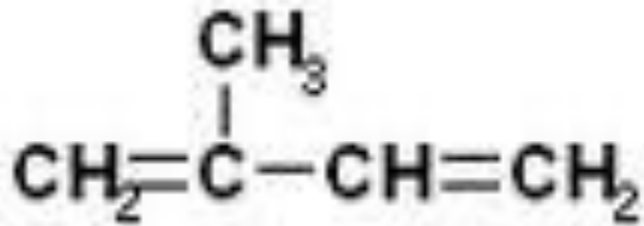
# **2. Egyszerű lipidek:** lúgos hidrolízissel nem bonthatók

2.1. Terpének

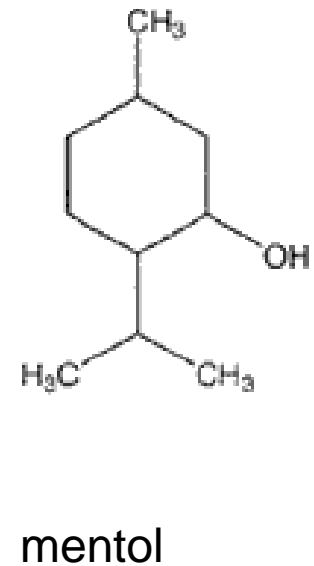
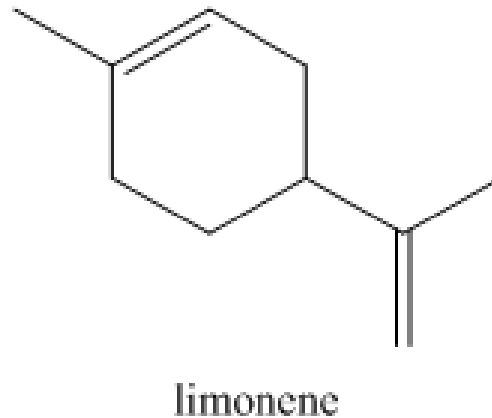
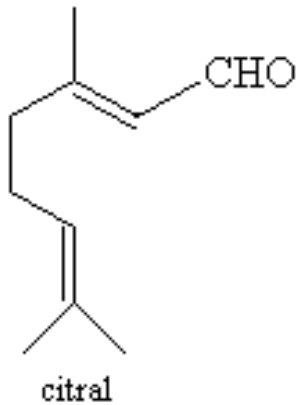
2.3. Szteroidok

# Terpének

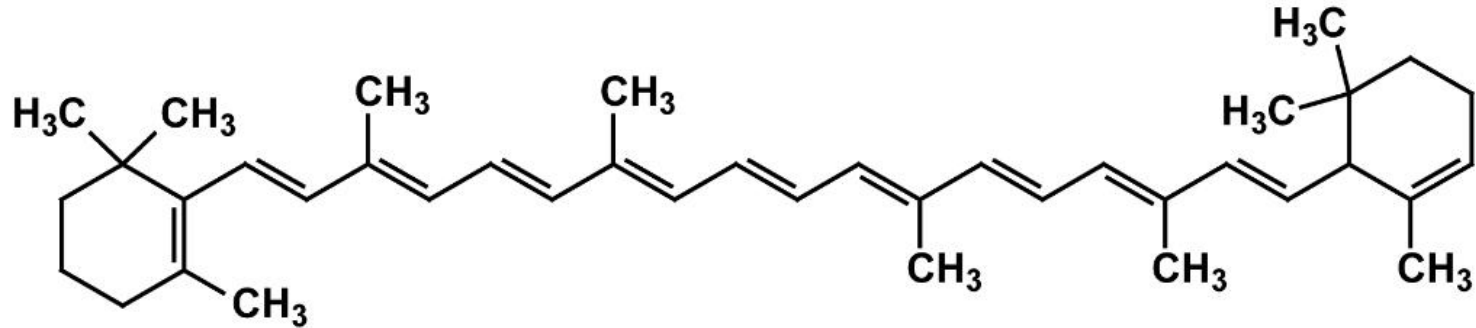
- Az izoprén oligomer vagy polimer származékai



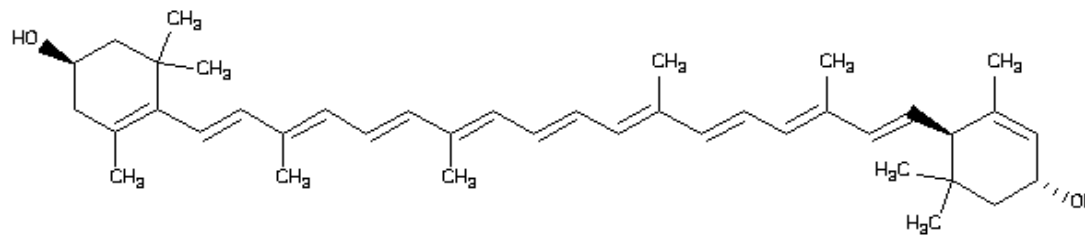
# Oligoterpének (illóolajok)



# 8 izoprén egységből álló terpének: karotinooidok



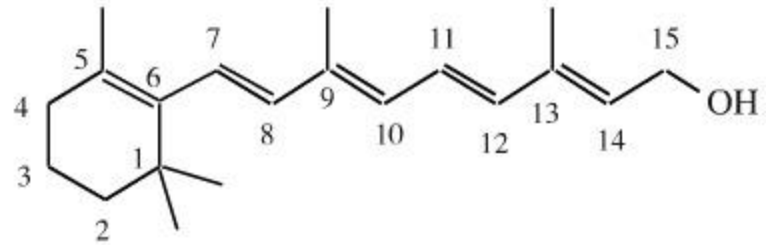
karotin



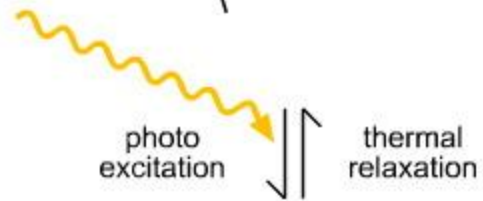
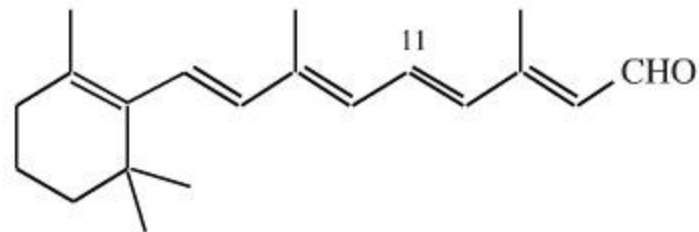
xantofill



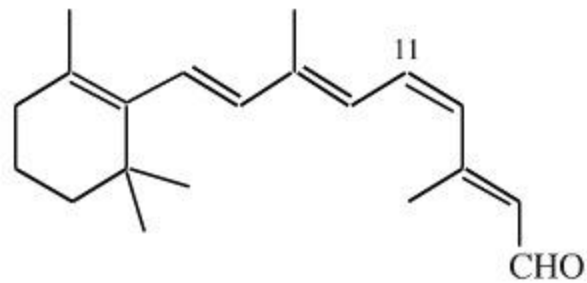
Retinol (vitamin A)



All *trans*-Retinal

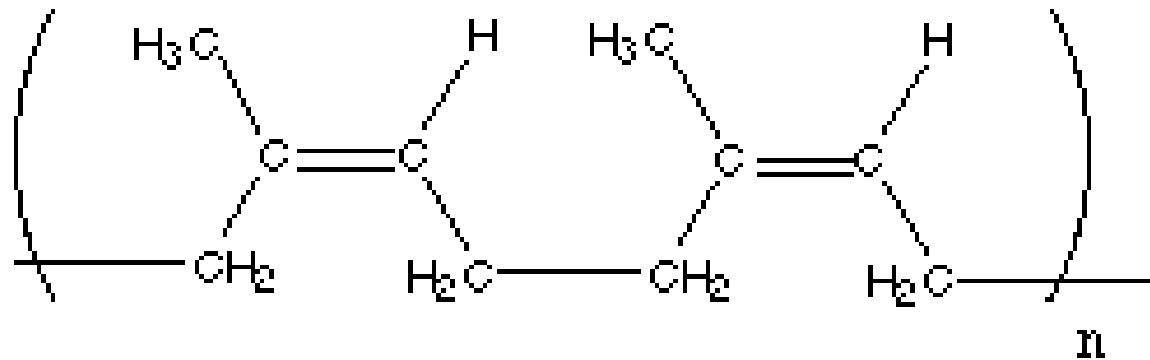


11-*cis*-Retinal

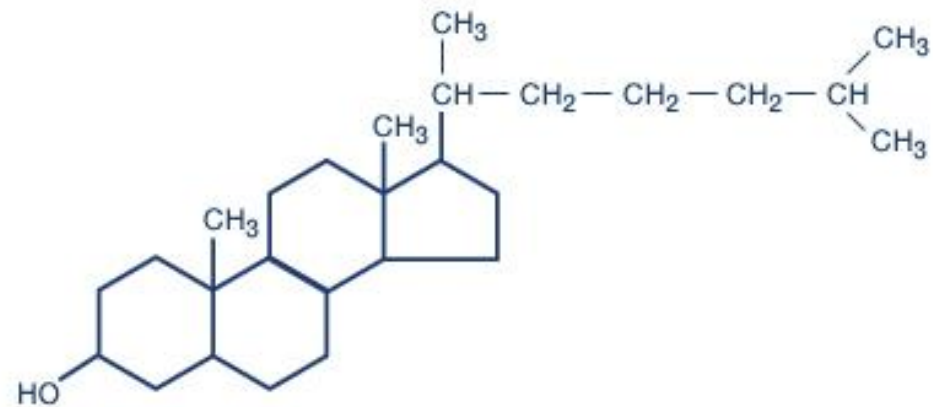




# Politerpének: kaucsuk

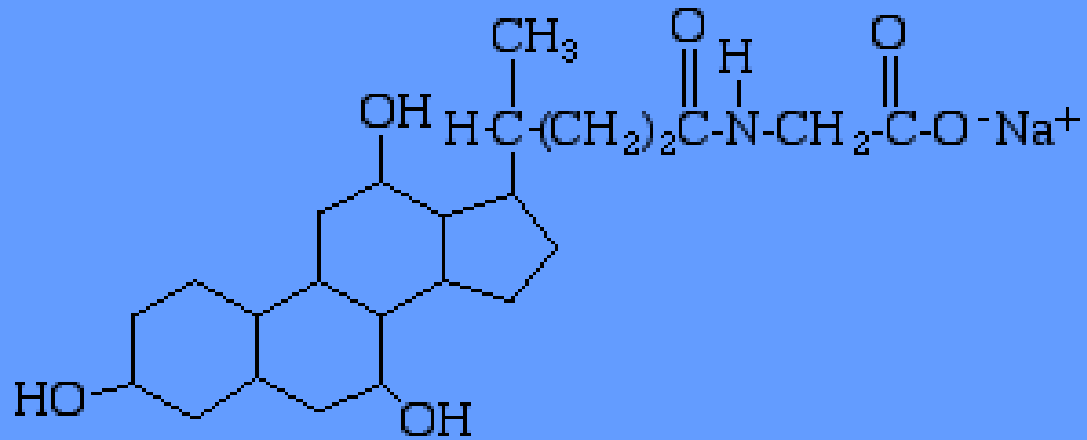


# Szteroidok

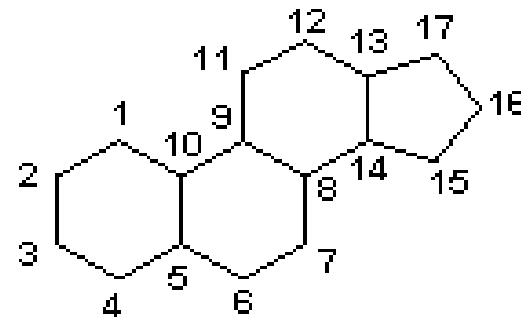


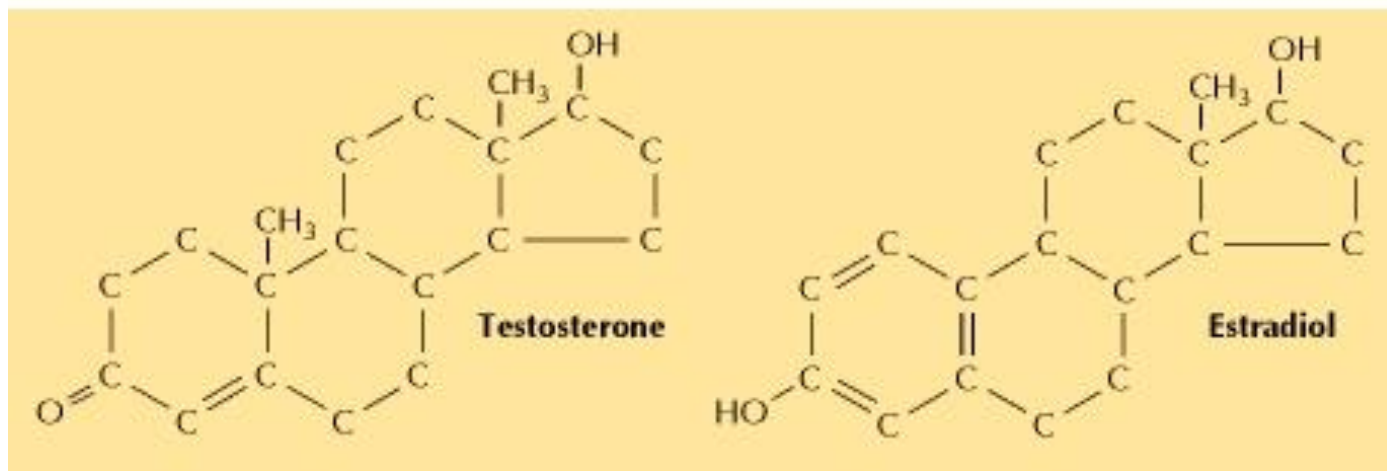
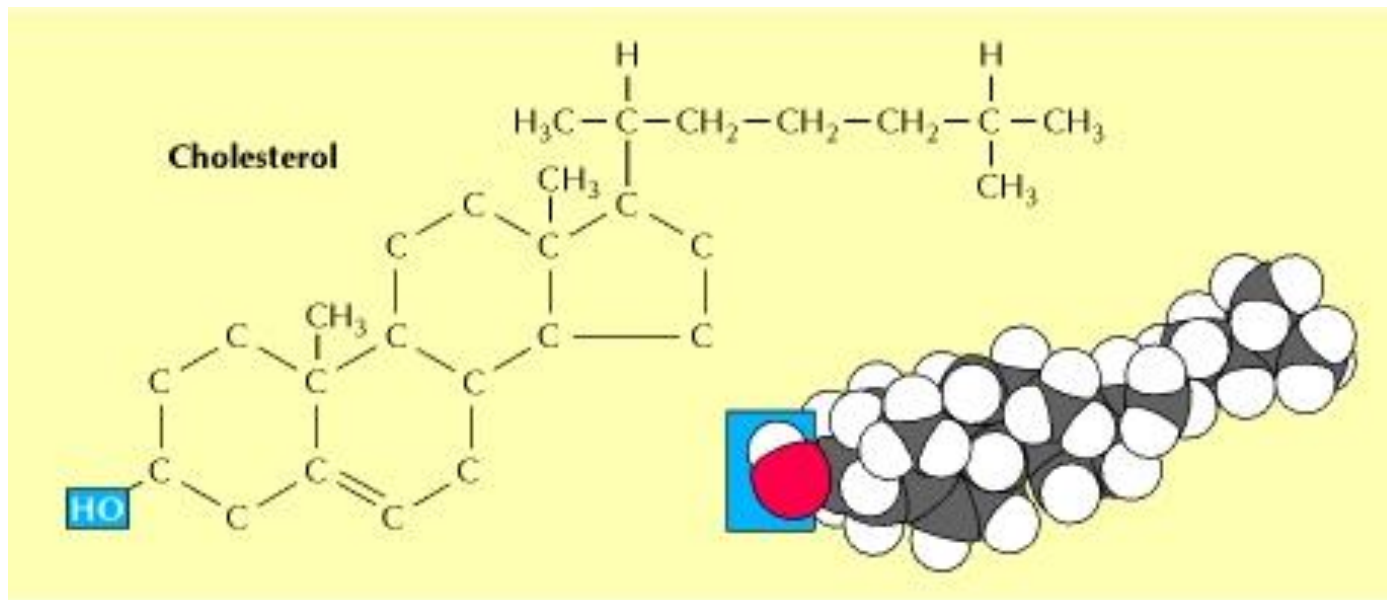
koleszterin

# Bile Salt

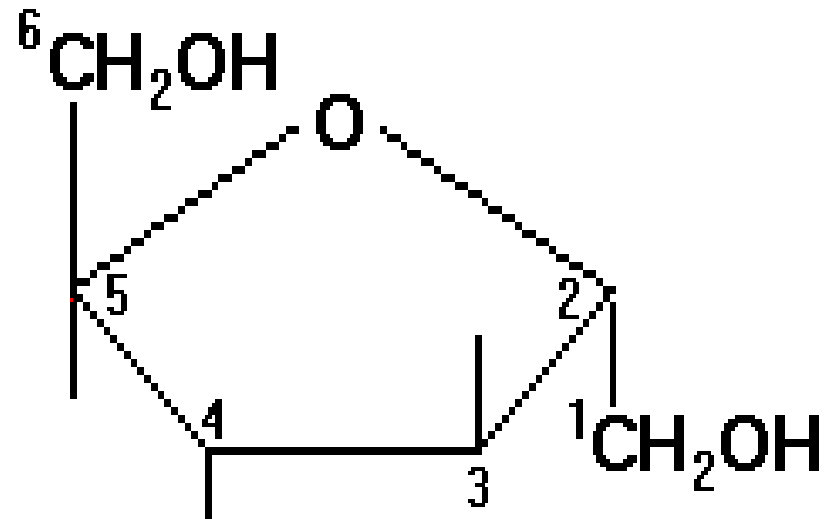
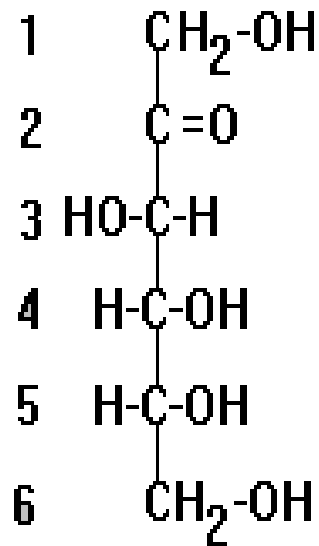


sodium glycocholate



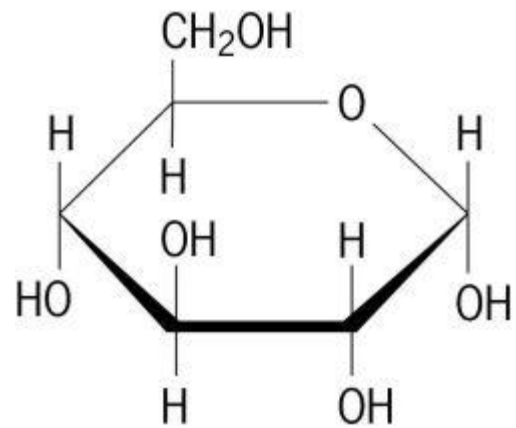
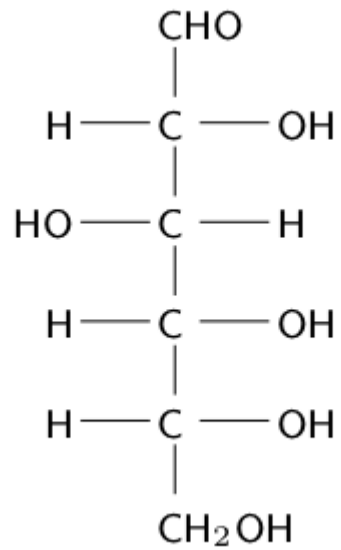


# Fruktóz

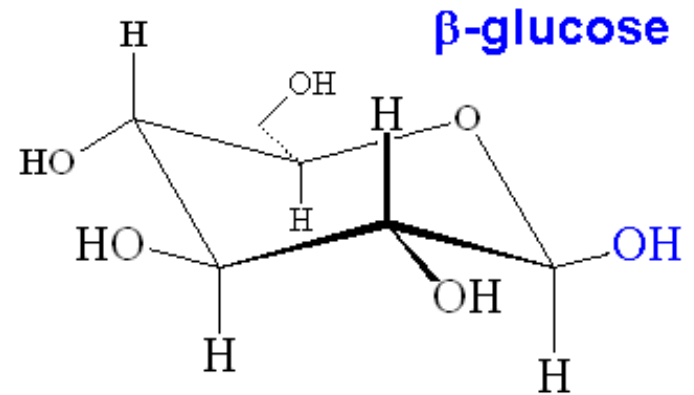
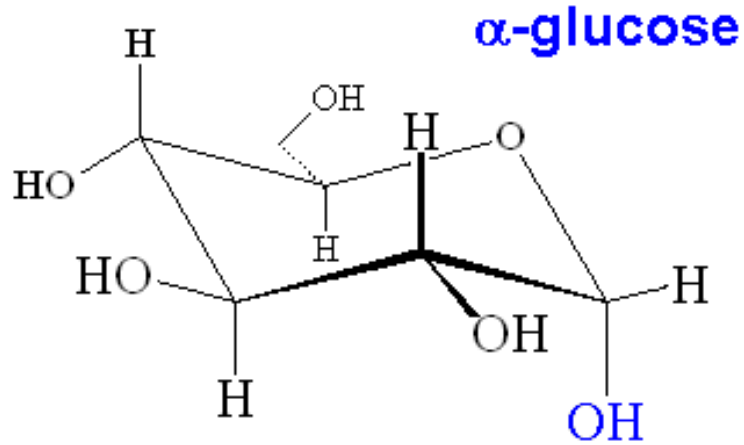


Fructose

# Glükóz

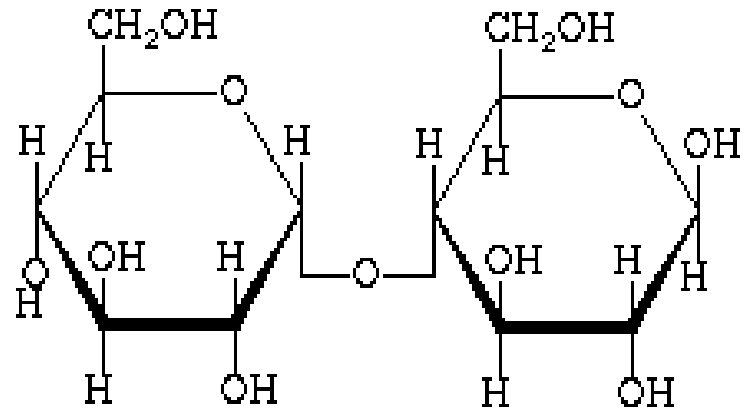
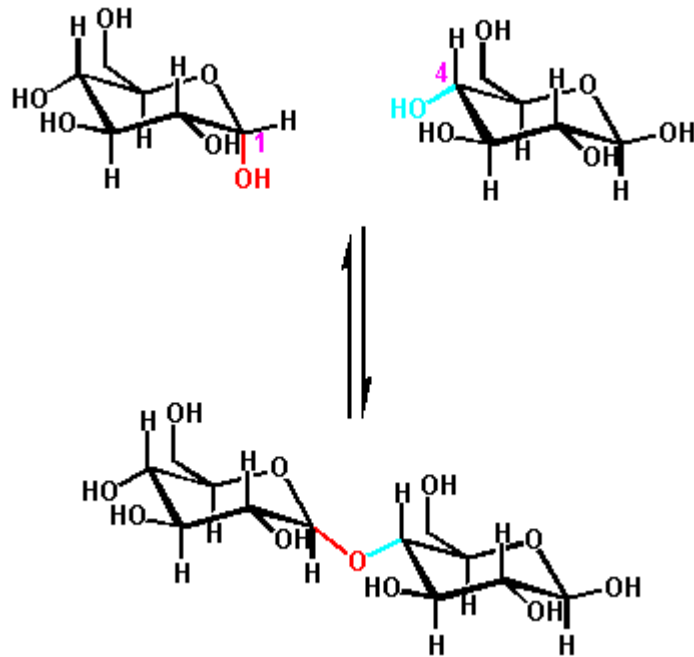


# Glükóz izomerek



# Diszacharidok

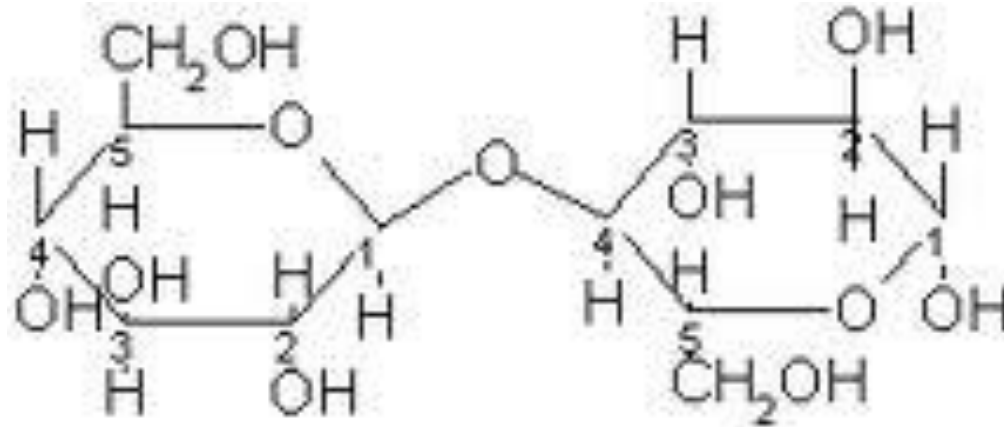
- Maltóz





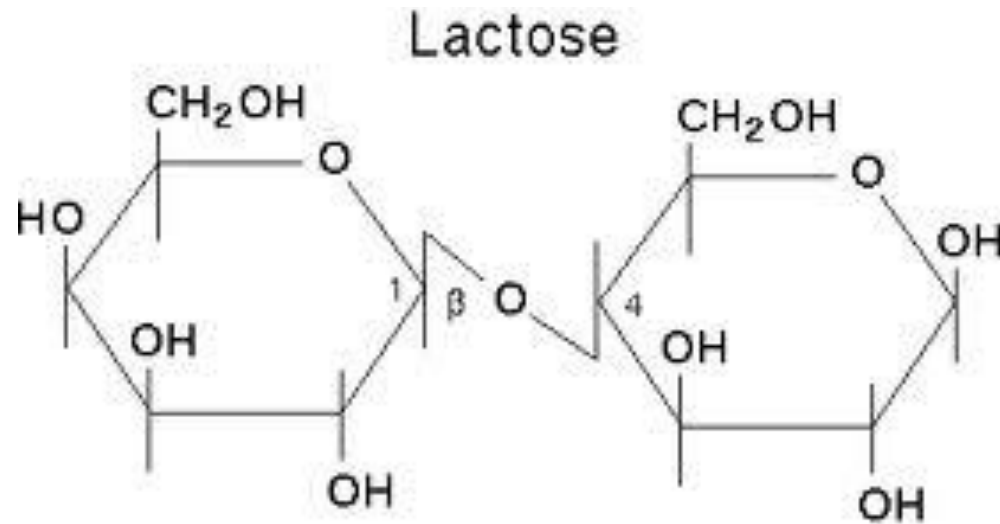
# Diszacharidok

- Cellobióz



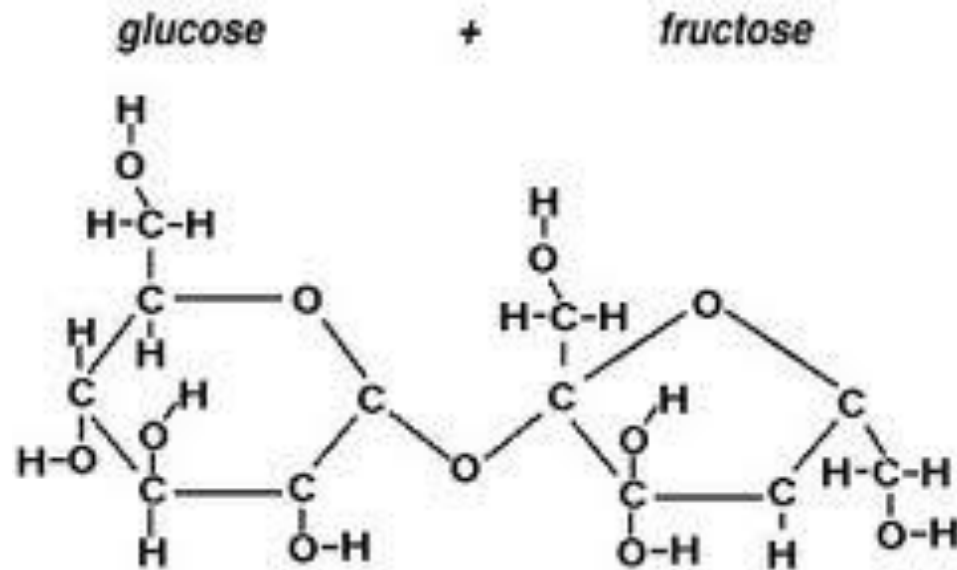
# Diszacharidok

- Laktóz



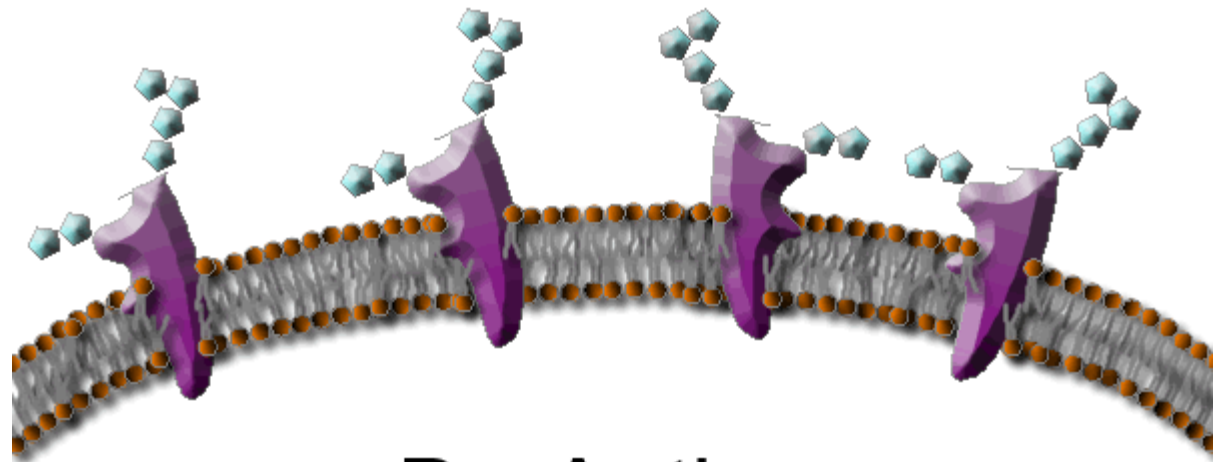
# Diszacharidok

- Szacharóz



# Oligoszacharidok

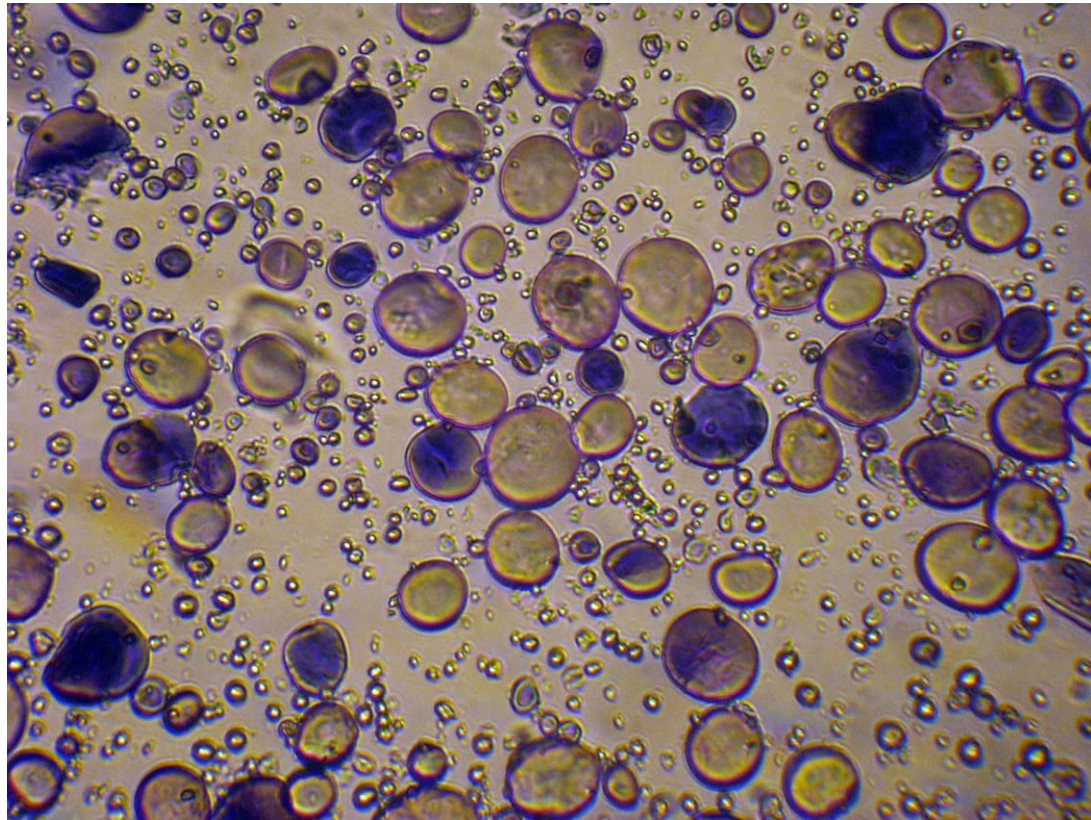
Proteins in the membrane  
Blood Group



B - Antigen

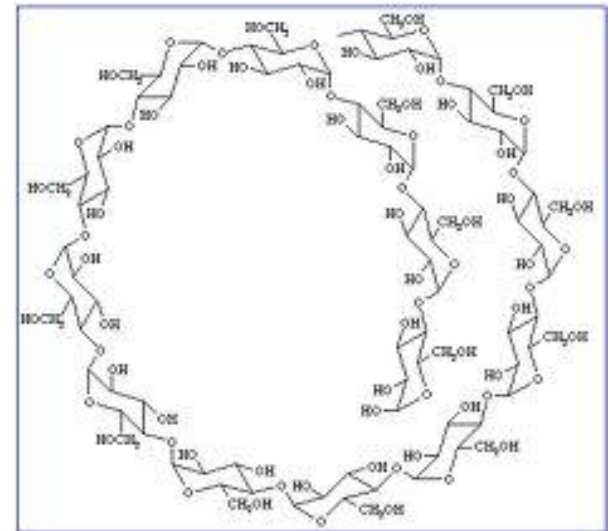
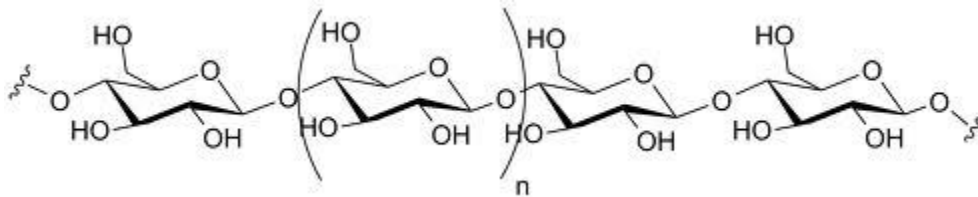
# Poliszacharidok

- Amilum

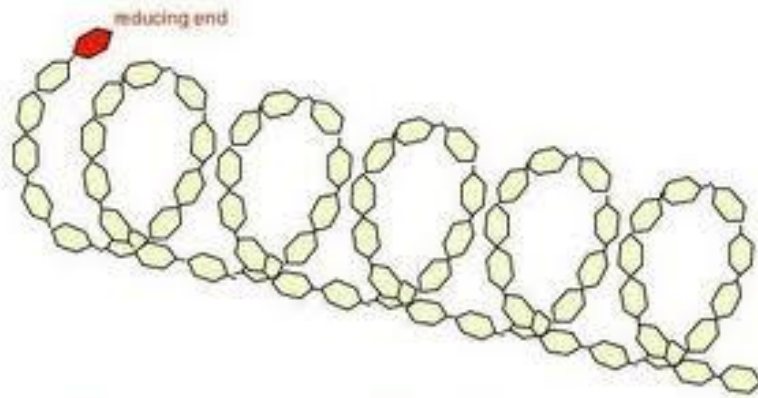


# Amilum = amilóz + amilopektin

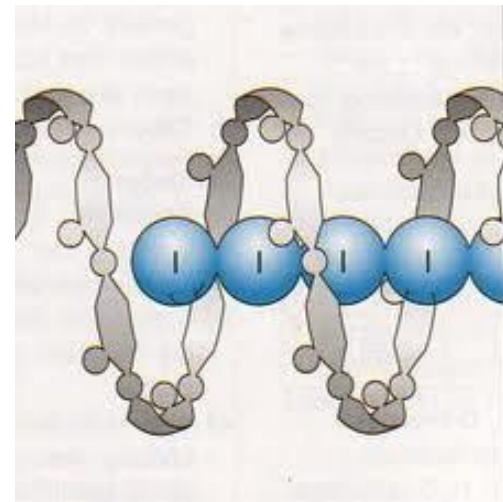
- Amilóz



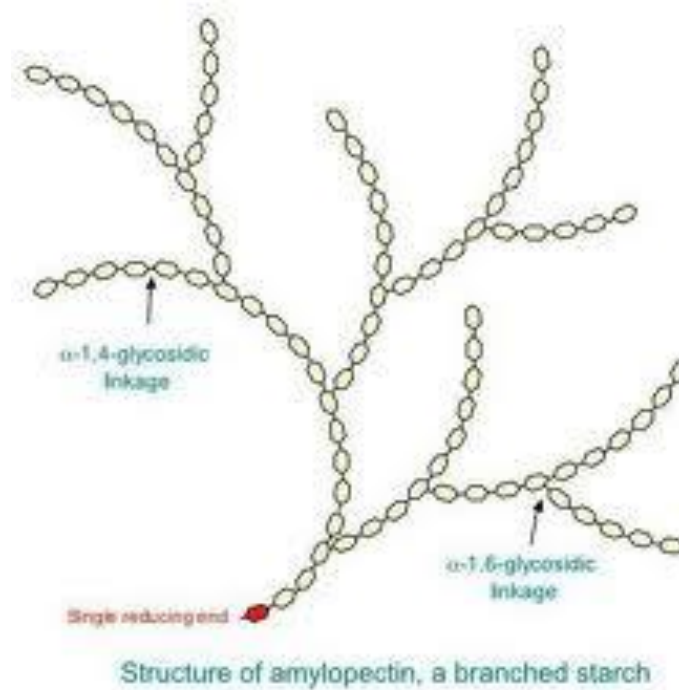
# Amilóz



Amylose, an unbranched starch

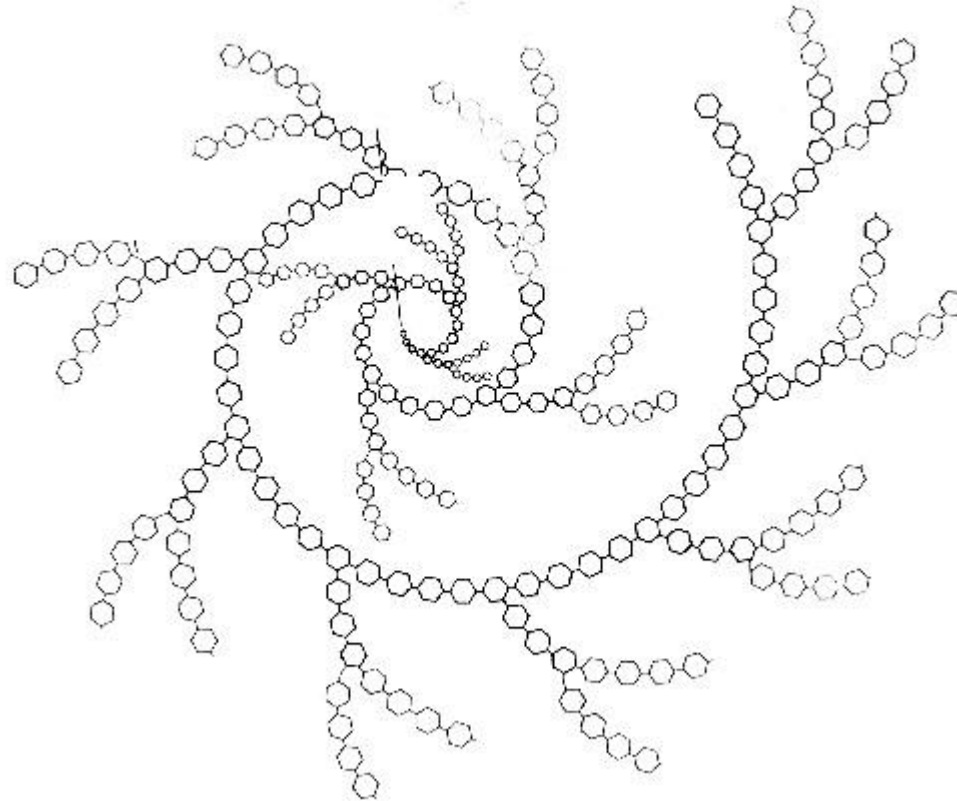


# Amilopektin



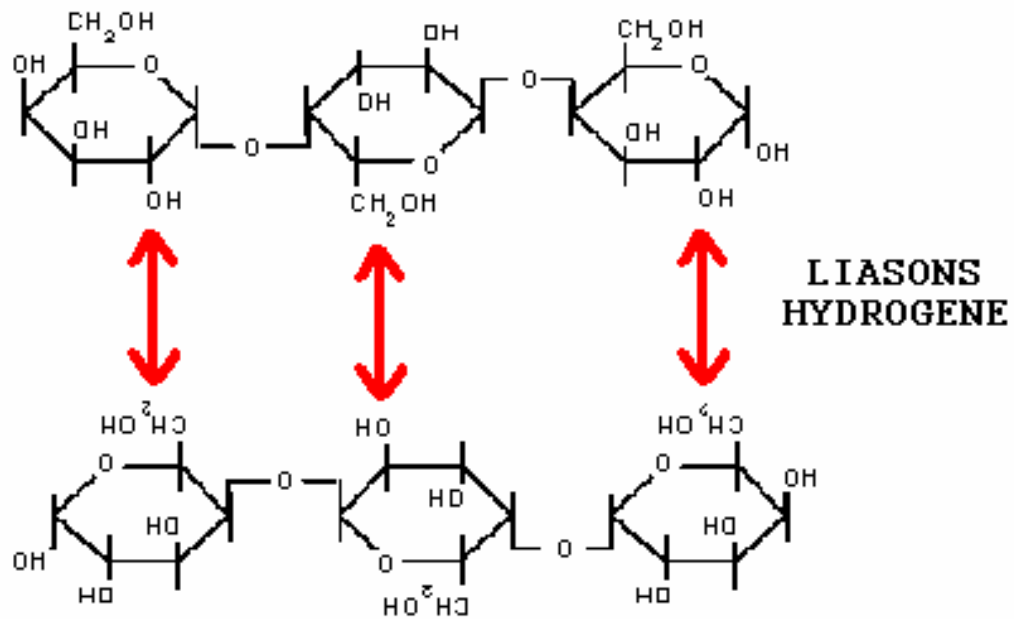


# Glikogén

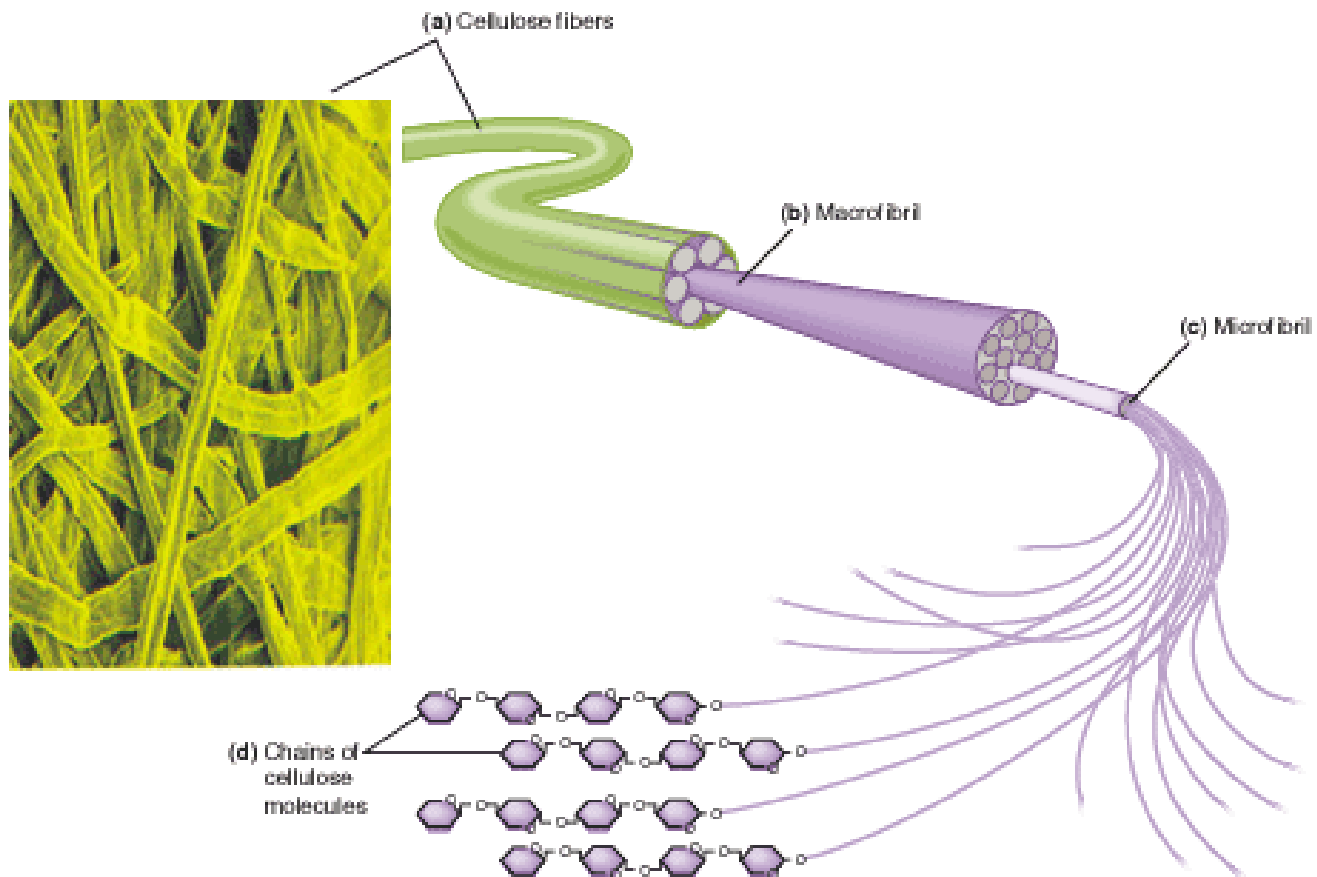


# Cellulóz

## FIBRES DE CELLULOSES

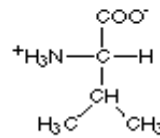


# Cellulóz

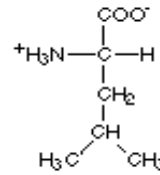


# Aminosavak

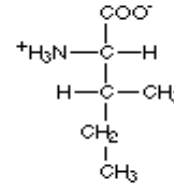
## Amino acids with hydrophobic side groups



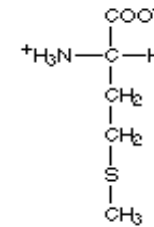
Valine  
(val)



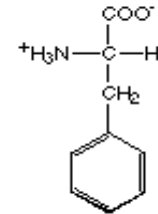
Leucine  
(leu)



Isoleucine  
(ile)

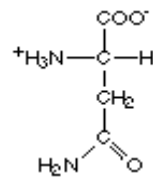


Methionine  
(met)

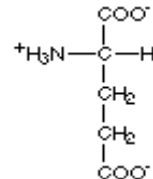


Phenylalanine  
(phe)

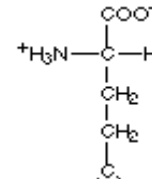
## Amino acids with hydrophilic side groups



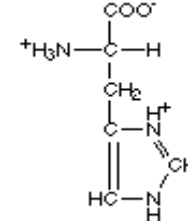
Asparagine  
(asn)



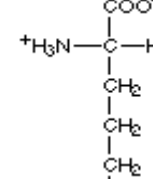
Glutamic acid  
(glu)



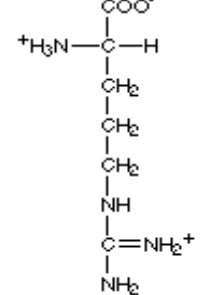
Glutamine  
(gln)



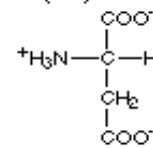
Histidine  
(his)



Lysine  
(lys)

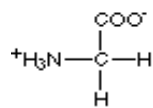


Arginine  
(arg)

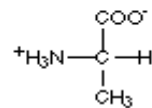


Aspartic acid  
(asp)

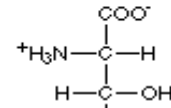
## Amino acids that are in between



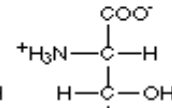
Glycine  
(gly)



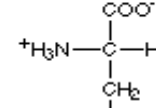
Alanine  
(ala)



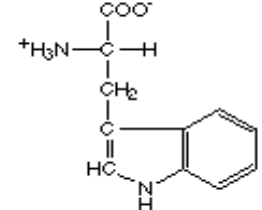
Serine  
(ser)



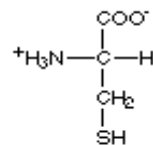
Threonine  
(thr)



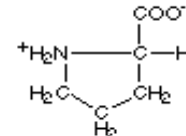
Tyrosine  
(tyr)



Tryptophan  
(trp)

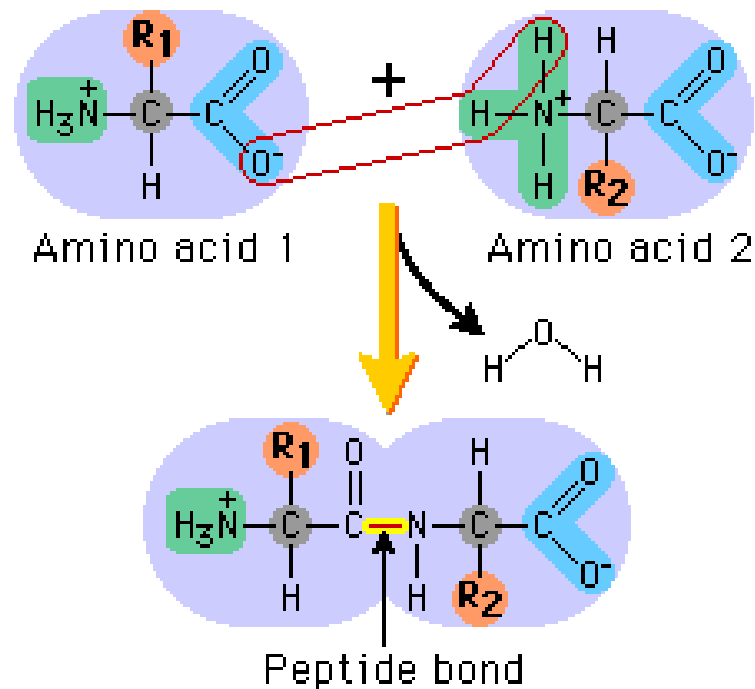


Cysteine  
(cys)

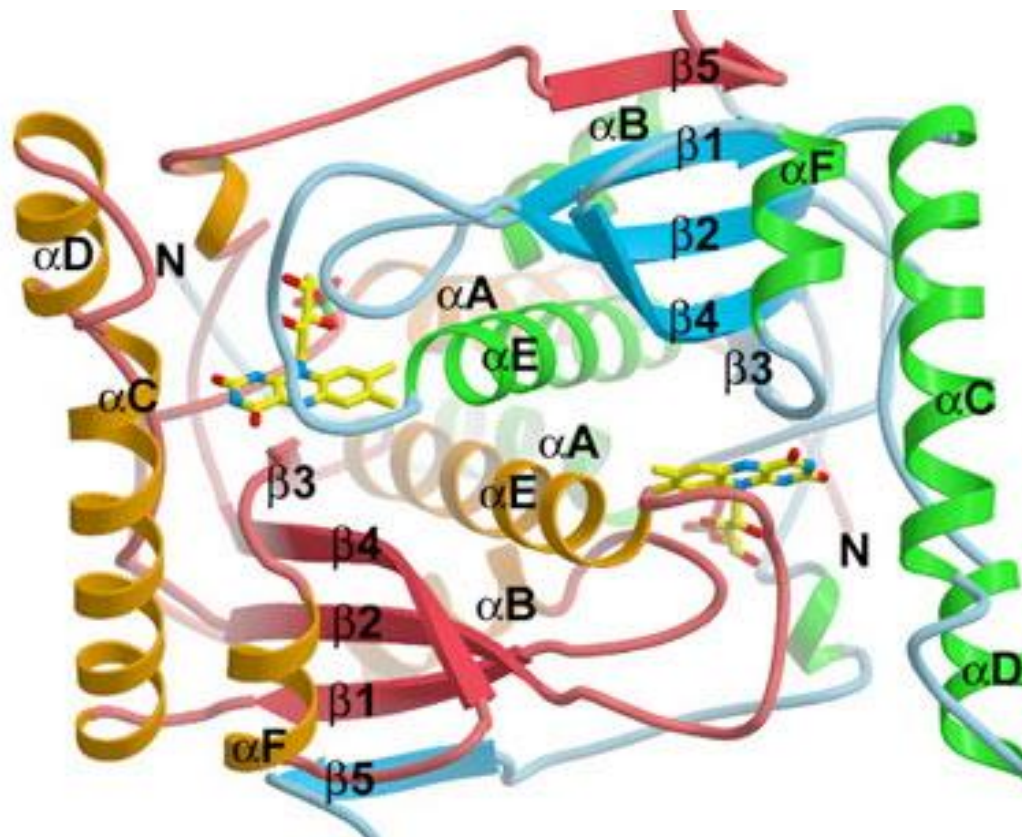


Proline  
(pro)

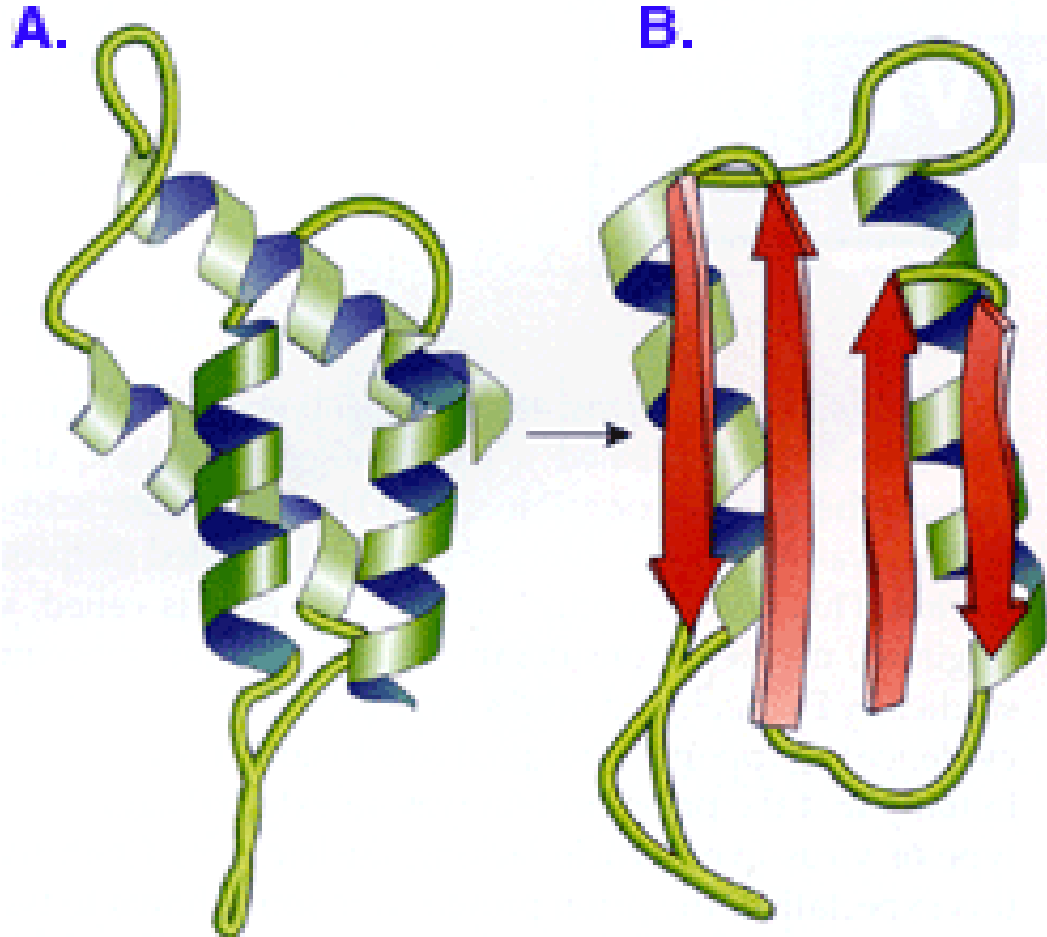
# A peptidkötés kialakulása



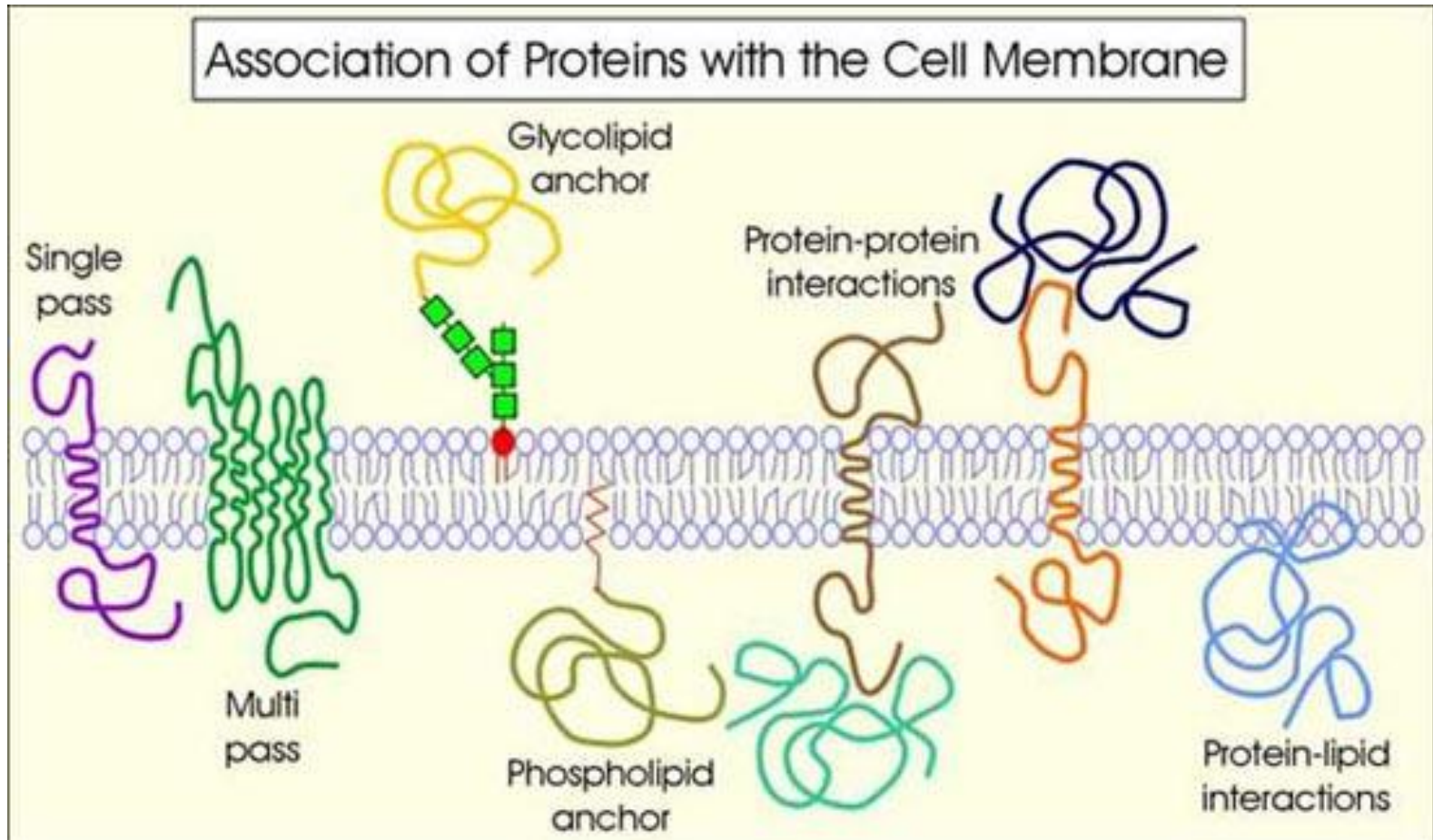
# Harmadlagos szerkezet



# Egészséges (A) és hibás (B) prionfehérje

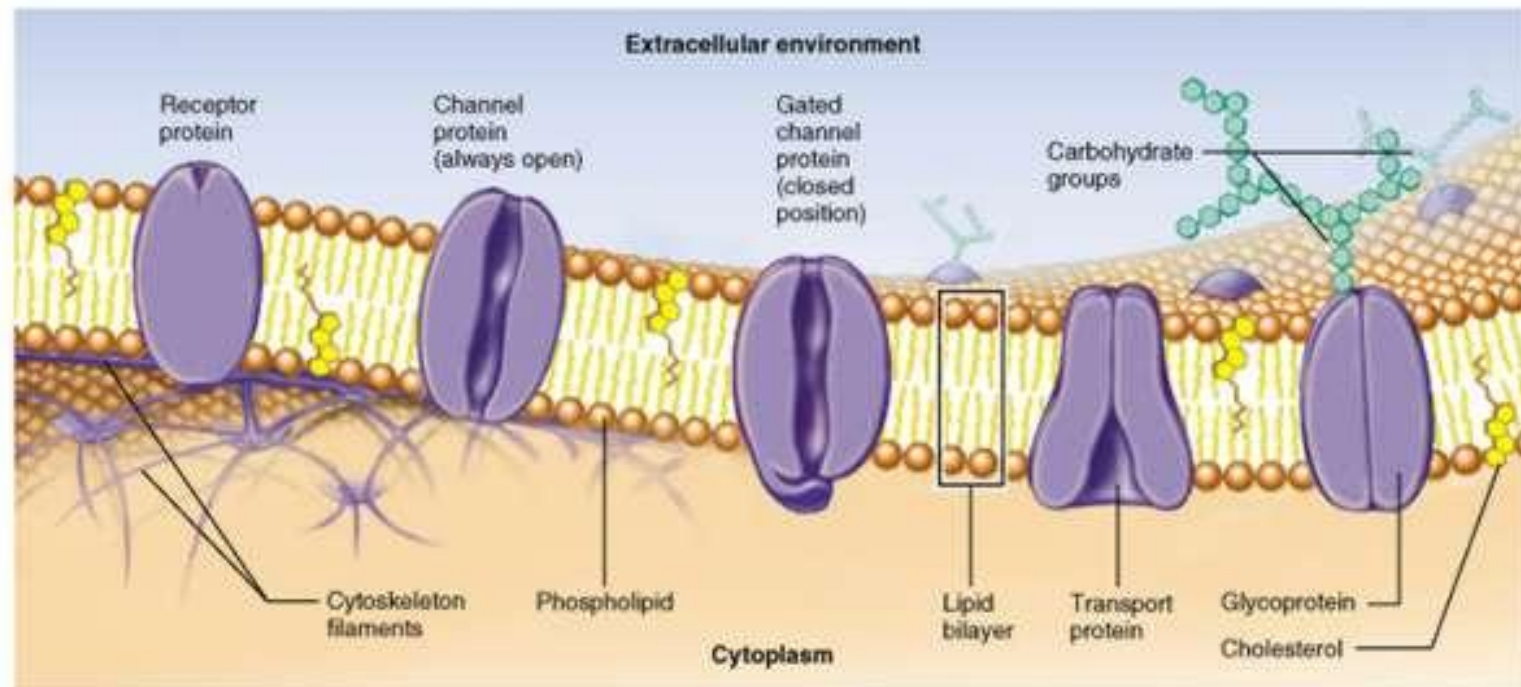


# Membránfehérjék



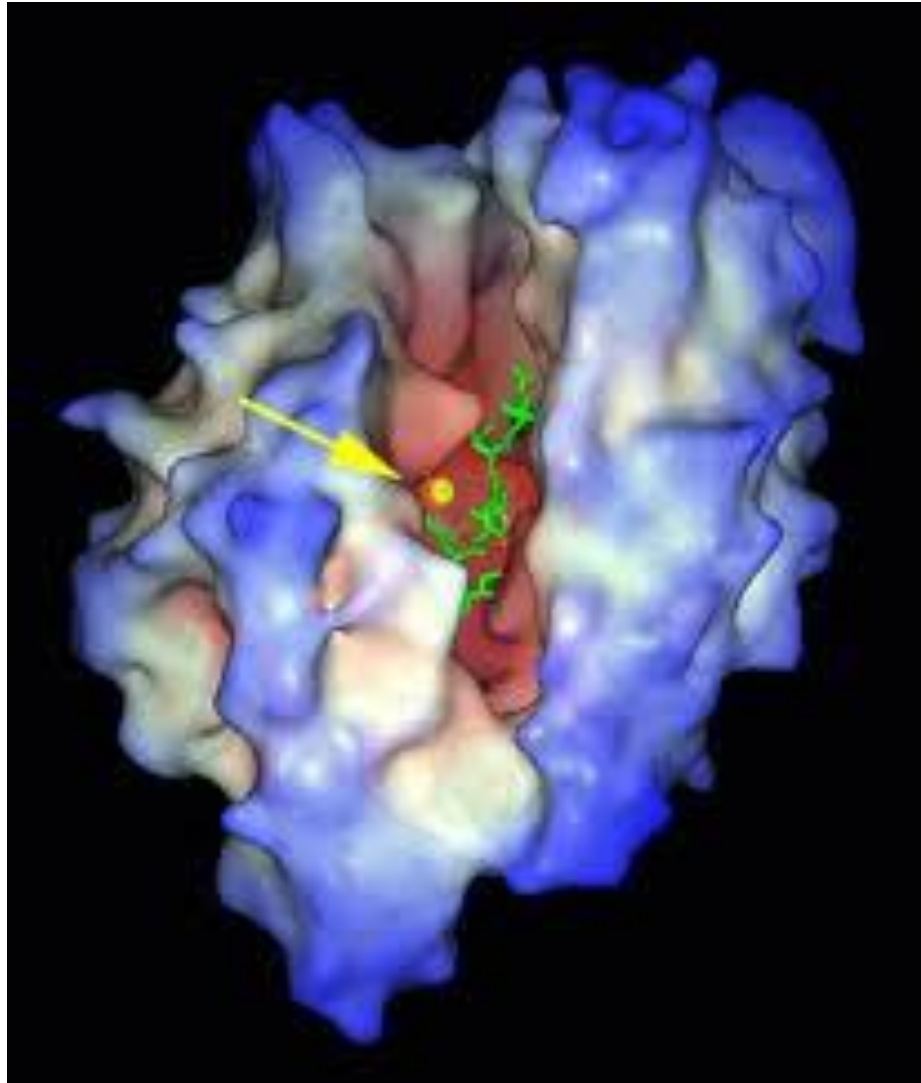


# A membránfehérjék funkciói



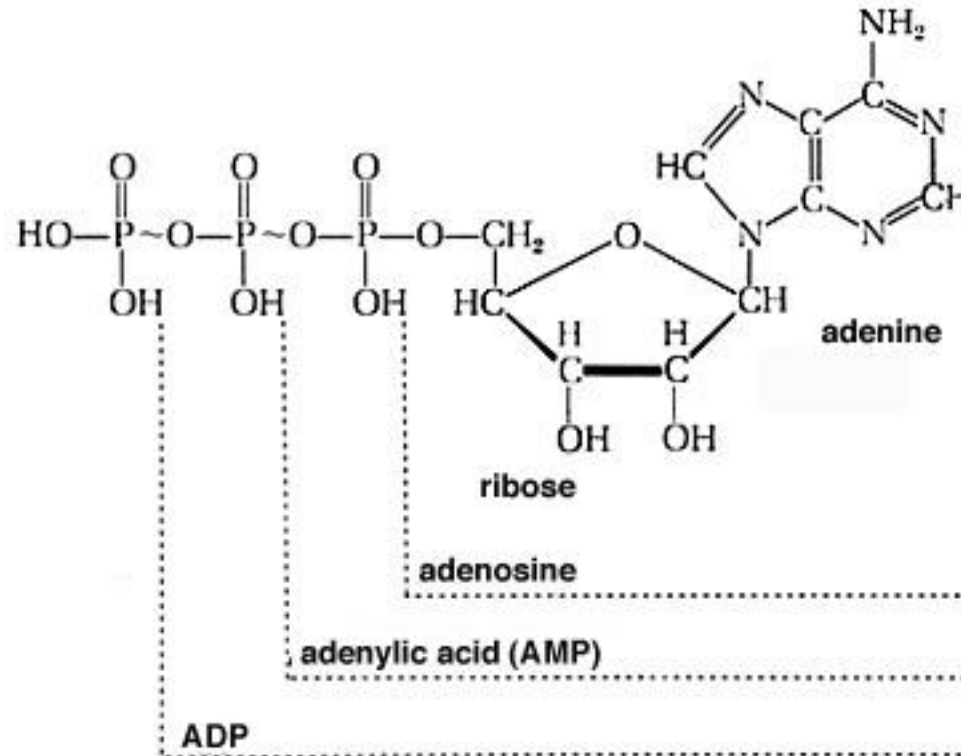
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# Enzimfehérjék



# Nukleotid-származékok

- ATP



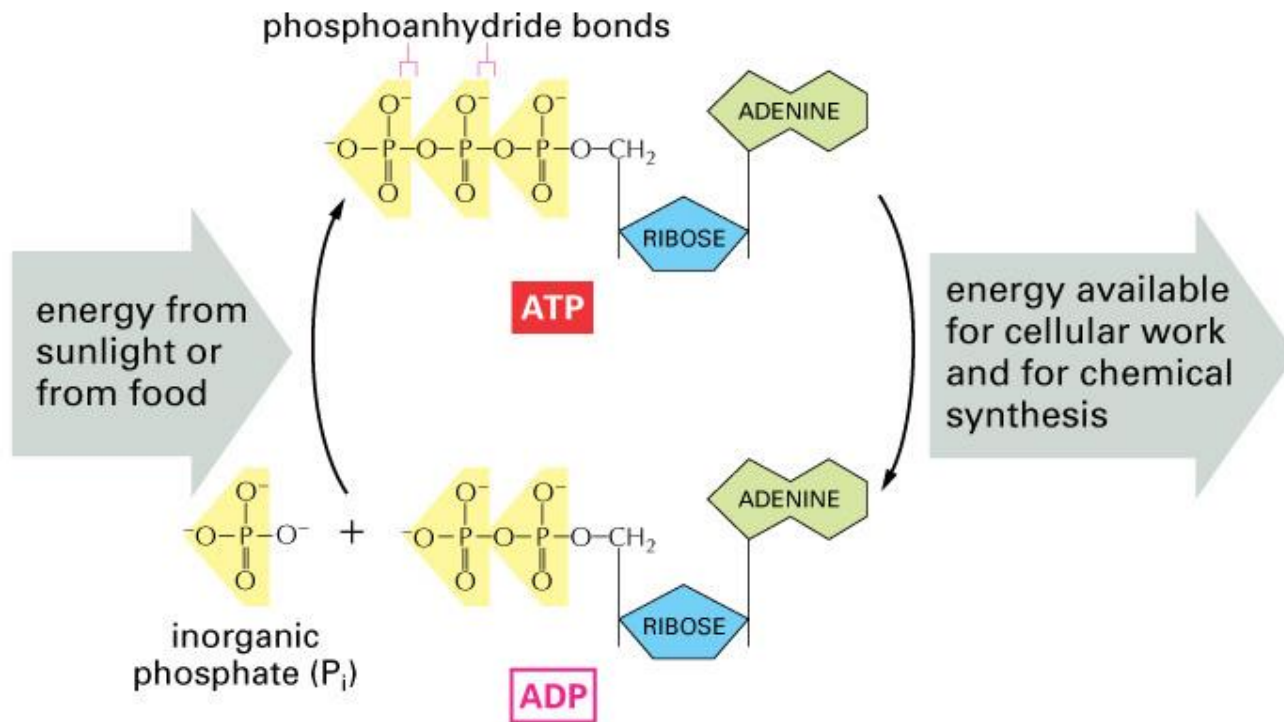
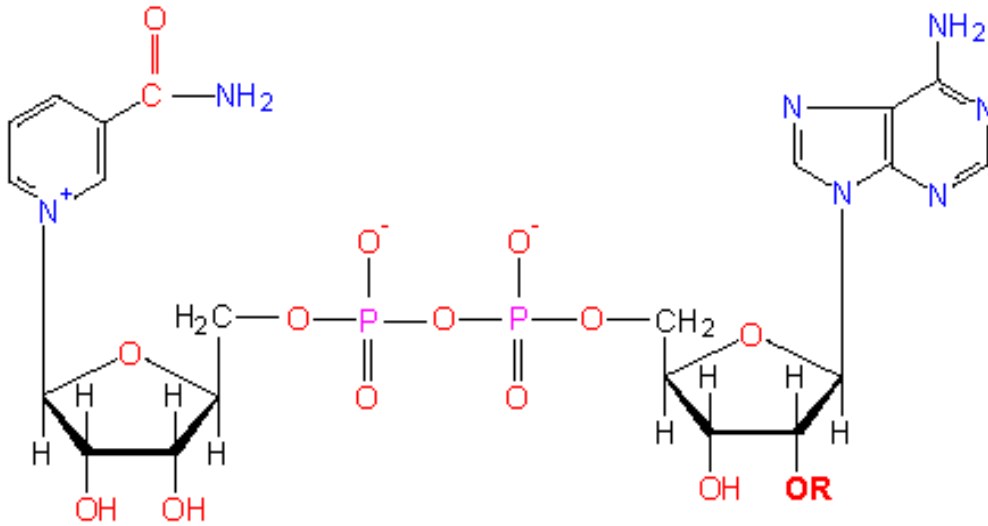
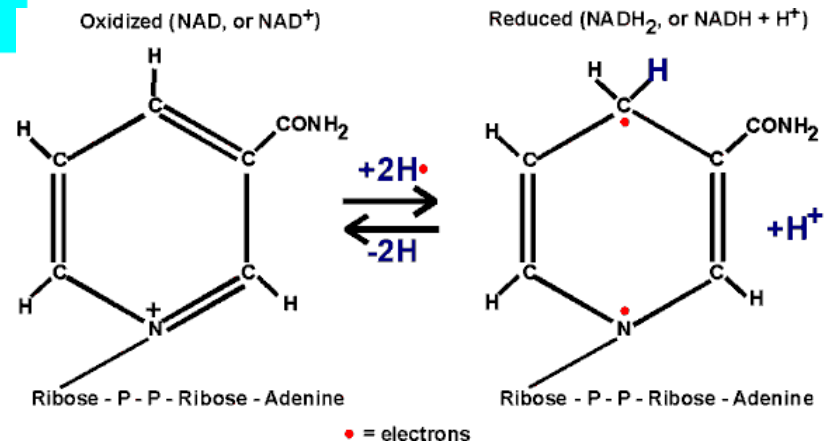


Figure 3-32 Essential Cell Biology, 2/e. (© 2004 Garland Science)

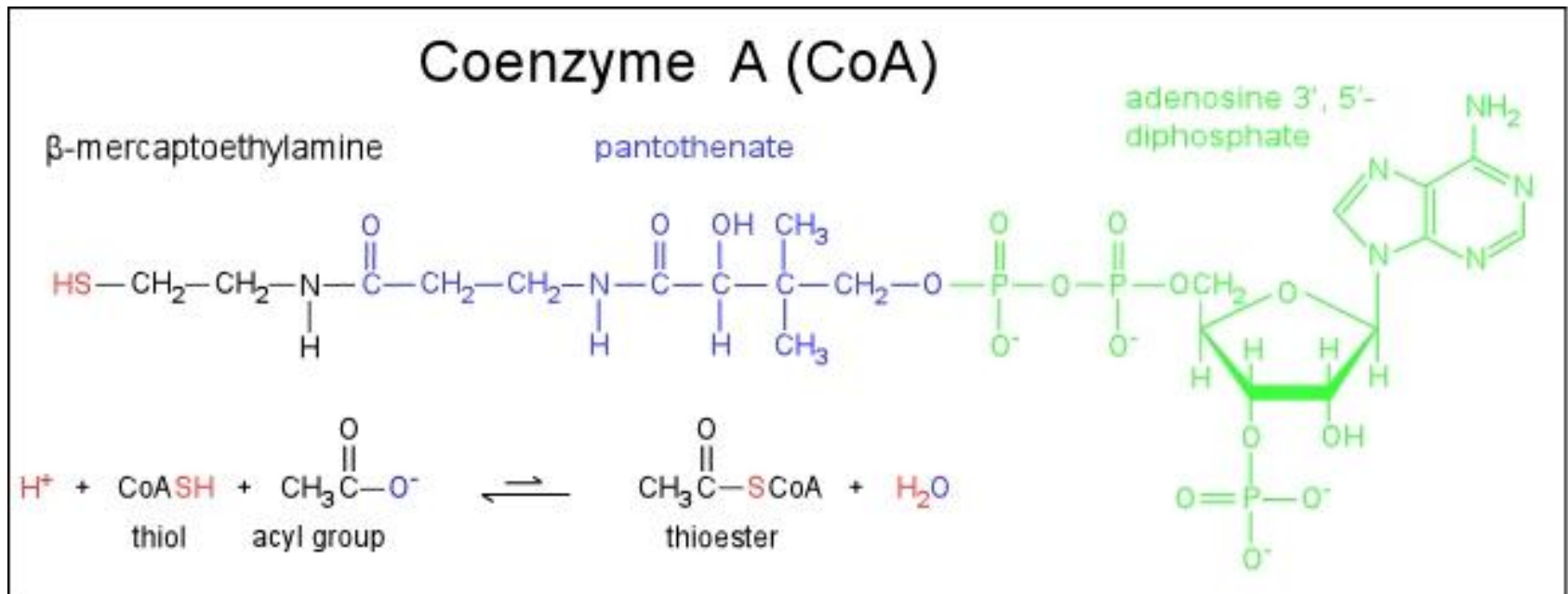
# Nukleotid származékok: NAD<sup>+</sup>



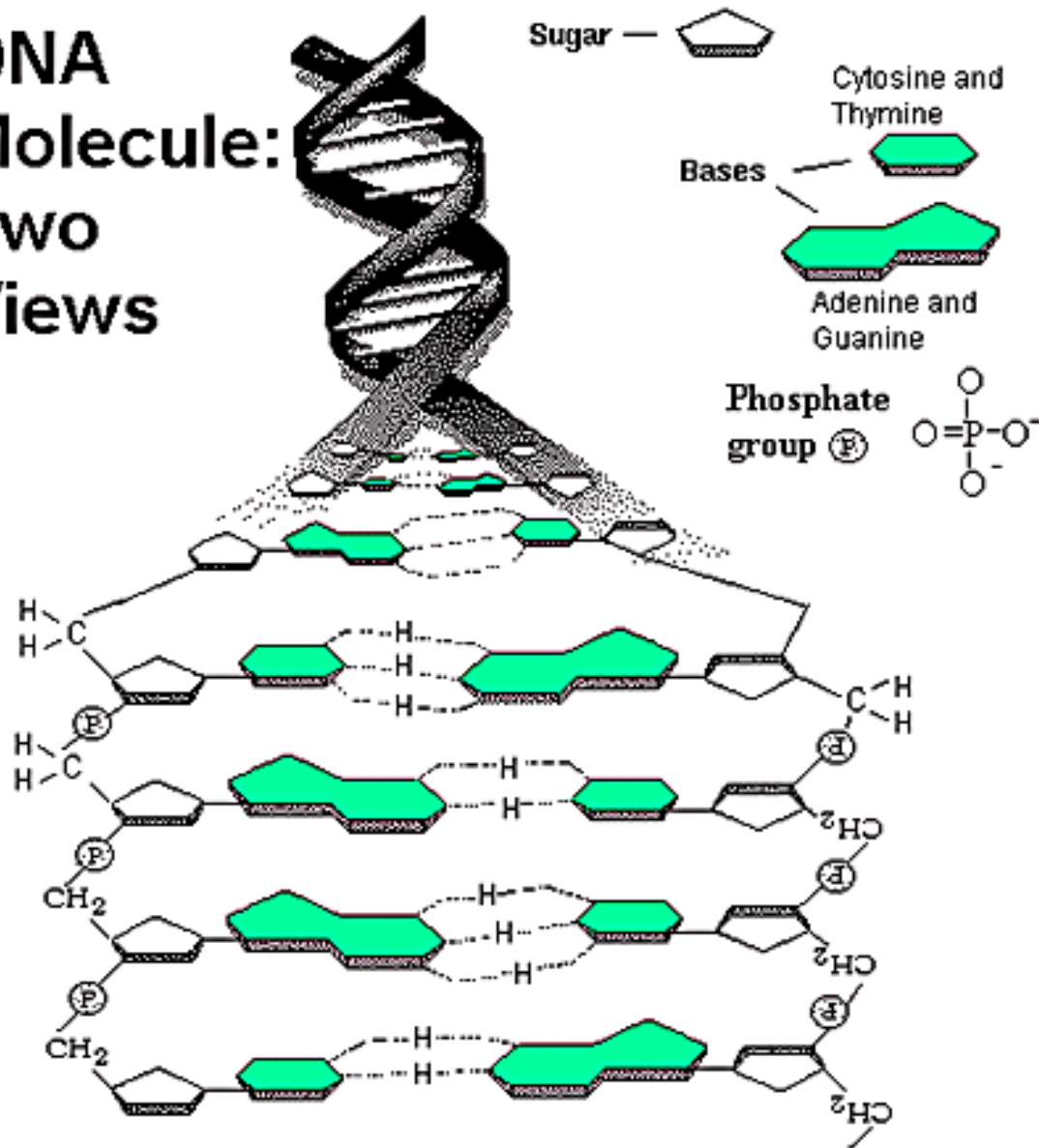
nicotinamid adenine dinucleotide (NAD<sup>+</sup>)

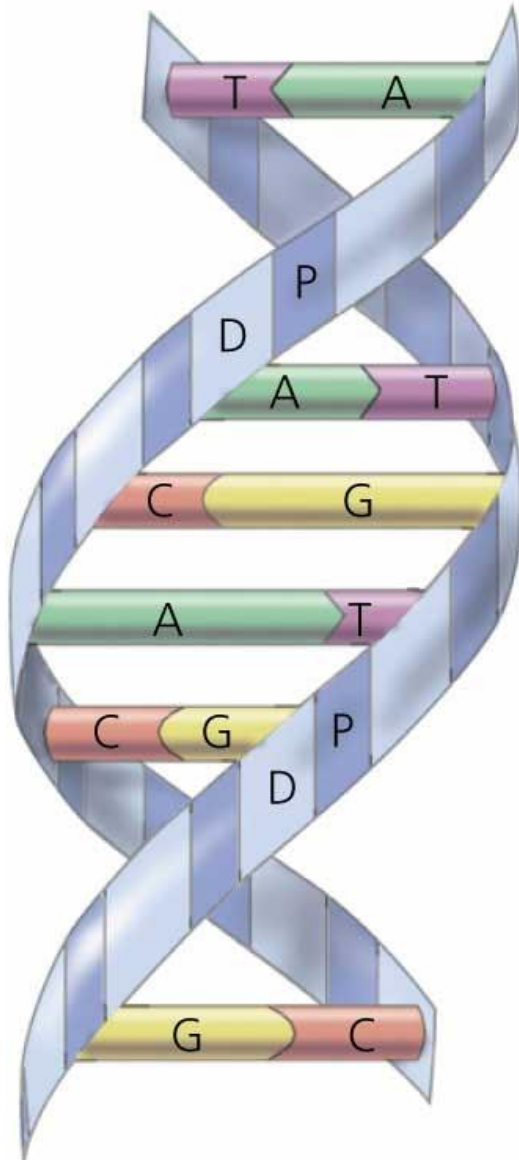


# Nukleotid származékok: Koenzim-A



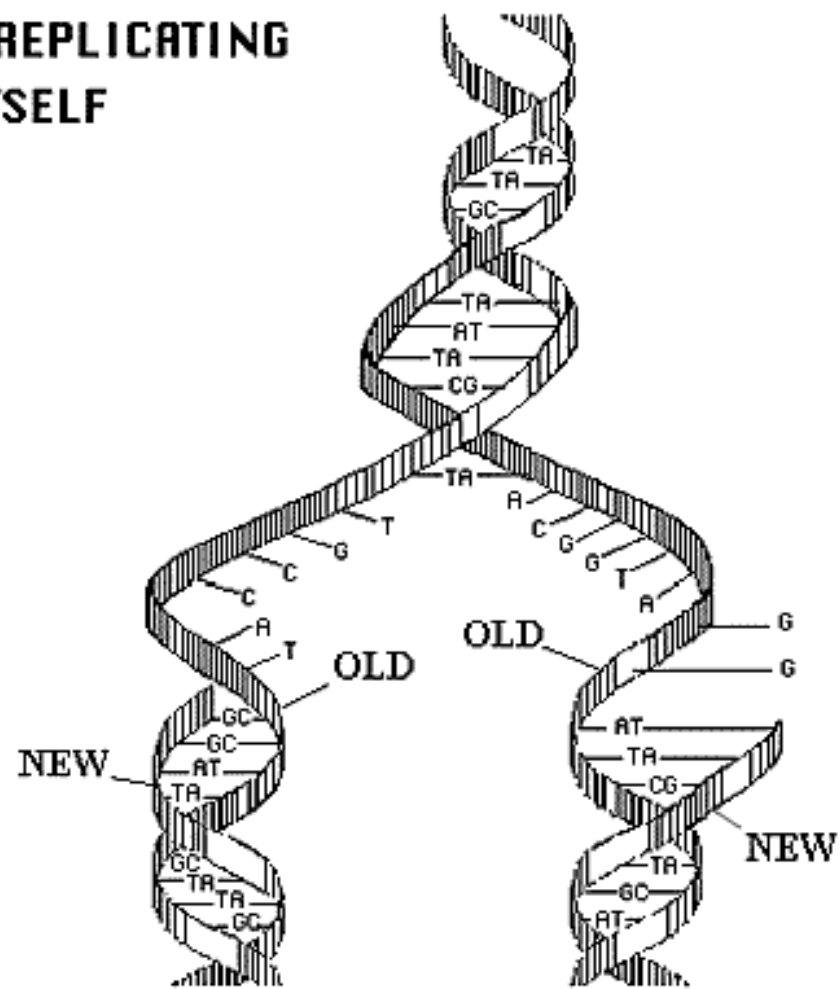
# DNA Molecule: Two Views

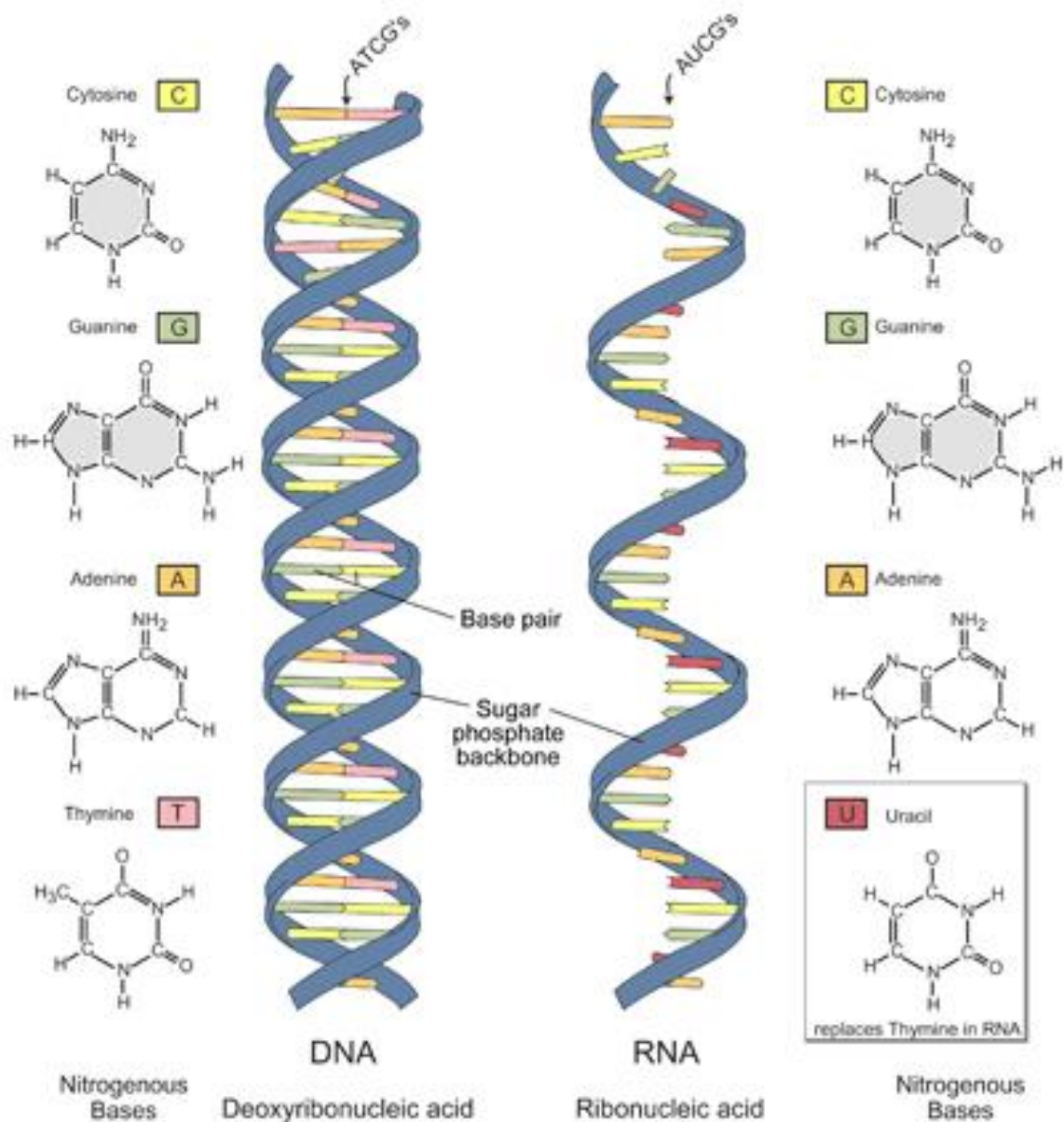




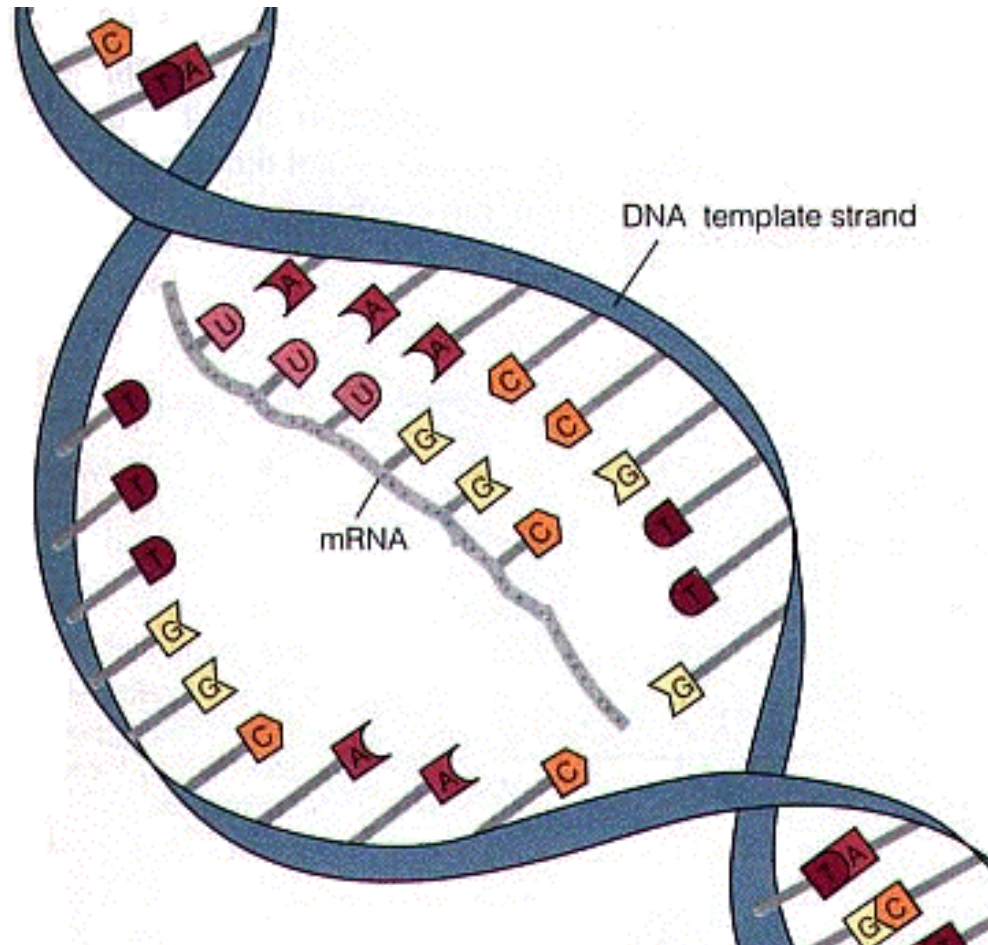


# DNA REPLICATING ITSELF

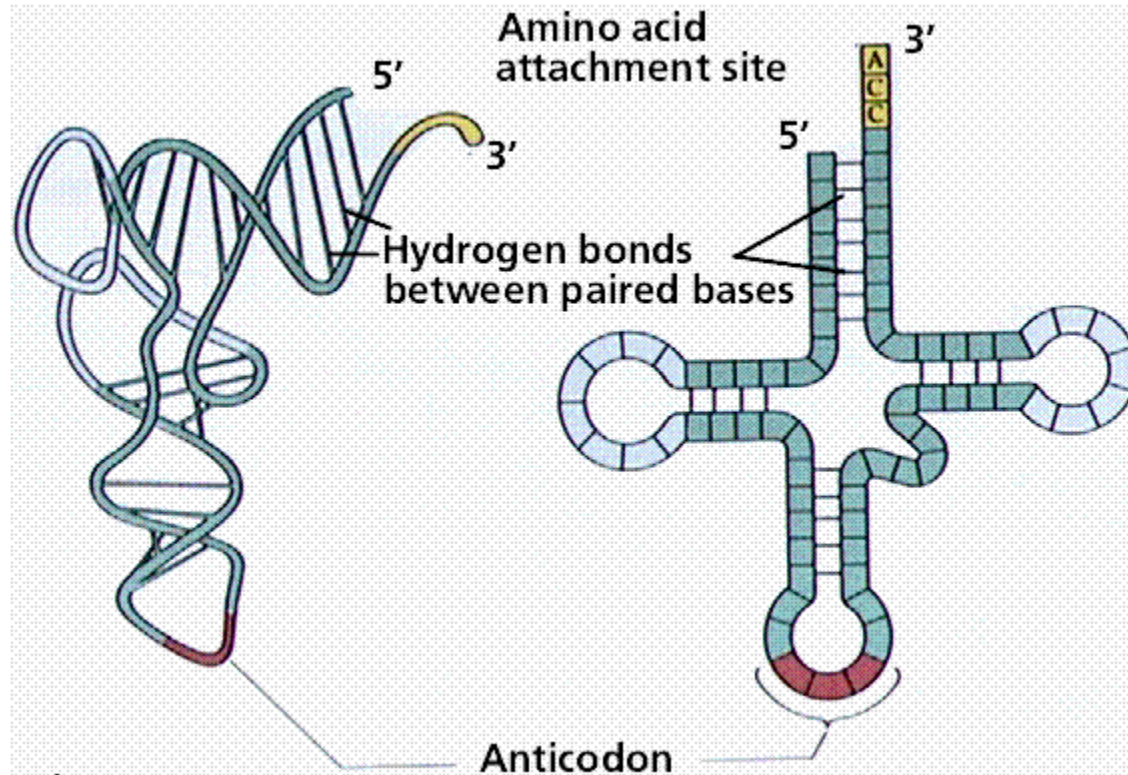




# mRNS leíródása DNS-ről



# tRNS



# rRNS

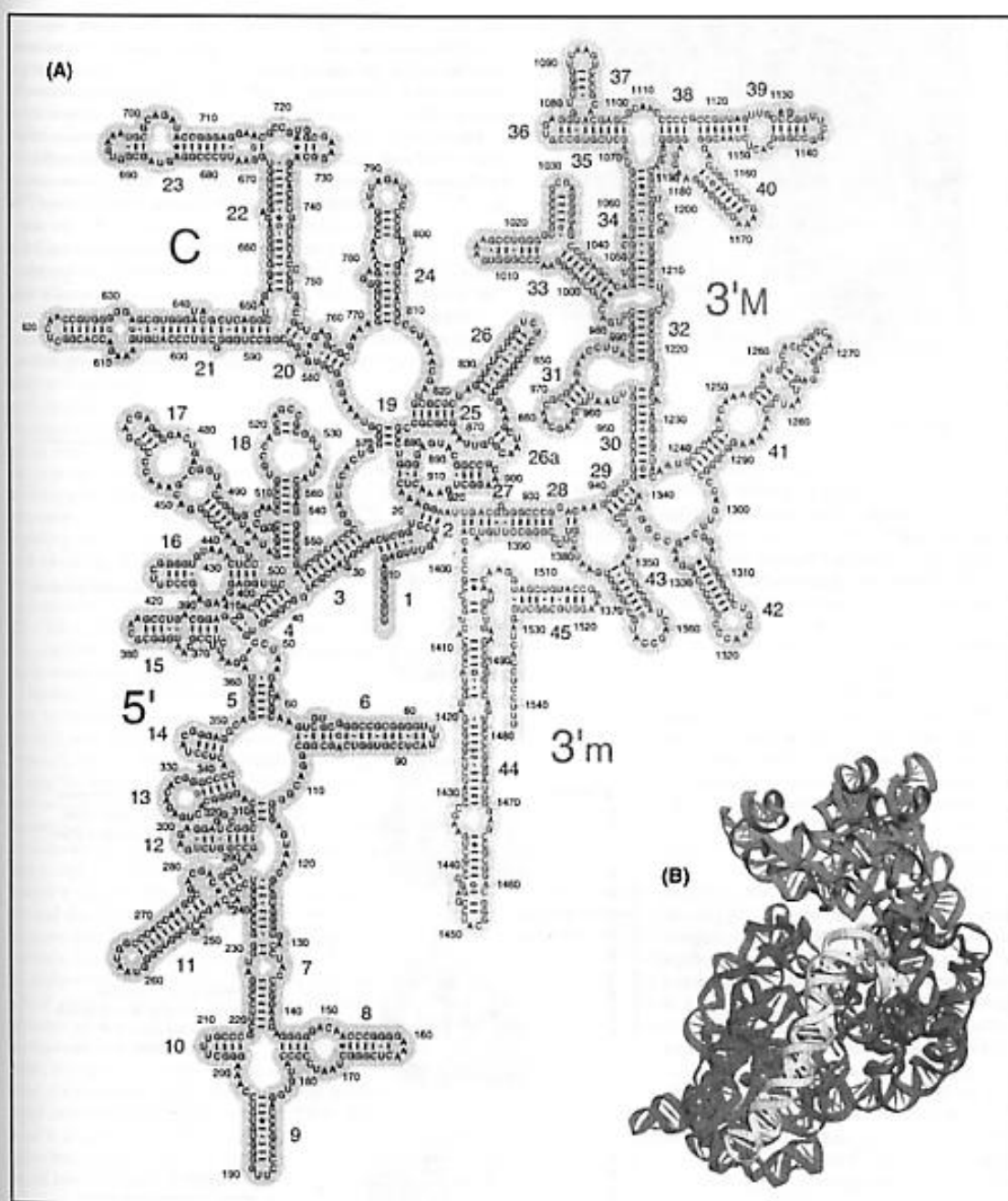


Figure 4.10. Nucleotide base layout (A) and 3-D folded structure (B) of the 16S rRNA, comprising the small 30S subunit, <sup>16SR</sup> (courtesy of Yusupov et al)