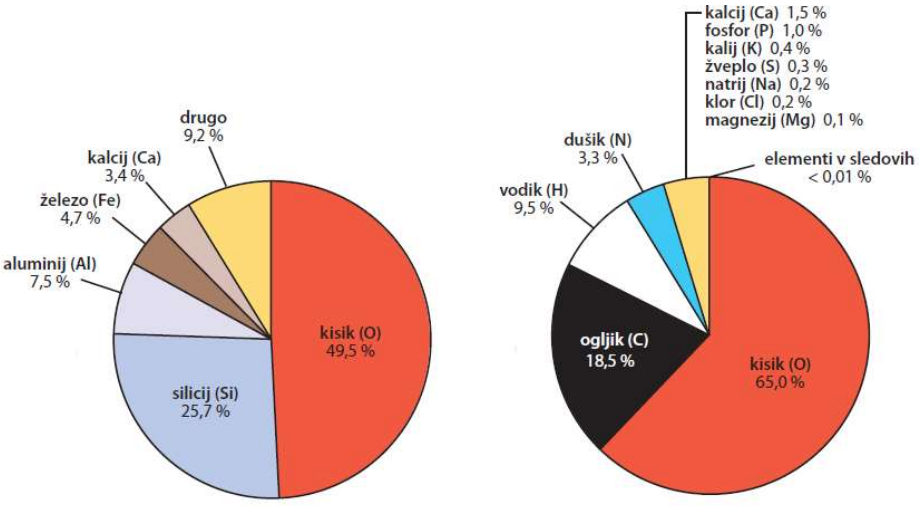
KEMIJSKA ZGRADBA ŽIVIH ORGANIZMOV

Masni deleži različnih elementov



Napaka v učbeniku pri ogljiku, str, **29, slika 2.4**

Table 2.1 Naturally Occurring Elements in the Human Body

Symbol	Element	Atomic Number (see p. 33)	Percentage of Human Body Weight
Elements making up about 96% of human body weight			
O	Oxygen	8	65.0
C	Carbon	6	18.5
H	Hydrogen	1	9.5
N	Nitrogen	7	3.3
Elements making up about 4% of human body weight			
Ca	Calcium	20	1.5
P	Phosphorus	15	1.0
K	Potassium	19	0.4
S	Sulfur	16	0.3
Na	Sodium	11	0.2
Cl	Chlorine	17	0.2
Mg	Magnesium	12	0.1
Elements making up less than 0.01% of human body weight (trace elements)			
Boron (B), chromium (Cr), cobalt (Co), copper (Cu), fluorine (F), iodine (I), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), silicon (Si), tin (Sn), vanadium (V), zinc (Zn)			

BIOGENI ELEMENTI
-makroelementi
-mikroelementi
(Fe, Zn, Se, Mn, Mo, B,..)

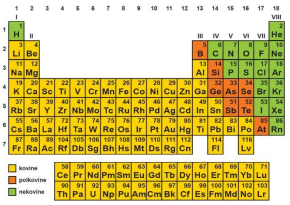
MAKROELEMENTI

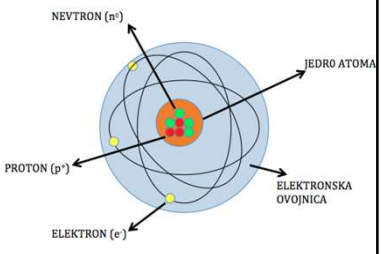
MIKROELEMENTI

ELEMENTI→ snovi, ki so sestavljene iz enakih atomov,

ATOMI→ gradniki molekul in snovi, sestavljeni iz protonov, elektronov in nevtronov,

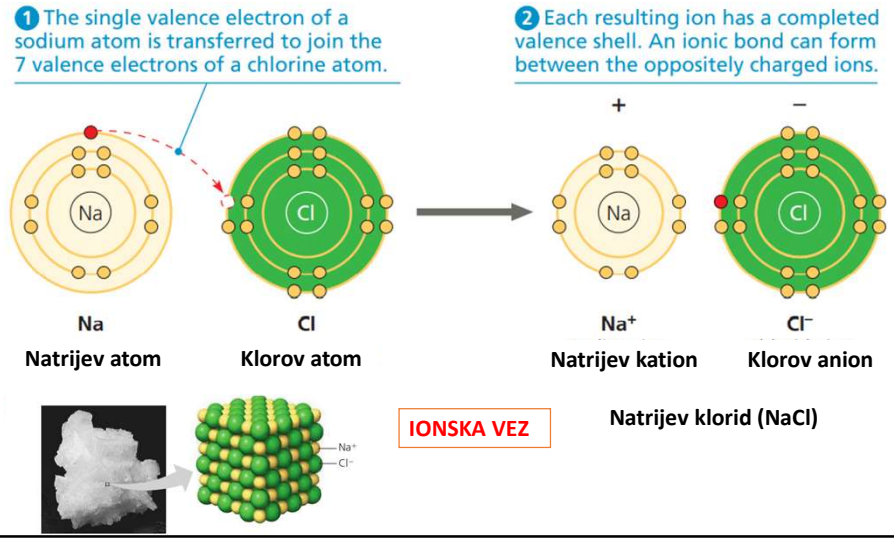
MOLEKULE→ najmanjši nedeljiv delec kemijskega elementa ali spojine, ki ohranja kemijske in fizikalne lastnosti te snovi,





Water (H_2O)

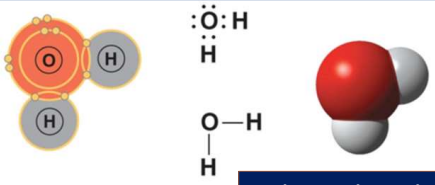
IONI→ eno ali mnogoatomni električno nabiti delec, ki nastane, če se atomu, molekuli ali »skupini atomov« odvzame ali doda en ali več elektronov.



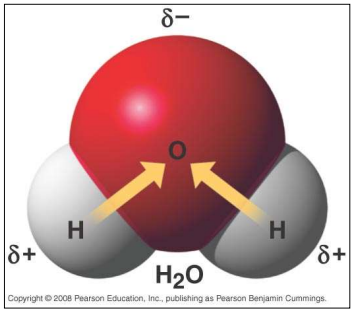
IONSKA VEZ

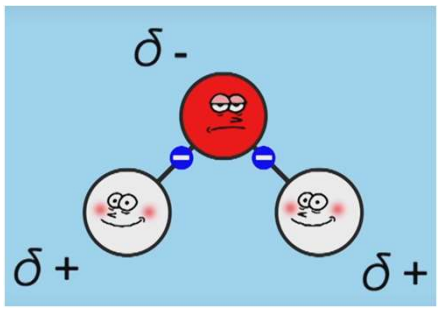
Natrijev klorid (NaCl)

VODA



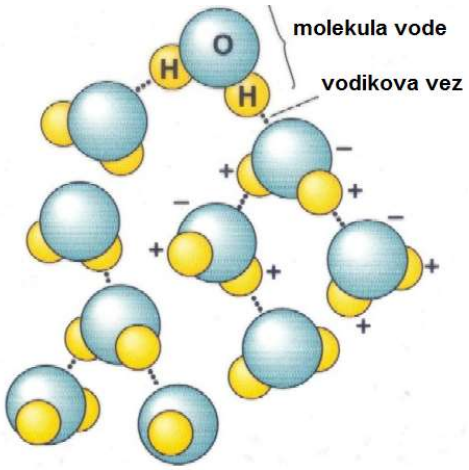
Polarna kovalentna vez



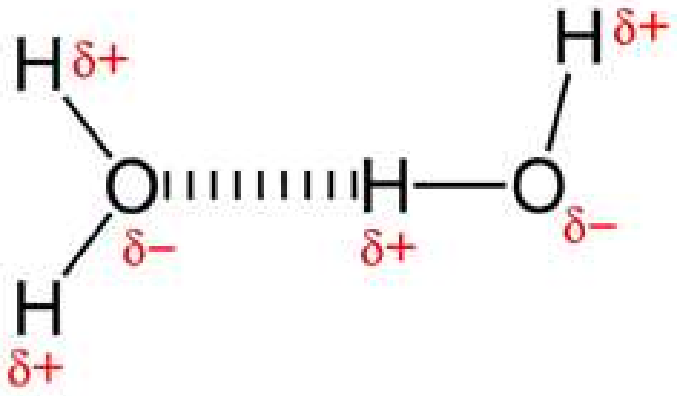


https://www.youtube.com/watch?v=h0py6BFlFZw; 23. 1. 2016

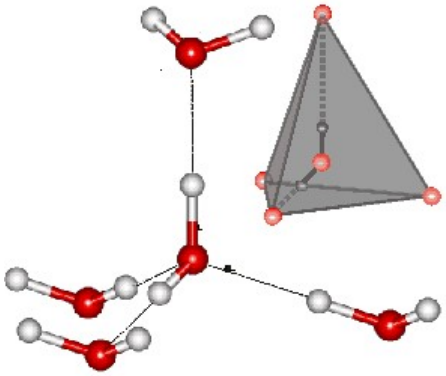
- kot med vodikoma je 104,52°
- vez med vodikom in kisikom je **kovalentna** (energija je 110 kcal/mol)



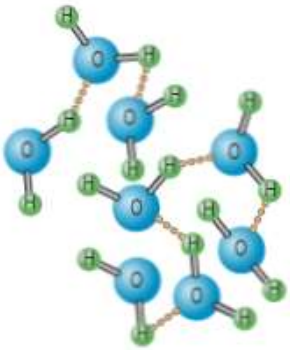
- s sosednjimi molekulami vode tvori **vodikove vezi** (energija je 4,5 kcal/mol)



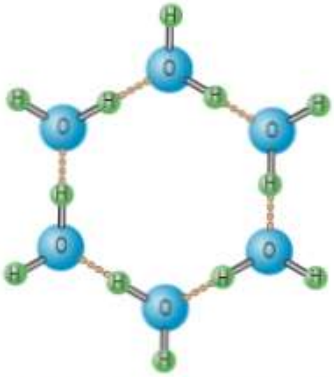
- Molekula vode tvori vodikove vezi s štirimi sosednjimi molekulami vode.



- molekule vode se razporedijo v heksagonalno strukturo (LED-trdno agregatno stanje).



tructure of molecules in water



Structure of molecules in ice

Pomen vode

Voda sodeluje v kemijskih reakcijah, nujnih za vzdrževanje življenja

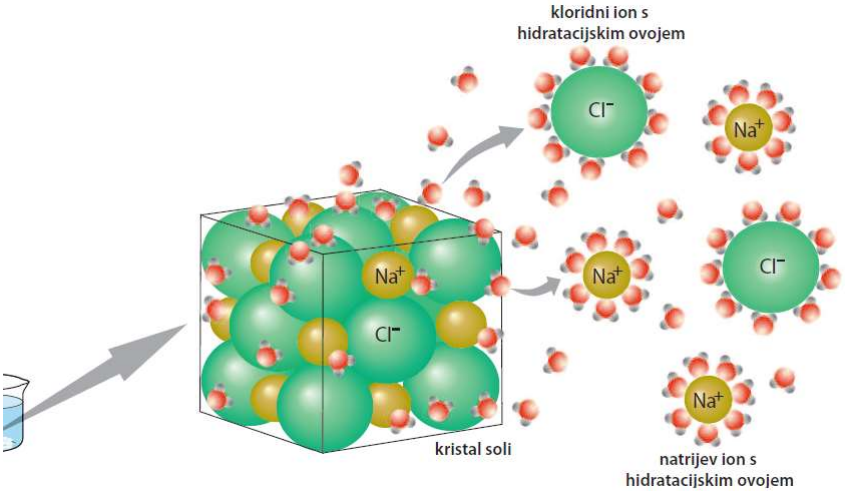
➔ VIR KISIKA

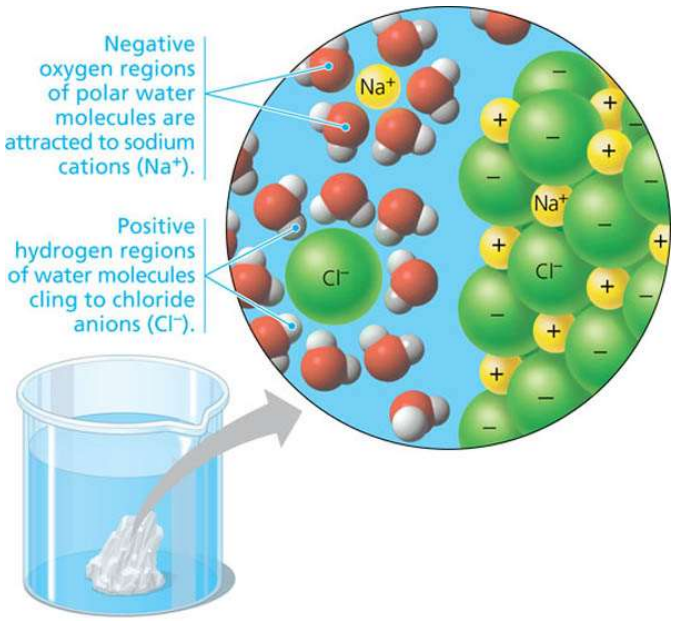
➔ VIR VODIKA

➔METABOLNA VODA

➔TRANSPORTNO SREDSTVO

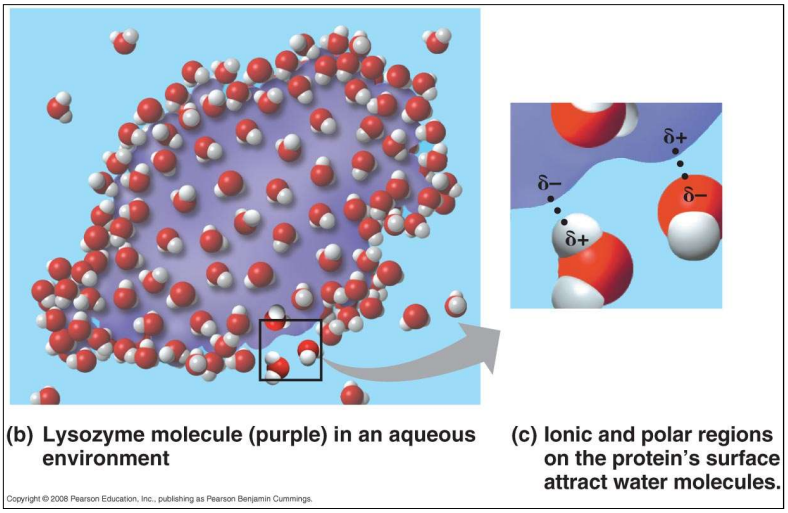
- Odlično topilo za druge električno nabite (polarne) delce





https://www.youtube.com/watch?v=A88ih2PQDNs&t=27s

VEZANA VODA
vodni ovoj = HIDRATACIJSKI OVOJ

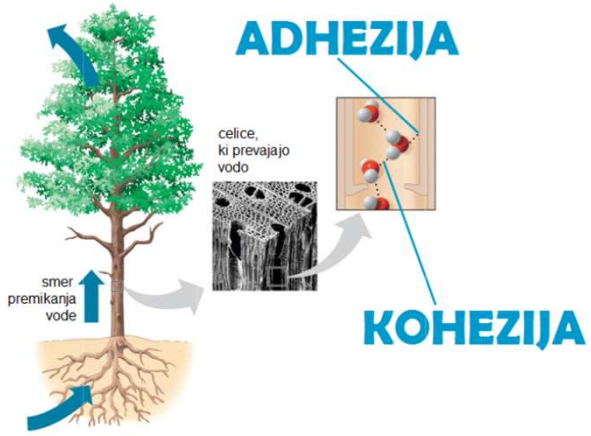


(b) Lysozyme molecule (purple) in an aqueous environment

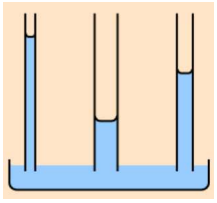
(c) Ionic and polar regions on the protein's surface attract water molecules.

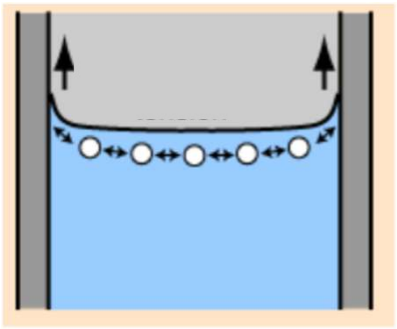
LASTNOSTI VODE

- KOHEZIJA
- ADHEZIJA



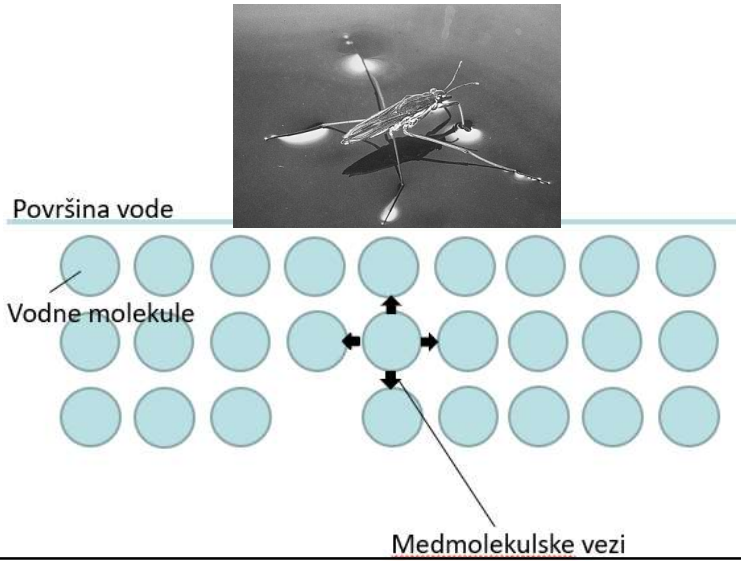
kapilarnost



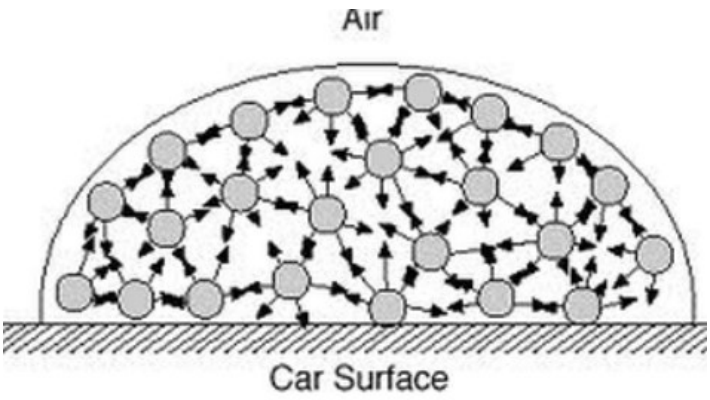


LASTNOSTI VODE

- POVRŠINSKA NAPETOST

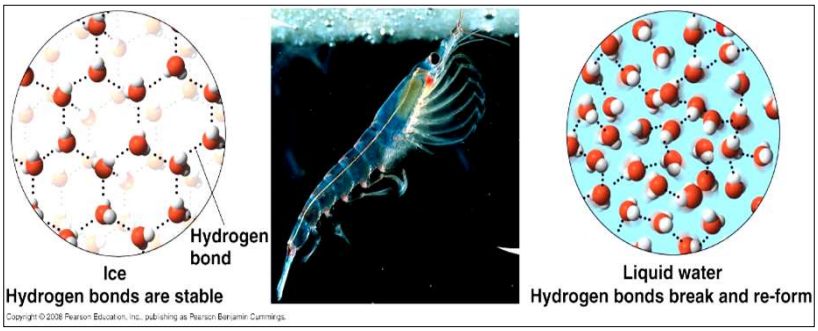


- Molekule zavzamejo čim manjšo površino…



Voda kot življenjski prostor –
brezbarvna in zelo propustna za svetlobo

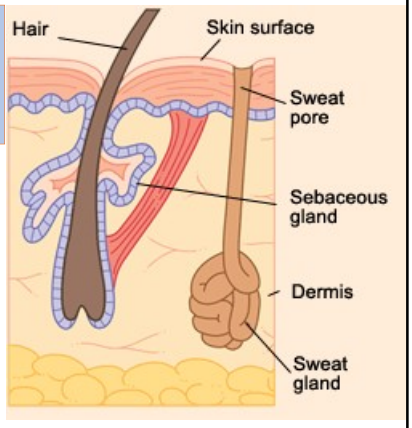
LED plava na vodi – izolira vodo pod seboj



Visoka IZPARILNA TOPLOTA –

da lahko voda izhlapi, mora absorbirati veliko energije → HLAJENJE ORGANIZMA

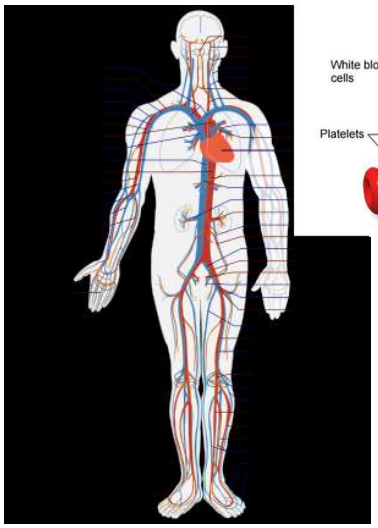
Posledica H – vezi!

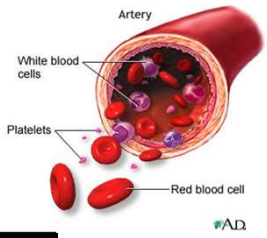


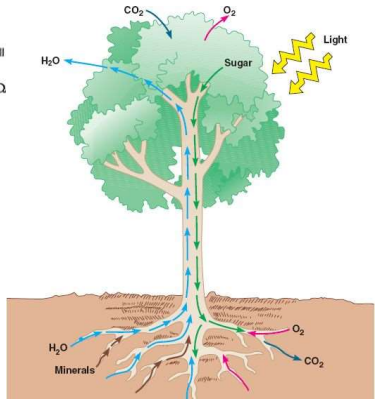
Visoka SPECIFIČNA TOPLOTA - TOPLOTNO STABILNO okolje
→ organizmi (75% iz vode) – temperatura telesa ne niha kot zunanja temperatura (zrak)

VODA - majhna VISKOZNOST → dober transportni medij (kri), limfa

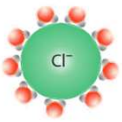
podaja notranje trenje tekočin

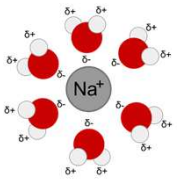






Nariši natrijev in kloridni ion s hidratacijskim ovojem.





Razloži, zaradi katerih lastnosti in na kakšen način voda deluje kot transportno sredstvo.

Kohezija, Adhezija
Majhna viskoznost
Polarnost – dobro topilo

Utemelji, zakaj je vodno okolje (morje, jezera, reka) tako ugoden življenjski prostor številnim živim organizmom.

Prepustna za svetlobo
Temperaturno stabilna
Manj prepušča UV žarke

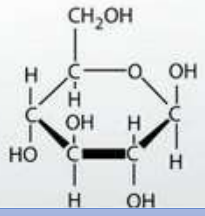
Razloži, kaj je to termoregulacija.

Opiši mehanizem hlajenja telesa s pomočjo znojenja.

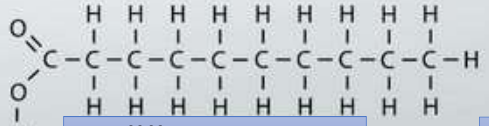
Uravnavanje telesne T

ORGANSKE MOLEKULE

BELJAKOVINE (PROTEINI)

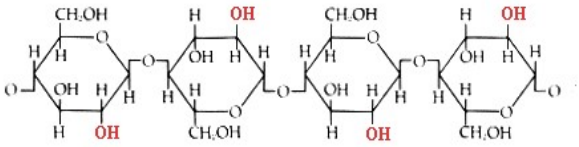


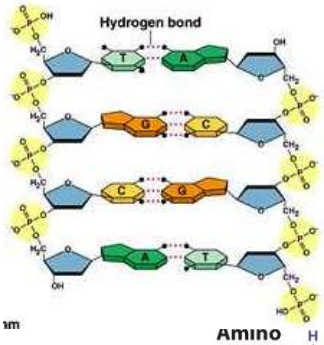
OGLJIKOVI HIDRATI

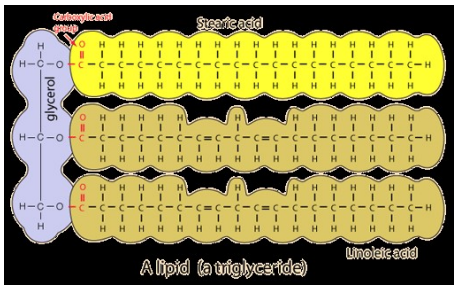


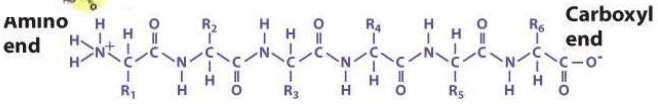
MAŠČOBE (LIPIDI)

NUKLEINSKE KISLINE



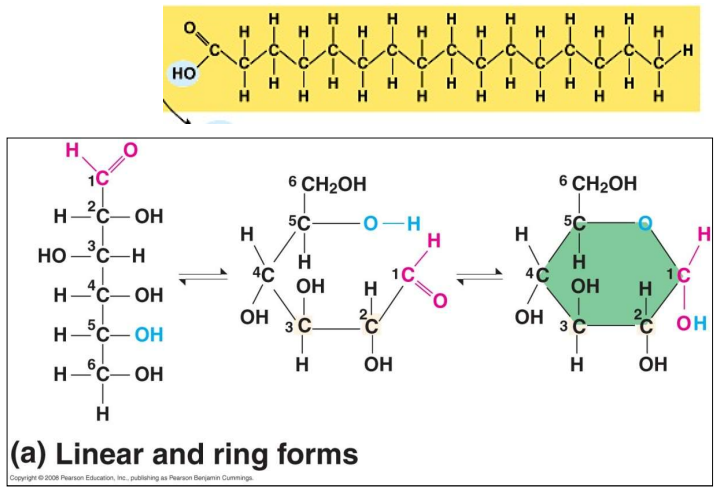


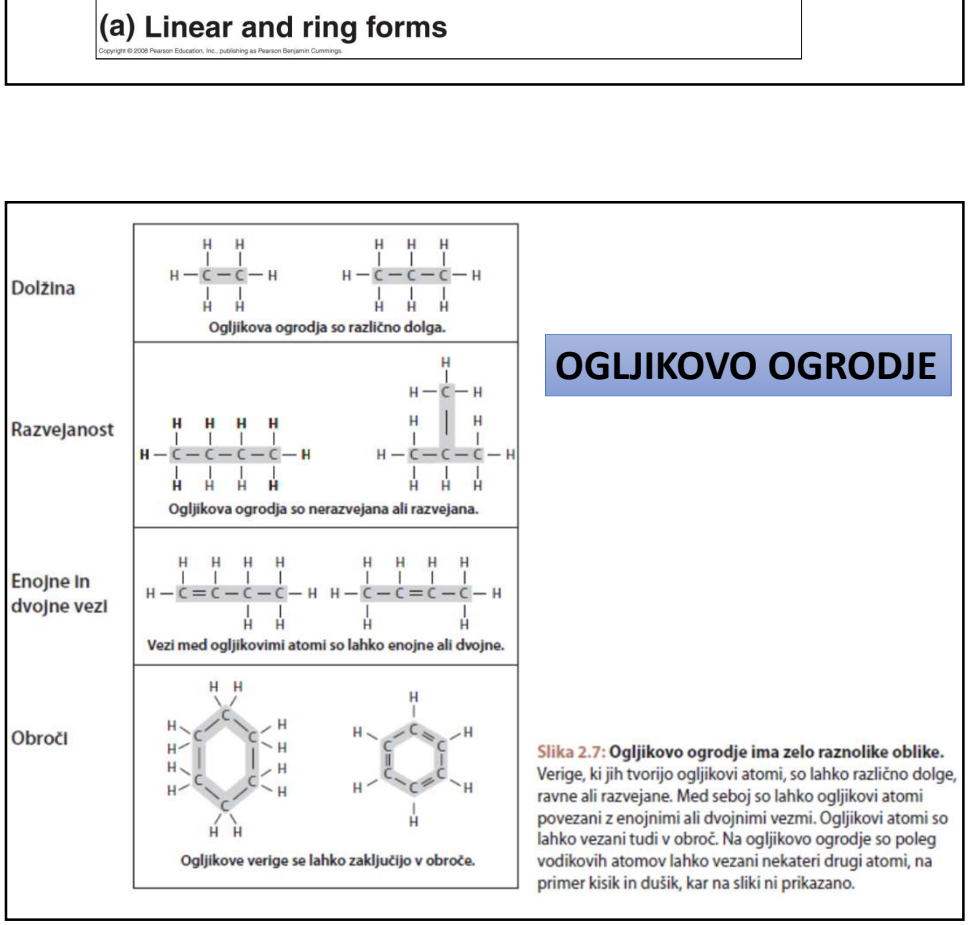




C – ogljikovi atomi: povezujejo se lahko v ravne, obročaste, razvejane verige

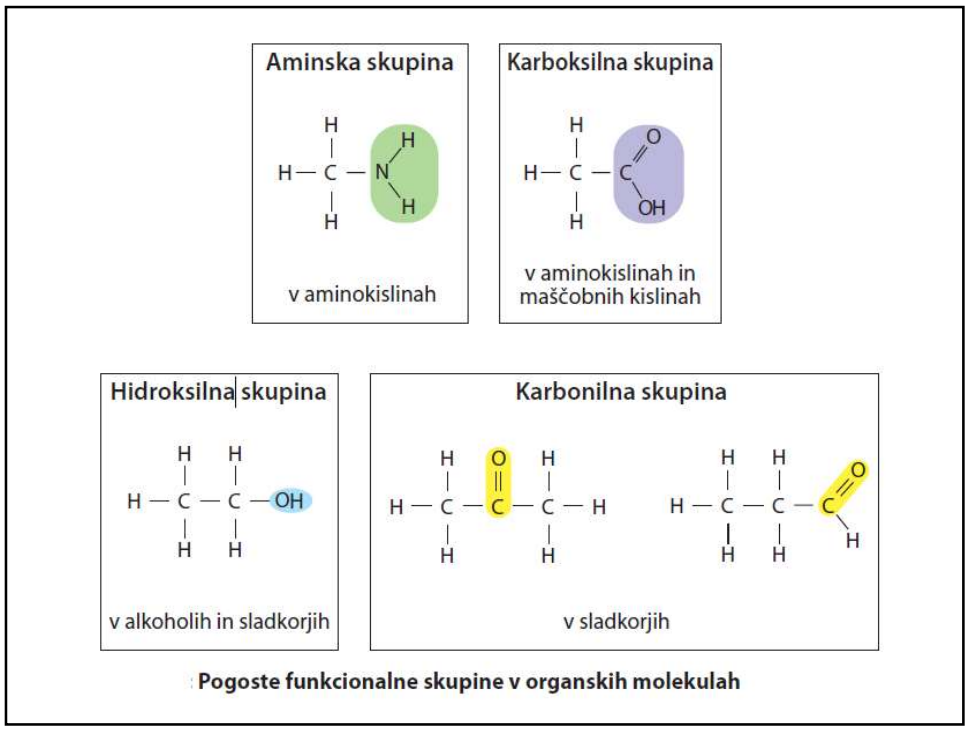
→ ogljikove verige. Ogrodje večine organskih molekul





OGLJIKOVO OGRODJE

Slika 2.7: Ogljikovo ogrodje ima zelo raznolike oblike. Verige, ki jih tvorijo ogljikovi atomi, so lahko različno dolge, ravne ali razvejane. Med seboj so lahko ogljikovi atomi povezani z enojnimi ali dvojnimi vezmi. Ogljikovi atomi so lahko vezani tudi v obroč. Na ogljikovo ogrodje so poleg vodikovih atomov lahko vezani nekateri drugi atomi, na primer kisik in dušik, kar na sliki ni prikazano.



Pogoste funkcionalne skupine v organskih molekulah

Nastanek bioloških makromolekul

BIOMONOMERI
Majhne organske molekule, osnovne gradbene enote večjih organskih molekul.

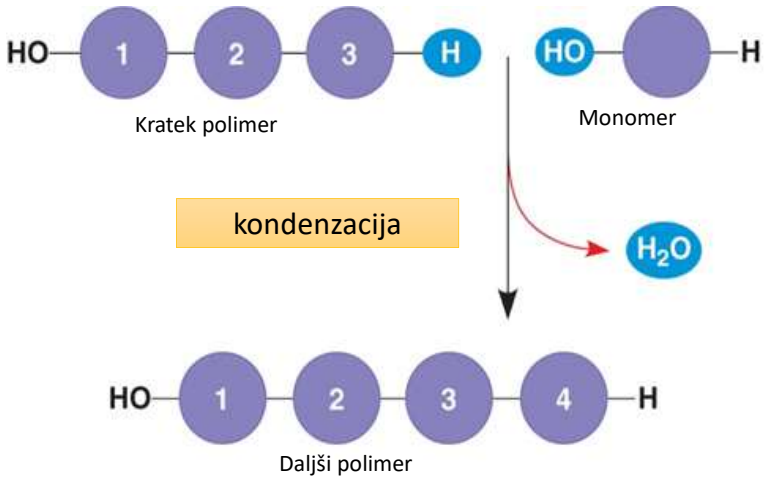
Sladkorji (monosaharidi): glukoza
Aminokisline
Nukleotidi

POLIMERIZACIJA
- Kondenzacija (odcepi se voda)

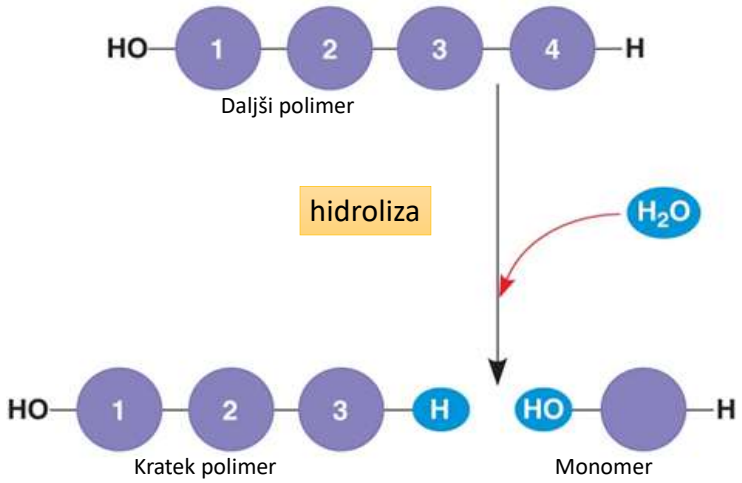
BIOPOLIMERI

Polisaharidi: škrob
Beljakovine
Nukleinske kisline: DNK

POLIMERIZACIJA S KONDENZACIJO

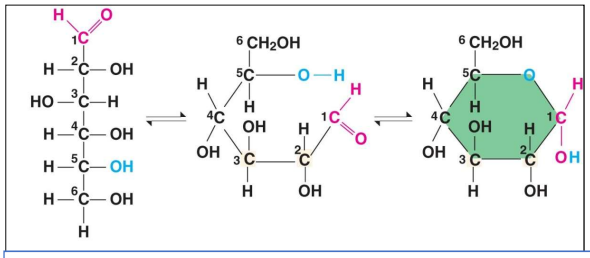


RAZPAD POLIMEROV S HIDROLIZO



OGLJIKOVI HIDRATI

- sestavljeni iz ogljika, vodika in kisika v razmerju 1:2:1



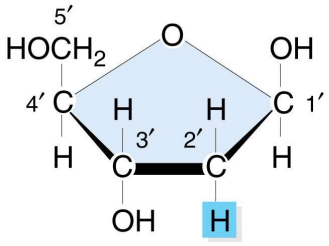
LINEARNO OGRODJE SE V RAZTOPINI POGOSTO SKLENE V OBROČ

Glukoza
$C_6H_{12}O_6$

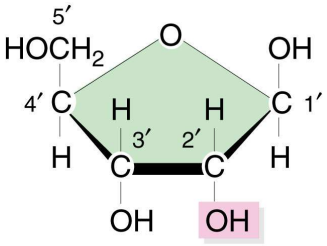
MONOSAHARIDi (3-10 C atomov)

RIBOZA, DEOKSIRIBOZA

HEKSOZE, PENTOZE

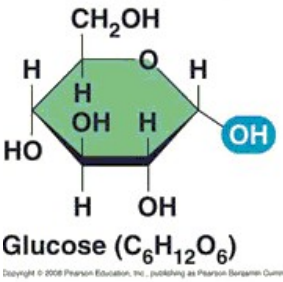


Deoxvribose

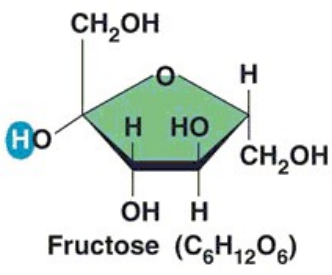


Ribose

GLUKOZA, FRUKTOZA

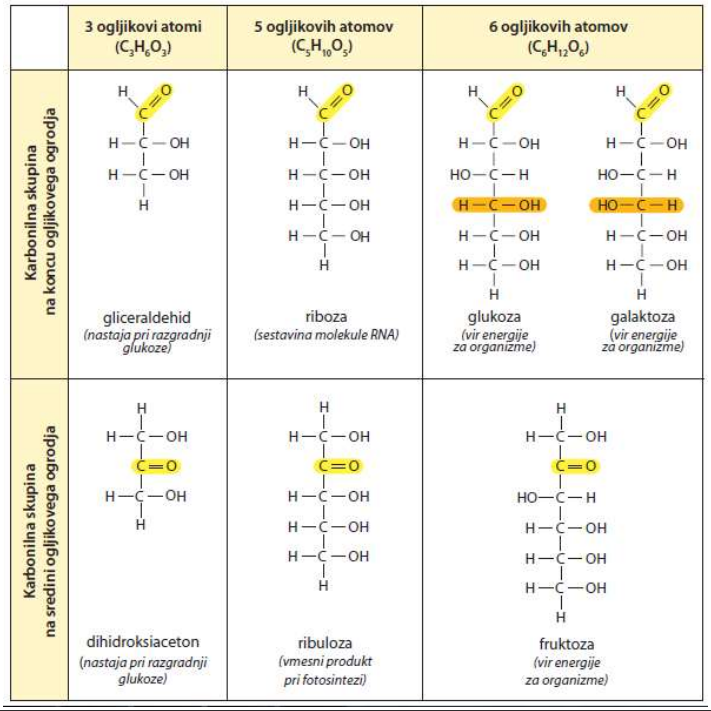


Glucose ($C_6H_{12}O_6$)



Fructose ($C_6H_{12}O_6$)

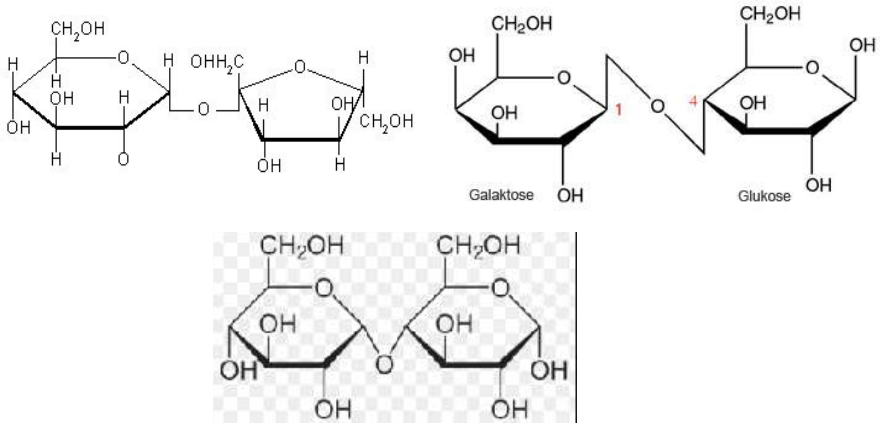
ALDOZE, KETOZE



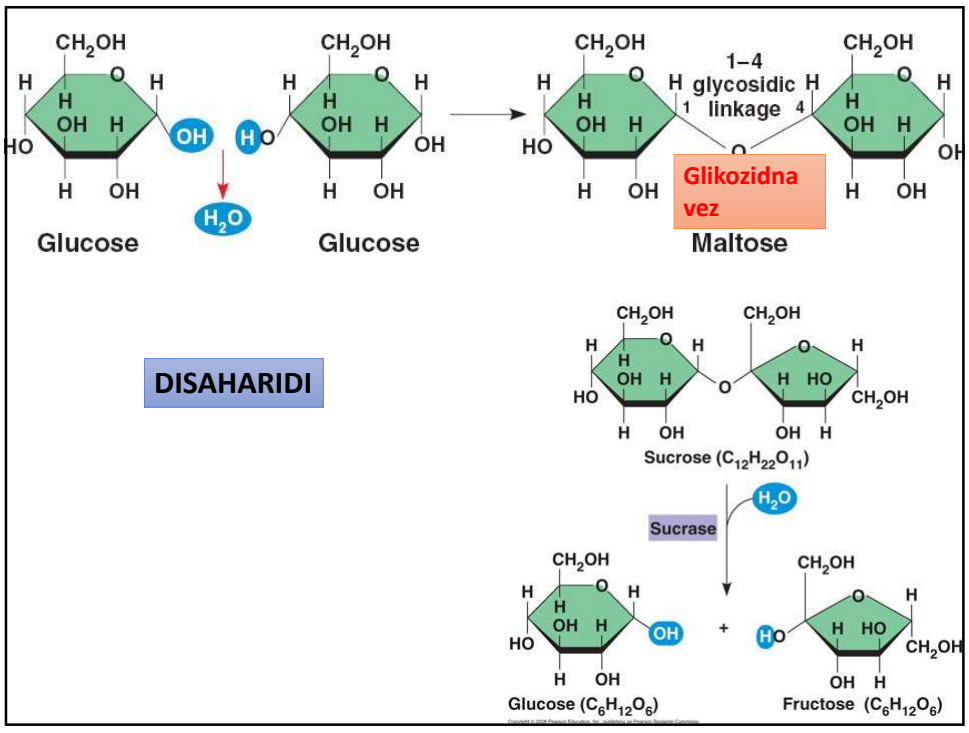
VLOGE MONOSAHARIDOV

- ➔ Vir E (glukoza, galaktoza, fruktoza)
- ➔ gradniki drugih organskih molekul
- ➔ surovina

Disaharidi

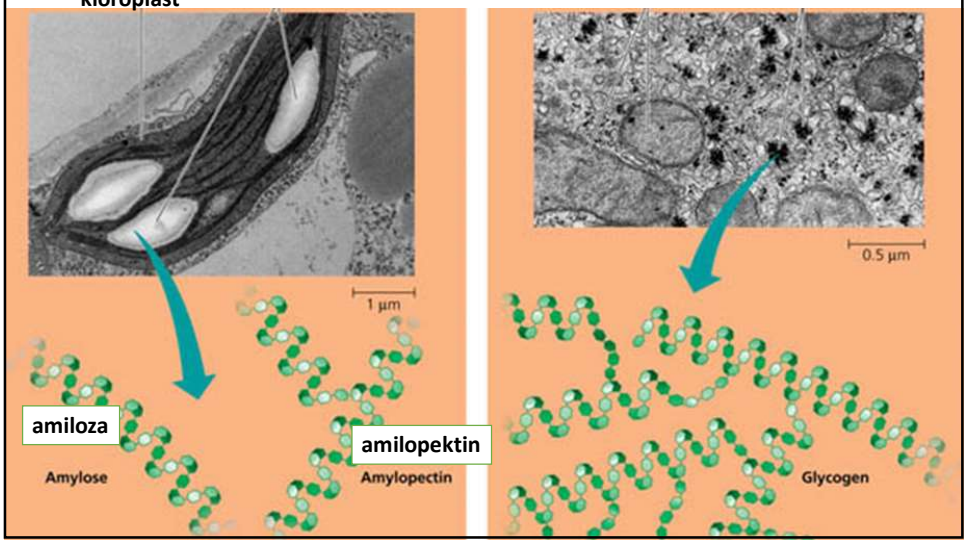


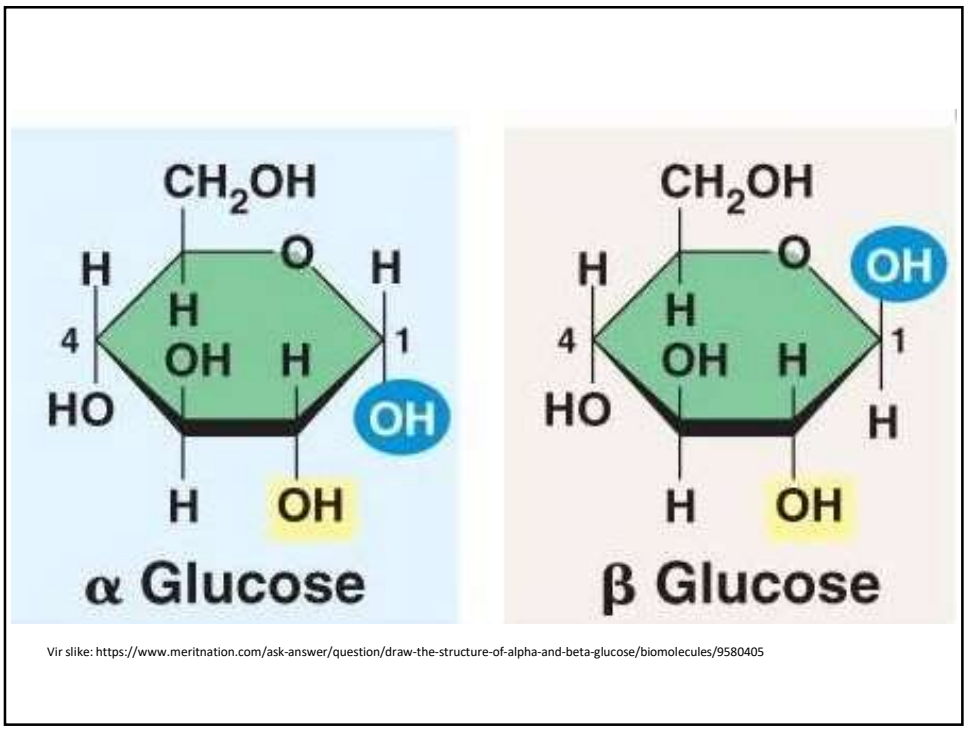
Vir slike: https://www3.hhu.de/biodidaktik/zucker/Zucker/laktose.html



polisaharidi

ŠKROB **GLIKOGEN**



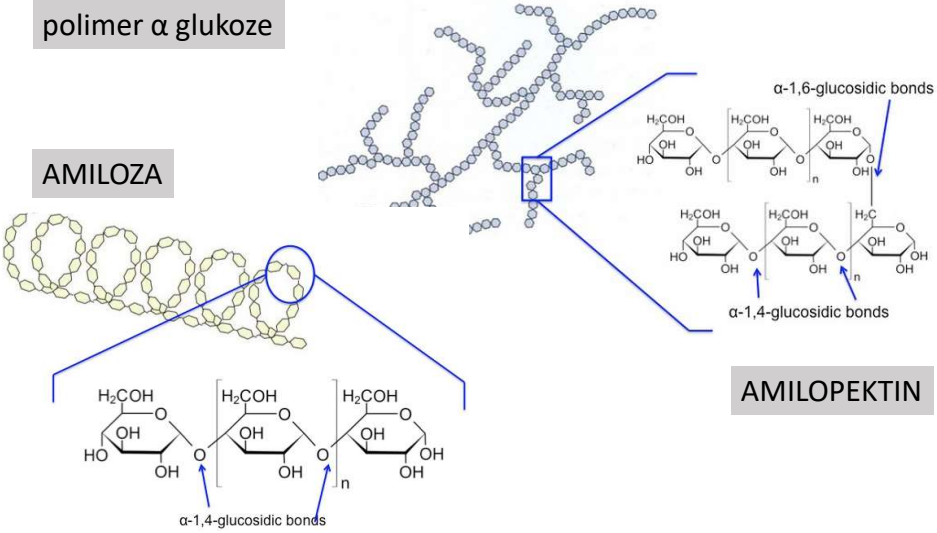


Vir slike: https://www.meritnation.com/ask-answer/question/draw-the-structure-of-alpha-and-beta-glucose/biomolecules/9580405

Škrob: amiloza in amilopektin

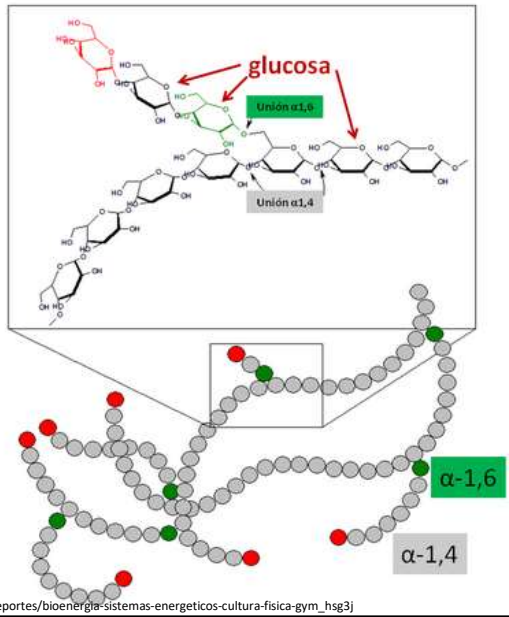
polimer α glukoze

AMILOZA

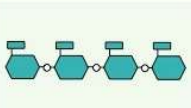
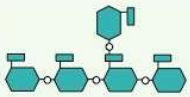
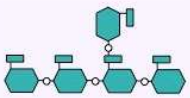
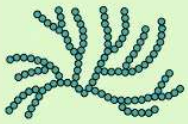
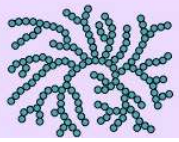


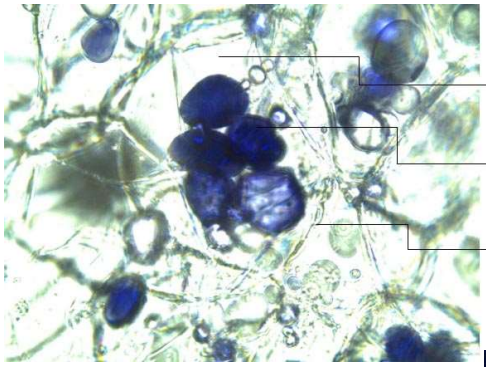
AMILOPEKTIN

glikogen: 1,4 vezi α-glukoze, 1,6 razvejitve

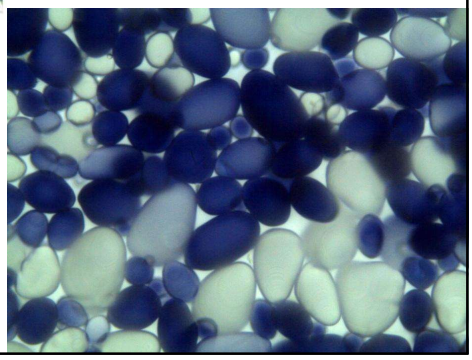


Vir slike: https://www.taringa.net/+deportes/bioenergia-sistemas-energeticos-cultura-fisica-gym_hsg3j

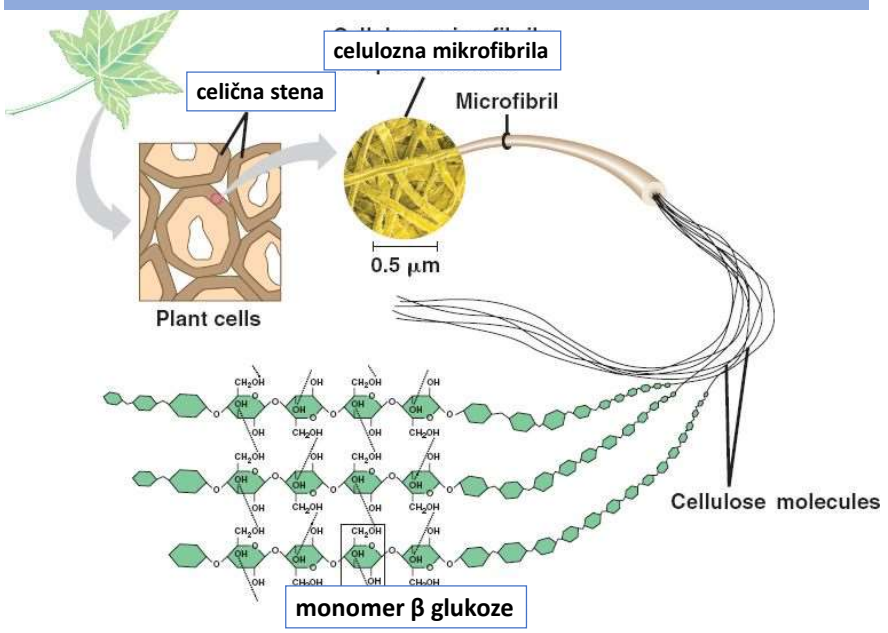
	Starch		Glycogen
	Amylose	Amylopectin	
Source	Plant	Plant	Animal
Subunit	α-glucose	α-glucose	α-glucose
Bonds	1-4	1-4 *and* 1-6	1-4 *and* 1-6
Branches	No	Yes (~per 20 subunits)	Yes (~per 10 subunits)
Diagram			
Shape			

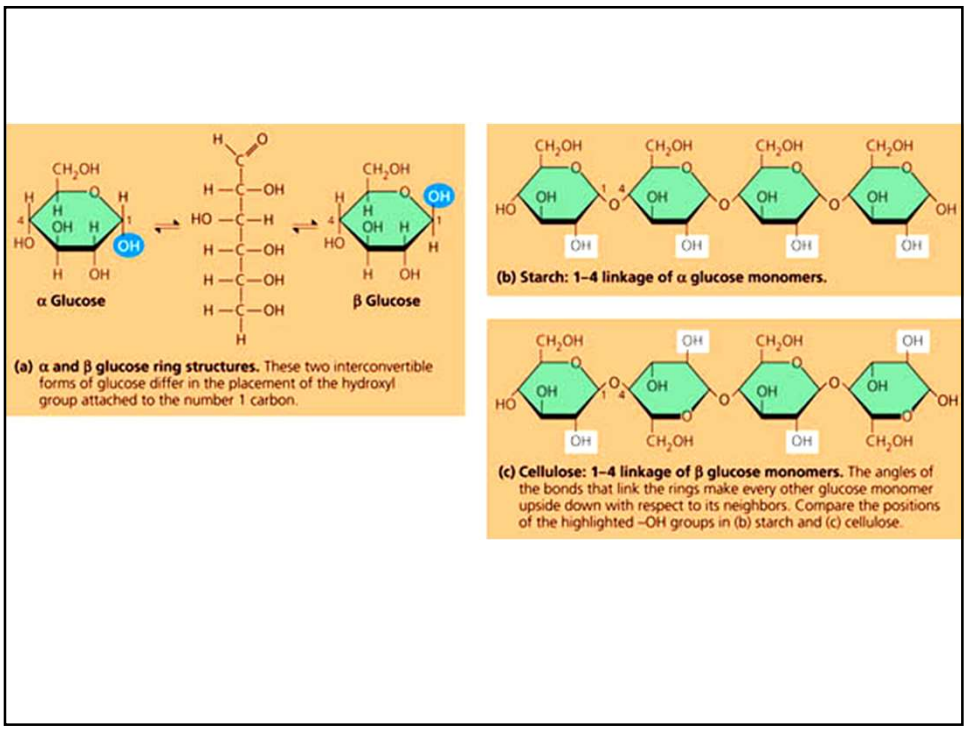


S KATERIM REAGENTOM BI DOKAZALI PRISOTNOST ŠKROBA?

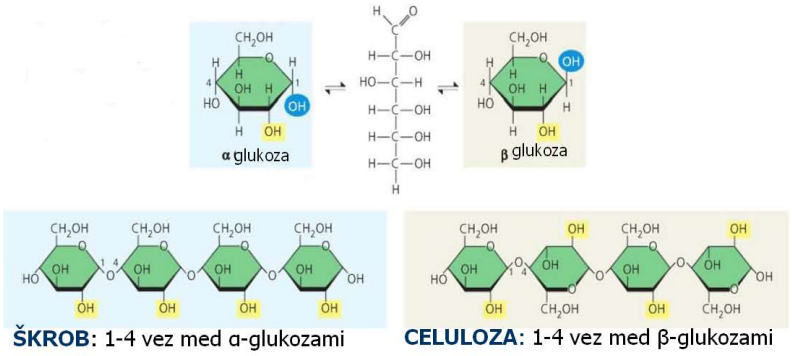


celuloza


celulozna mikrofibrila
celična stena
Microfibril
0.5 μm
Plant cells
Cellulose molecules
monomer β glukoze

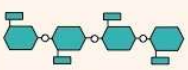
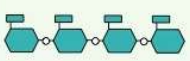
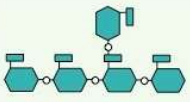
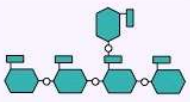
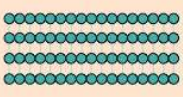
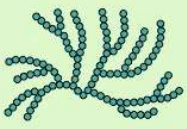
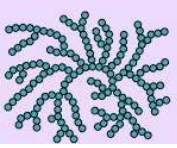

α Glucose
β Glucose
(a) α and β glucose ring structures. These two interconvertible forms of glucose differ in the placement of the hydroxyl group attached to the number 1 carbon.
(b) Starch: 1–4 linkage of α glucose monomers.
(c) Cellulose: 1–4 linkage of β glucose monomers. The angles of the bonds that link the rings make every other glucose monomer upside down with respect to its neighbors. Compare the positions of the highlighted –OH groups in (b) starch and (c) cellulose.

- Kako se razlikujeta škrob in celuloza?
- Nekateri organizmi imajo encime za razgradnjo celuloze. Kateri?

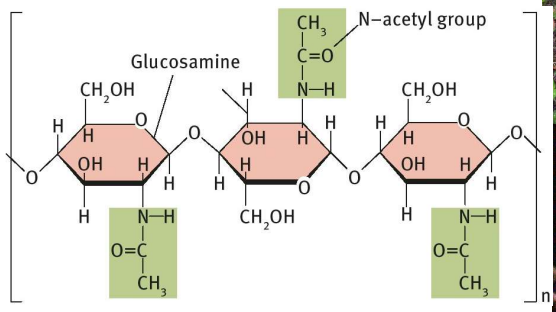


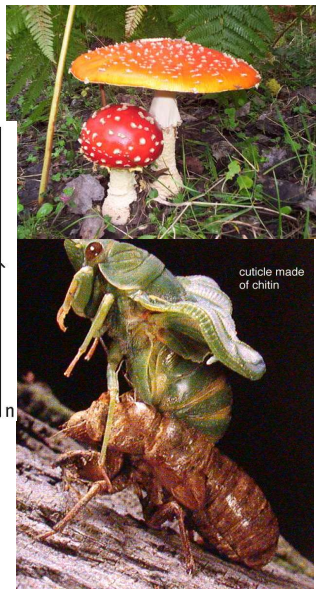
ŠKROB: 1-4 vez med α-glukozami

CELULOZA: 1-4 vez med β-glukozami

	Cellulose	Starch		Glycogen
		Amylose	Amylopectin	
Source	Plant	Plant	Plant	Animal
Subunit	β-glucose	α-glucose	α-glucose	α-glucose
Bonds	1-4	1-4	1-4 *and* 1-6	1-4 *and* 1-6
Branches	No	No	Yes (~per 20 subunits)	Yes (~per 10 subunits)
Diagram				
Shape				

hitin





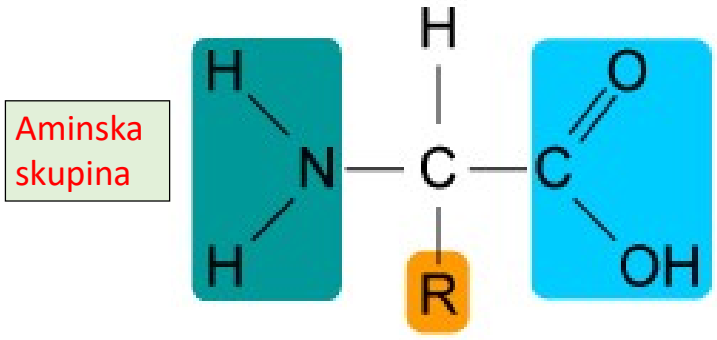
Vloga polisaharidov

- vir energije
- strukturni
- skladiščenje energije

BELJAKOVINE (PROTEINI)

Beljakovine gradijo osnovni gradniki **AMINOKISLINE** (amino (-NH_2) in karboksilne (-COOH) skupine vezane na skupen C atom + spremenljivi del molekule (-R, radikal)).

SPLOŠNA FORMULA AMINOKISLINE:

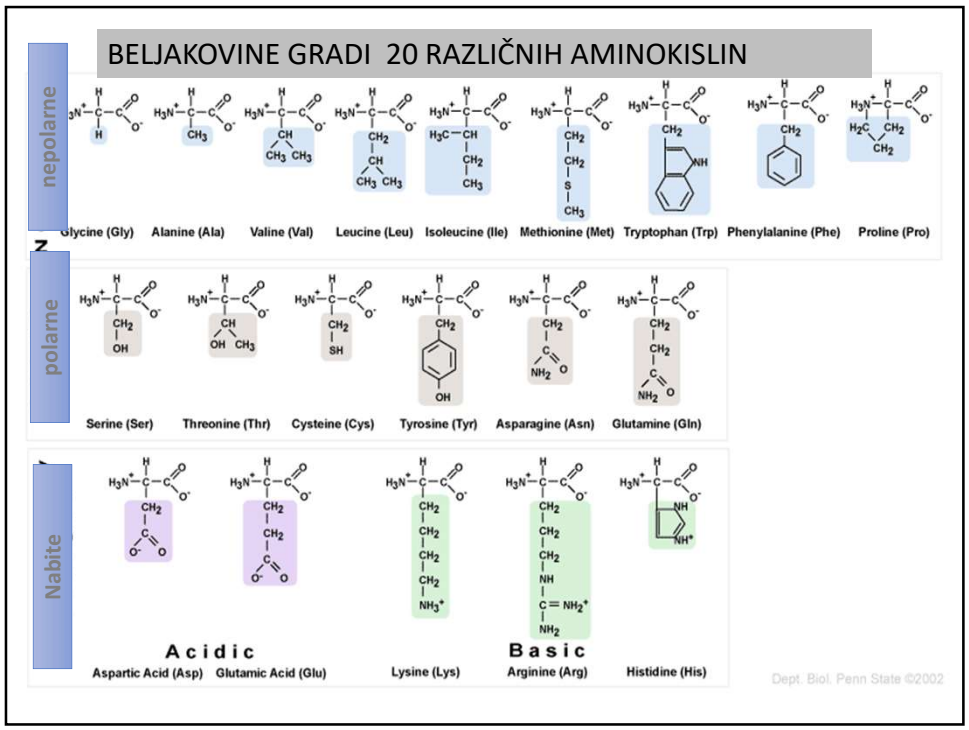


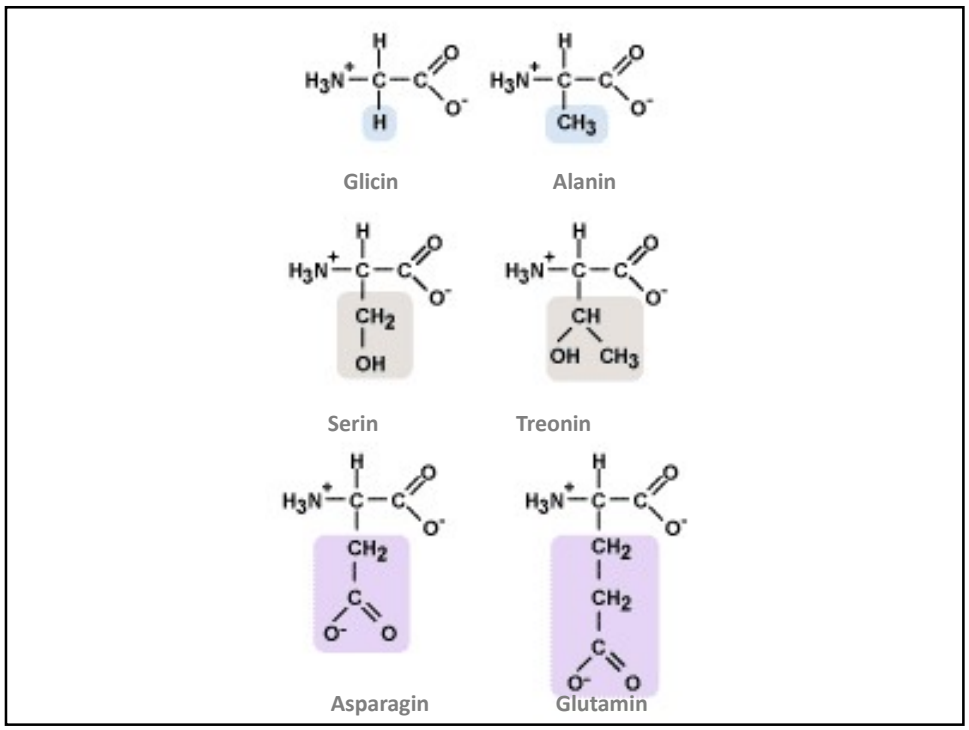
KATERE BELJAKOVINE POZNAMO?

Vrsta beljakovin	Vloga	Primer	
encimi	pospeševanje kemijskih reakcij		Prebavni encimi v želodcu sodelujejo pri razgradnji hrane.
strukturne beljakovine	zaščita in opora		Keratin je osnovna sestavina las, nohtov in perja.
založne beljakovine	zaloga aminokislin		Beljak jajca je zaloga aminokislin za zarodek.
transportne beljakovine	prenos snovi in plinov		Hemoglobin v eritrocitih prenaša kisik po telesu.
receptorske beljakovine	prepoznavanje in vezava drugih molekul		Prenašajo živčne signale med živčnimi celicami.
motorične beljakovine	krčenje in premikanje		Omogočajo krčenje mišičnih celic.

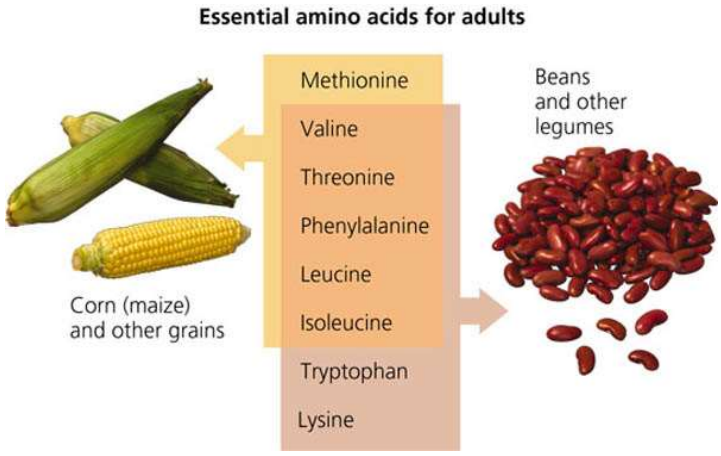
Funkcije beljakovin: https://www.youtube.com/watch?v=x1-m71WRBD8, 5.44 min

Vir: Tomažič, I. Zidar, P., Dolenc Koce, J., Ambrožič Avguštin ,J.: Biologija 1, Učbenik za biologijo v gimnazijah in srednjih strokovnih šolah. Založba Mladinska knjiga, Ljubljana, 2017.


BELJAKOVINE GRADI 20 RAZLIČNIH AMINOKISLIN
nepolarne
Glycine (Gly)
Alanine (Ala)
Valine (Val)
Leucine (Leu)
Isoleucine (Ile)
Methionine (Met)
Tryptophan (Trp)
Phenylalanine (Phe)
Proline (Pro)
polarne
Serine (Ser)
Threonine (Thr)
Cysteine (Cys)
Tyrosine (Tyr)
Asparagine (Asn)
Glutamine (Gln)
Nabite
Acidic
Aspartic Acid (Asp)
Glutamic Acid (Glu)
Lysine (Lys)
Basic
Arginine (Arg)
Histidine (His)
Dept. Biol. Penn State ©2002


Glicin
Alanin
Serin
Treonin
Asparagin
Glutamin

Esencialne aminokisline

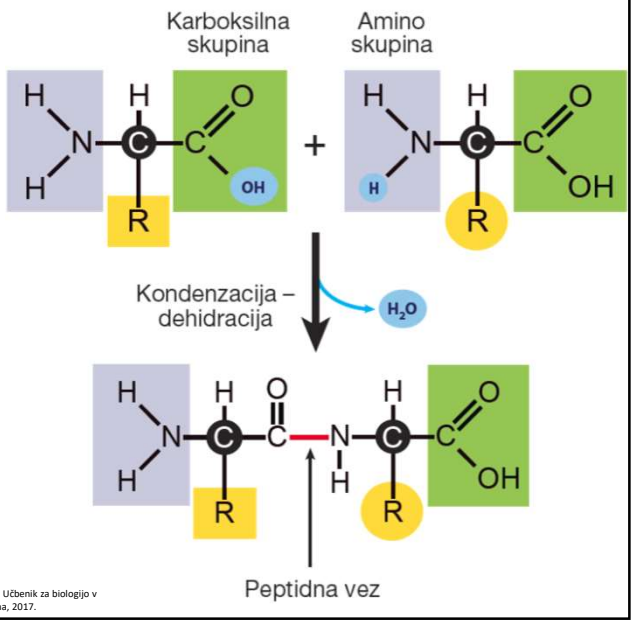


TVORBA PEPTIDNE VEZI

AMINOKISLINE se med seboj povezujejo s kovalentno vezjo med –COOH in $–NH_2$ skupino.

Rečemo ji tudi PEPTIDNA ali AMIDNA VEZ.

Beljakovine se povezujejo z reakcijo POLIMERIZACIJE (odcep H_2O).



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Polimer, ki nastane iz do preko 1000 aminokislin je **POLIPEPTID**.
Več kot 50 povezanih aminokislin oblikuje beljakovino imenovano **PROTEIN**.

Na sliki je polipeptid !
- Koliko aminokislin (aminokislinskih ostankov) ga gradi?
- Koliko peptidnih vezi vsebuje ta molekula?
- Označi amino skupino in karboksilno skupino!