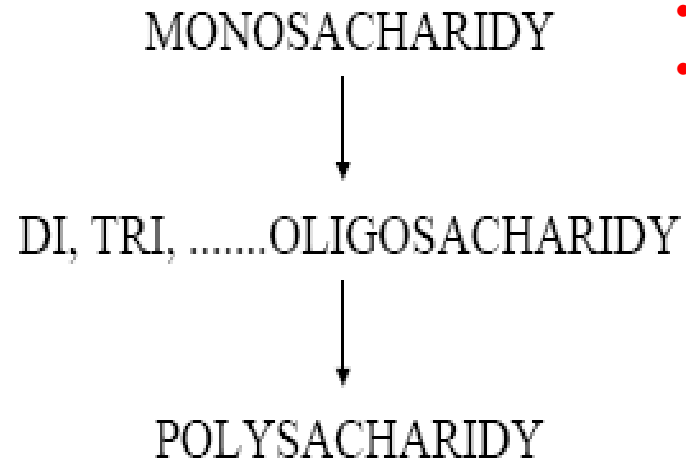


SACHARIDY

Sacharidy - *saccharum* - *cukr*

Synonyma : cukry - glycidy - uhlohydráty *carbohydrates* - $(\text{CH}_2\text{O})_n$

Funkce - zdroj energie **glukosa**
zásobní látky **glykogen, škrob**
stavební a podpůrná funkce **celulosa, chitin**
složky nukleotidů, koenzymů, glyko-proteinů, -lipidů
prekurzory aminokyselin, lipidů
antigenní determinanty buněk



- Fotosyntéza
- Glukoneogenese

Monosacharidy : → Nemohou být rozloženy na menší jednotky

chemicky - polyhydroxyaldehydy
- polyhydroxyketony

Rozdělení

A. podle povahy karbonylové skupiny

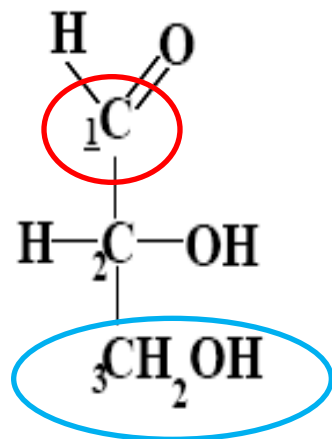
- ALDOSY
- KETOSY

B. podle počtu uhlíkových atomů - TRIOSY, TETROSY,
PENTOSY, HEXOSY, HEPTOSY,

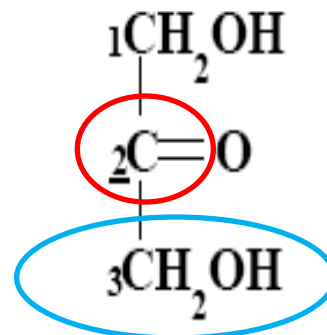
ALDOHEXOSA



Číslování



D - glyceraldehyd



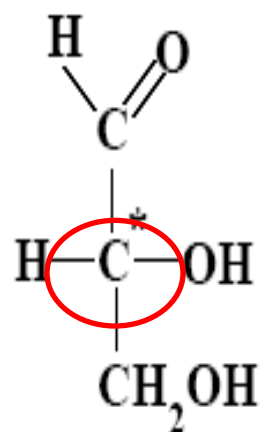
dihydroxyacetol

PRIMÁRNÍ HYDROXYLOVÁ SKUPINA

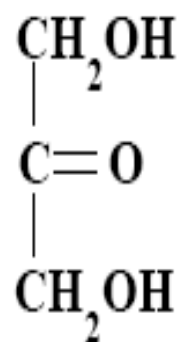
Názvosloví : triviální

aldosa -OSA

ketosa -ULOSA



D - glyceraldehyd



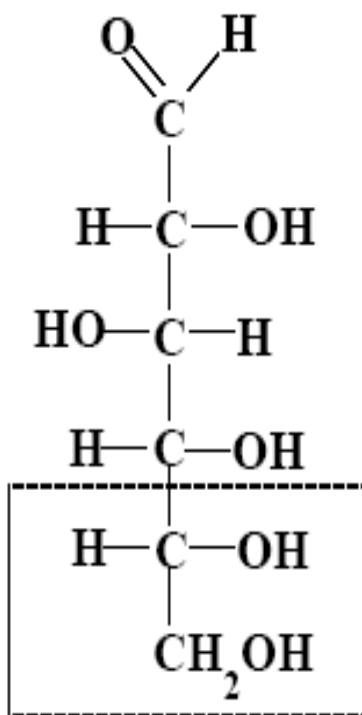
dihydroxyaceton

počet stereoizomerů = 2^x (x = počet C^*)

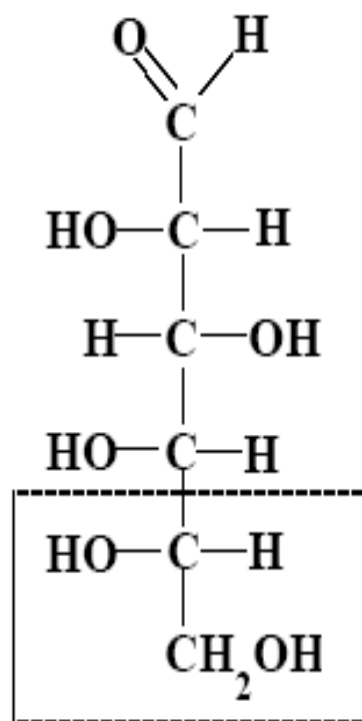
aldosy - $x = n - 2$

ketosy - $x = n - 3$

n = počet C atomů



D - glukosa



L - glukosa

Aldosy – 2^{n-2}

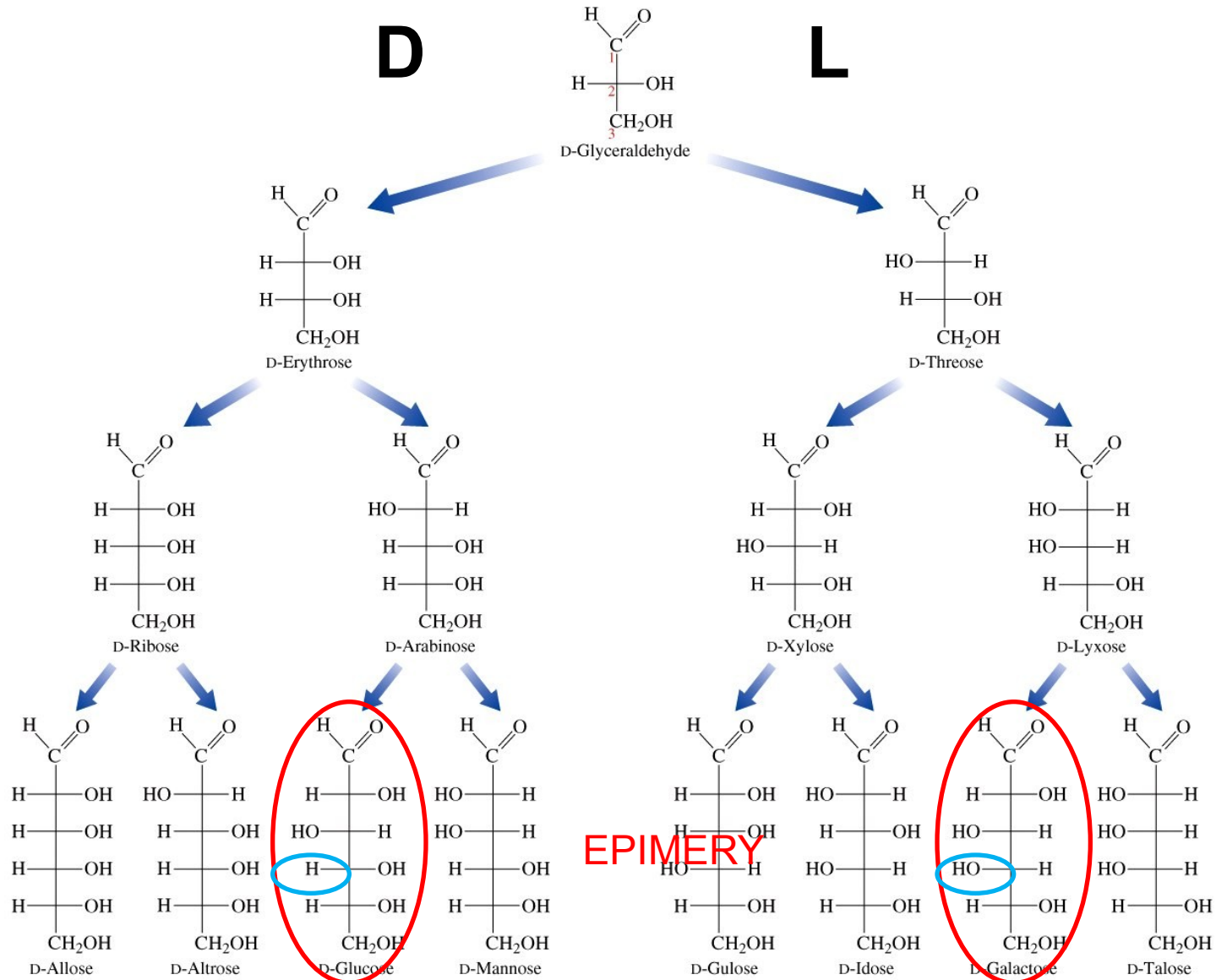


Figure 7-5 Concepts in Biochemistry, 3/e

Ketoses – 2^{n-3}

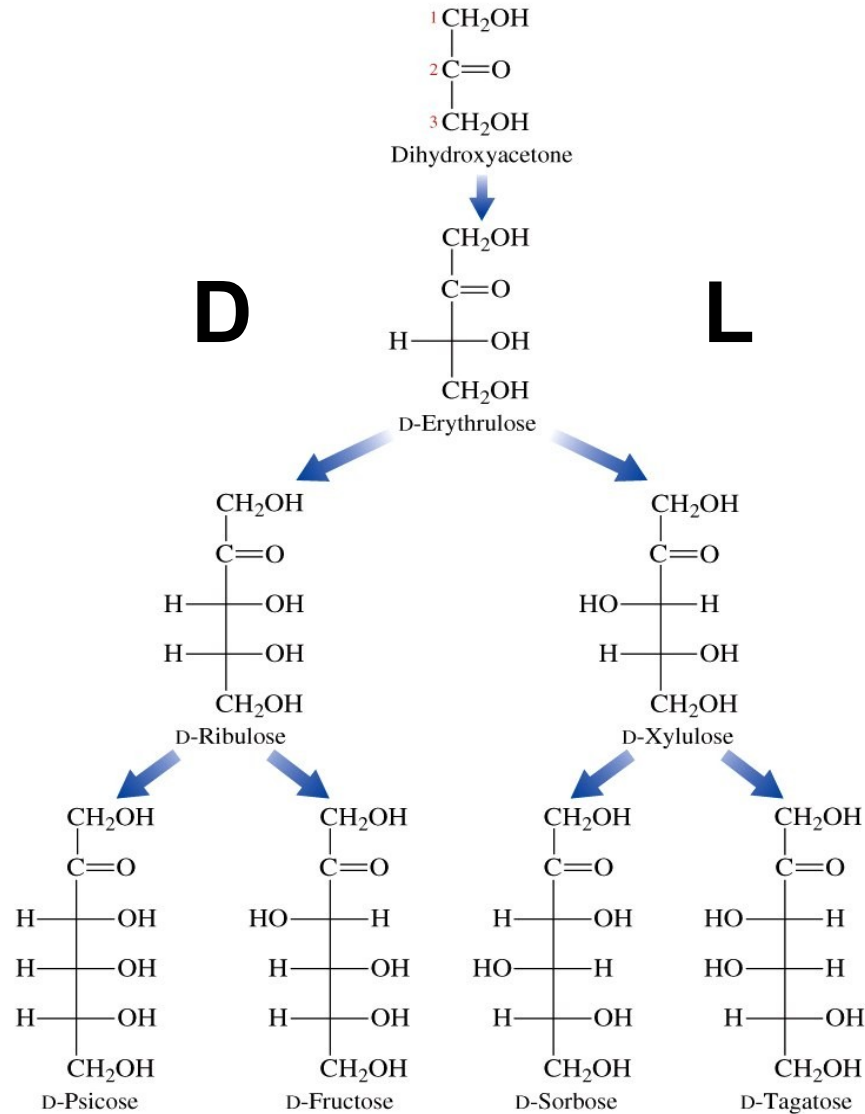
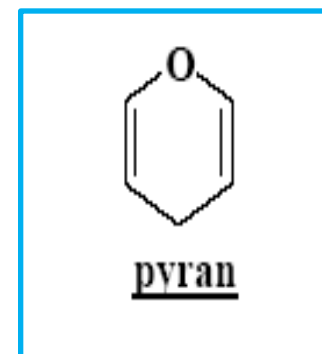
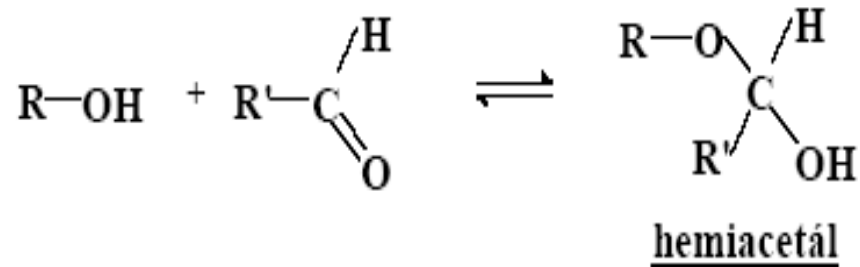
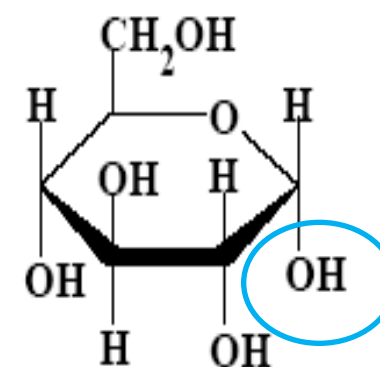
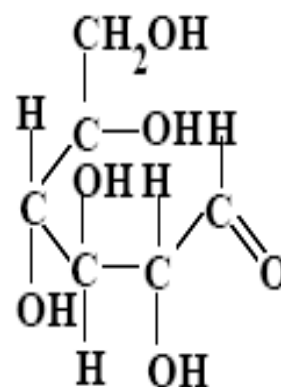
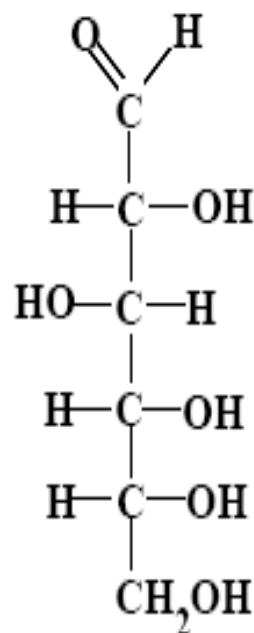


Figure 7-6a Concepts in Biochemistry, 3/e
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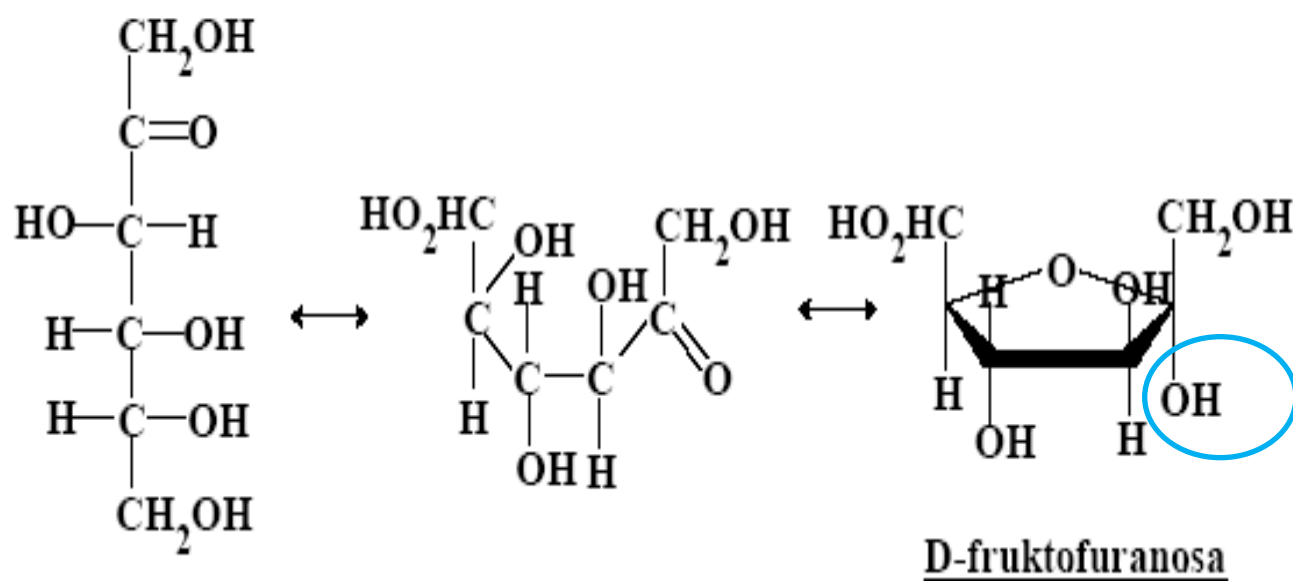
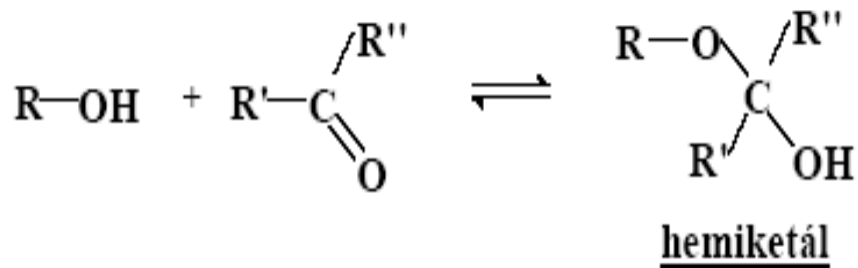
Fischerovy vzorce



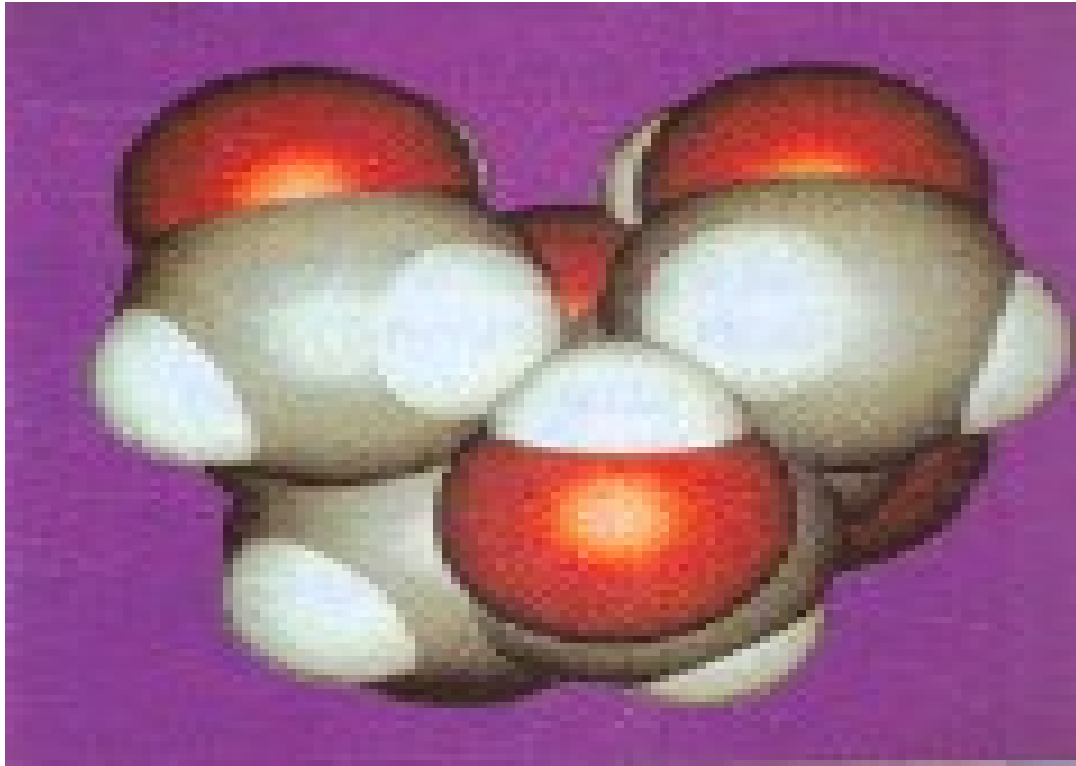
D-glukopyranosa

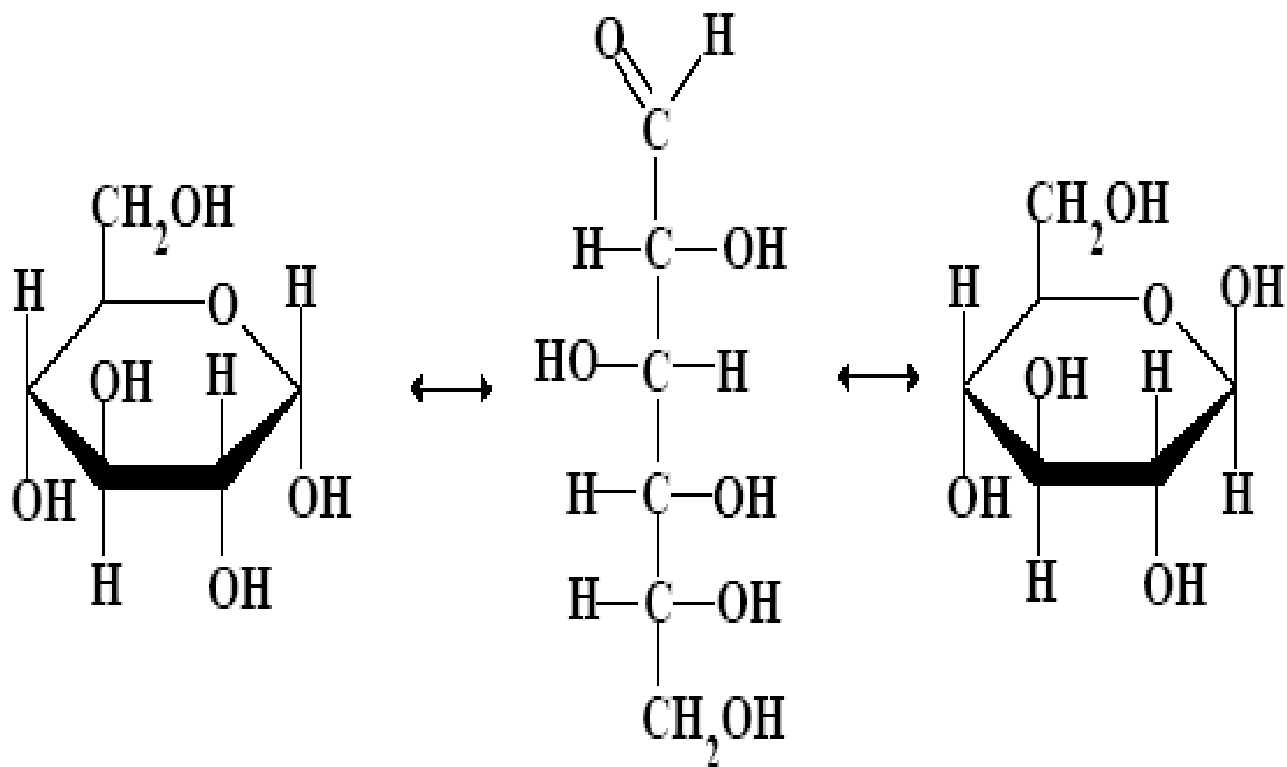
POLOACETÁLOVÝ HYDROXYL - 1



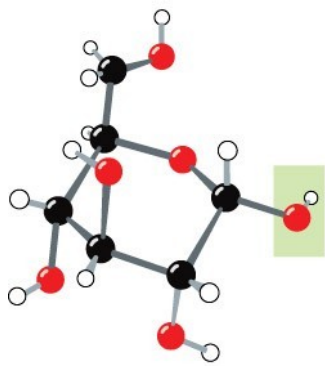


POLOACETÁLOVÝ HYDROXYL - 2

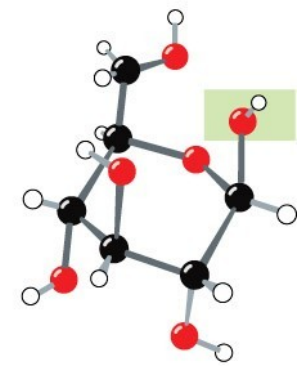
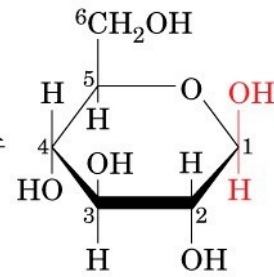
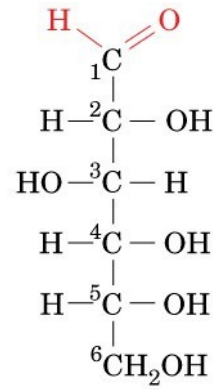
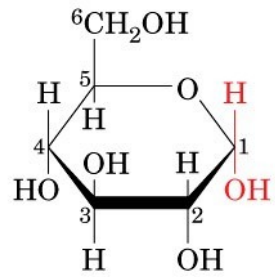




α -anomer (63 %) \longleftrightarrow MUTAROTACE \longleftrightarrow β -anomer (36 %)

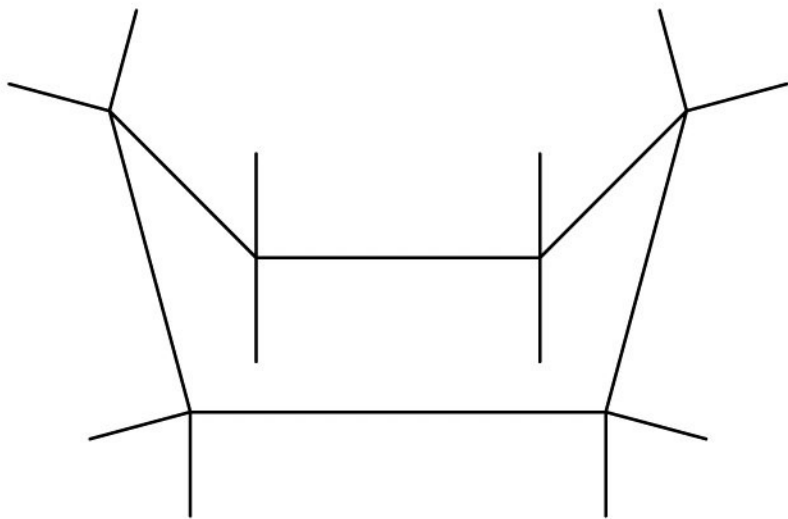


α -D-Glucopyranose

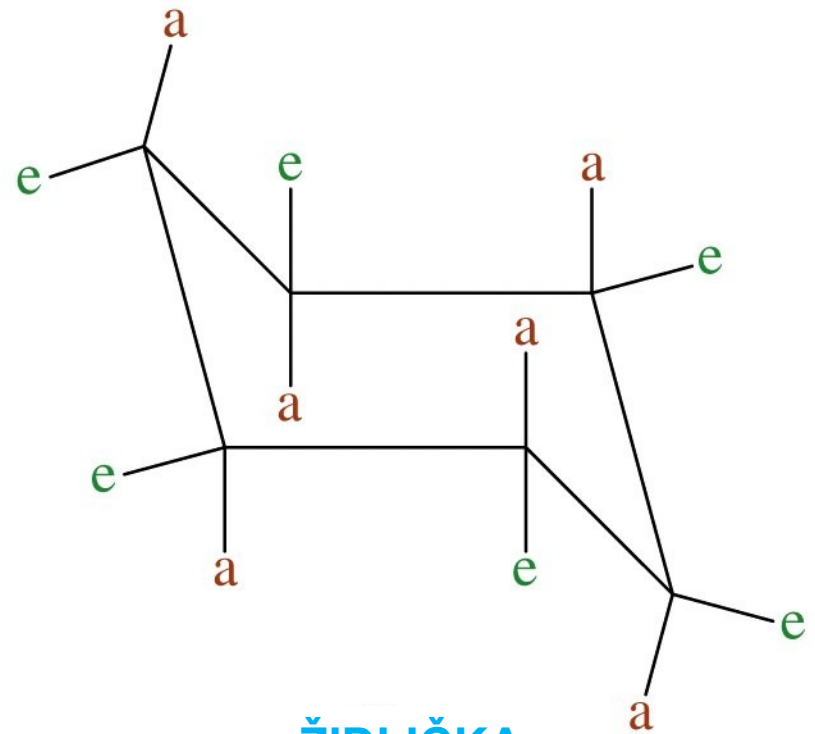


β -D-Glucopyranose

**D-Glucose
(linear form)**



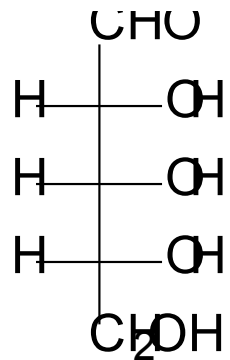
VANIČKA



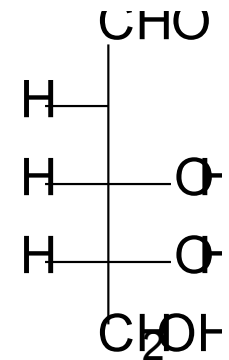
ŽIDLIČKA

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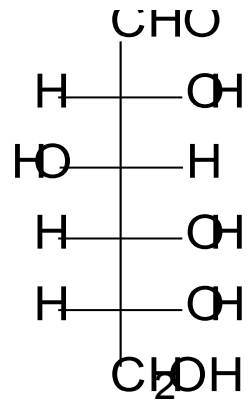
Fischerova projekce:



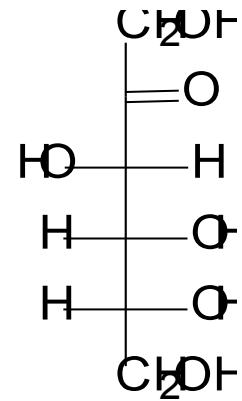
D-ribosa



2-deoxy-D-ribosa

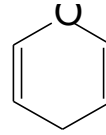
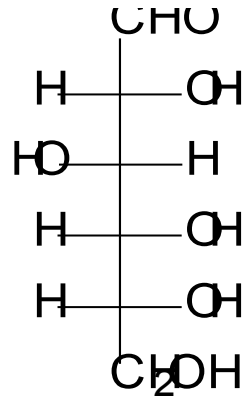


D-glukosa

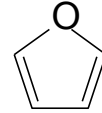


D-fruktosa

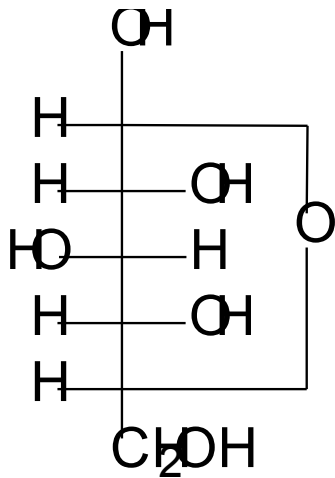
Tollensovy vzorce *D*-glukosy:



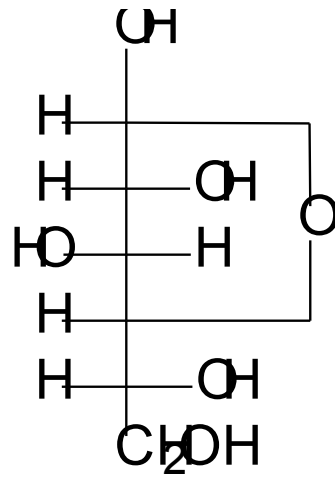
Pyran



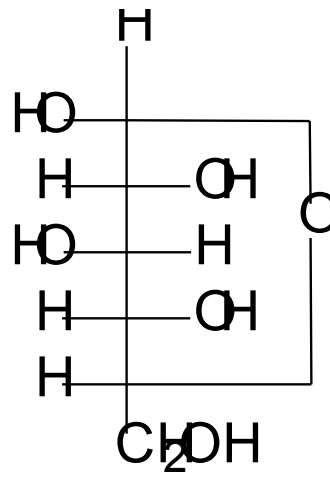
Furan



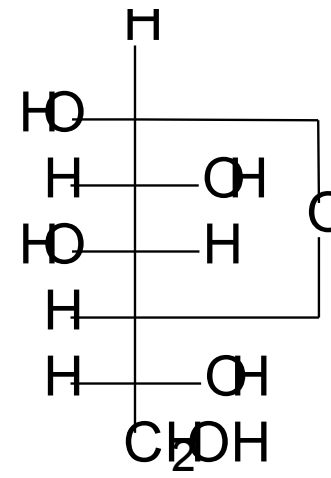
α-*D*-glukopyranosa



α-*D*-glukofuranosa

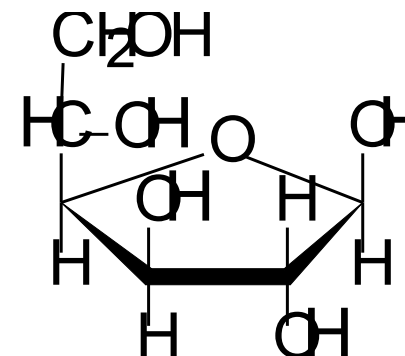
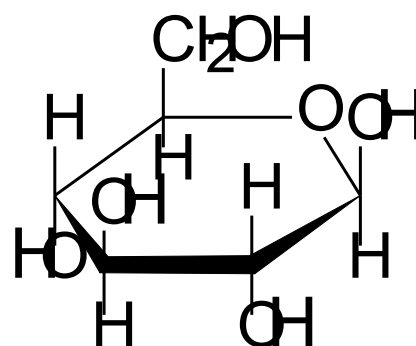
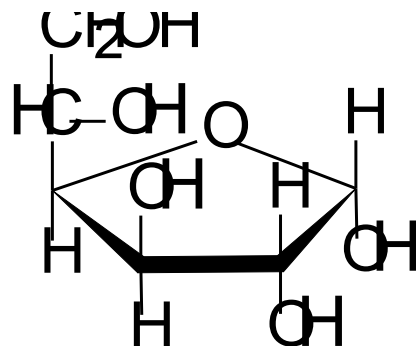
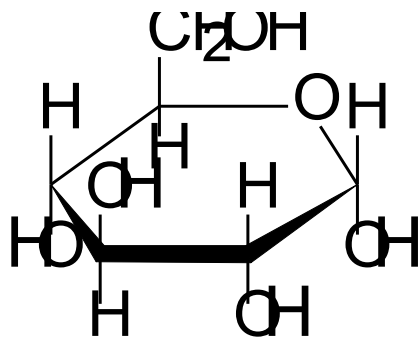
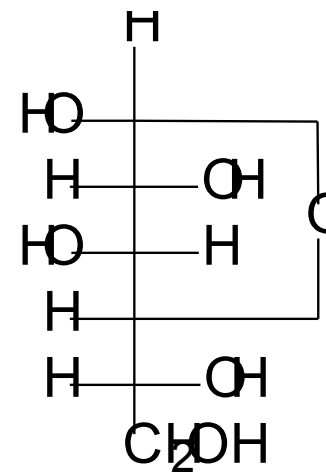
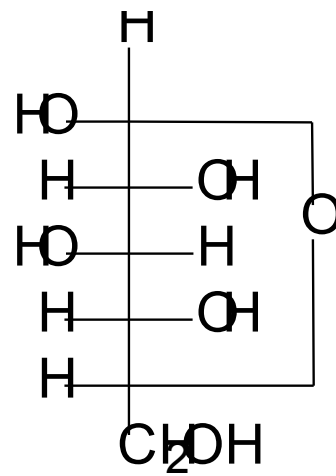
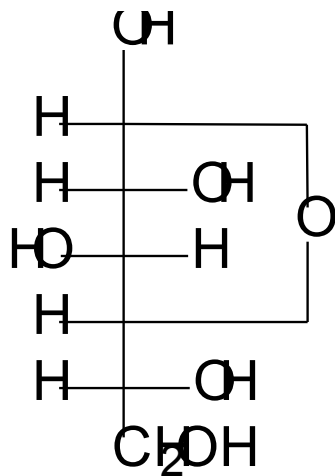
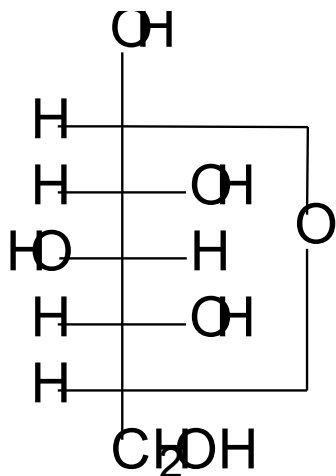


β-*D*-glukopyranosa



β-*D*-glukofuranosa

Haworthovy vzorce *D*-glukosy:



α -D-glukopyranosa

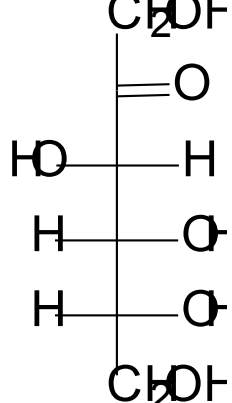
α -D-glukofuranosa

β -D-glukopyranosa

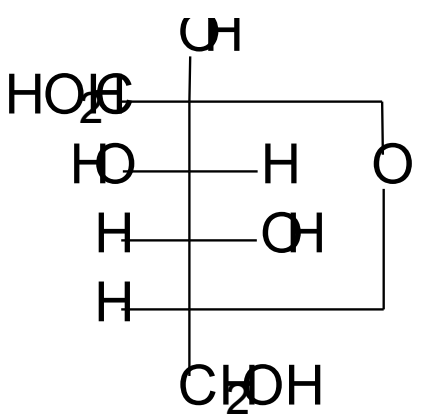
β -D-glukofuranosa

Vlevo – nad

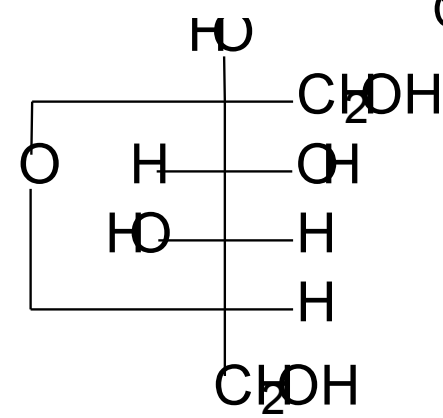
Vpravo - pod



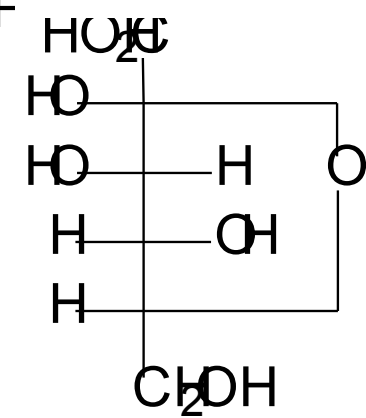
Tollensovy vzorce fruktofuranosy:



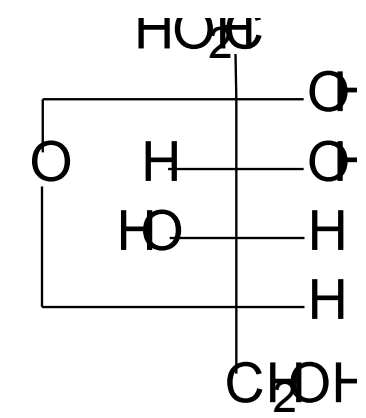
α-D-fruktofuranosa



α-L-fruktofuranosa

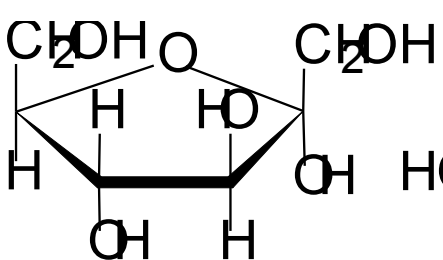


β-D-fruktofuranosa

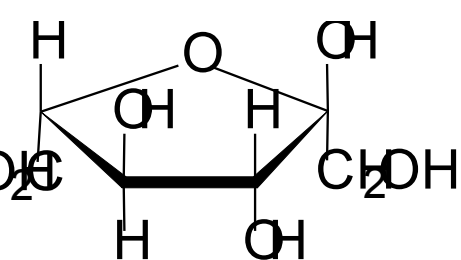


β-L-fruktofuranosa

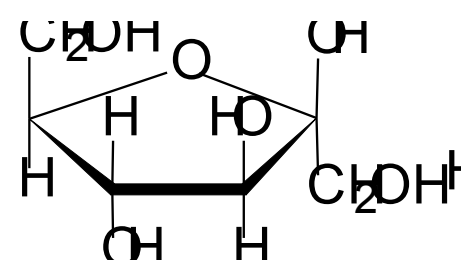
Haworthovy vzorce fruktofuranosy:



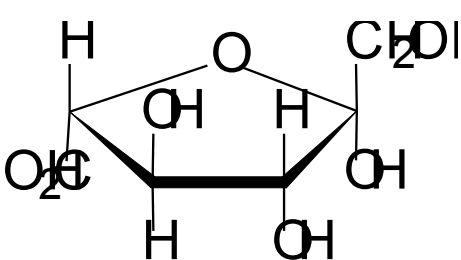
α-D-fruktofuranosa



α-L-fruktofuranosa



β-D-fruktofuranosa



β-L-fruktofuranosa

Přehled

Triosy - glycerinaldehyd, dihydroxyaceton

Tetrosy - threosa, erythrosa

Pentosy - ribosa, deoxyribosa

Hexosy - glukosa, manosa, galaktosa

fruktosa

Heptosa - sedoheptulosa

Aldosy

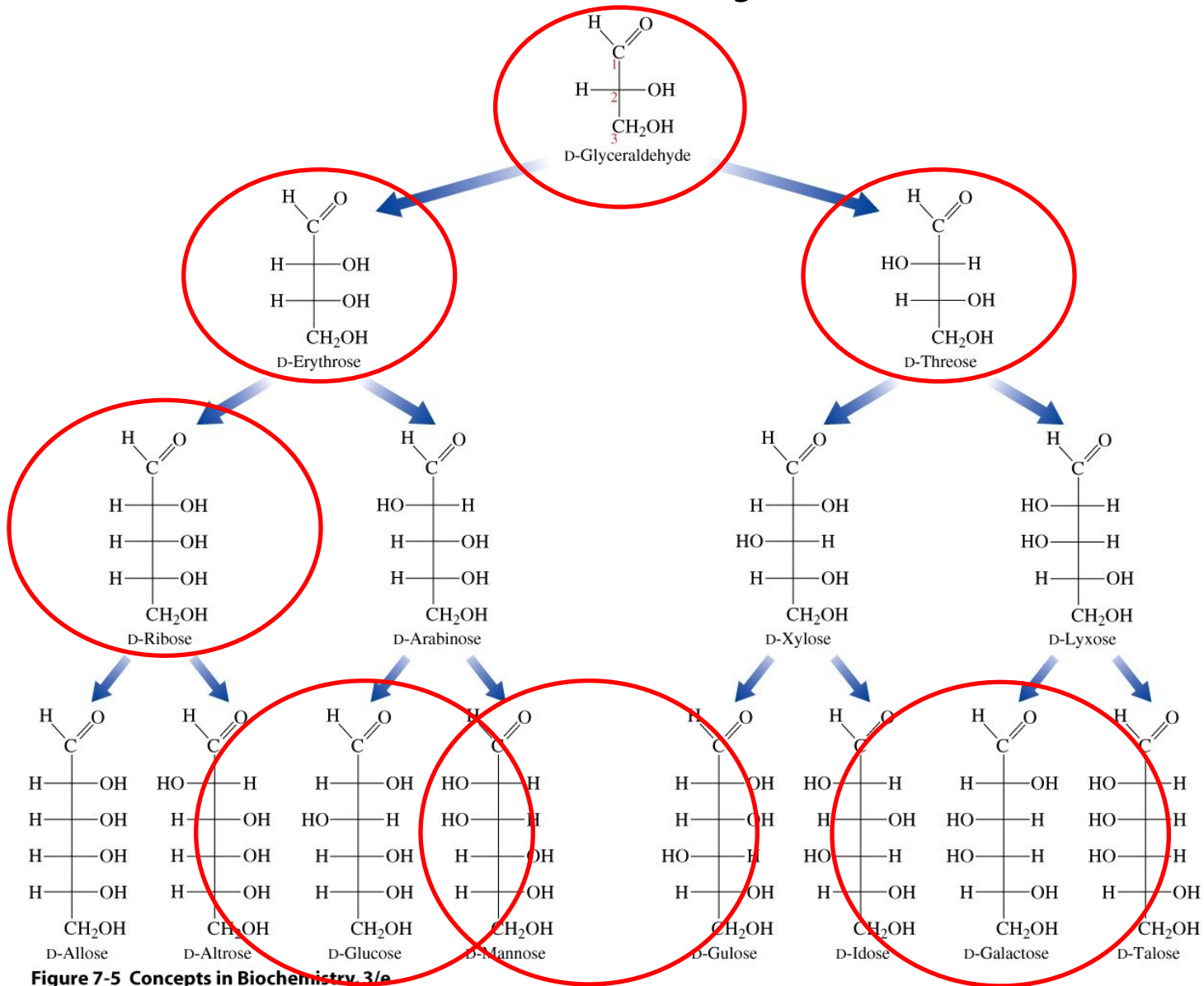


Figure 7-5 Concepts in Biochemistry, 3/e

Ketose

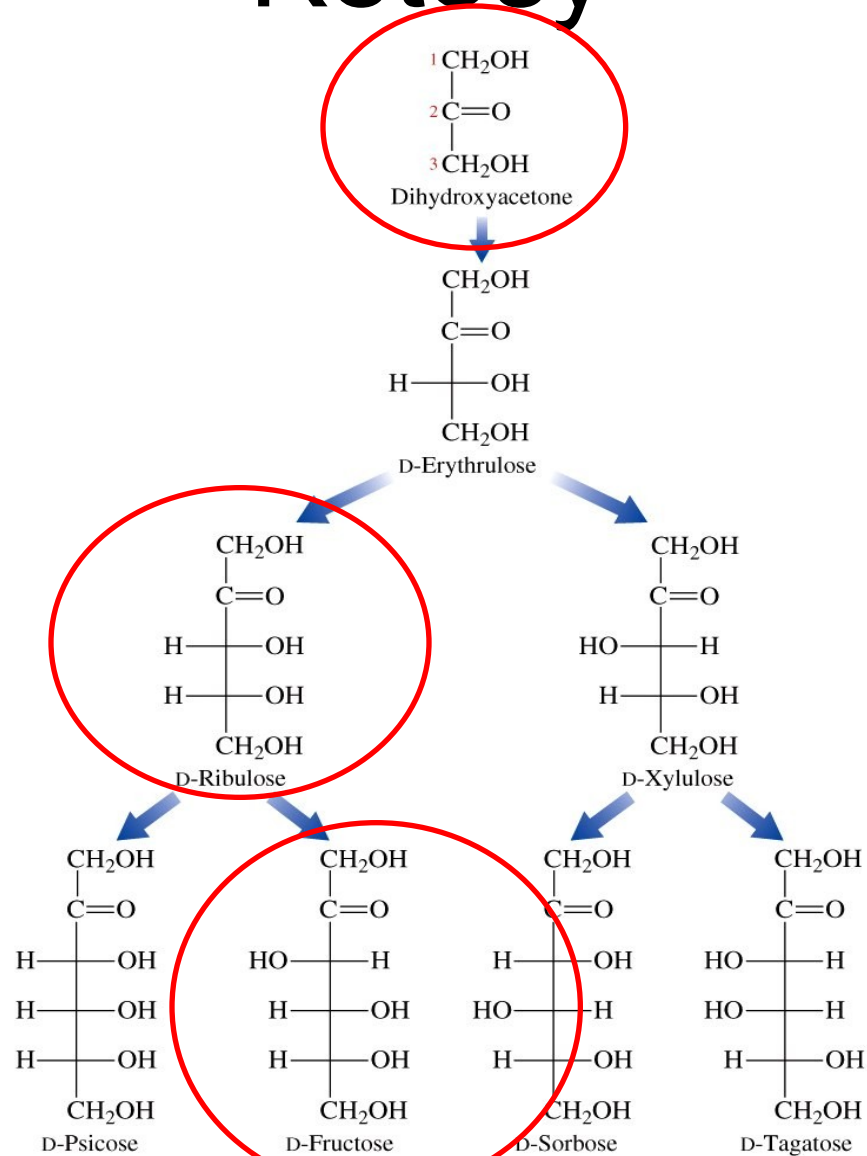
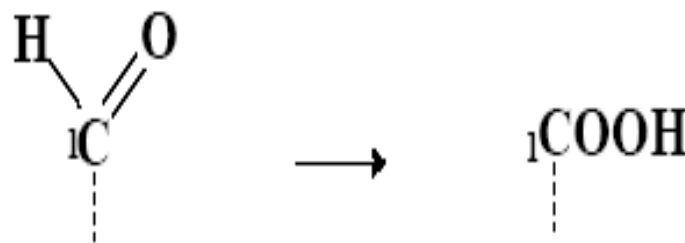


Figure 7-6a Concepts in Biochemistry, 3/e
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Deriváty monosacharidů

Oxidace :

A. Mírná \Rightarrow aldehydická skupina \rightarrow karboxylovou skupinu



ALDONOVÉ KYSELINY - glukosa \rightarrow k. glukonová

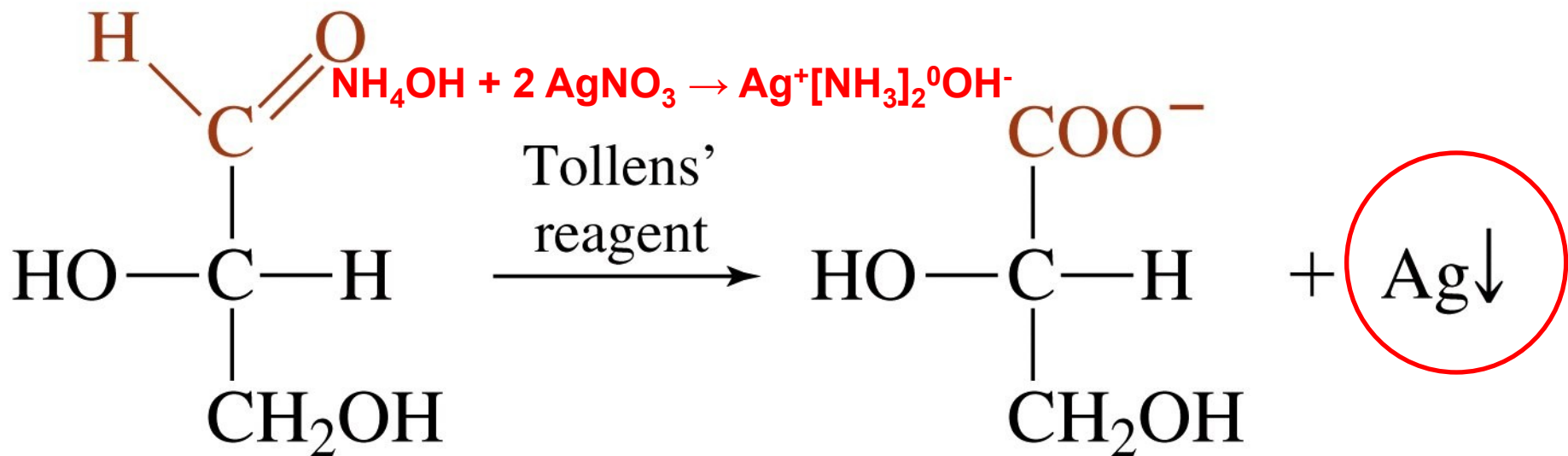


Figure 7-11a Concepts in Biochemistry, 3/e
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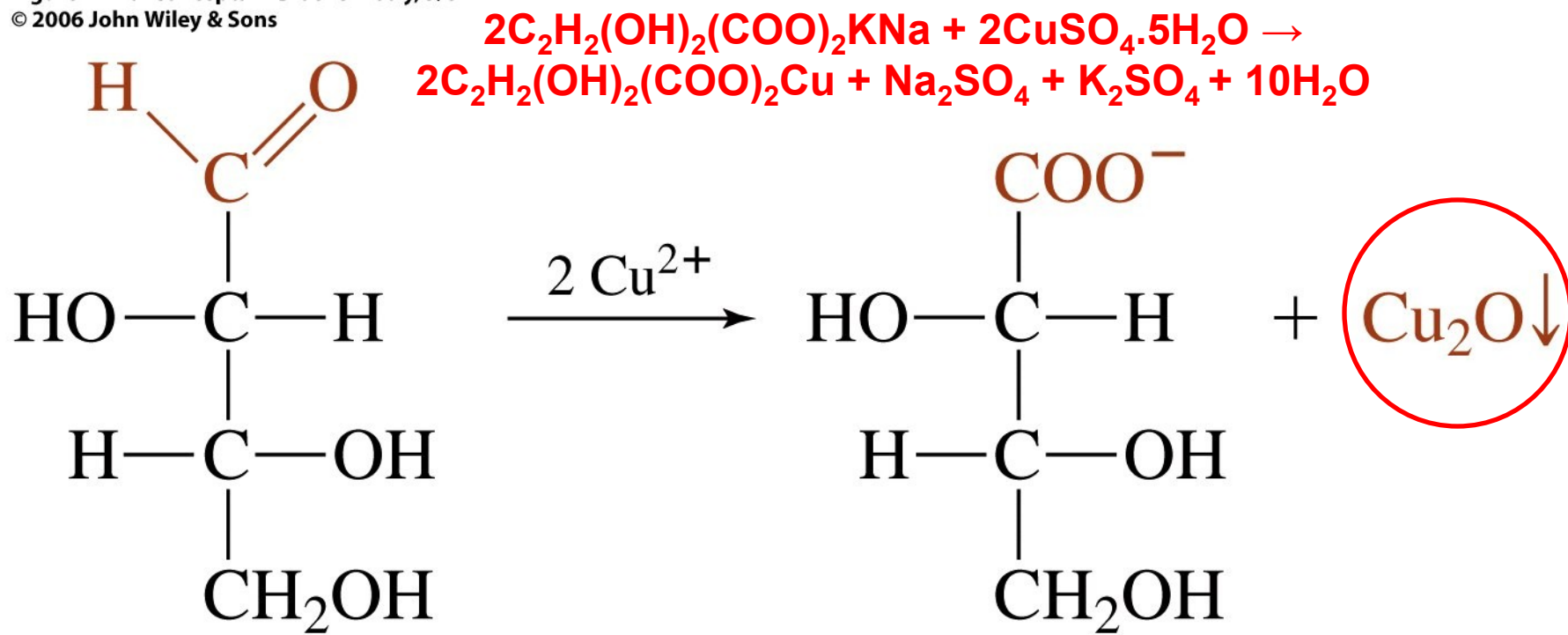


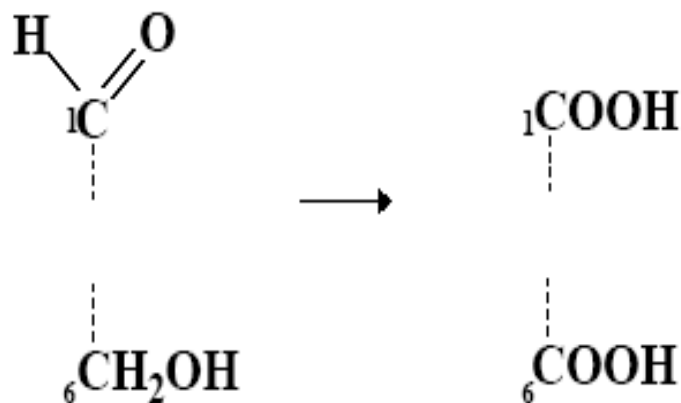
Figure 7-11b Concepts in Biochemistry, 3/e
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B. Specifická \Rightarrow primární OH skupina \rightarrow karboxylovou skupinu



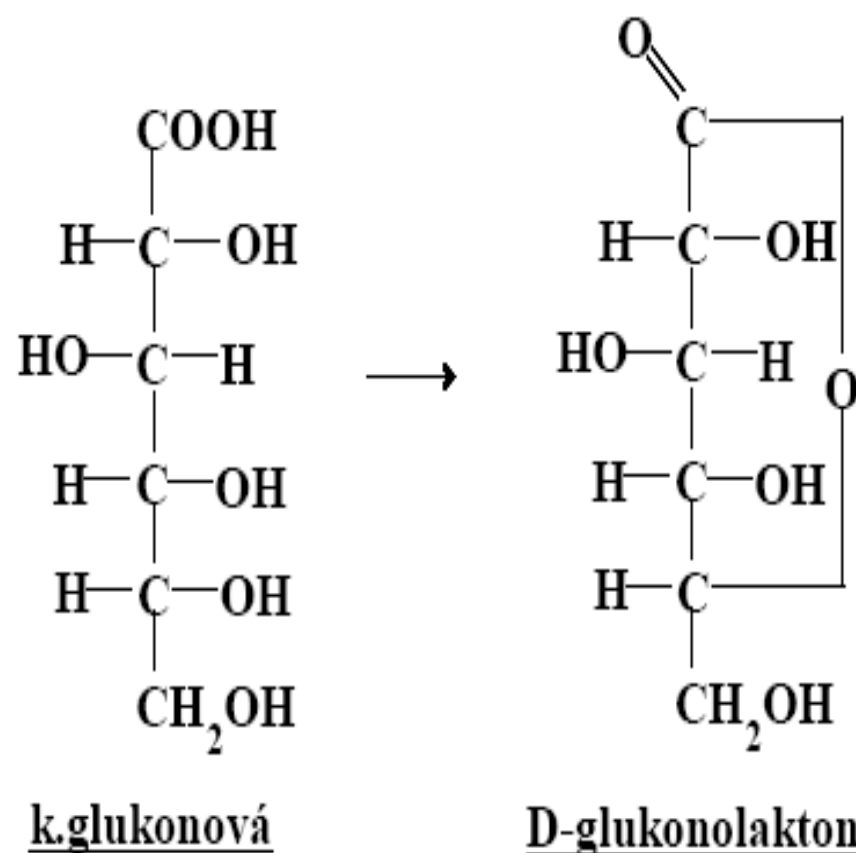
URONOVÉ KYSELINY - glukosa \rightarrow k. glukuronová

C. Silná \Rightarrow aldehydická skupina + primární OH skupina



ALDAROVÉ KYSELINY - glukosa \rightarrow k. glukarová

Tvorba laktonů u aldonových a uronových kyselin



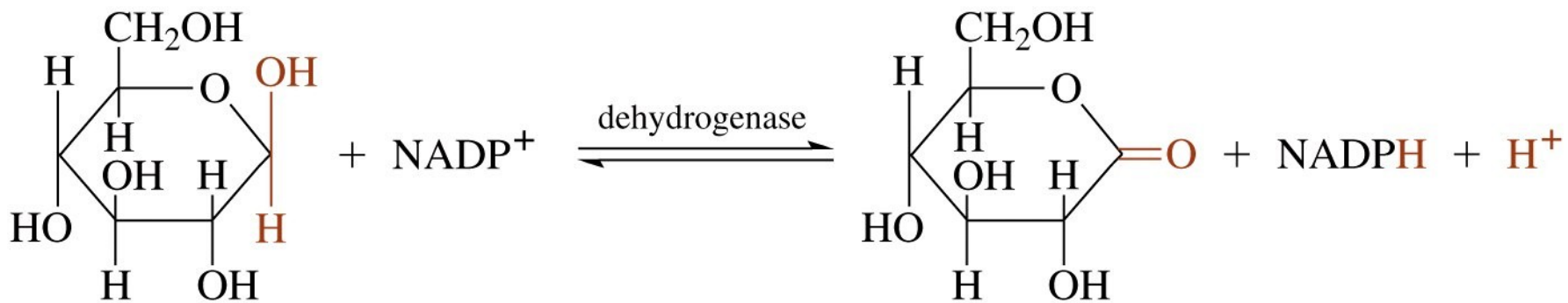
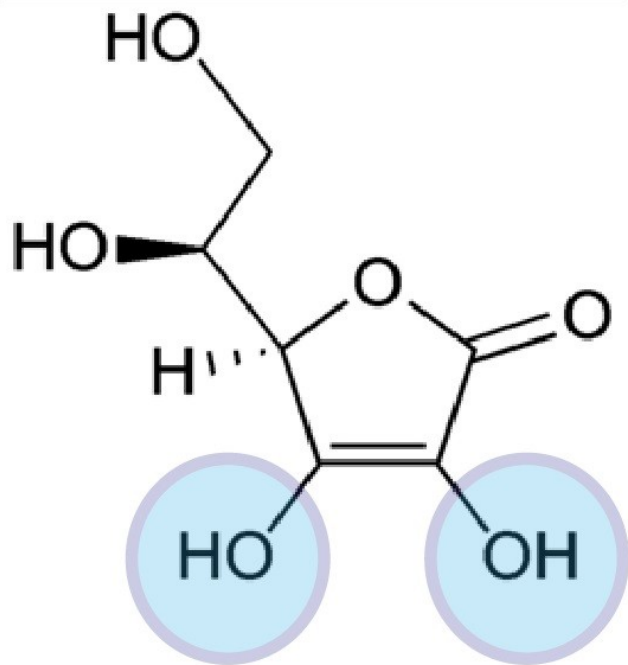
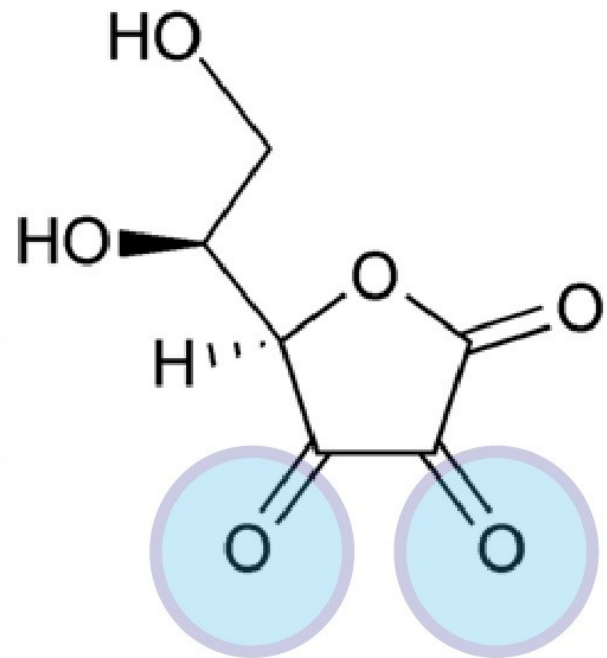
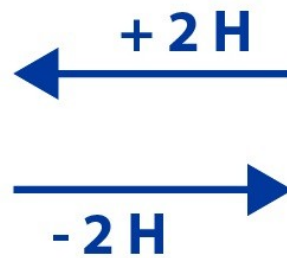


Figure 7-11c Concepts in Biochemistry, 3/e
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L-askorbová kyselina

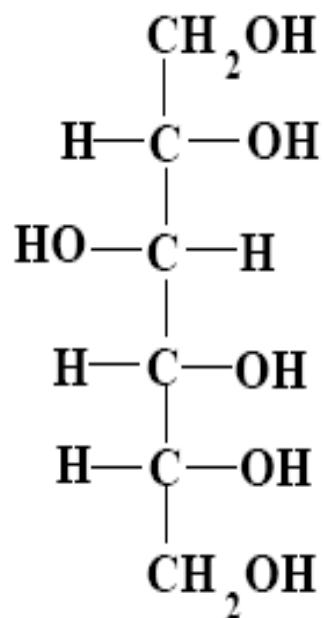


L-dehydroaskorbová kyselina

Redukce :

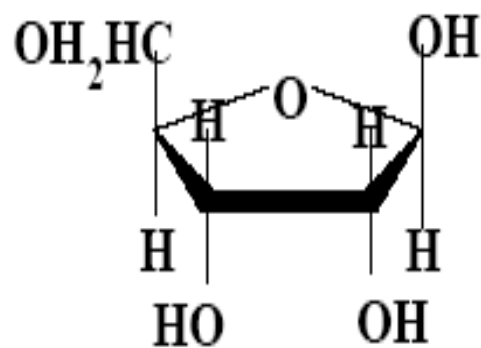
mírná \Rightarrow karbonylová skupina \rightarrow hydroxy skupinu

POLYHYDROXYALKOHOLY - ALDITOLY -itol

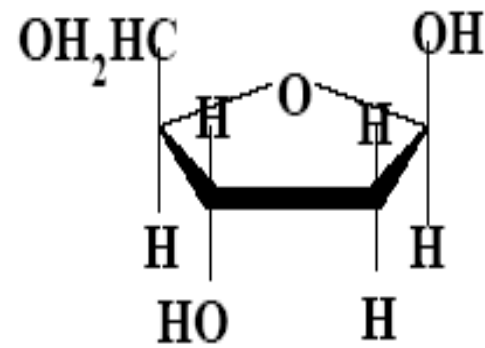


GLUCITOL - SORBITOL

Deoxycukry - OH skupina nahrazena H

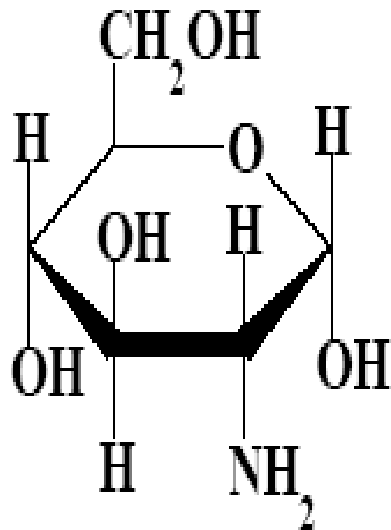


RIBOSA

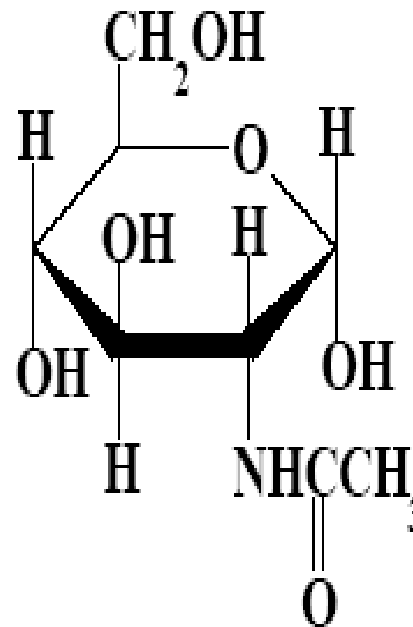


DEOXYRIBOSA

Aminocukry - OH skupina nahrazena NH₂ skupinou



GLUKOSAMIN

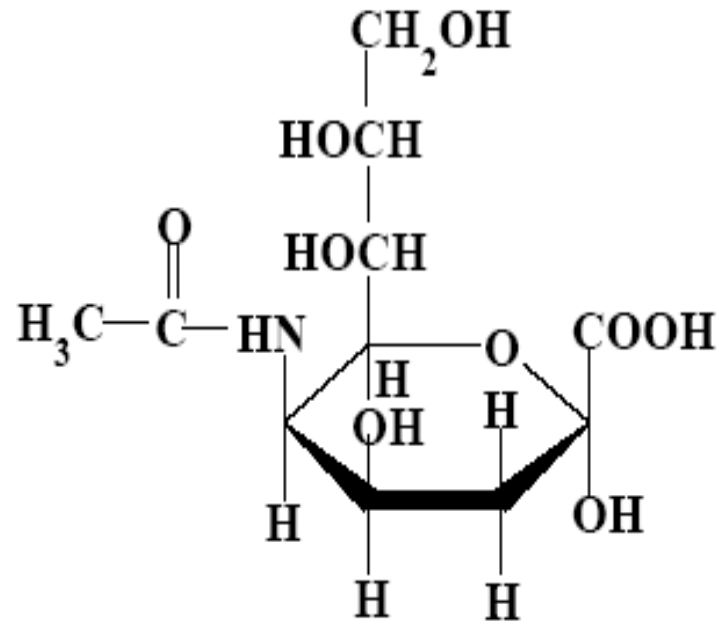


N-ACETYLGLUKOSAMIN

N-acetylglucosamin – chitin

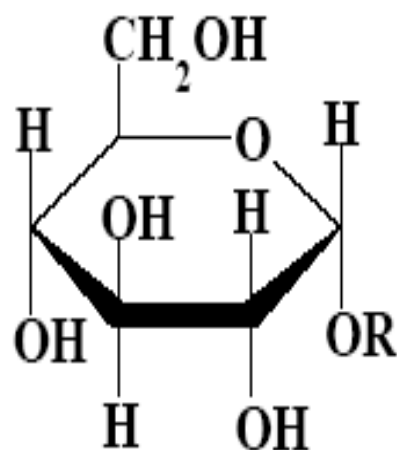
N-acetylgalaktosamin – chondrotinisulfát

Sialové kyseliny - kondenzace N-acetylmanosaminu + pyruvátu



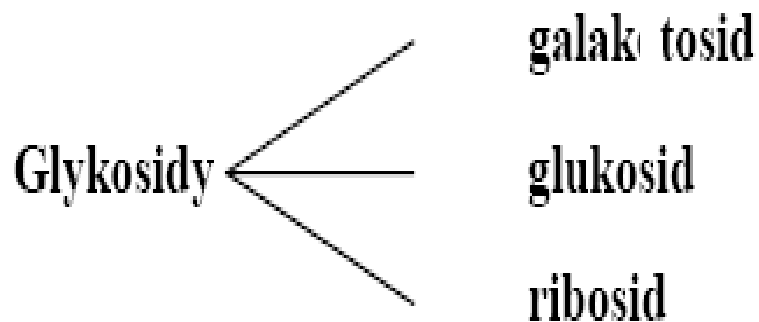
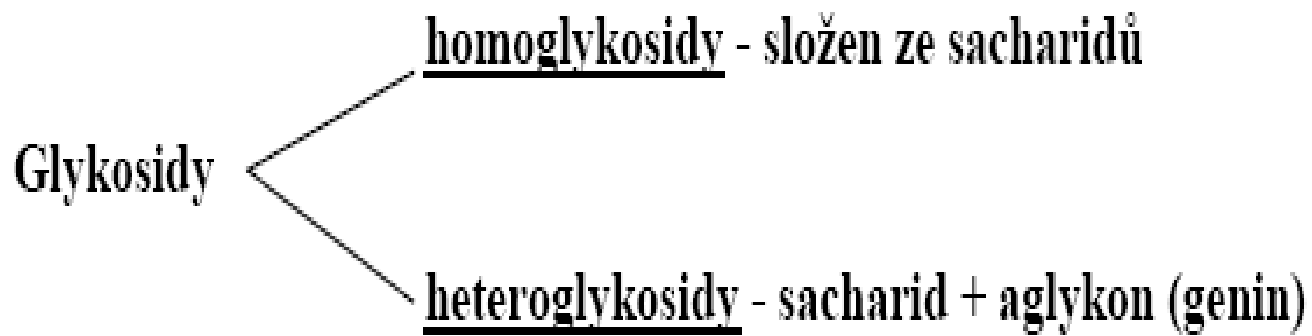
K. SIALOVÁ

Glykosidy :



O-glukosid

glykosidická vazba - OR, SR, NR - specificky štěpí glykosidasy



Disacharidy :

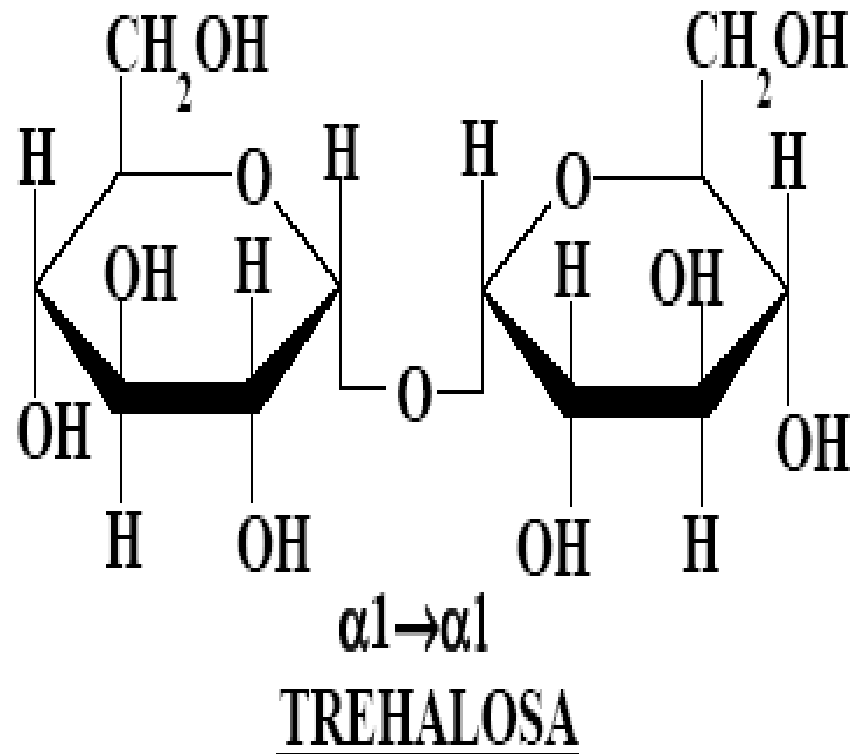
A. Neredukující - trehalosový typ - yl - id

O - α - D - glukopyranosyl (1 \rightarrow 1) - α - D - glukopyranosid

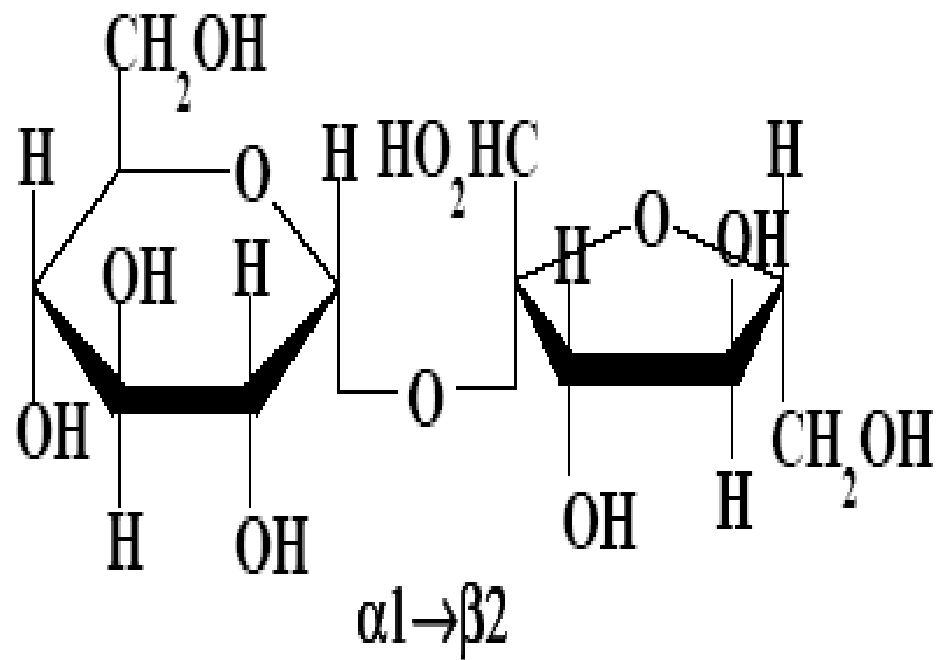
B. Redukující - maltosový typ - yl - osa

O - α - D - glukopyranosyl (1 \rightarrow 4) - α - D - glukopyranosa

Neredukující disacharidy



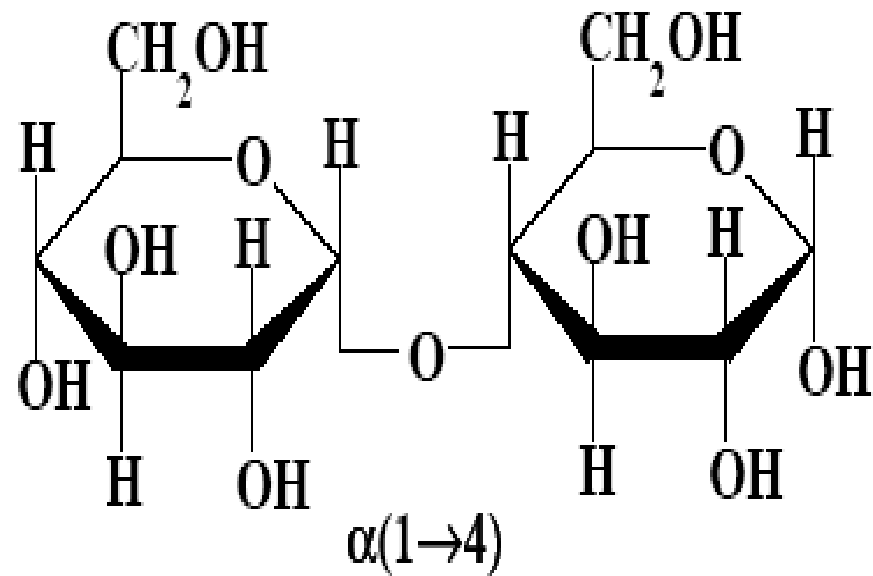
O - α - D - glukopyranosyl (1 \rightarrow 1) - α - D - glukopyranosid



SACHAROSA

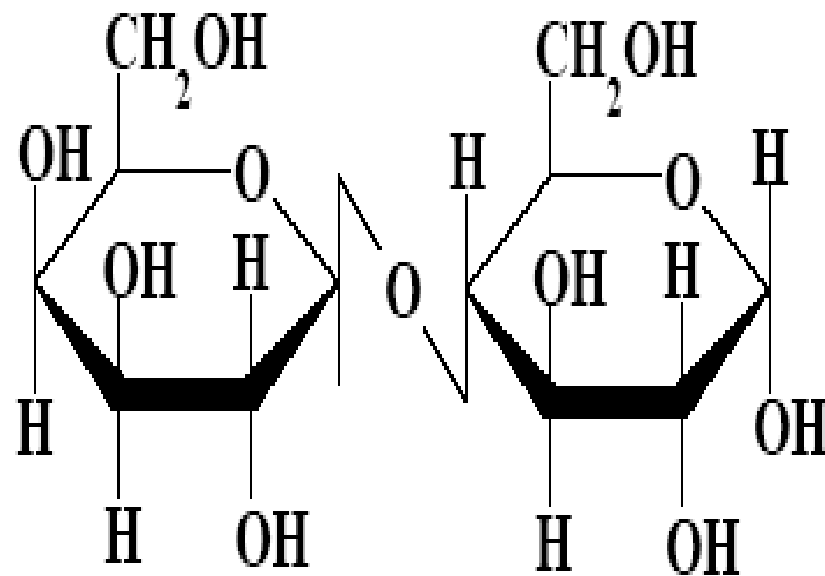
O - α - D - glukopyranosyl (1→2) - β - D - fruktofuranosid

Redukující disacharidy



MALTOSA

O - α - D - glukopyranosyl (1 \rightarrow 4) - α - D - glukopyranosa

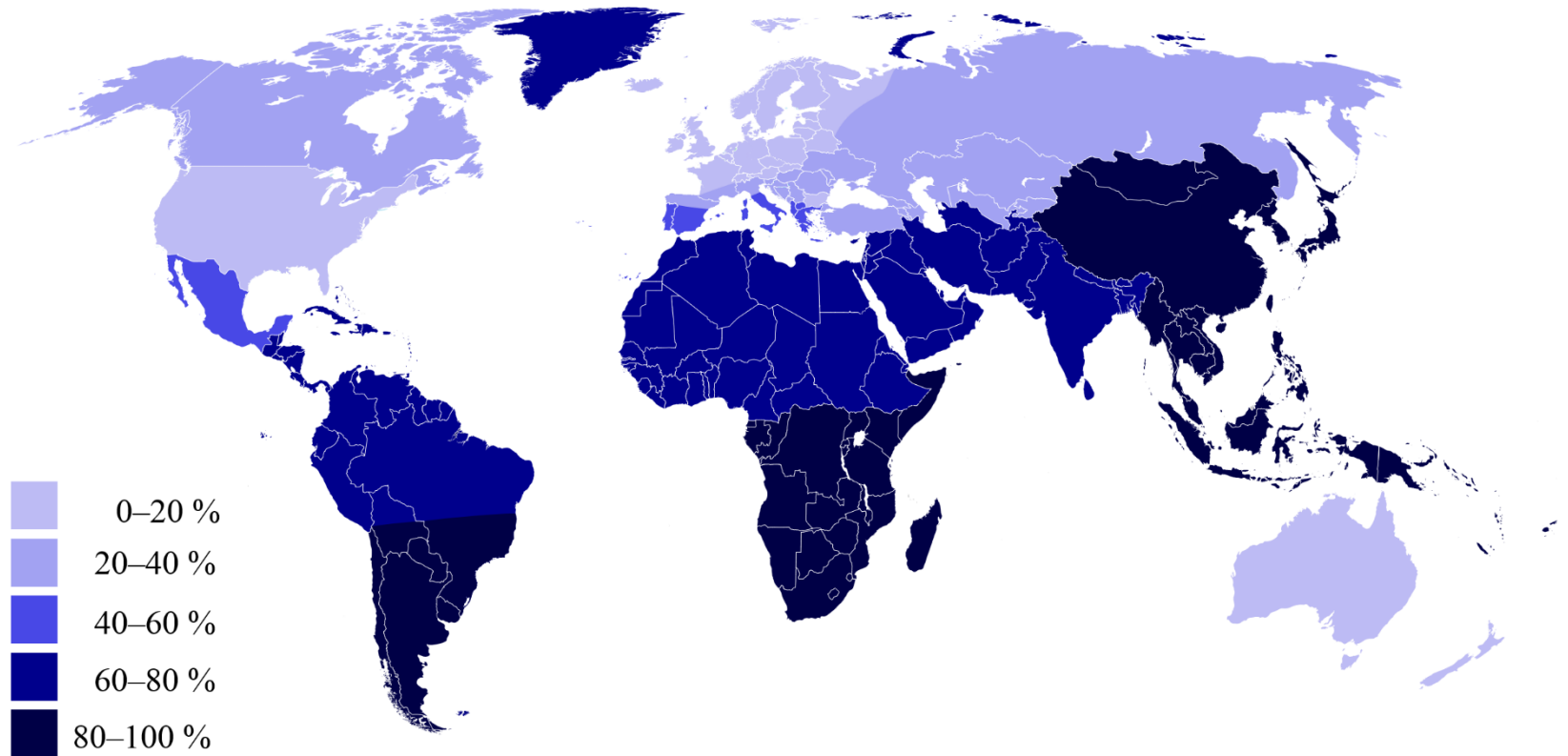


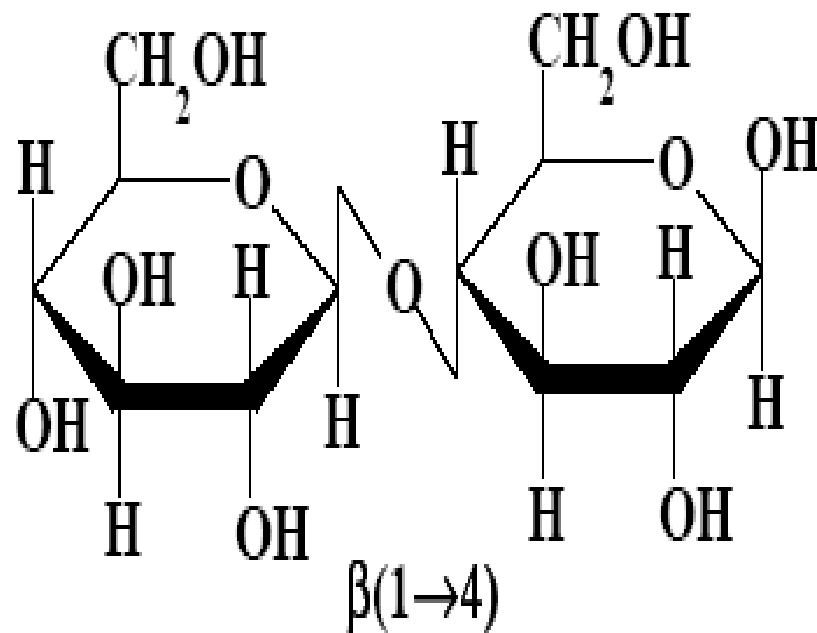
$\beta(1\rightarrow4)$

LAKTOSA

O - β - D - galaktopyranosyl (1 \rightarrow 4) - β - D - glukopyranosa

Intolerance na laktosu

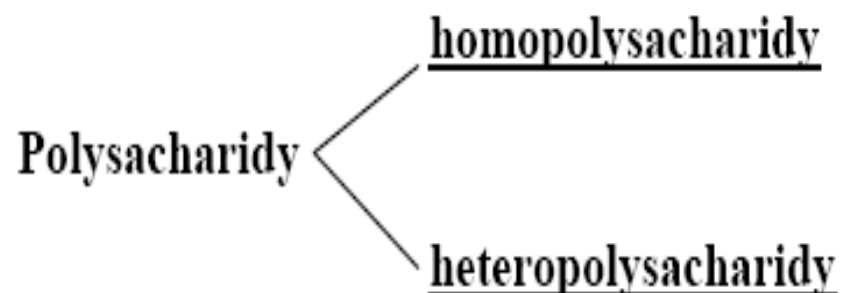




CELLOBIOSA

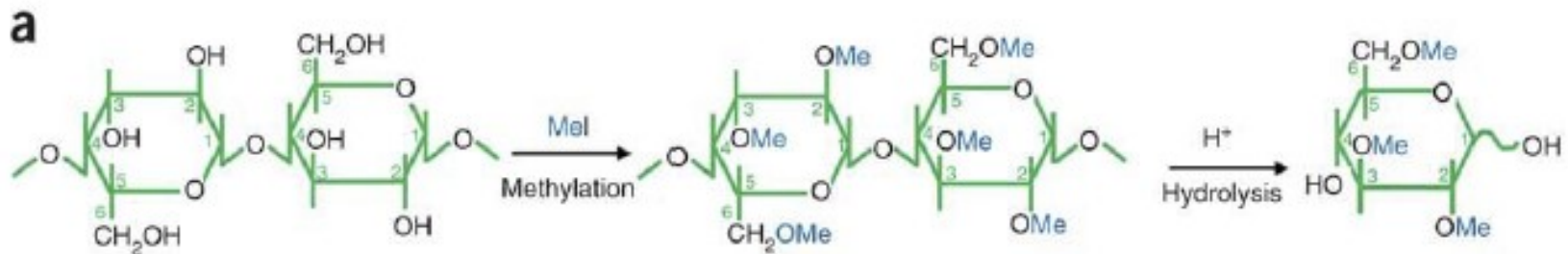
O - β -D - glukopyranosyl (1 \rightarrow 4) - β -D - glukopyranosa

Polysacharidy :



- Funkce - stavební
- zásobní

Metylační analýza



HOMOPOLYSACHARIDY

Stavební homopolysacharidy :

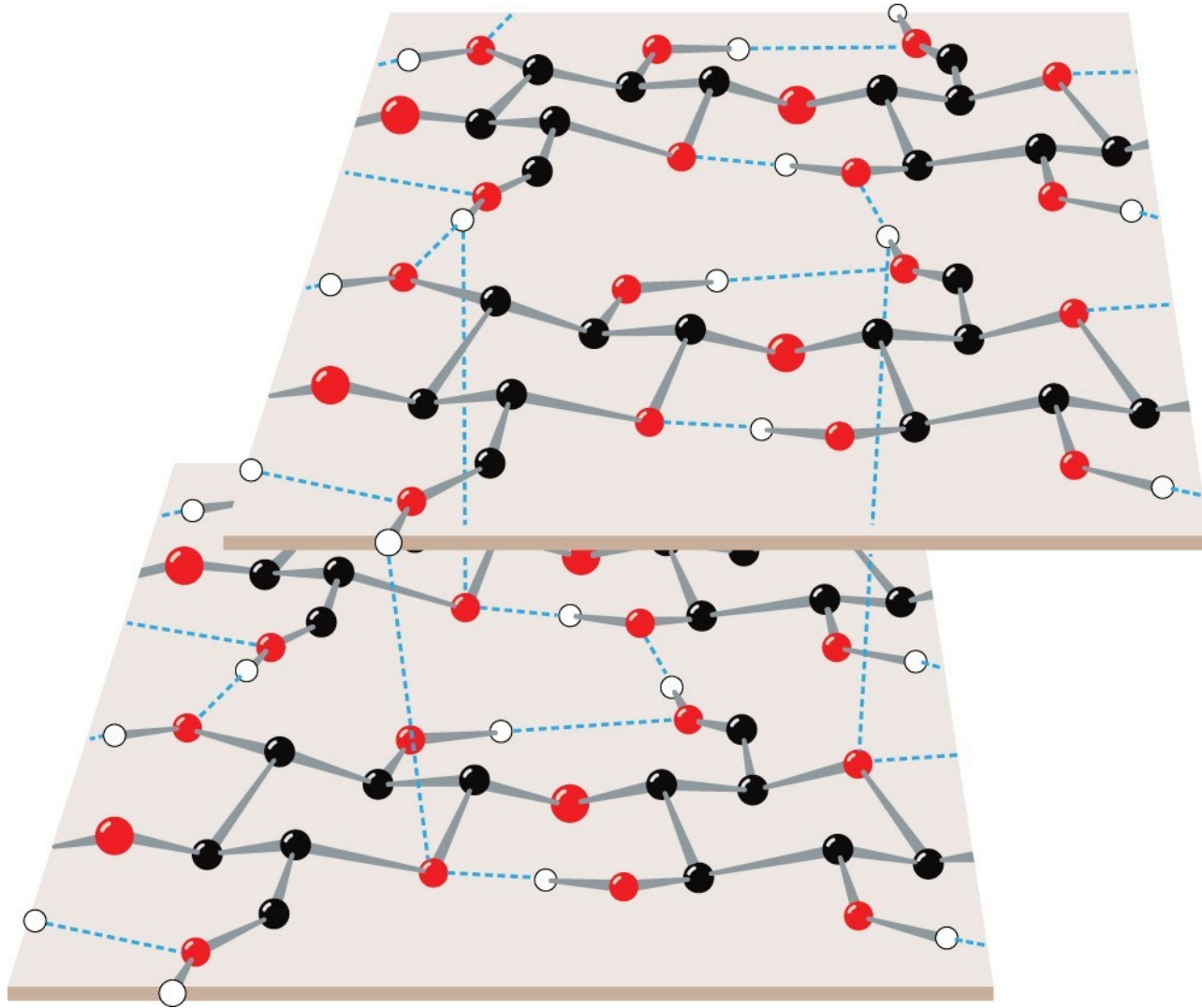
CELULOZA - glukosa (celobiosa)

CHITIN - N-acetylglukosamin

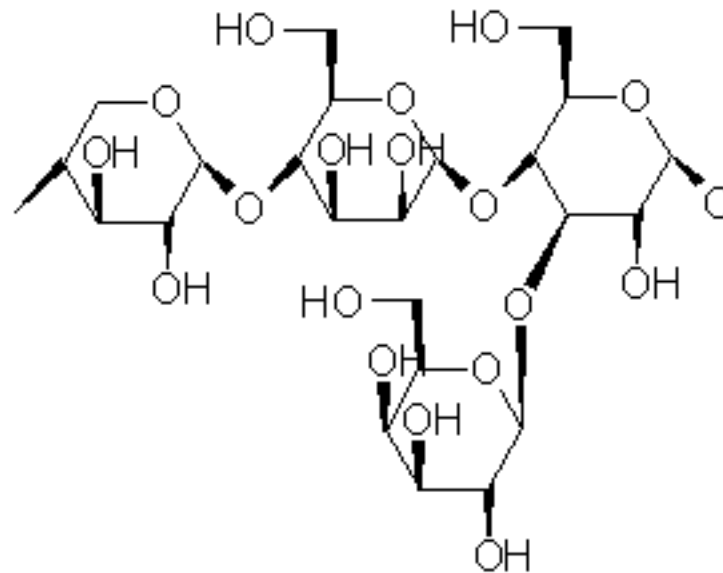
AGAROSA - galaktosa + 3, 6 - anhydrogalaktosa

PEKTINY - galakturonová kyselina

Celulosa



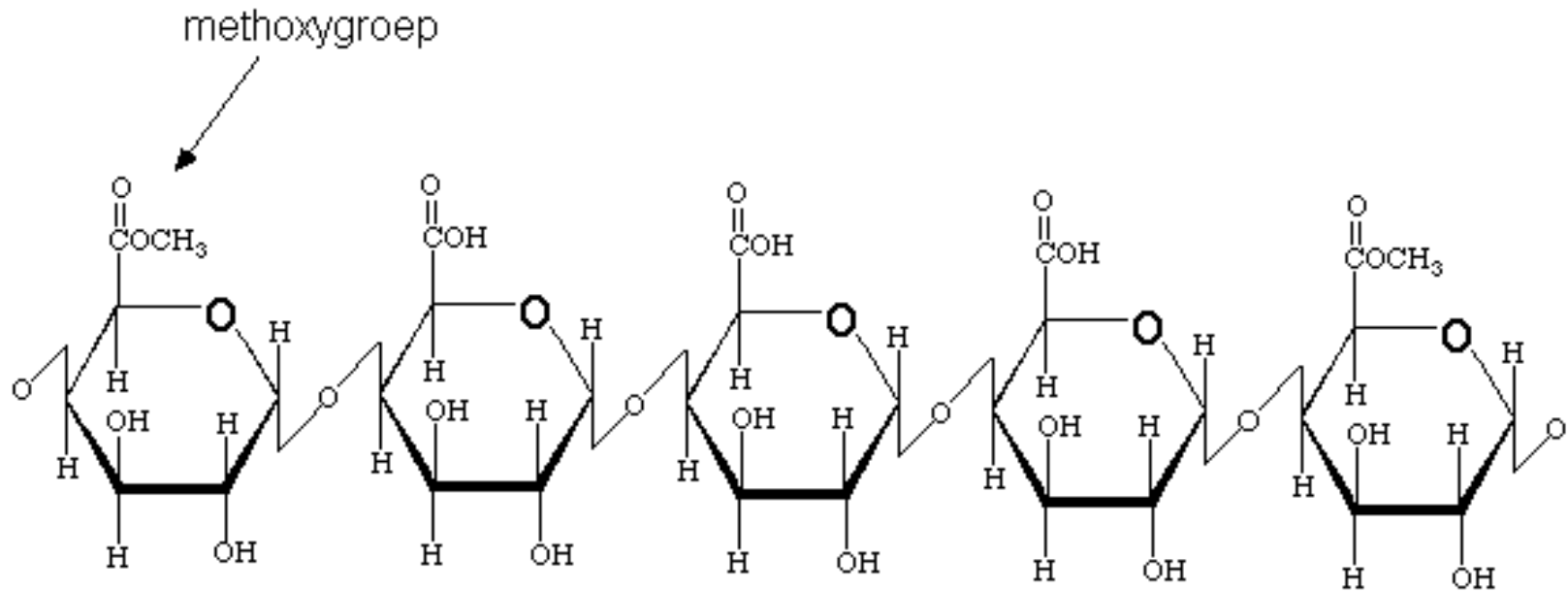
Hemicelulosa

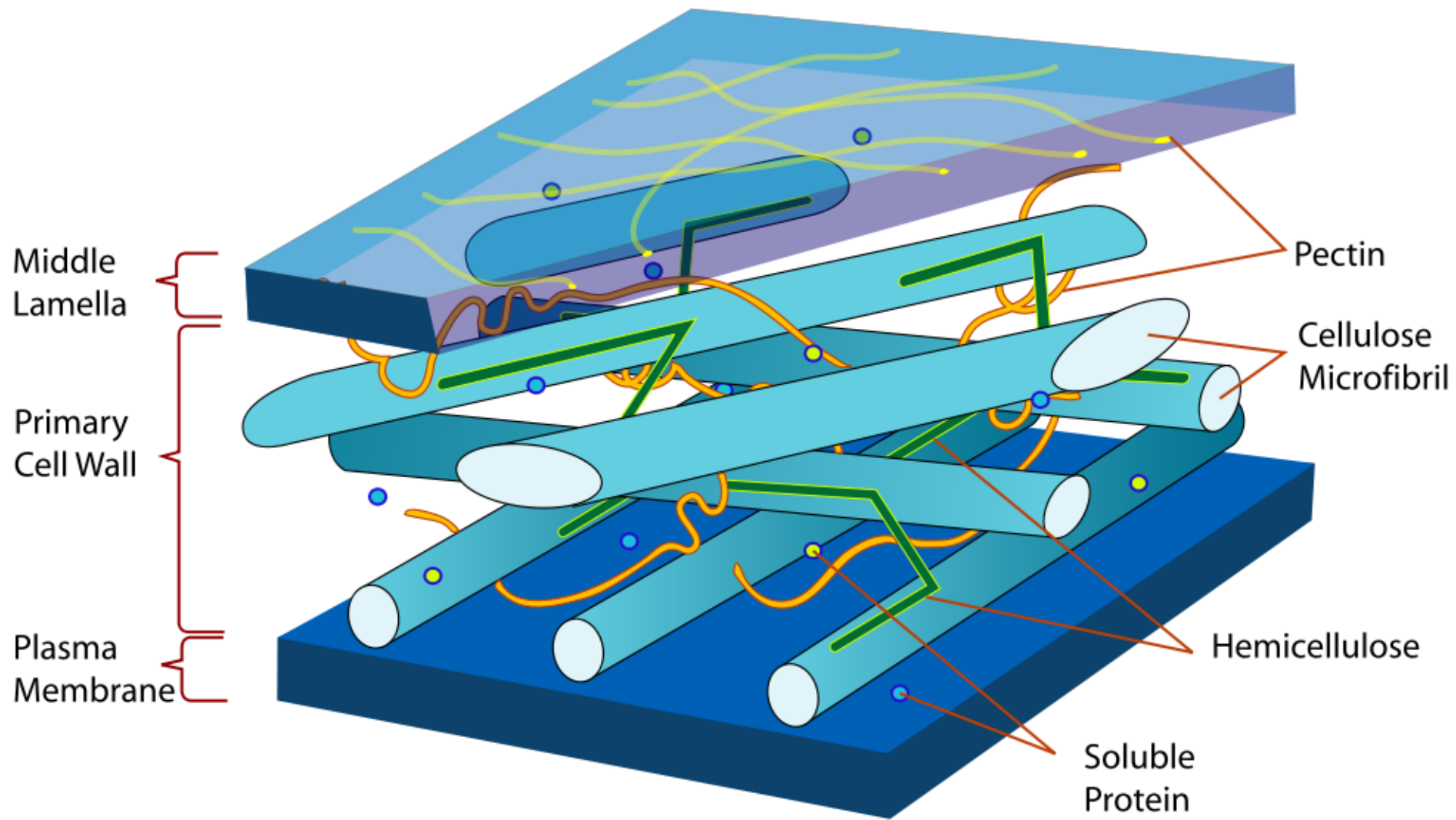


- Xylose - $\beta(1,4)$ - Mannose - $\beta(1,4)$ - Glucose -
- $\alpha(1,3)$ - Galactose

Hemicellulose

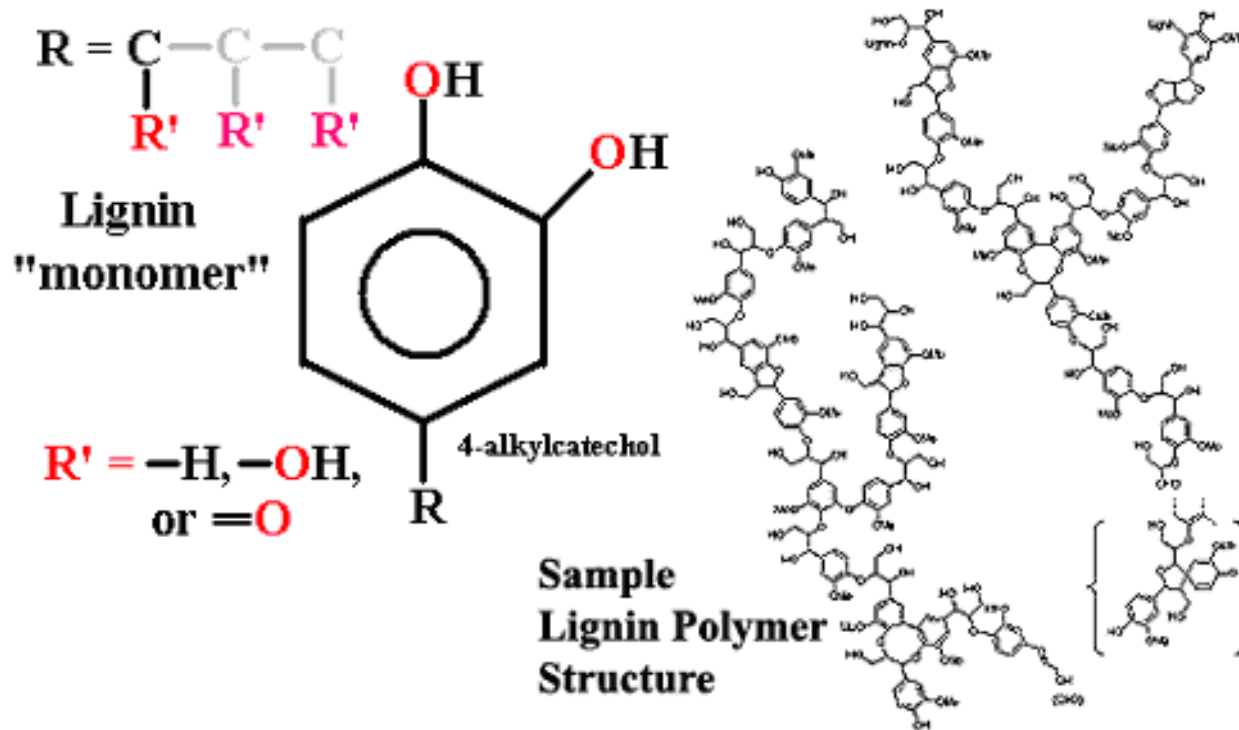
Pektiny

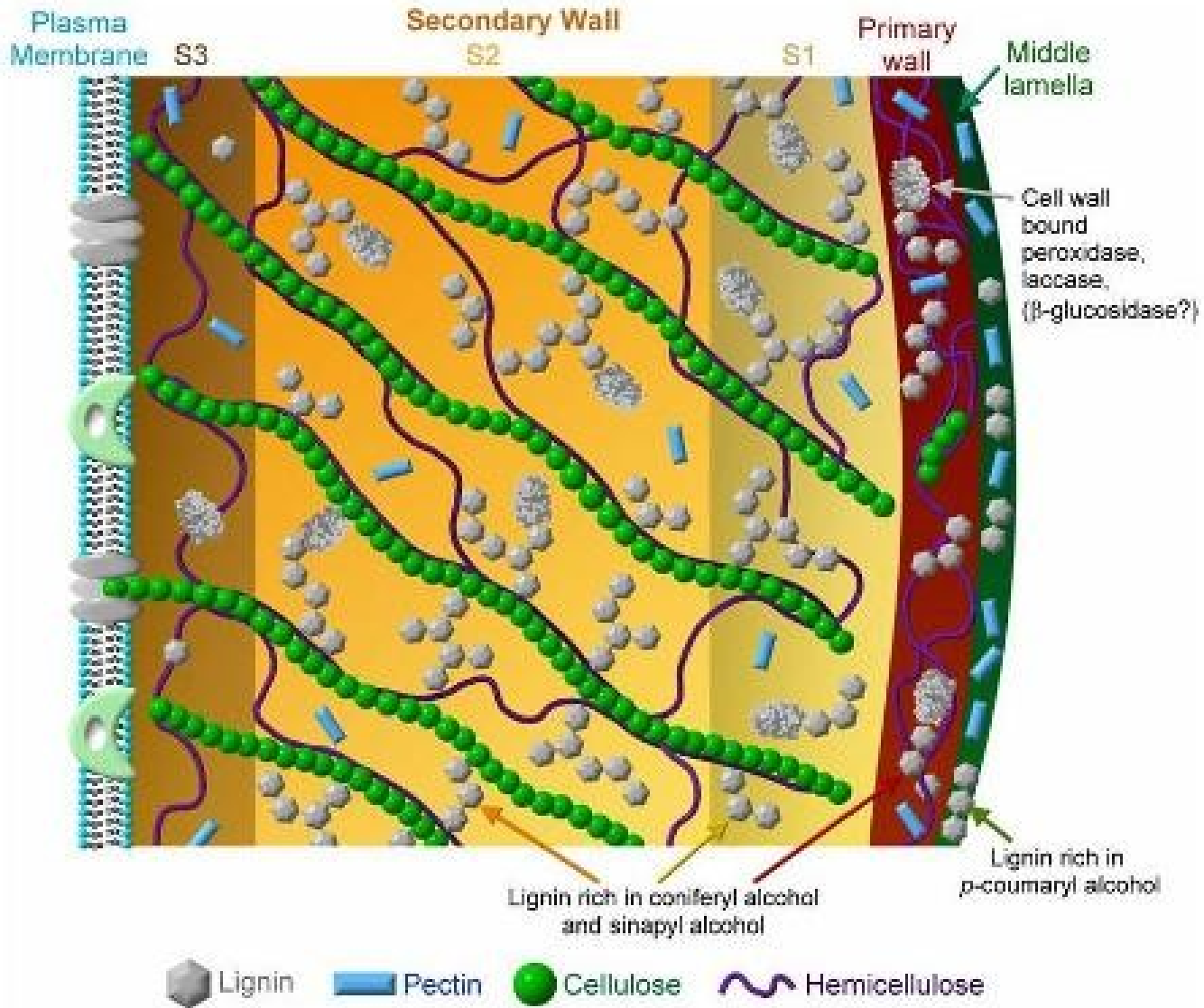






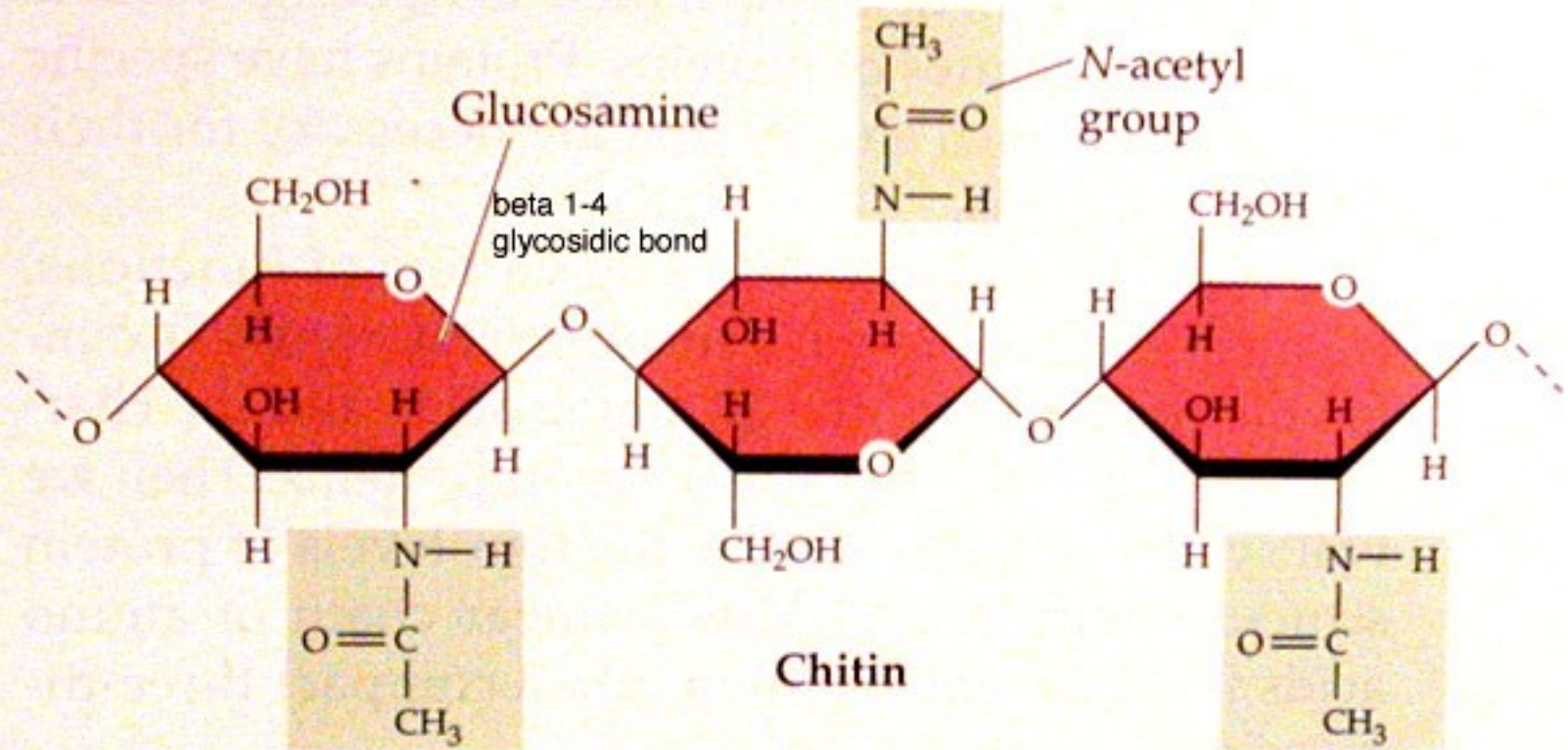
Lignin





Chitin

(c) Chitin



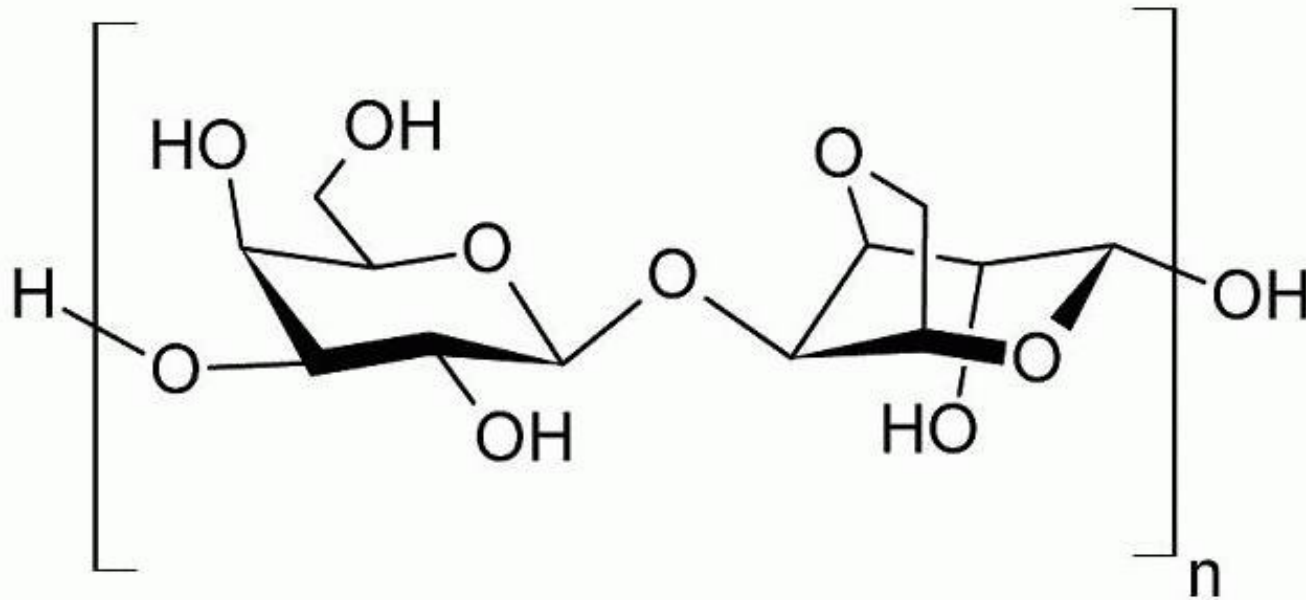
CELLULOSE



CHITIN



Agarosa



Zásobní homopolysacharidy :

ŠKROB - amylosa - glukosa - α (1→4) - 20 %

(40 - 150 000 MW)

amylopektin - glukosa - α (1→4) + α (1→6) - 80 %

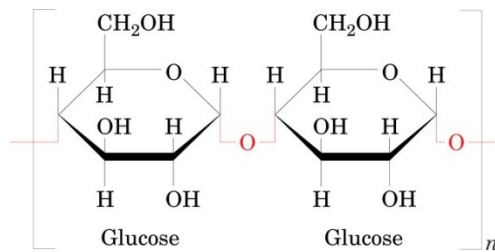
(50 000 MW)

GLYKOGEN - glukosa - α (1→4) + α (1→6)

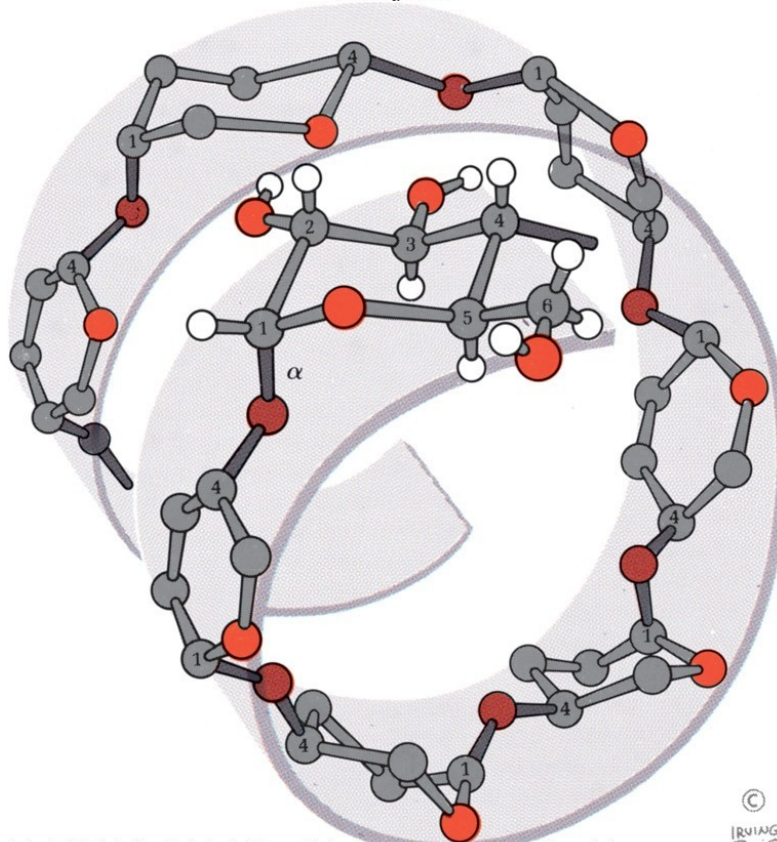
DEXTRAN - glukosa - α (1→6) + α (1→4) + α (1→3)

INULIN - fruktosa β (1→)

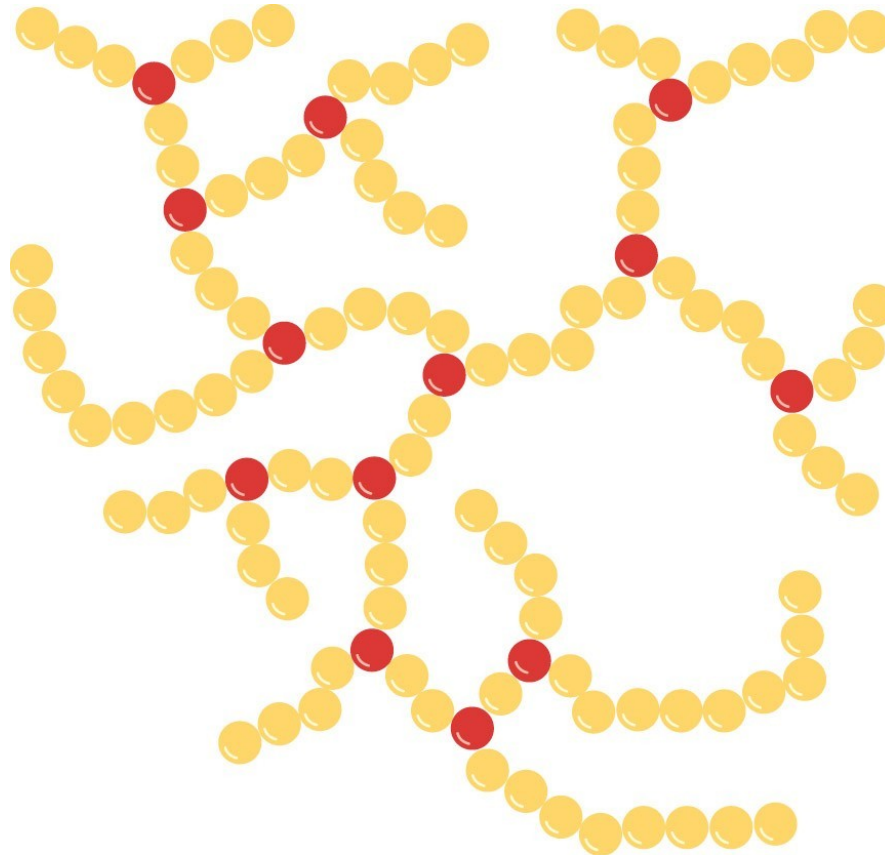
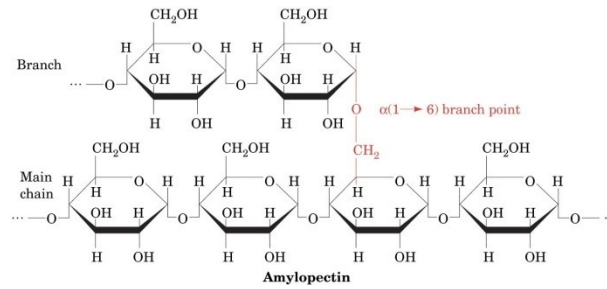
Amylose



α -Amylose

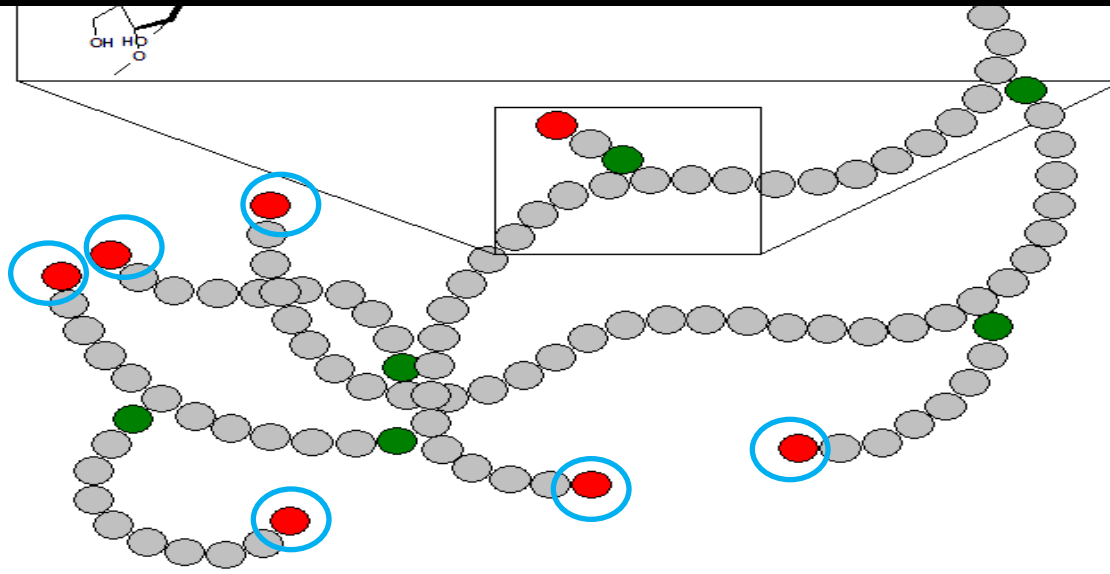
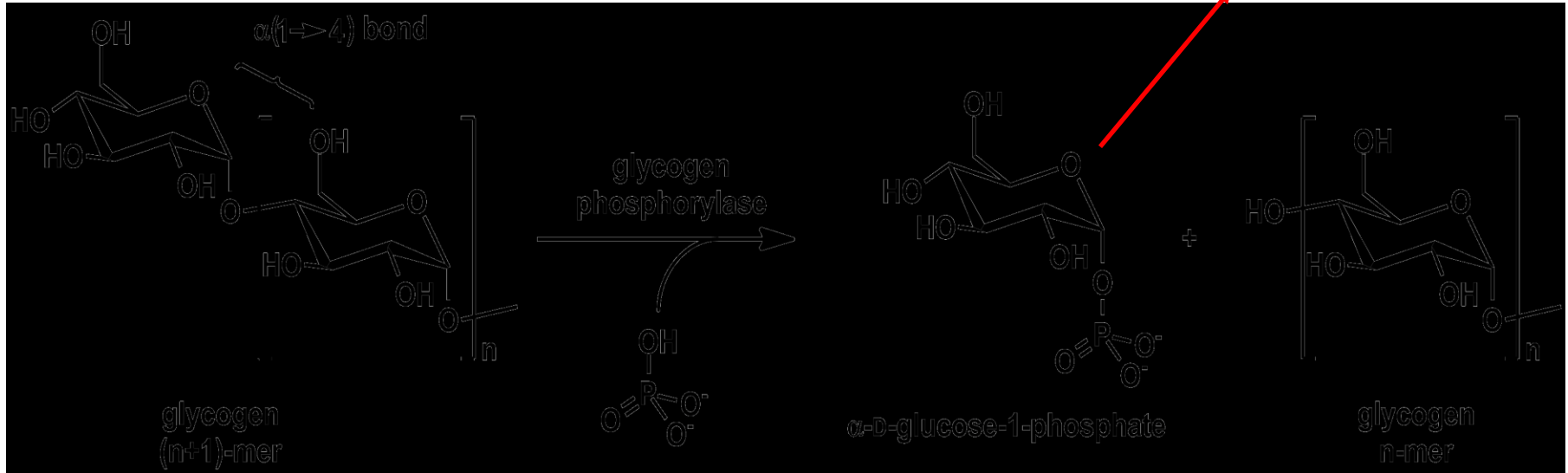


Amylopektin



Glykogen

glykolysa



Škrob (a) a glykogen (b)

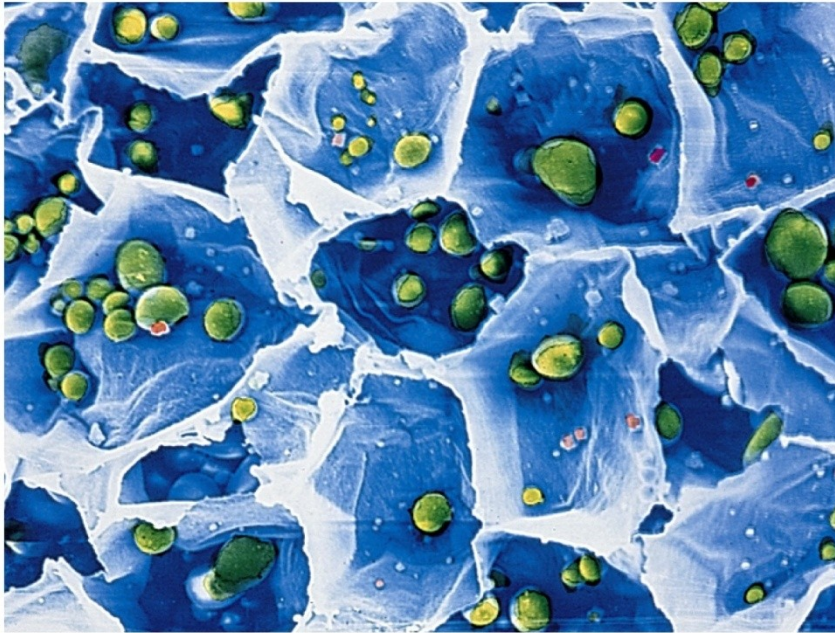


Figure 7-19a Concepts in Biochemistry, 3/e

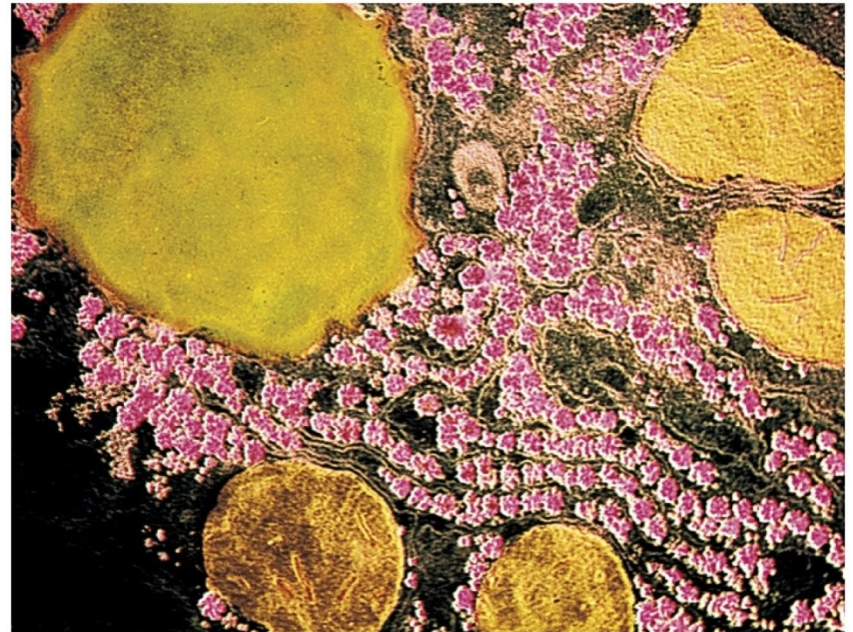
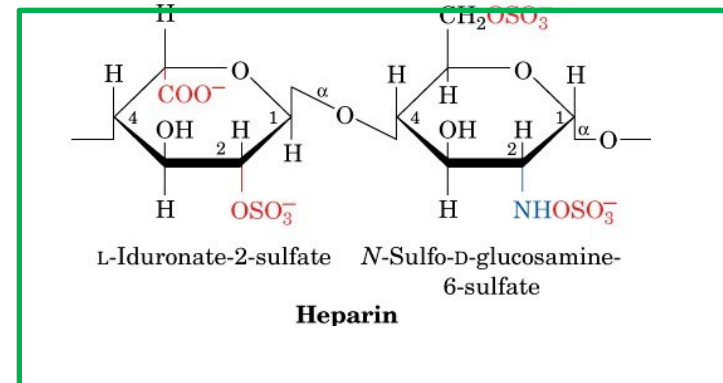
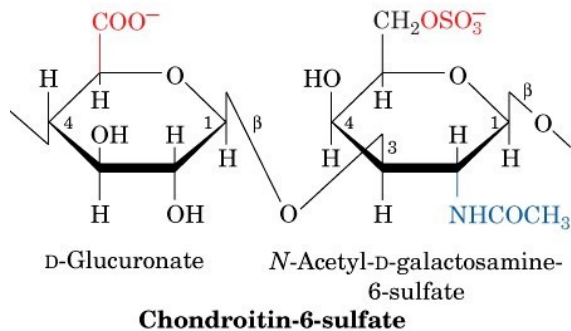
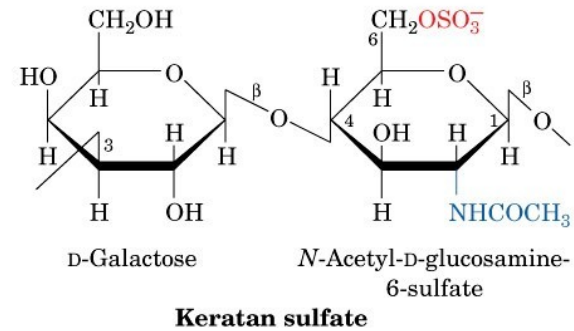
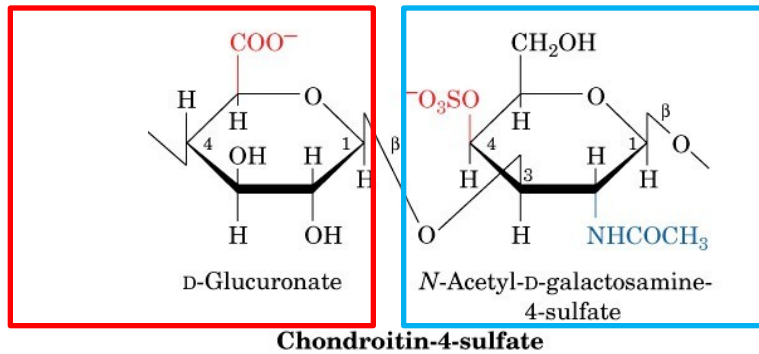
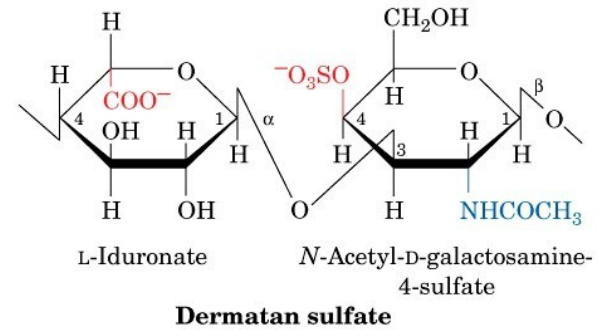
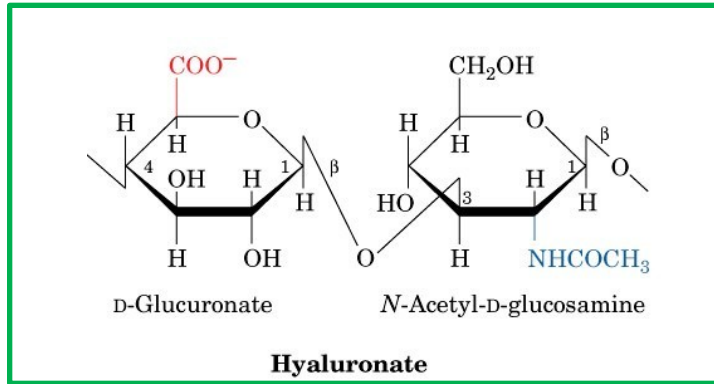


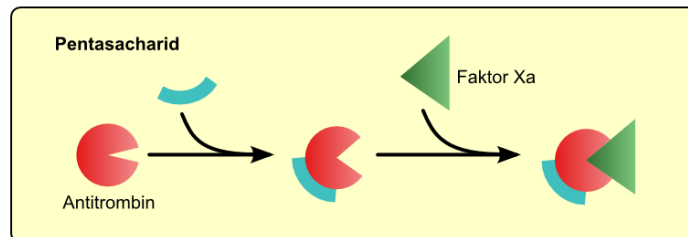
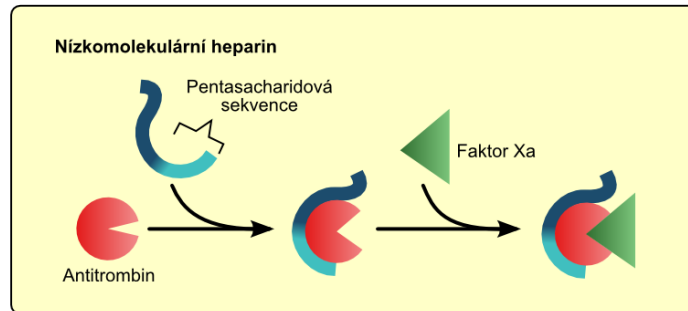
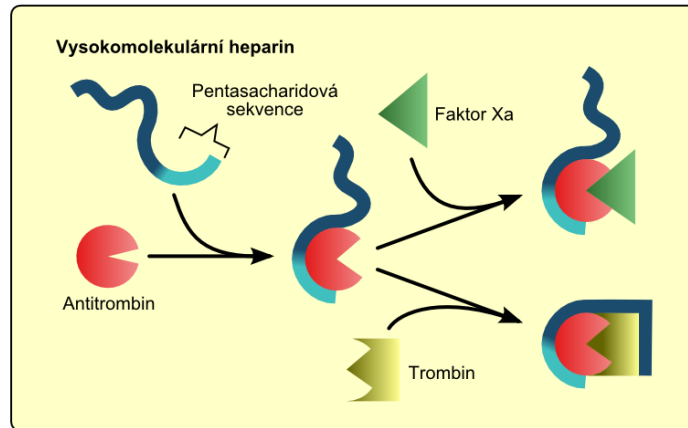
Figure 7-19b Concepts in Biochemistry, 3/e

Heteropolysacharidy



Heparin

Antikoagulancia - Nepřímé inhibitory trombinu / faktoru Xa



Složené sacharidy

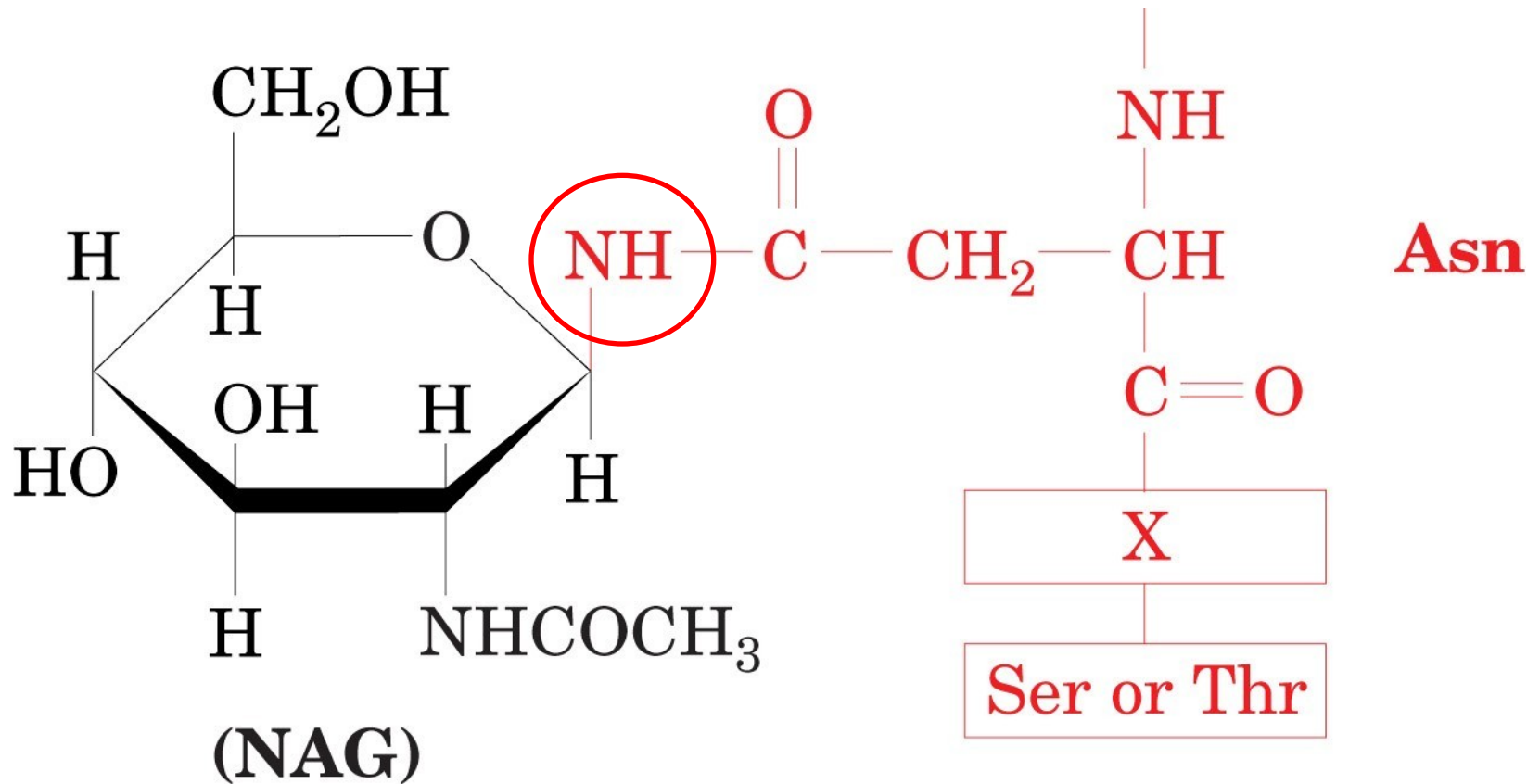
- Glykolipidy

- Glykoproteiny

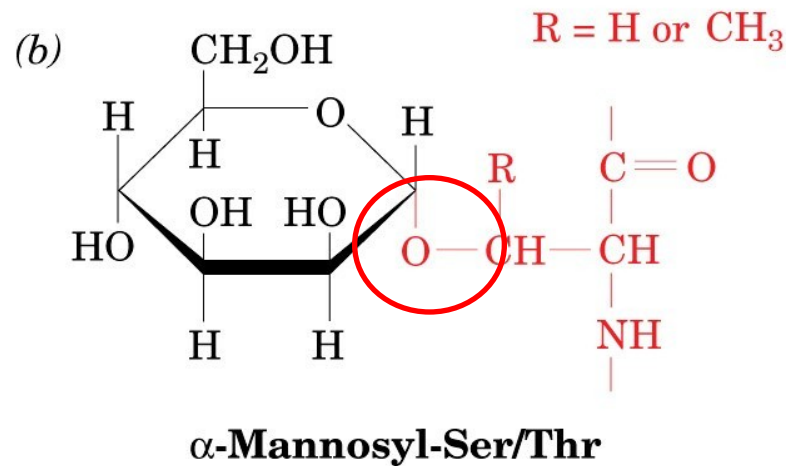
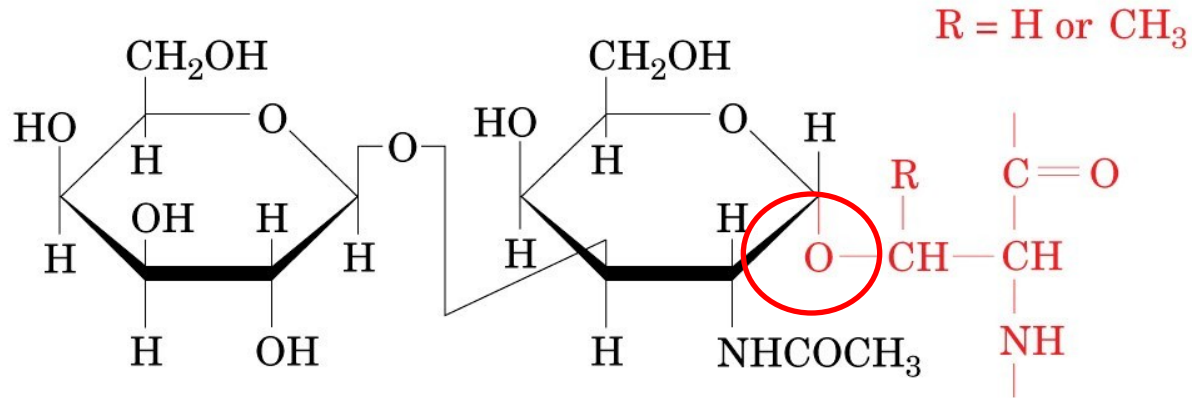
- Proteoglykany

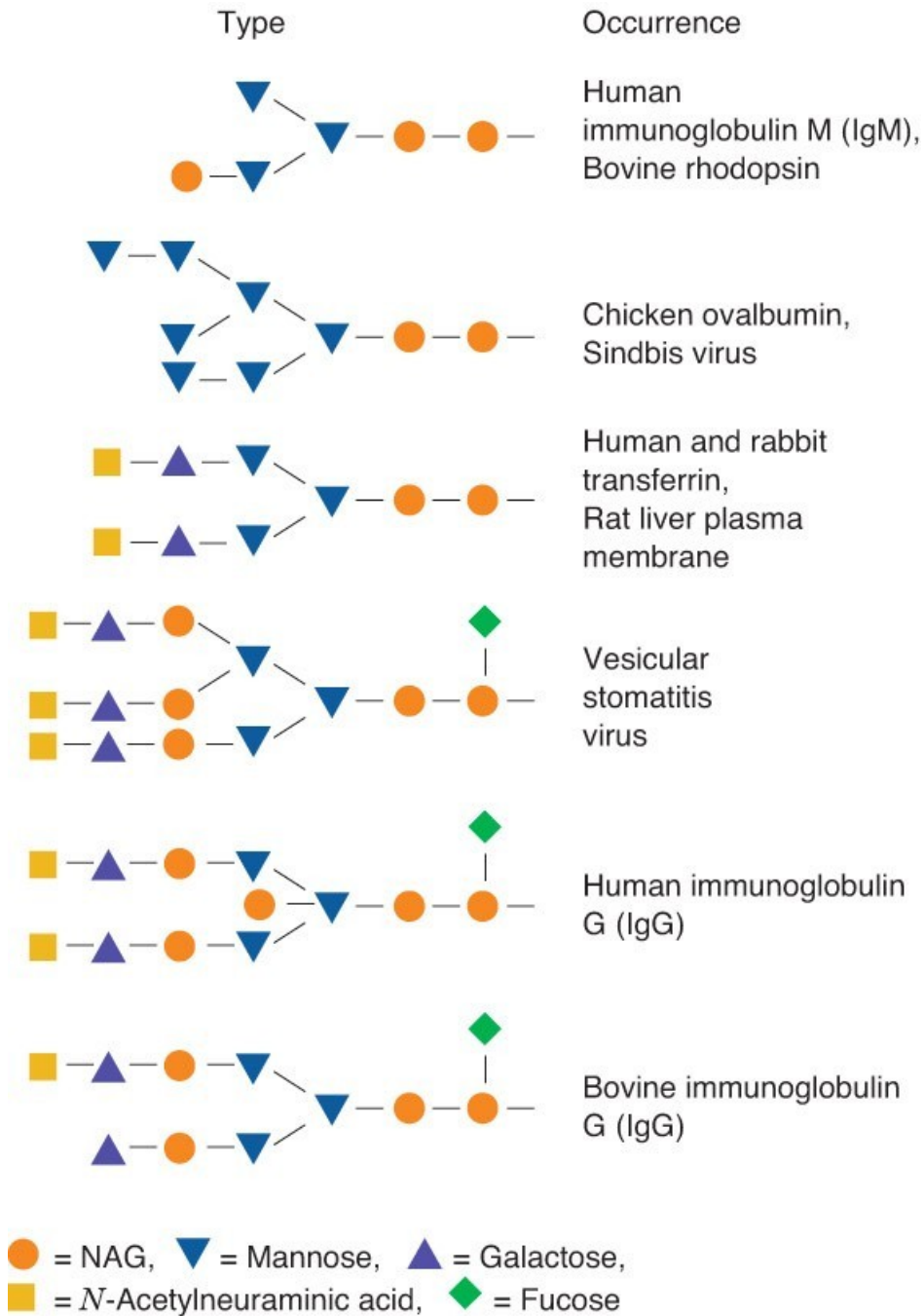
LIŠÍ SE POMĚREM SLOŽEK

Glykoproteiny – N-linked



Glykoproteiny – O-linked





Glykoproteiny

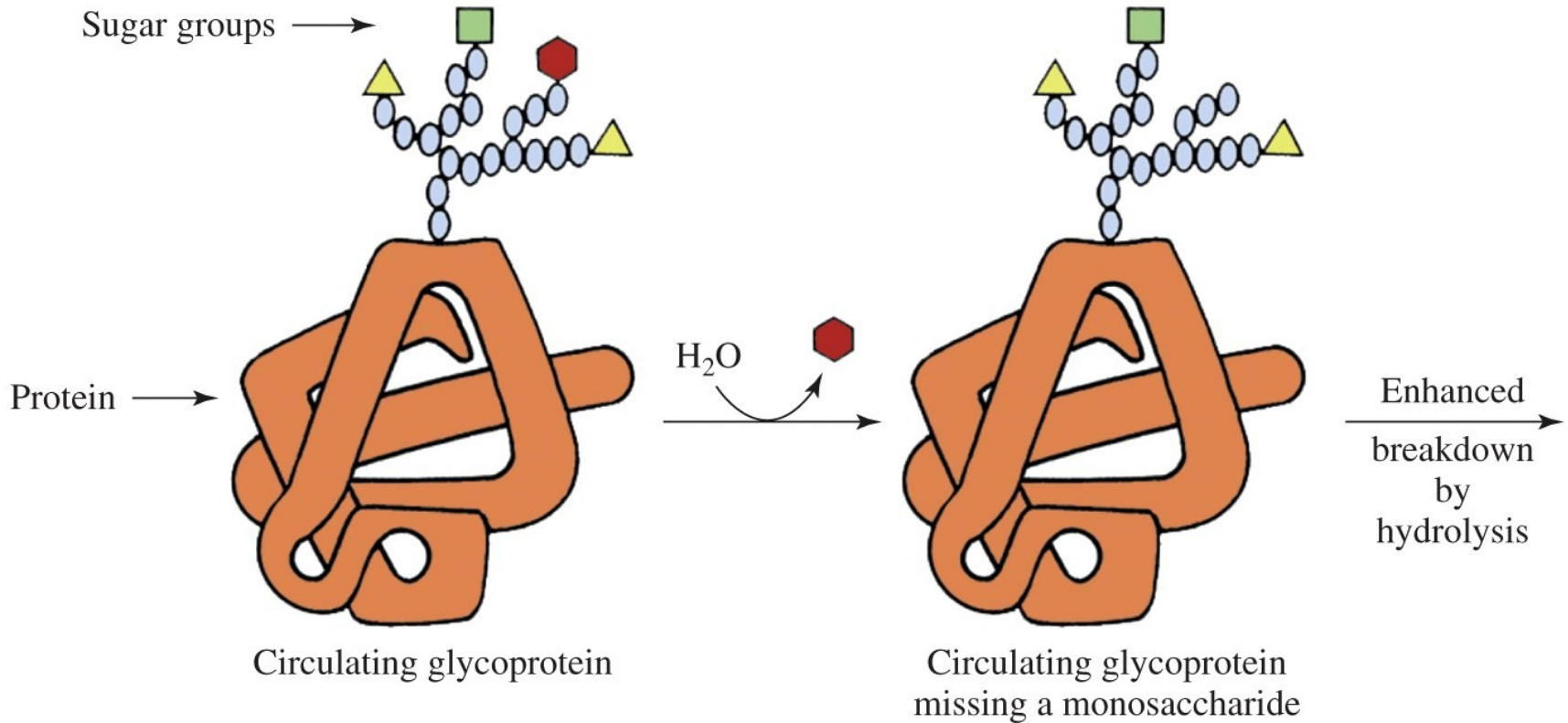


Figure 7-32 Concepts in Biochemistry, 3/e
© 2006 John Wiley & Sons

Antimrazové glykoproteiny



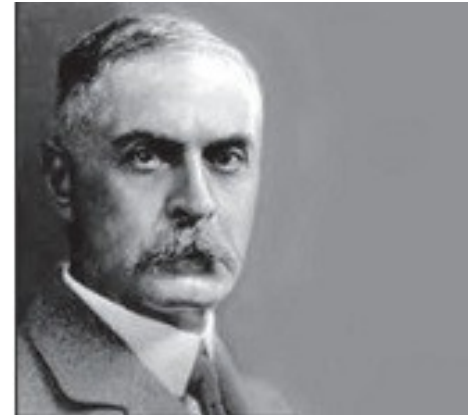
Krevní skupiny

- V současné době nejméně 21 systémů lidských krevních skupin (AB0, Rh, MNS,)
- Definovaný systém antigenů přítomných na červených krvinkách
- Krevní typ (antigenní fenotyp) je určován pomocí vhodných protilátek



Krevní skupiny AB0

- **Karl Landsteiner 1900**
(1930 NC)

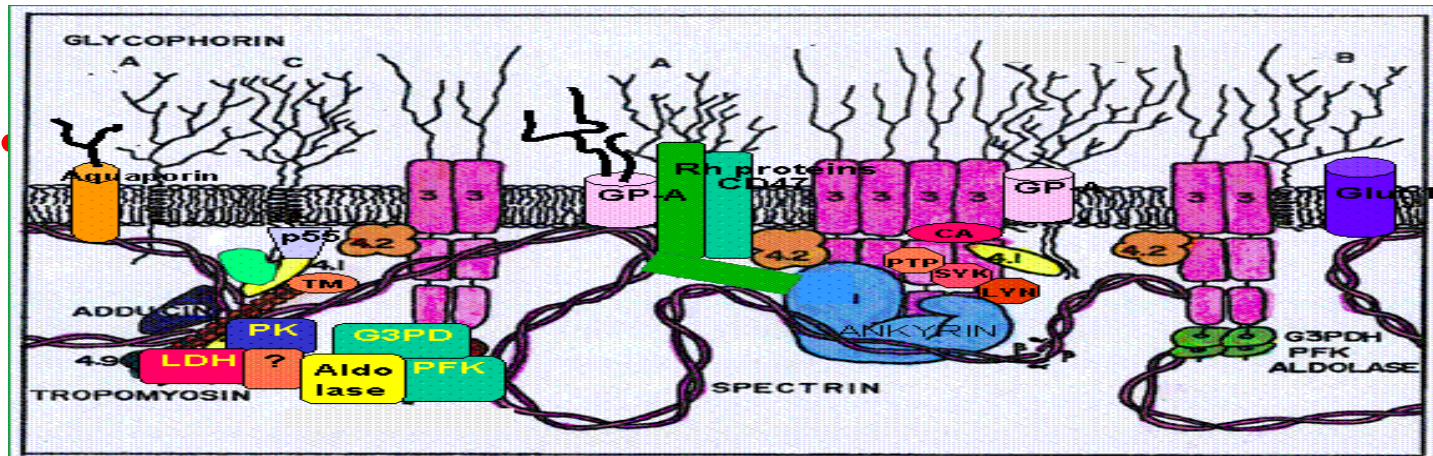


- **Jan Jánský 1907**



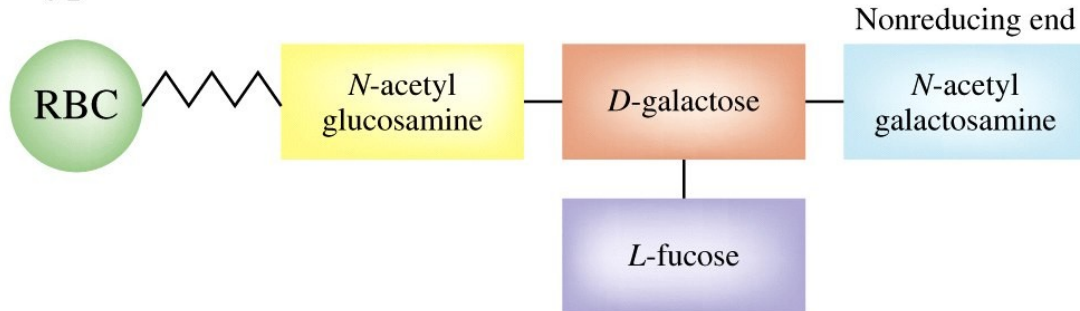
Chemická podstata aglutinogenů a aglutininů AB0

- **Aglutinogeny** – antigenní struktury na membránovém povrchu ERY
Základní jednotka – oligosacharid vzniklý kombinací 4 monosacharidů

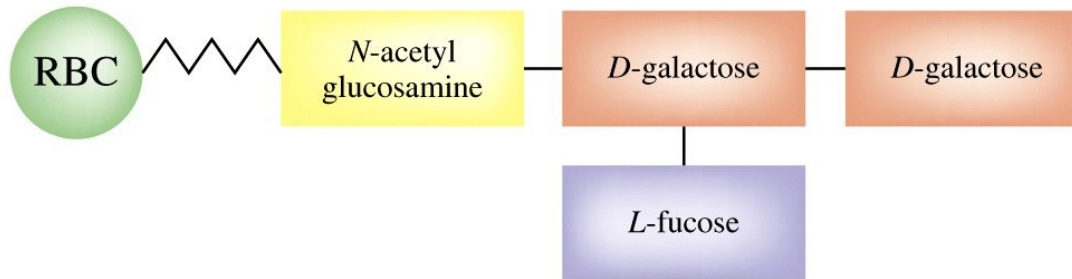


Krevní skupiny

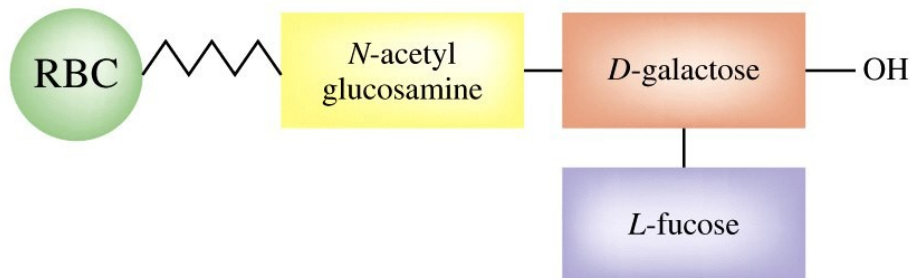
Type A



Type B

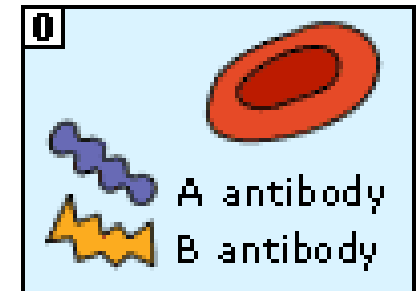
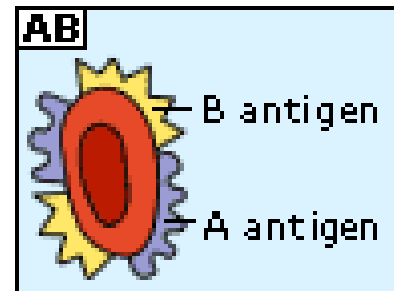
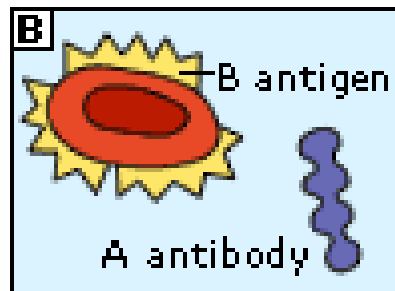
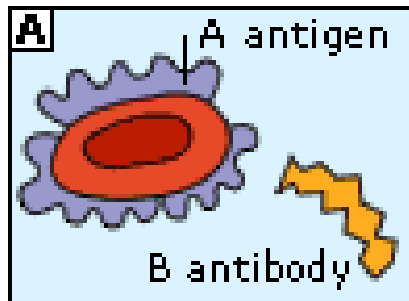


Type O



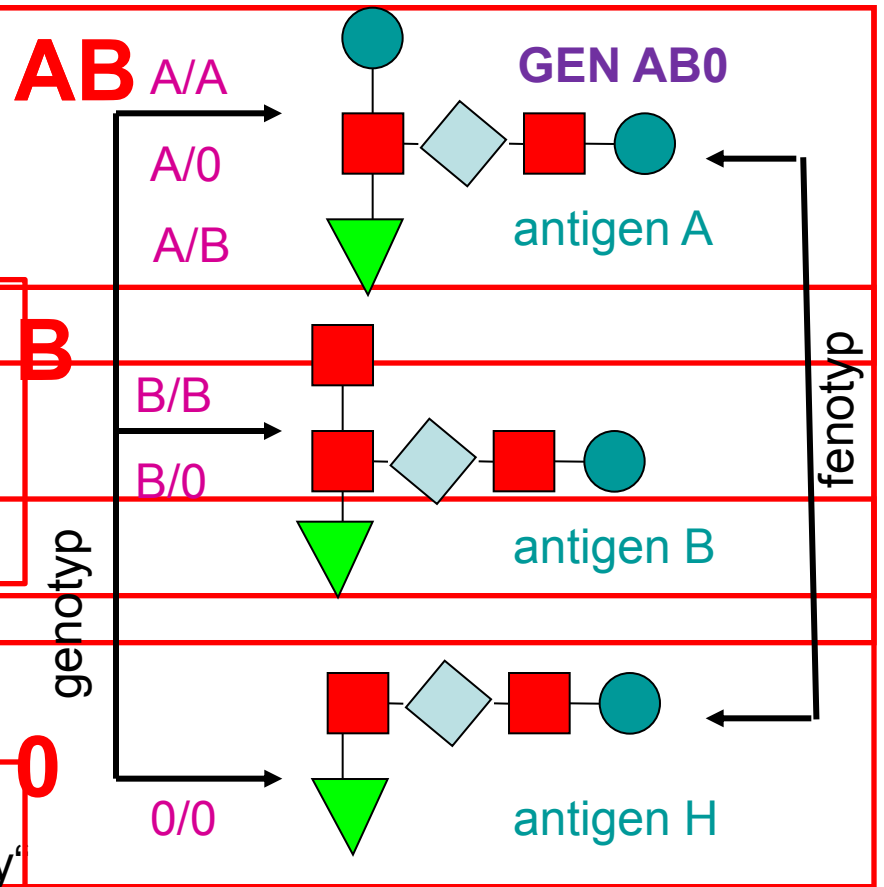
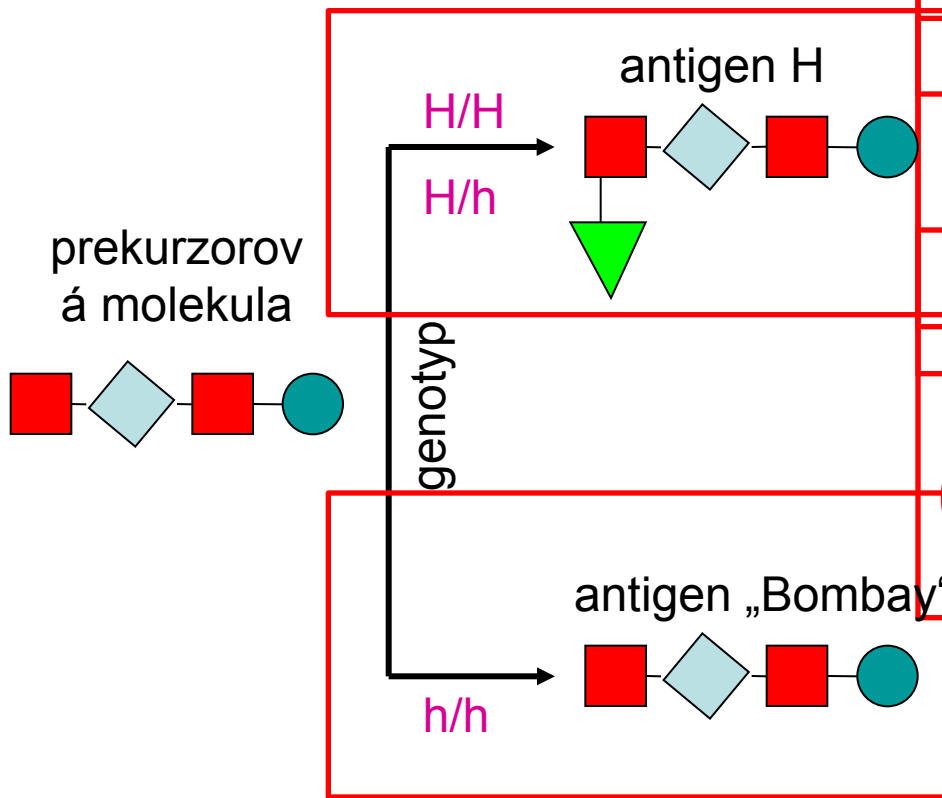
AB0(H) systém

- 4 základní krevní skupiny – A, B, AB a 0(H) podle přítomnosti aglutinogenů (antigenů) A a B na povrchu membrány ERY
- Protilátky v plazmě (aglutininy) se vytvářejí v 1.roce života, proti těm antigenům, které neobsahují vlastní ERY



GEN H

fucosyl transferase



D-galaktosa



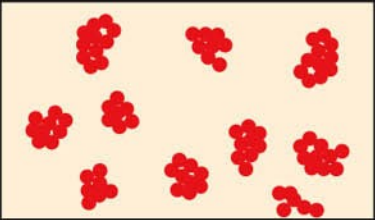
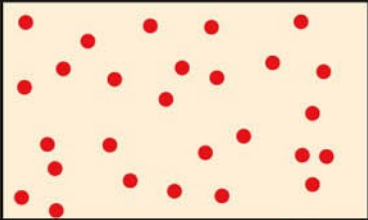
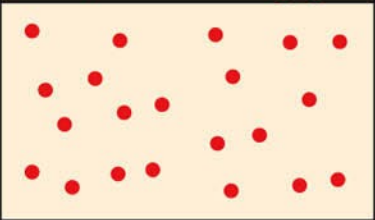
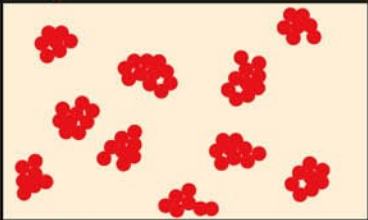
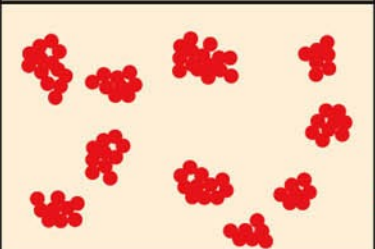
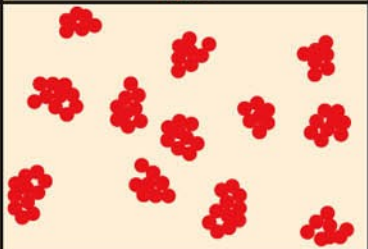
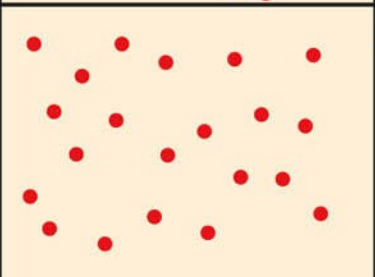
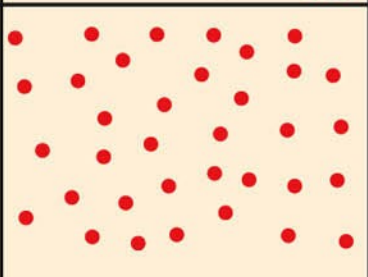
N-acetylgalaktozamin




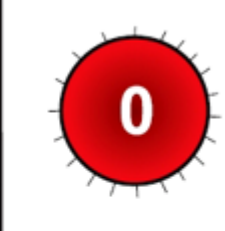








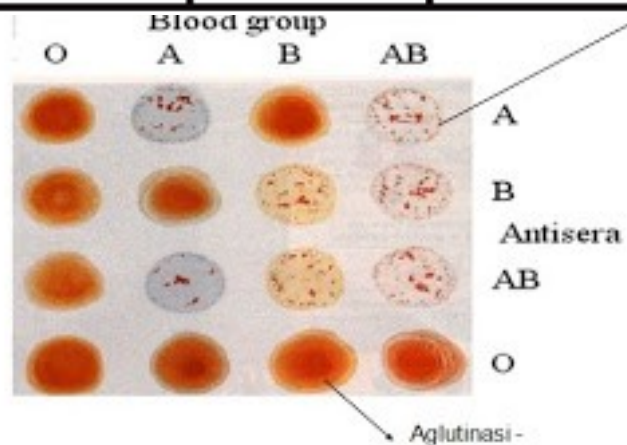
N-acetylglukosamin



L-fukosa

Blood type of cells	Genotype	Antibodies made by body	Reaction to added antibodies	
			Anti-A	Anti-B
A	$I^A I^A$ or $I^A i^O$	Anti-B	 Agglutination (clumping) of red blood cells.	 No agglutination (uniformly distributed red blood cells).
B	$I^B I^B$ or $I^B i^O$	Anti-A	 No agglutination (uniformly distributed red blood cells).	 Agglutination (clumping) of red blood cells.
AB	$I^A I^B$	Neither anti-A nor anti-B	 Agglutination (clumping) of red blood cells.	 Agglutination (clumping) of red blood cells.
O	$i^O i^O$	Both anti-A and anti-B	 No agglutination (uniformly distributed red blood cells).	 No agglutination (uniformly distributed red blood cells).

	SKUPINA A	SKUPINA B	SKUPINA AB	SKUPINA 0
erytrocyty				
protilátky	 Anti-B	 Anti-A	žádné	 Anti-A Anti-B
antigeny	 A antigen	 B antigen	 A a B antigeny	žádné

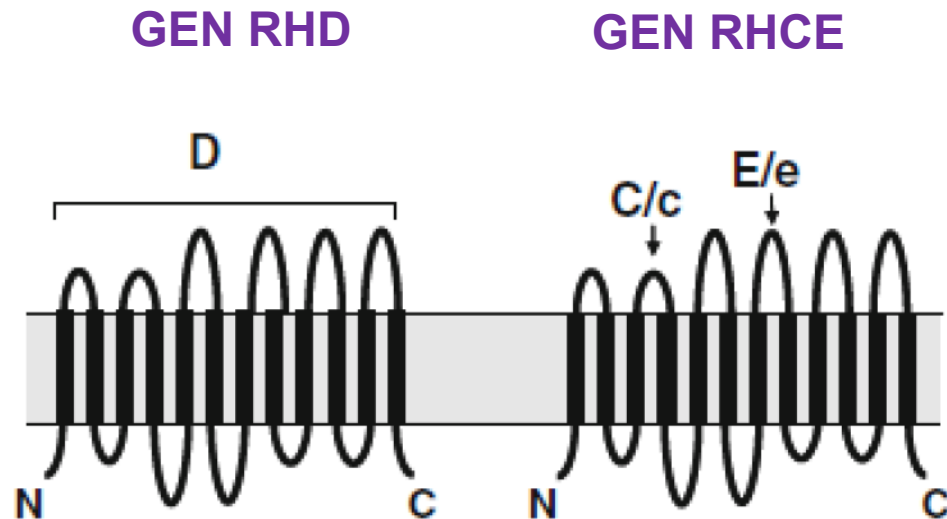


Dědičnost krevních skupin

Matka\Otec	0	A	B	AB
0	0	0, A	0, B	A, B
A	0, A	0, A	0, A, B, AB	A, B, AB
B	0, B	0, A, B, AB	0, B	A, B, AB
AB	A, B	A, B, AB	A, B, AB	A, B, AB

System Rh Landstein Wiener

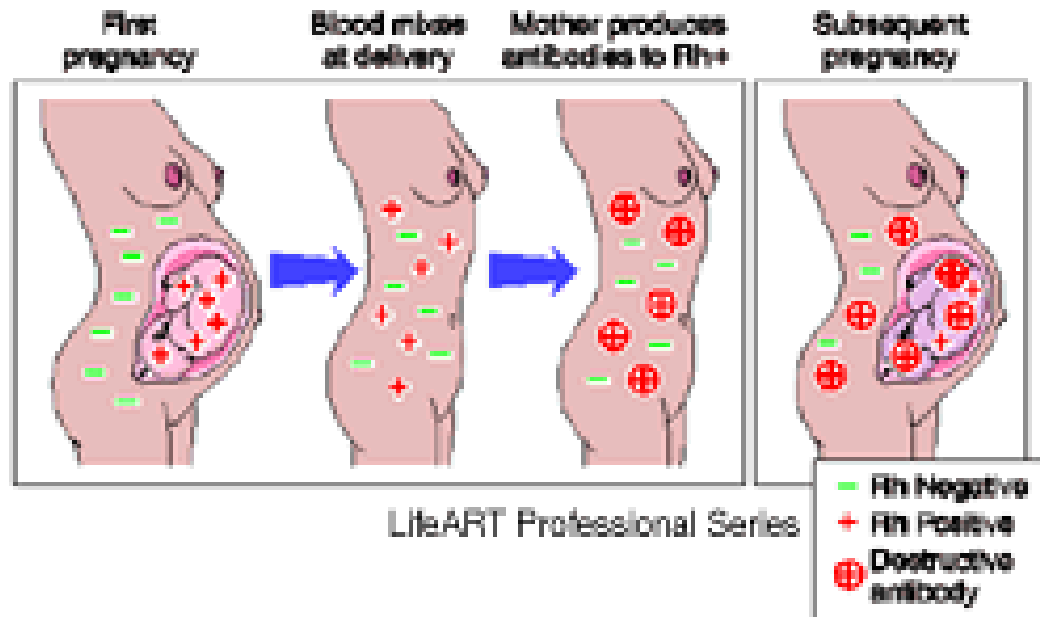
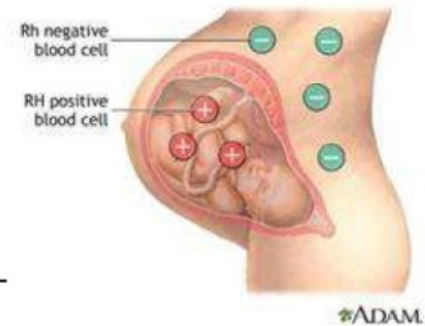
- Antigenní systém Rh je vysoce komplexní
- Antigeny C, **D**, E, c, d, e



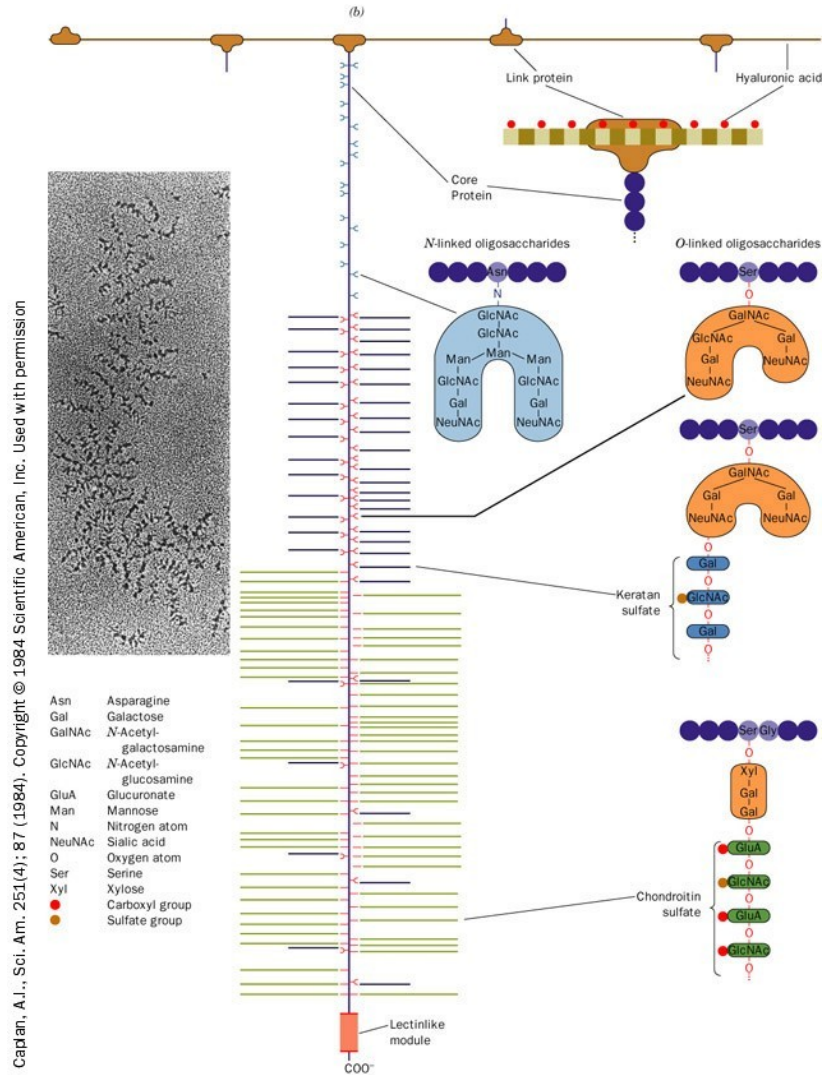
System Rh

- Je-li přítomen antigen D, **Rh-pozitivní jedinec**
- Chybí-li antigen D, **Rh-negativní jedinec**
- Protilátky anti-D vznikají pouze při imunizaci Rh⁻ příjemce krvinkami Rh⁺ dárce
- Protilátky jsou imunoglobuliny typu IgG

Hemolytická nemoc novorozenců



Proteoglykany – 95 % sacharid



Caplan, A.L., Sci. Am. 251(4): 87 (1984). Copyright © 1984 Scientific American, Inc. Used with permission

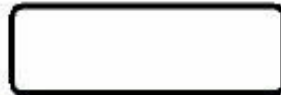
Buněčná stěna bakterií

grampozitivní(a) a gramnegativní(b)

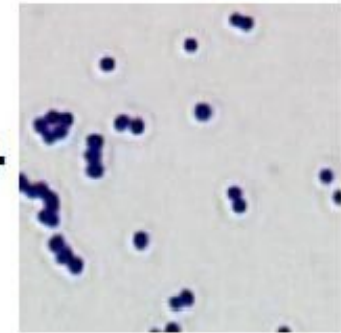
1. NEOBARVENÝ
PREPARÁT

Gram +

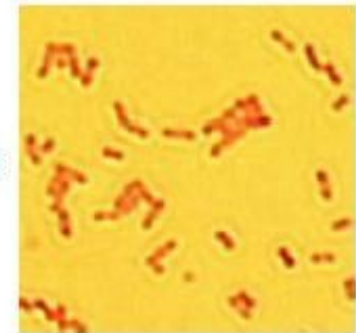
Gram -



G+



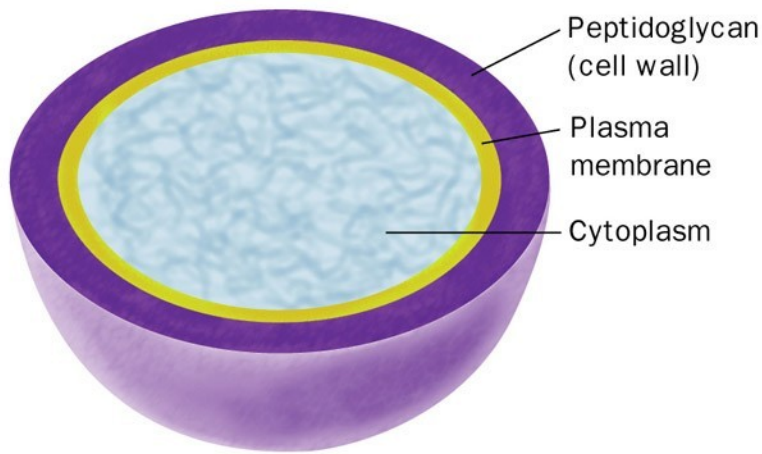
G-



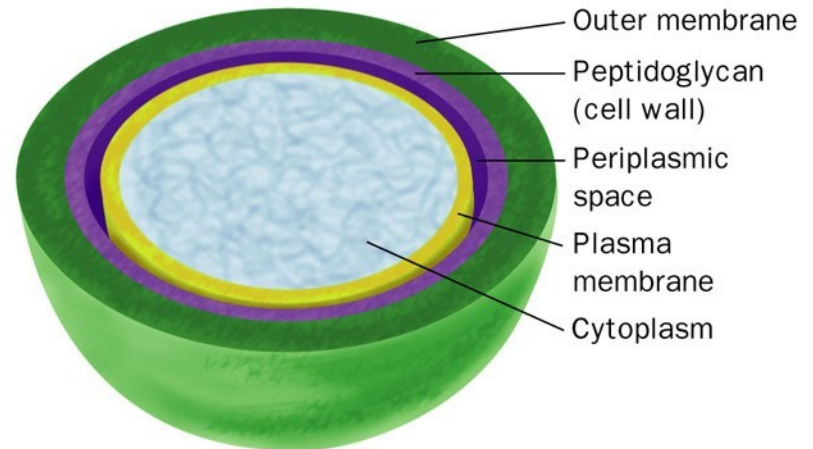
Buněčná stěna bakterií

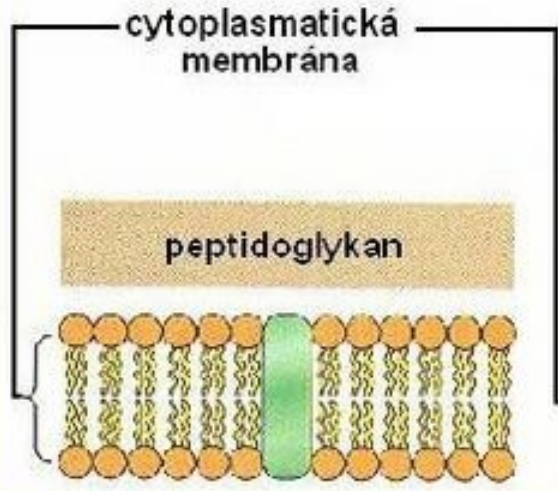
grampozitivní(a) a gramnegativní(b)

(a) Gram-positive bacteria



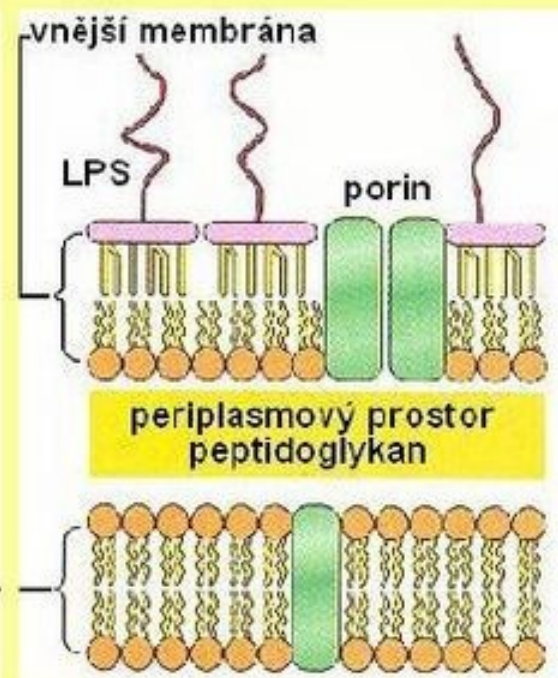
(b) Gram-negative bacteria





Buněčná stěna je poměrně silná, obsahuje kromě peptidoglykanu proteiny, polysacharidy a kyselinu teichoovou.

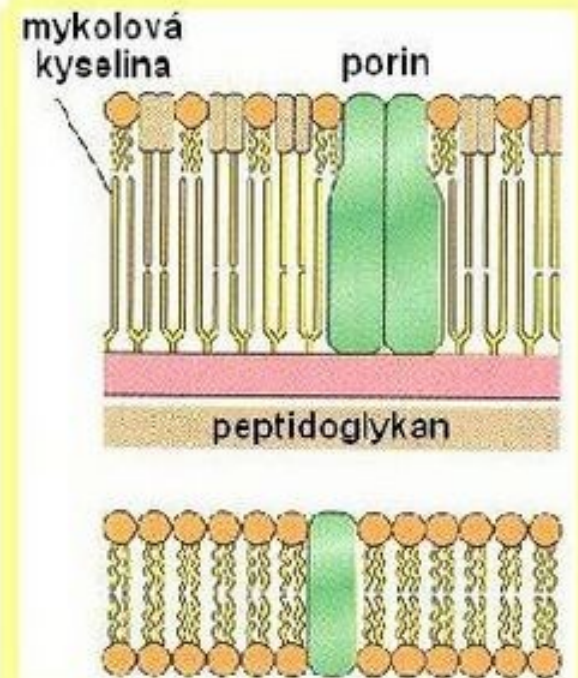
G+ bakterie



Vrstva peptidoglykanu (PG) je tenčí. Nad ní je vnější membrána (VM) – fosfolipidová dvojitá vrstva - spojená s PG molekulami lipoproteinu. Mezi PG a VM je periplasmový prostor. Zevní strana VM obsahuje lipopolysacharid (LPS). LPS se skládá z toxického lipidu A (endotoxin), základního polysacharidu a specifického polysacharidu, který vyčnívá z buňky (O antigen).

G- bakterie

Nebezpečnější



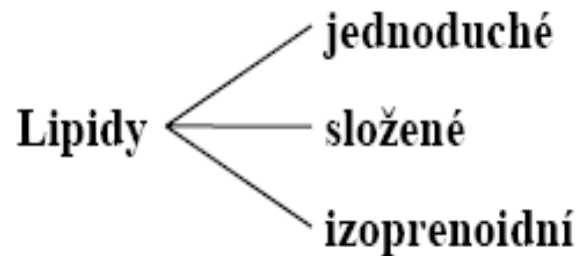
Odlíšné složení buněčné stěny
U kyseliny muramové v PG je místo N-acetylmu N-glykol
Ve stěně je velké množství volných i vázaných lipidových komponent obsahujících mykolové kyseliny.
Povrch je hydrofobní, chrání proti vyschnutí, detergentům, kyselinám a alkoholu - acidorezistence.
Nebarví se Gramovým barvením.

mykobakterie

LIPIDY

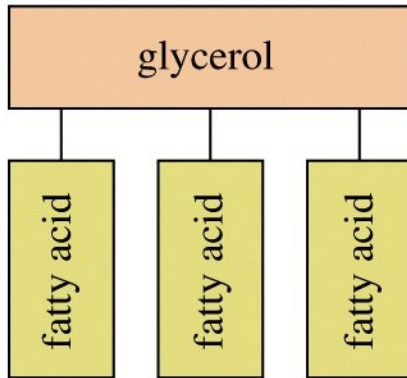
Lipos - tuk

Funkce : zdroj a reserva energie	Jednoduché - neutrální
strukturní funkce	Složené - polární, izoprenoidní - steroidní
ochranná a izolační funkce	Jednoduché - neutrální
různé biologické funkce	Izoprenoidní - steroidní



Neutrální

Triacylglycerols

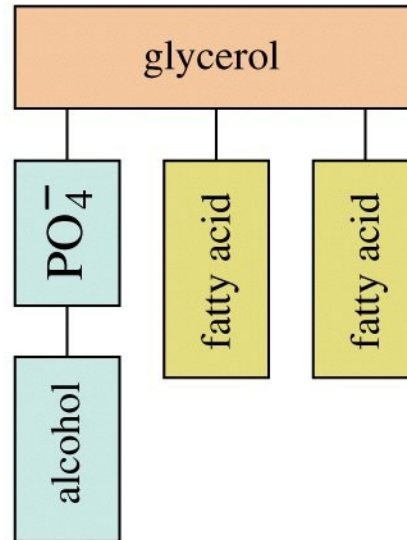


Storage lipids (nonpolar)

(a)

Polární

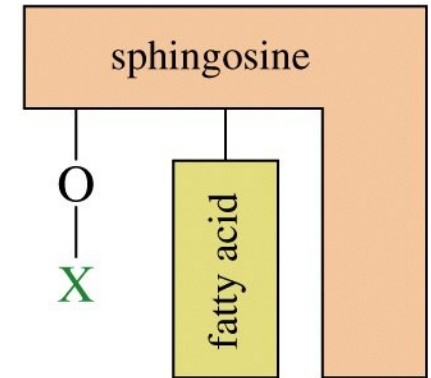
Glycerophospholipids



Membrane lipids (polar)

(b)

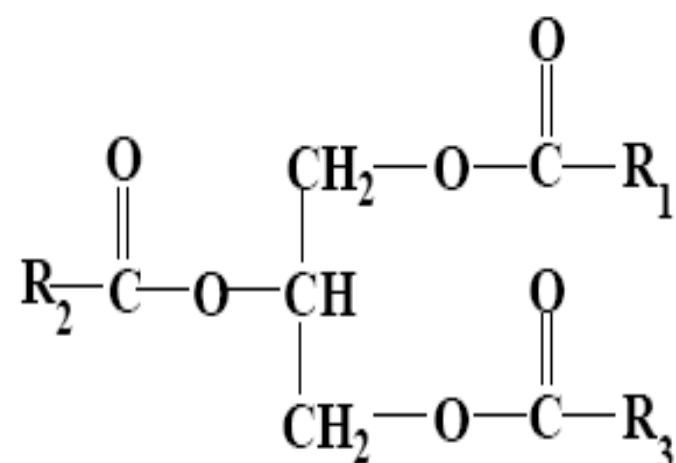
Sphingolipids



Jednoduché lipidy :

chemicky - estery mastných kyselin a alkoholů

ACYLGLYCEROLY - triglyceridy - estery mastných kyselin a glycerolu



Adipocyty

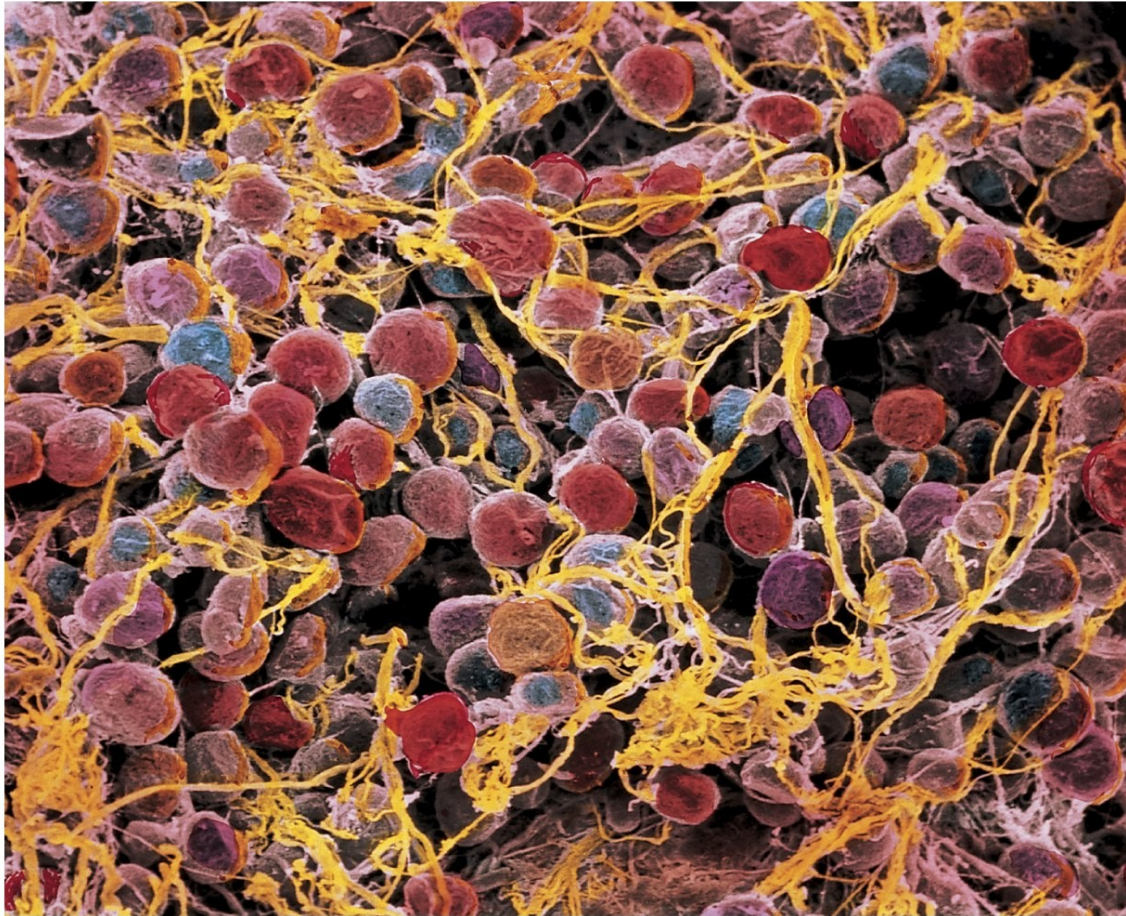
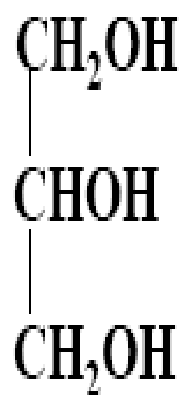
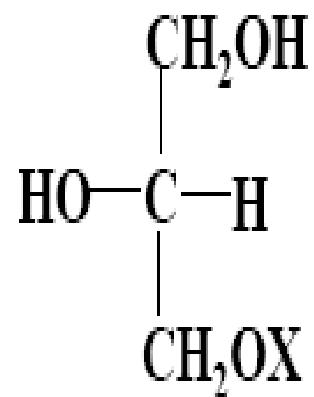


Figure 8-4 Concepts in Biochemistry, 3/e

Alkohol

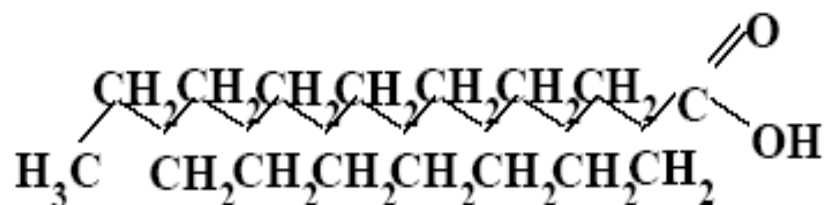


glycerol

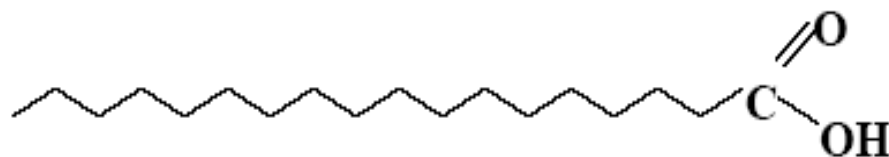
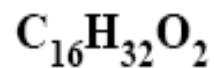


derivát sn-glycerol
(L-glycerol)

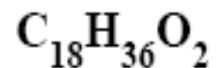
Mastné kyseliny - nasycené



K. PALMITOVÁ

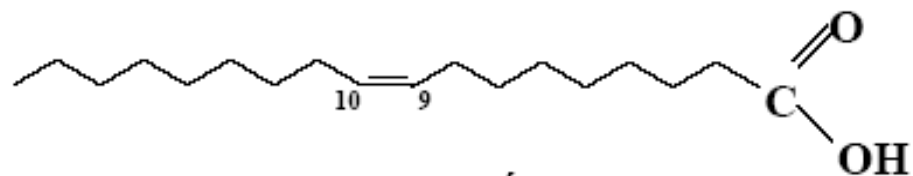


K. STEAROVÁ

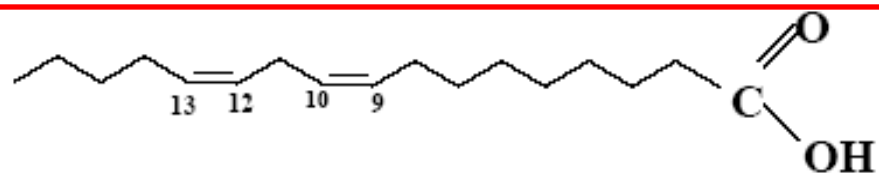
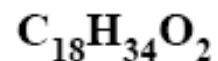


Mastné kyseliny - nenasycené

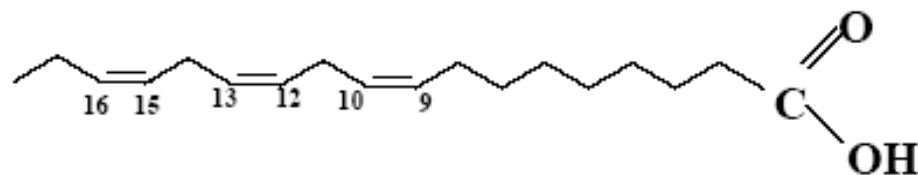
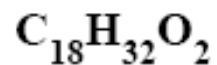
Vitamín F



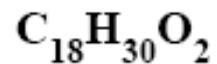
K. OLEJOVÁ



K. LINOLOVÁ



K. LINOLENOVÁ





**Saturated
chain**

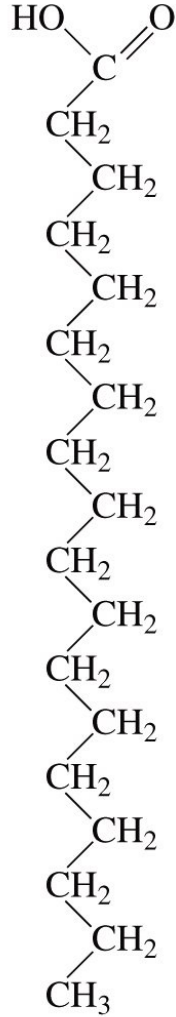


***trans*
Double bond**



***cis*
Double bond**

Carboxyl group



Hydrocarbon chain

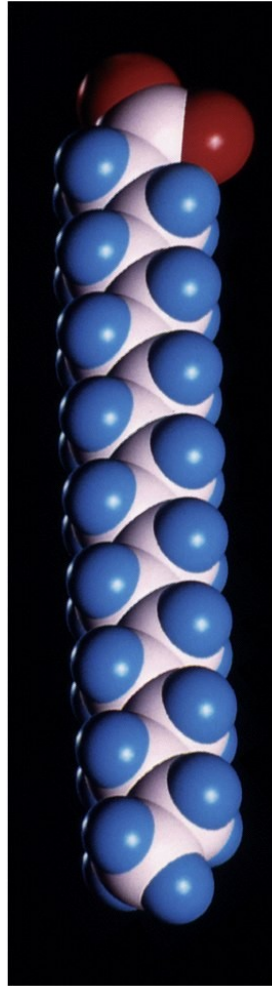


Figure 8-1a Concepts in Biochemistry, 3/e

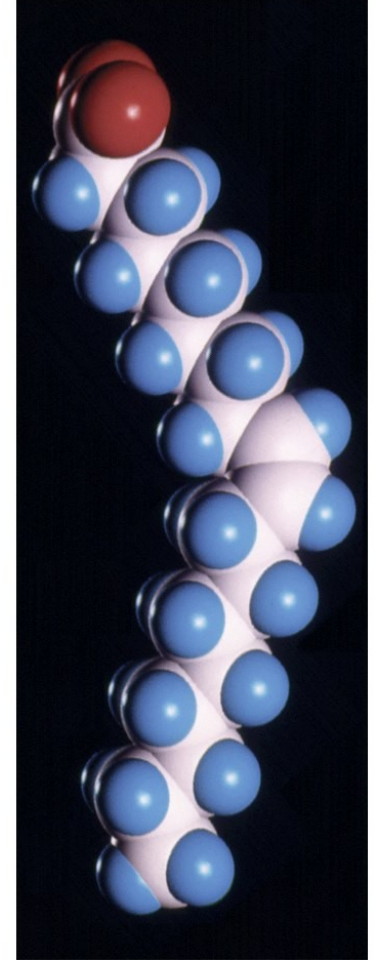
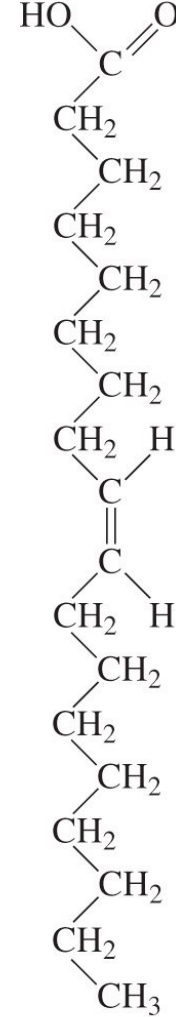
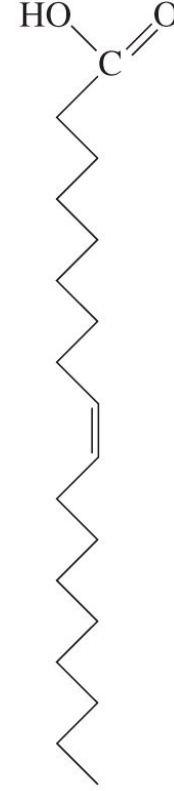
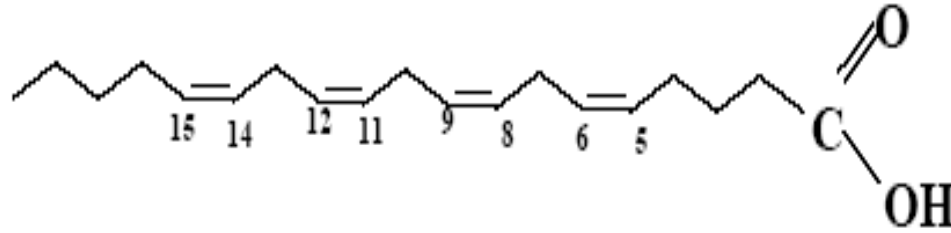
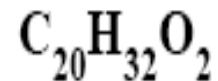


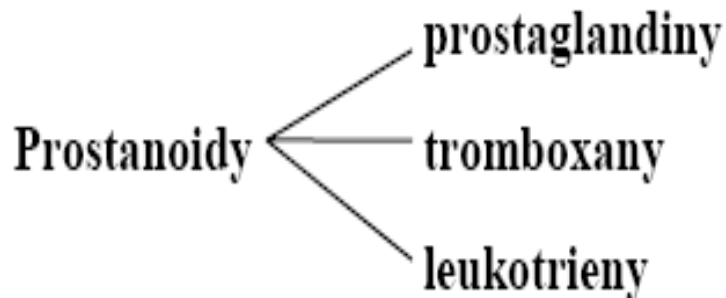
Figure 8-1b Concepts in Biochemistry, 3/e



K. ARACHIDONOVÁ

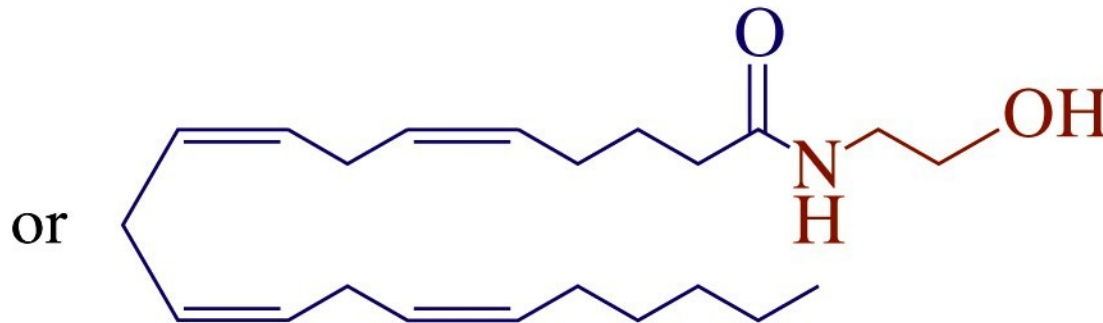
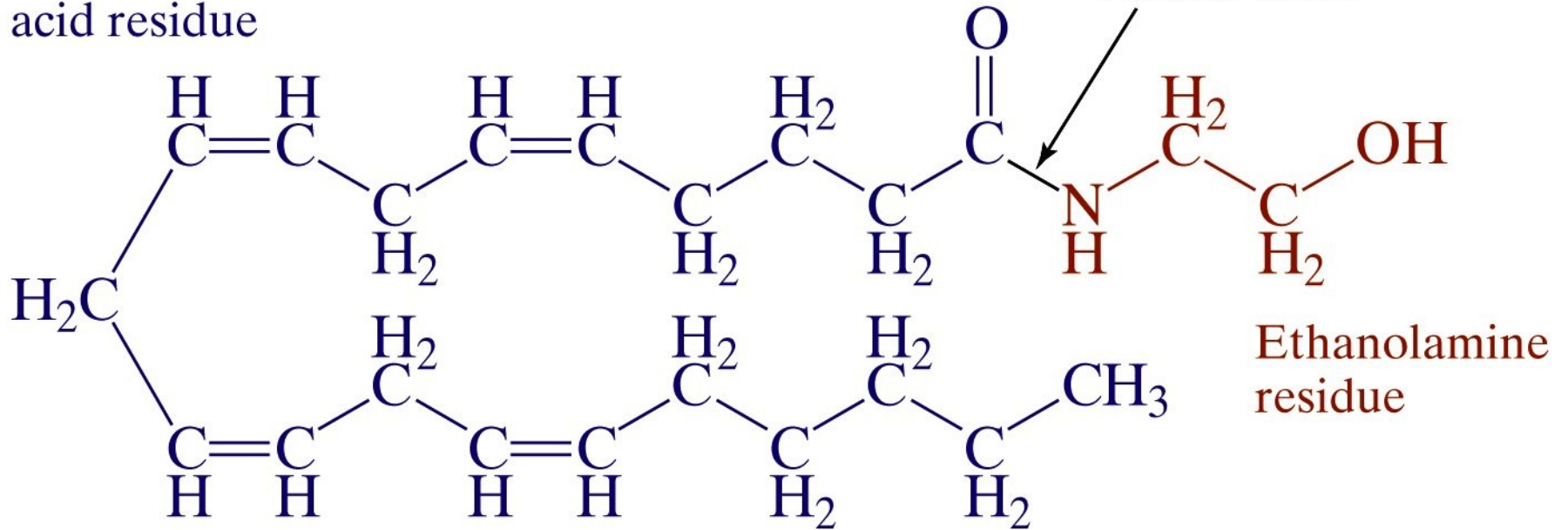


- Srdeční systém
- Respirační systém
- Reprodukční systém
- Gastrointestinální trakt



- Pocity bolesti
- Horečka
- Regulace krevního tlaku
- Indukci srážení krve
- Reprodukční funkce
- Regulace cyklu spánku

Arachidonic acid residue



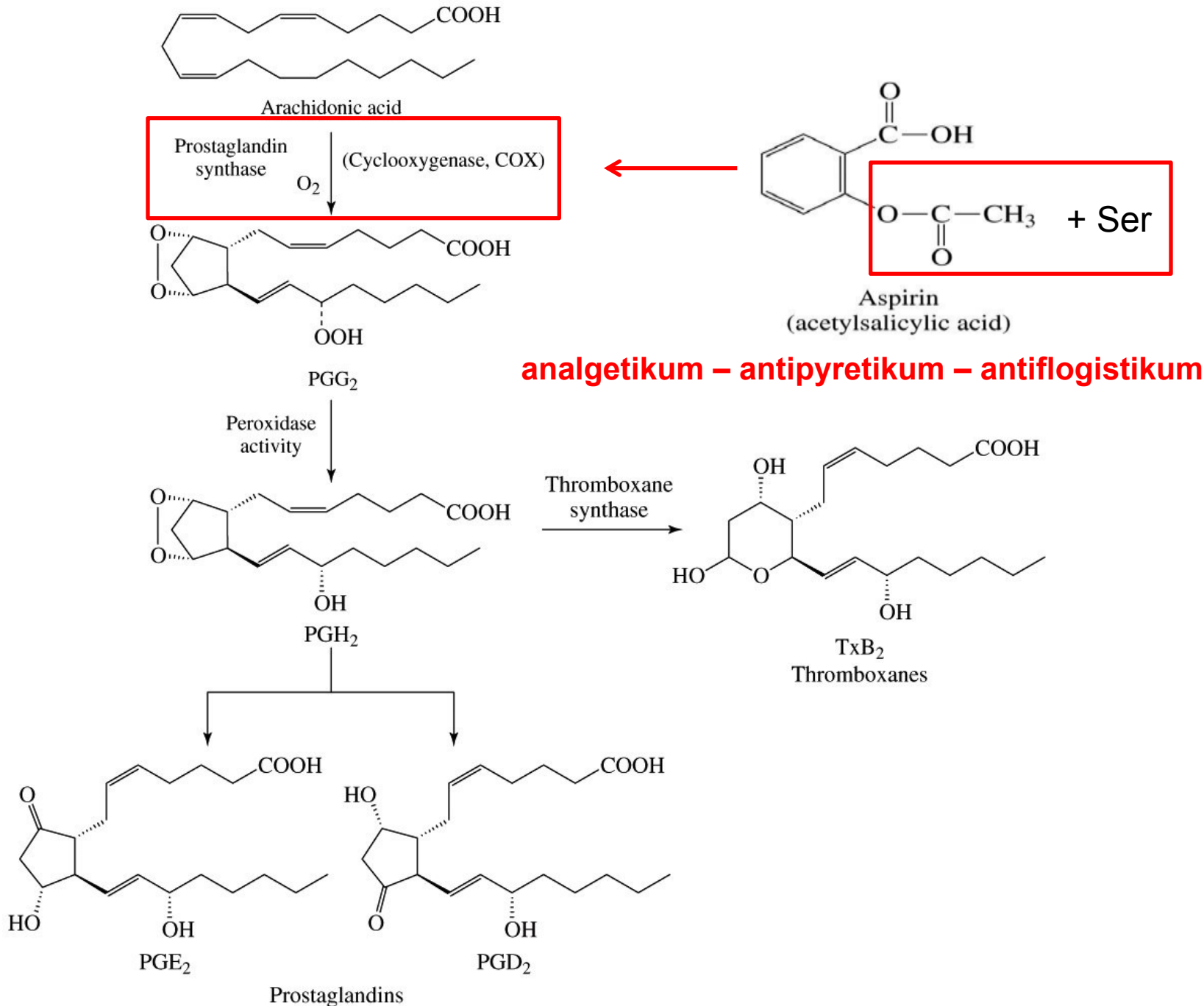
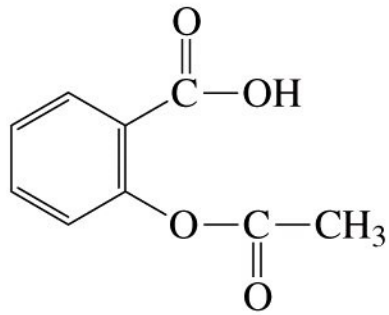
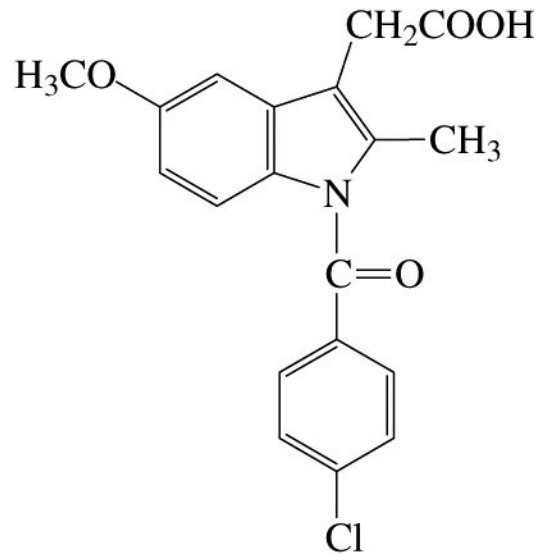


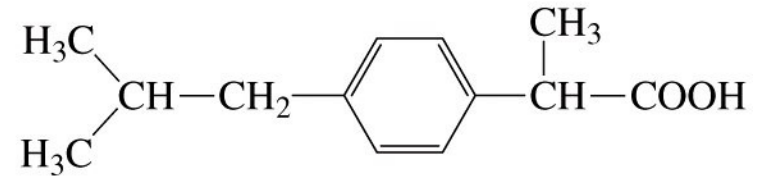
Figure 8-14 Concepts in Biochemistry, 3/e



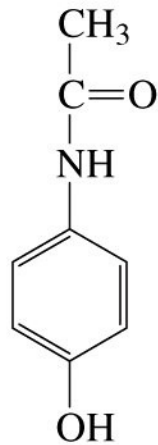
Aspirin
(acetylsalicylic acid)



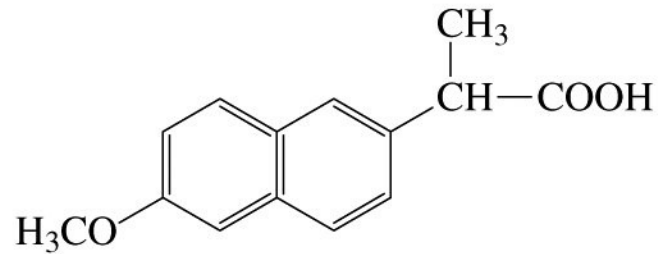
Indomethacin



Ibuprofen



Acetaminophen

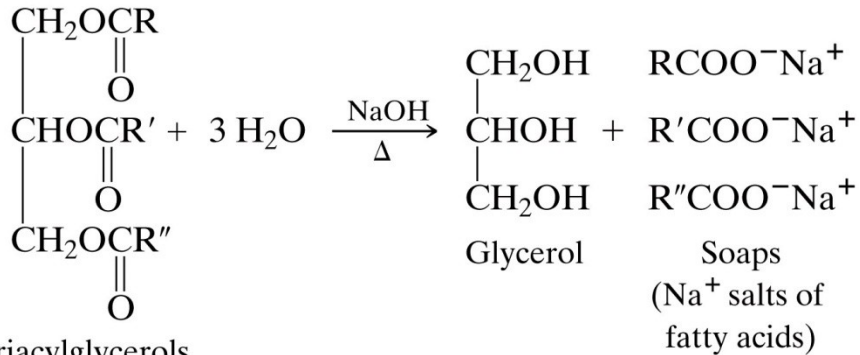


Naproxen (Aleve)

Důležité reakce tuků - zmydlování - NaOH

- ztužování - H₂

- žluknutí - O₂



Triacylglycerols

Unnumbered figure pg238b Concepts in Biochemistry, 3/e
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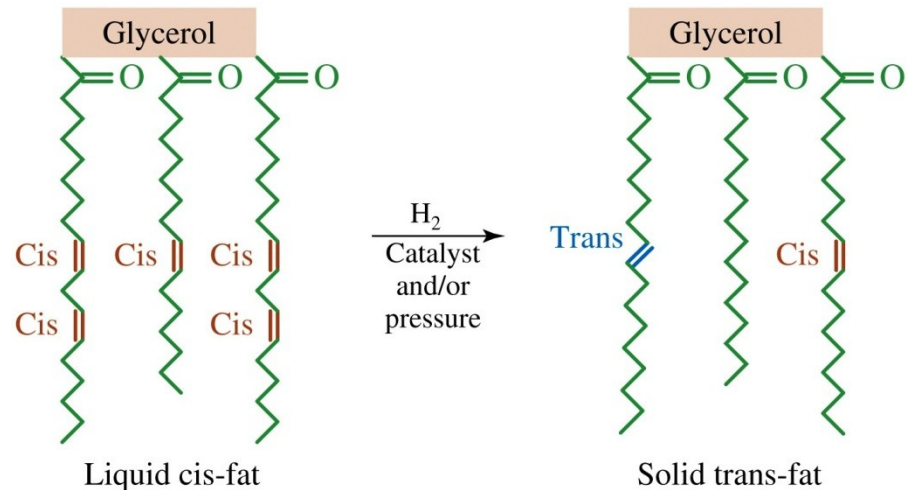
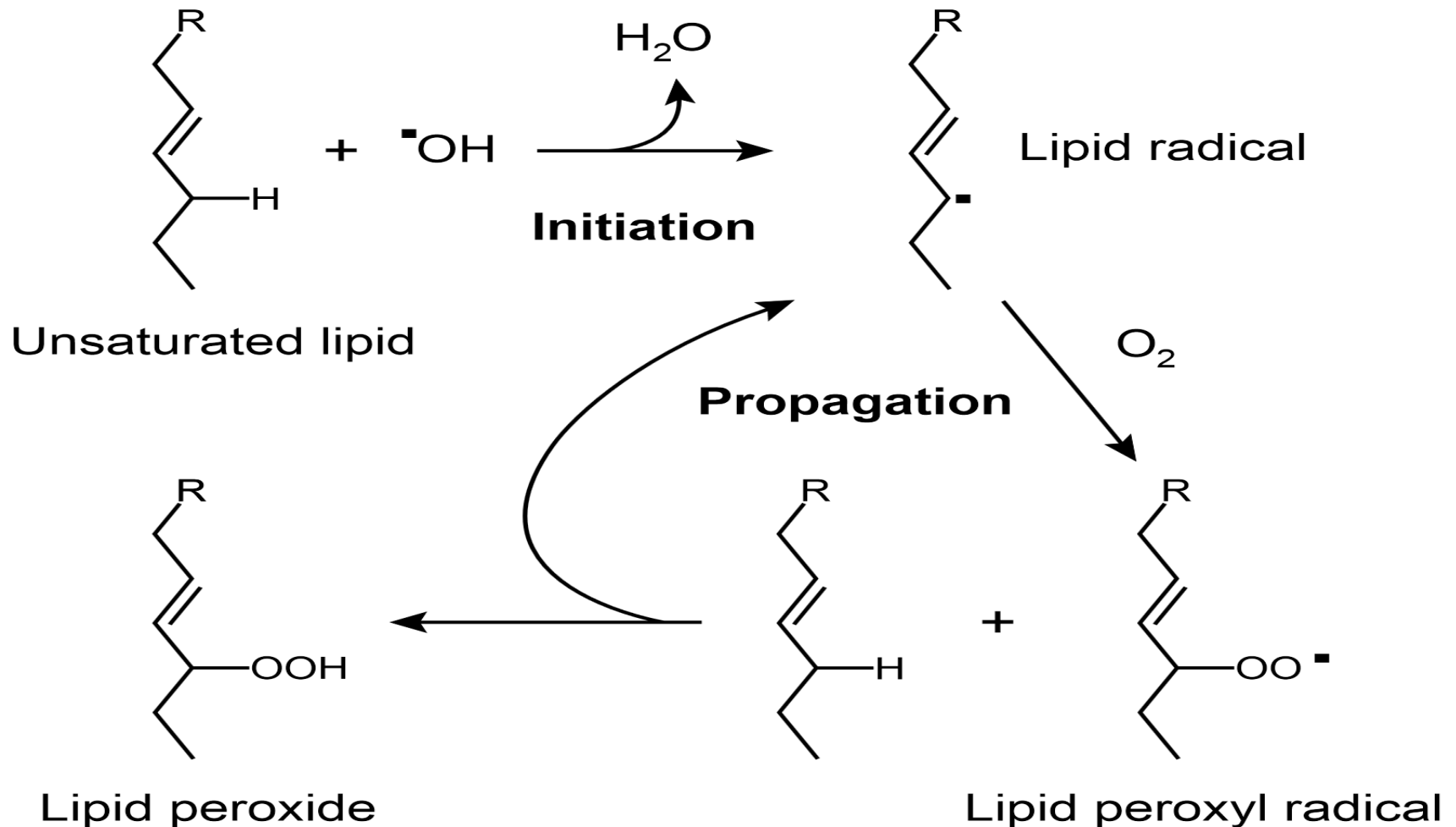


Figure 8-3 Concepts in Biochemistry, 3/e
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Lipoperoxidace

reaktivní formy kyslíku (ROS)



VOSKY - estery mastných kyselin a alifatických alkoholů

včelí vosk - palmitan myricylnatý ($C_{30}H_{61}OH$)

vorvaňovina - palmitan cetylnatý ($C_{16}H_{33}OH$)

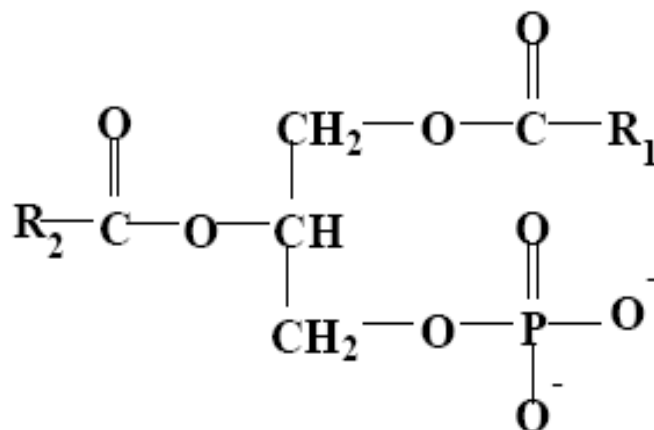
lanolin

karnaubský vosk

Složené lipidy :

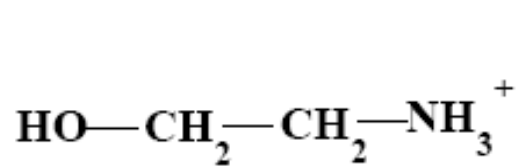
FOSFOLIPIDY

A. Fosfoacylglyceroly - fosfatidy

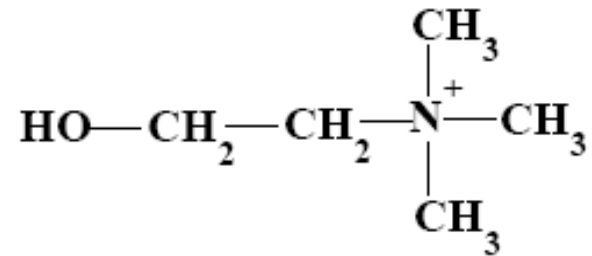


K. FOSFATIDOVÁ

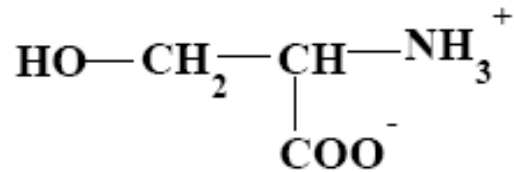
1,2-diacyl-glycerol-3-fosforečná k.



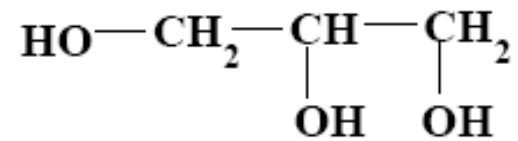
ETHANOLAMIN



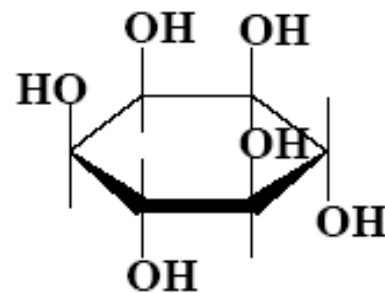
CHOLIN



SERIN



GLYCEROL

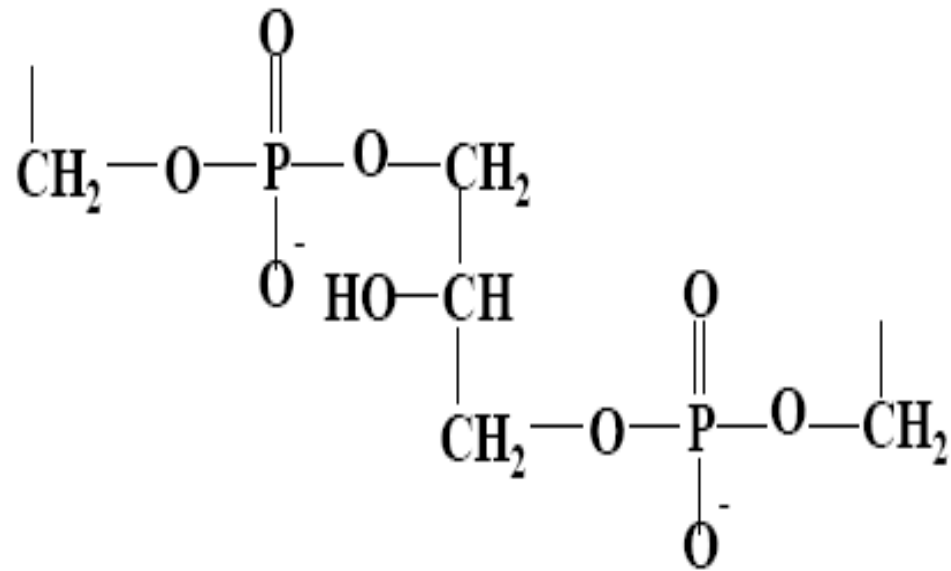


INOSITOL

Fosfatidylcholin - lecitiny

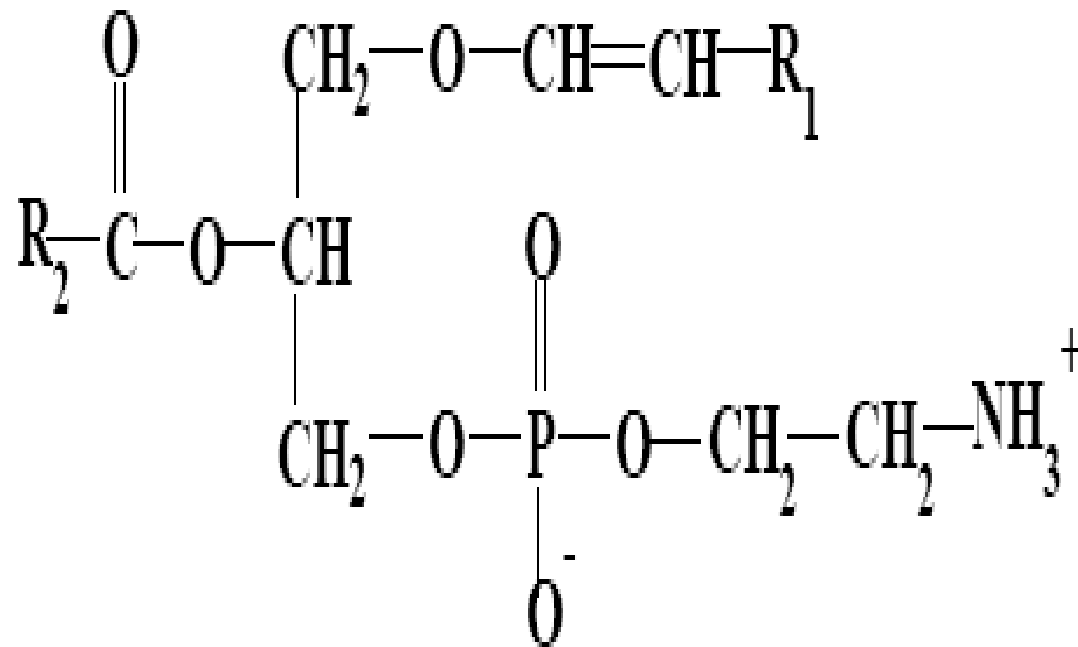
Fosfatidylethanolamin - kefaliny

Bisfosfatidylglycerol - kardiolipin



Fosfatidylinositol

Plazmalogeny



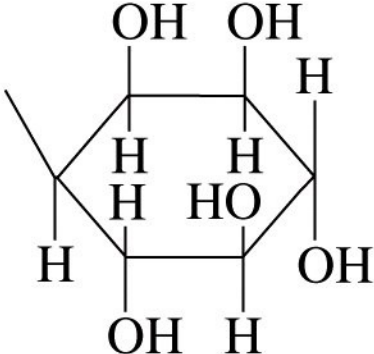
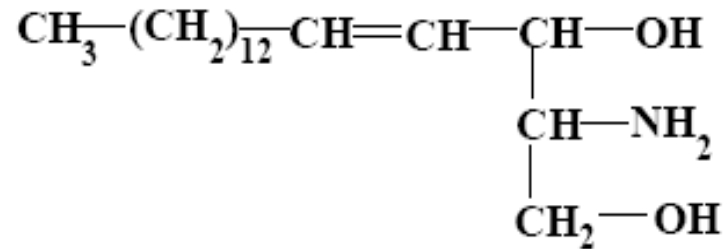
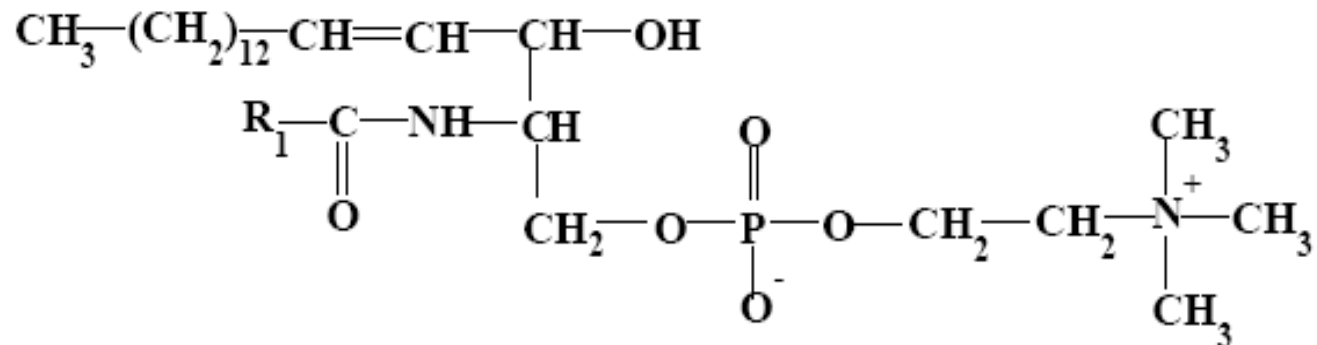
Name of X	Structure of X	Name of Glycerophospholipids
(a) Hydrogen	—H	Phosphatidic acid
(b) Ethanolamine	—CH ₂ —CH ₂ — $\overset{+}{\text{N}}\text{H}_3$	Phosphatidylethanolamine
(c) Choline	—CH ₂ —CH ₂ — $\overset{+}{\text{N}}(\text{CH}_3)_3$	Phosphatidylcholine
(d) Serine	$\begin{array}{c} \text{—CH}_2\text{—CH—}\overset{+}{\text{N}}\text{H}_3 \\ \\ \text{COO}^- \end{array}$	Phosphatidylserine
(e) Inositol		Phosphatidylinositol

Figure 8-7 part 2 Concepts in Biochemistry, 3/e
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B. Sfingomyeliny - sfingofosfolipidy



SFINGOSIN



SFINGOMYELIN

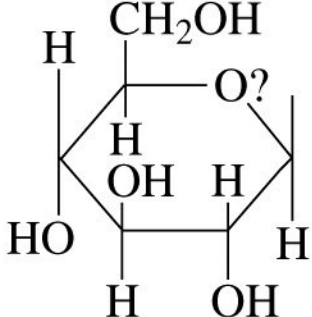
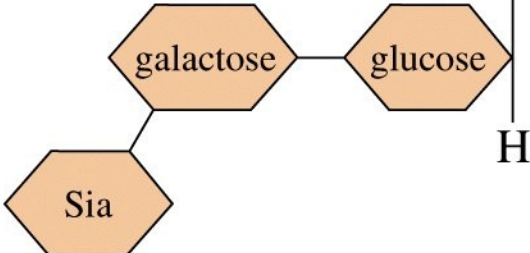
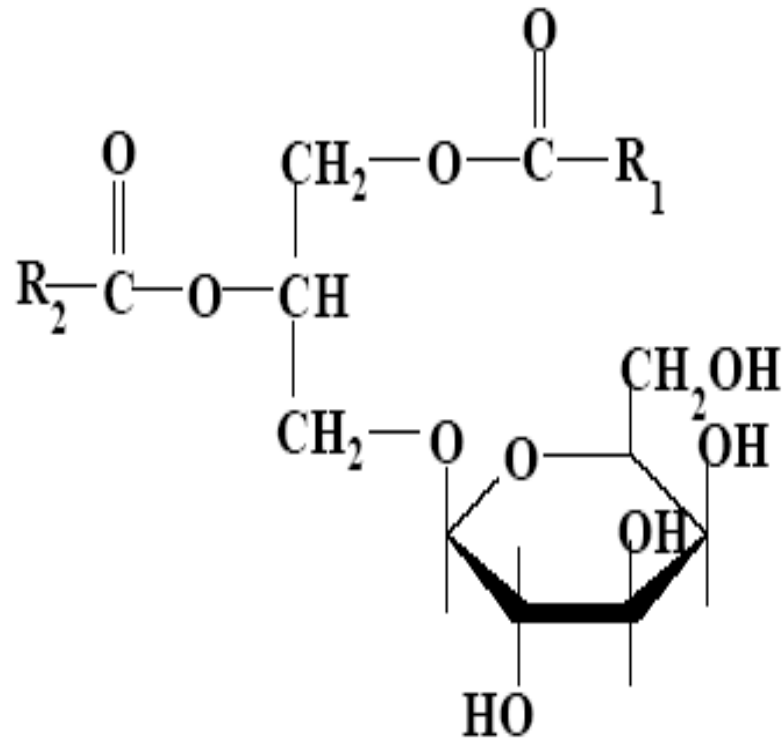
Name of X	Structure of X	Name of Sphingolipid
(b) Hydrogen	—H	Ceramide
(c) Phosphocholine	$\begin{array}{c} \text{O} \\ \parallel \\ \text{—P—O—CH}_2\text{CH}_2\text{N}^+(\text{CH}_3)_3 \\ \\ \text{O}^- \end{array}$	Sphingomyelin
(d) Glucose		Glucosylcerebroside
(e) Complex oligosaccharide		Ganglioside

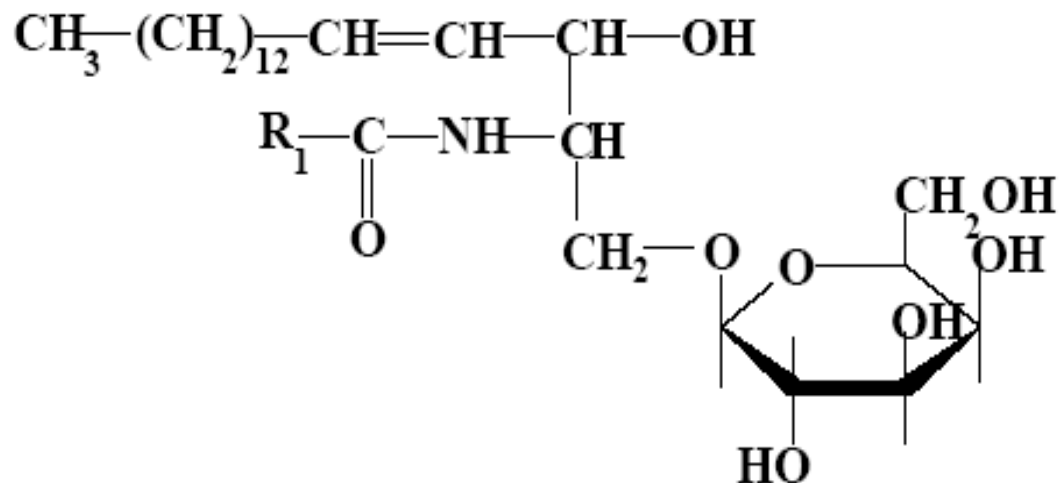
Figure 8-8 part 2 Concepts in Biochemistry, 3/e
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GLYKOLIPIDY

A. Glycerolglykolipidy



B. Cerebrosidy



galaktocerebrosidy - mozek

sulfatidy

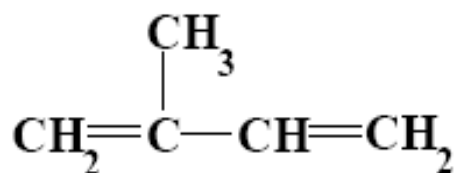
glukocerebrosidy - ostatní tkáně

C. Glykosfingolipidy

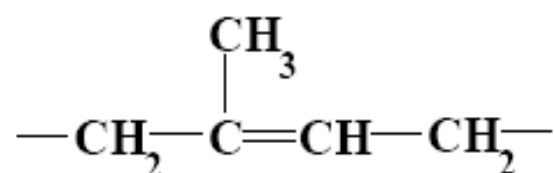
gangliosidy - sialová kyselina - ganglie nervových buněk

Izoprenoidní lipidy :

Základní strukturální jednotka - izopren 2-methyl-1,3-butadien

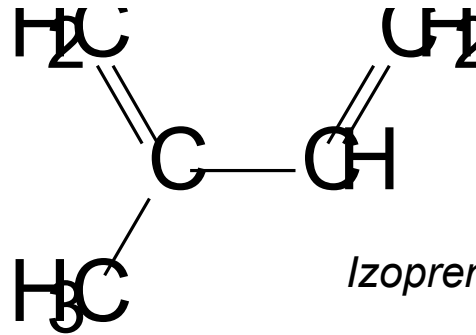


izopren

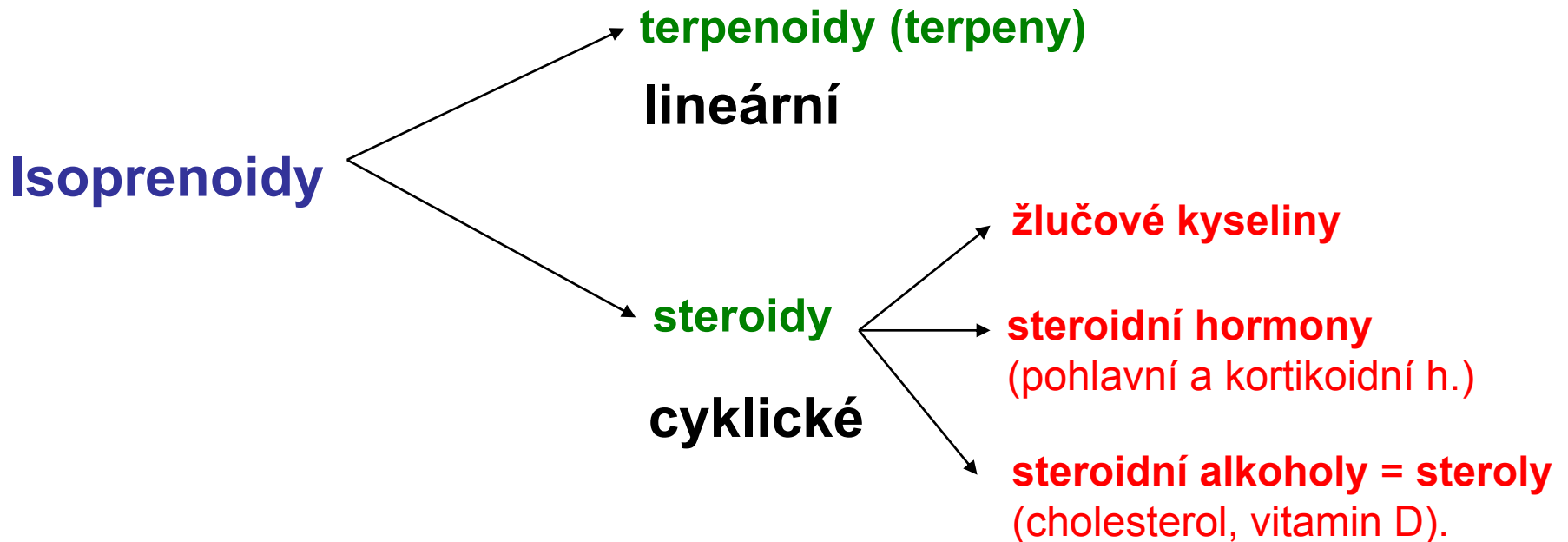


izopentenyl

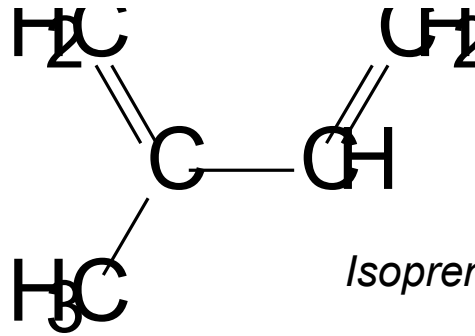
Izoprenoidy



Izopren (2-methylbuta-1,3-dien)



a) Terpenoidy = terpeny



Isopren (2-methylbuta-1,3-dien)

Monoterpeny	C10, 2 isopreny	Limonen, menthol, kafr, pinen
Seskviterpeny	C15, 3 isopreny	
Diterpeny	C20, 4 isopreny	Vitamin A (retinol), fytol
Triterpeny	C30, 6 isoprenů	
Tetraterpeny	C40, 8 isoprenů	Karotenoidy, skvalen
Polyterpeny	C5n, n isoprenů	Přírodní kaučuk

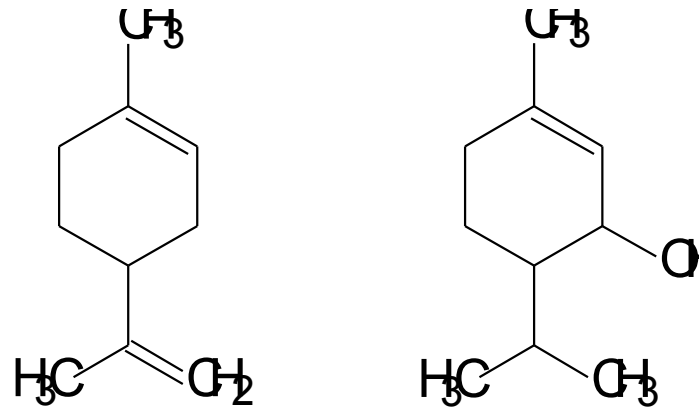
Izoprenoidy

zdroje: *silice* (éterické oleje) – vonící těkavé kapaliny
(hlavně květy a plody rostlin)

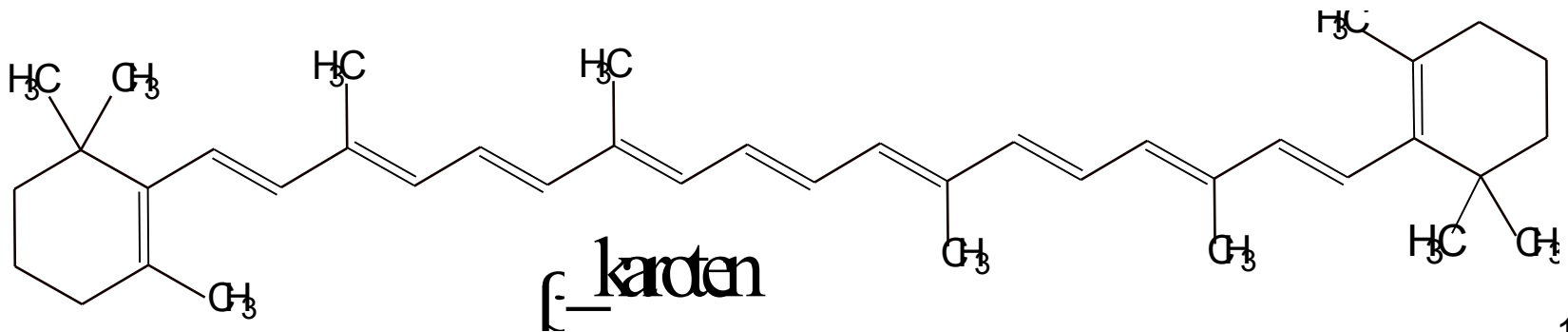
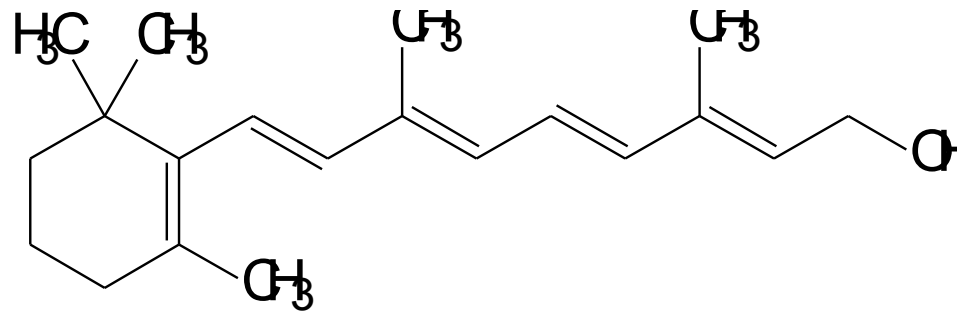


nerozpustné ve vodě, vznikají oxidací silic v místech
porušení kůry jehličnanů, specifická vůně
balzámy – polotekuté směsi silic a pryskyřic

Silice:



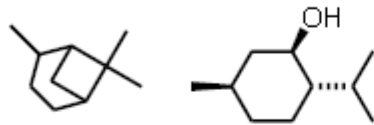
Vitamin A a karotenoidy:



Terpeny (Terpenoidy, Isoprenoidy)

Monoterpenes

C₁₀



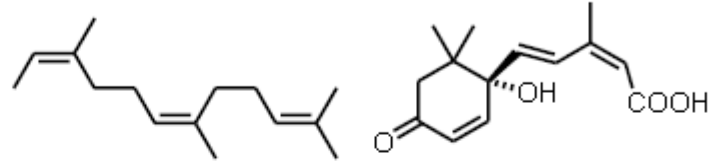
pinane

menthol

silice v terpentýnu silice v máčě

Sesquiterpenes

C₁₅



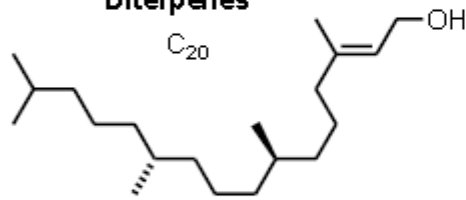
farnesane

abscisic acid

vůně zralých jablek rostlinný hormon

Diterpenes

C₂₀

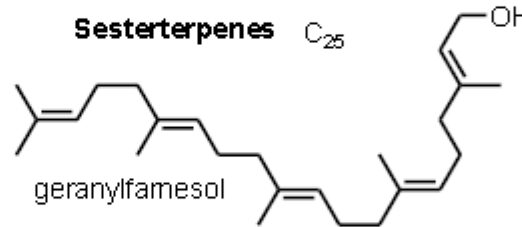


součást chlorofylu

phytol

Sesterterpenes

C₂₅

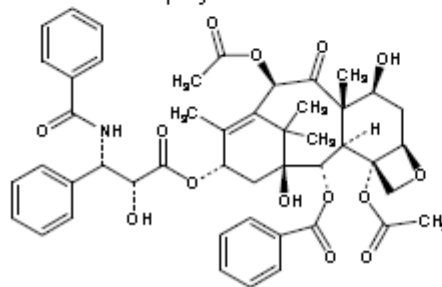


geranyl

farnesyl

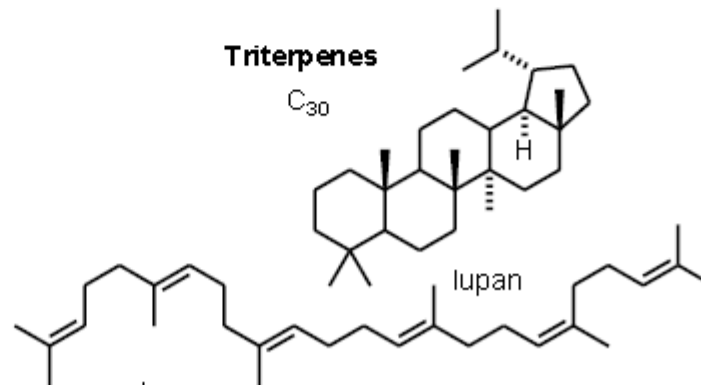
Triterpenes

C₃₀



Taxol

alkaloid z tisú



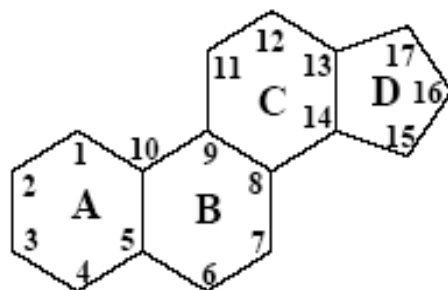
squalene

lupan

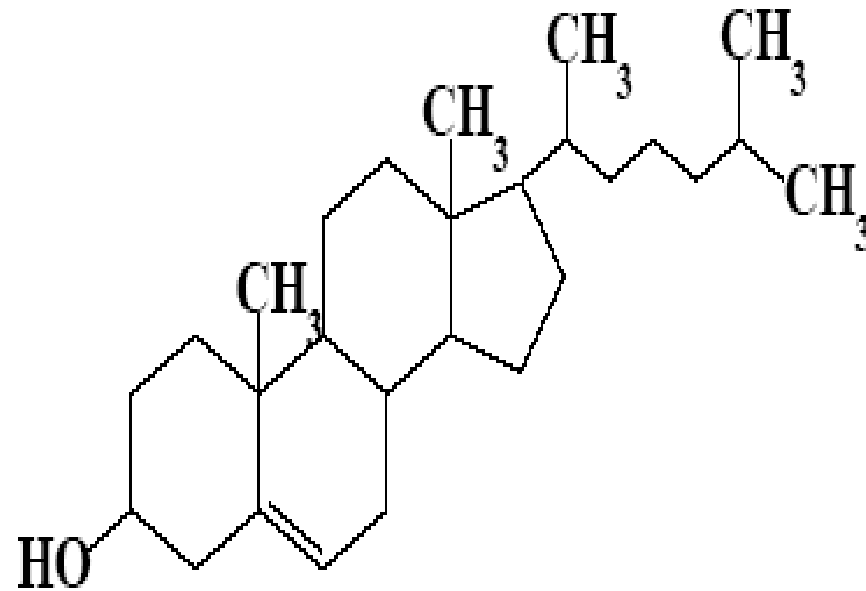
játra žraloka

STEROIDY

STERAN - cyklopentanoperhydrofenantren

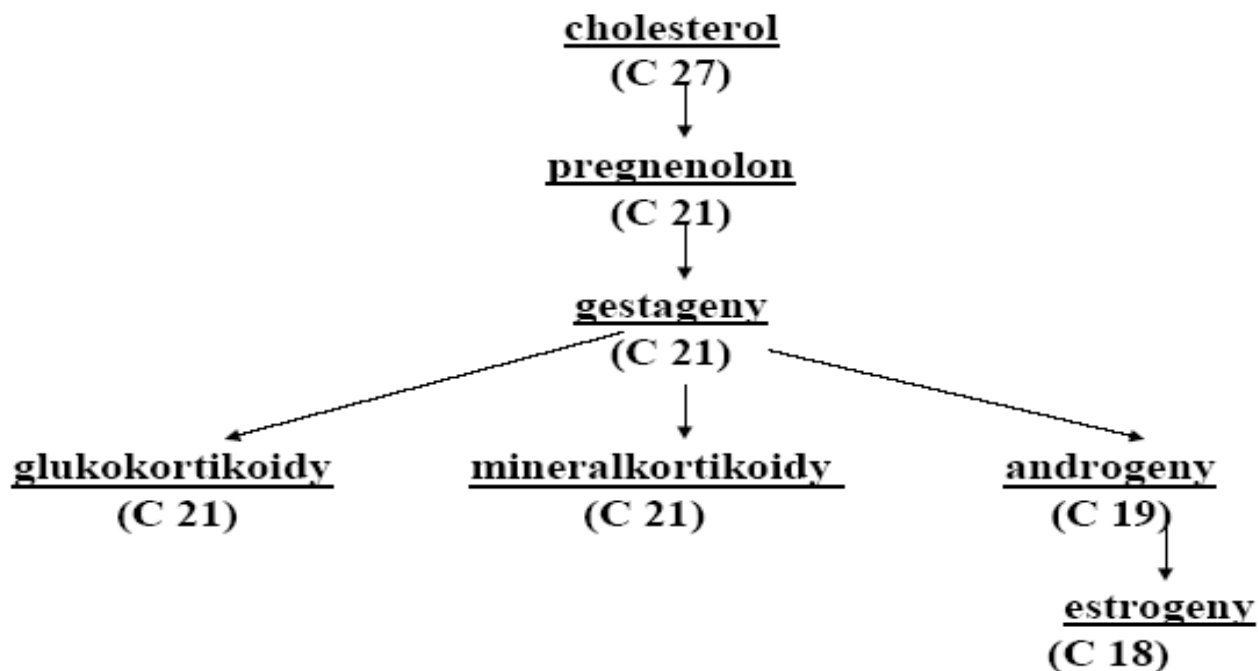


A. Steroly



CHOLESTEROL

Steroidní hormony



Glukokortikoidy - kortisol, kortikosteron - kůra nadledvinek

Mineralkortikoidy - aldosteron - kůra nadledvinek

Androgeny - testosteron - varlata

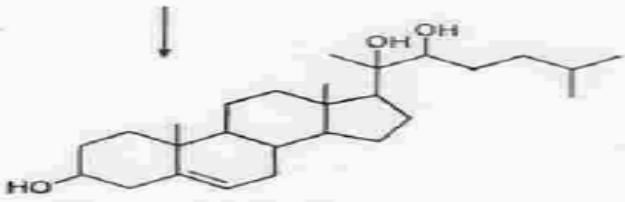
Estrogeny - estron, estradiol, estratriol - vaječníky

Gestageny - progesteron - vaječníky

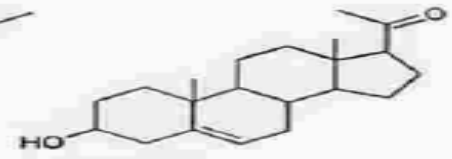
+biosyntesa glykogenu
- proteosyntesa

zadržování Na^+ , Cl^- , HCO_3^-
vyučování K^+

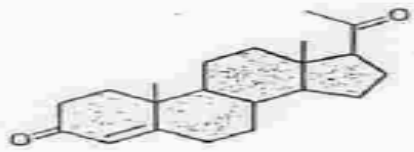
cholesterol \rightleftharpoons ester cholesterolu
(5-cholesten-3 β -ol)



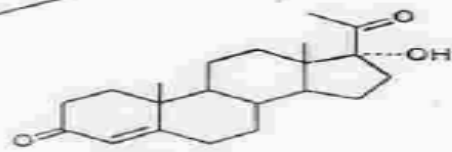
20,22-dihydroxycholesterol
(20,22-dihydroxy-5-cholesten-3 β -ol)



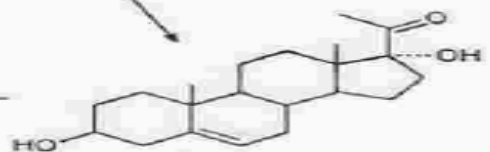
pregnenolon
(3 β -hydroxy-5-pregnen-20-on)



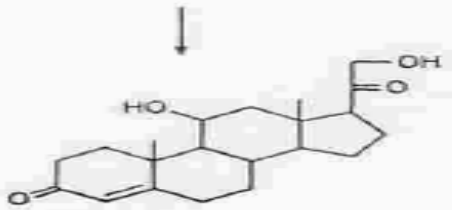
progesteron
(4-pregnen-3,20-dion)



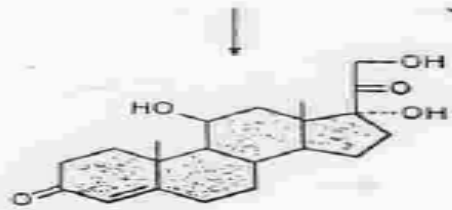
17-hydroxyprogesteron
(17-hydroxy-4-pregnen-3,20-dion)



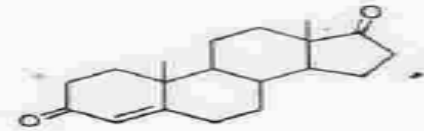
17-hydroxypregnenolon
(3 β ,17-dihydroxy-5-pregnen-20-on)



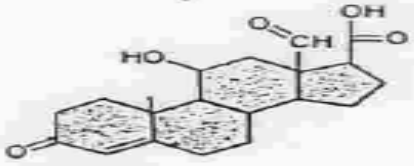
kortikosteron
(11 β ,21-dihydroxy-4-pregnen-3,20-dion)



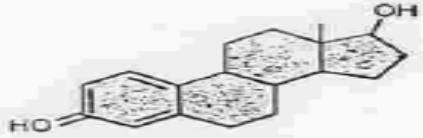
kortisol
(11 β ,17,21-trihydroxy-4-pregnen-3,20-dion)



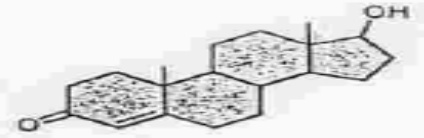
androstendion
(4-androsten-3,17-dion)



aldosteron
(11 β ,21-dihydroxy-3,20-dioxo-4-pregnen-18-al)



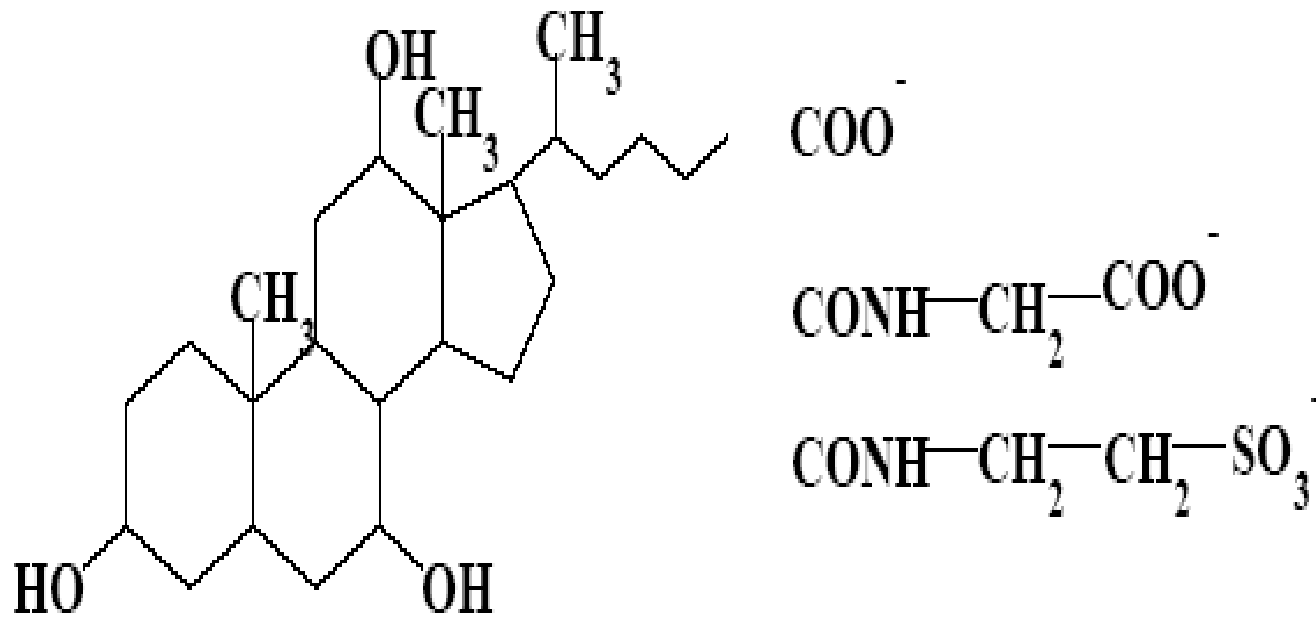
17 β -estradiol
(1,3,5(10)-estratrien-3,17 β -diol)



testosteron
(17 β -hydroxy-4-androsten-3-on)

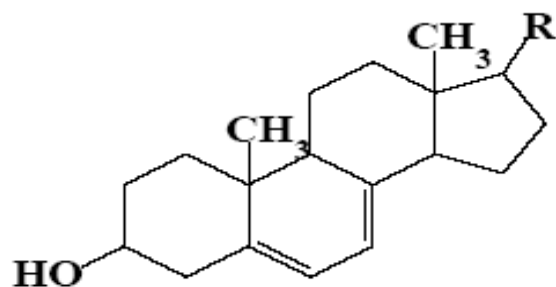
játra → žlučník

B. Žlučové kyseliny - k. cholová, k. glykocholová, k. taurocholová



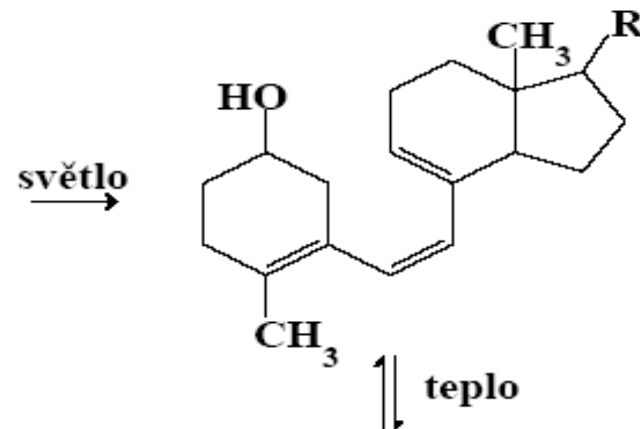
C. Kalciferoly - vitaminy - D₃ - cholekalciferol, D₂ - ergokalciferol

provitamin D

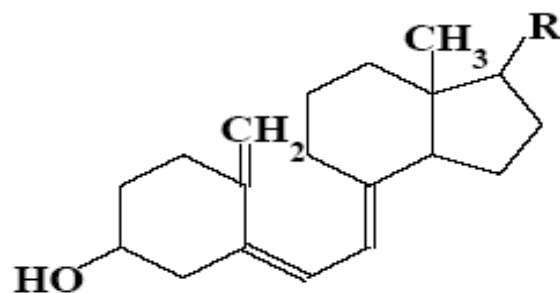


kůže

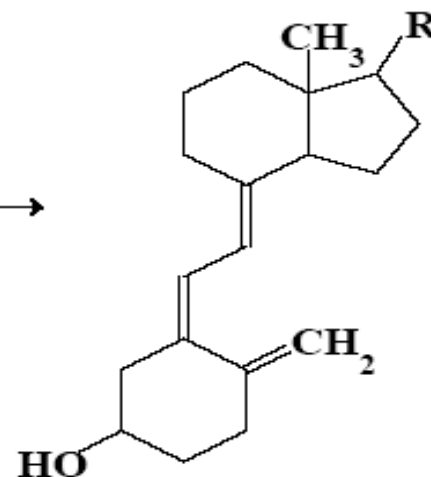
prekalciferol



teplo

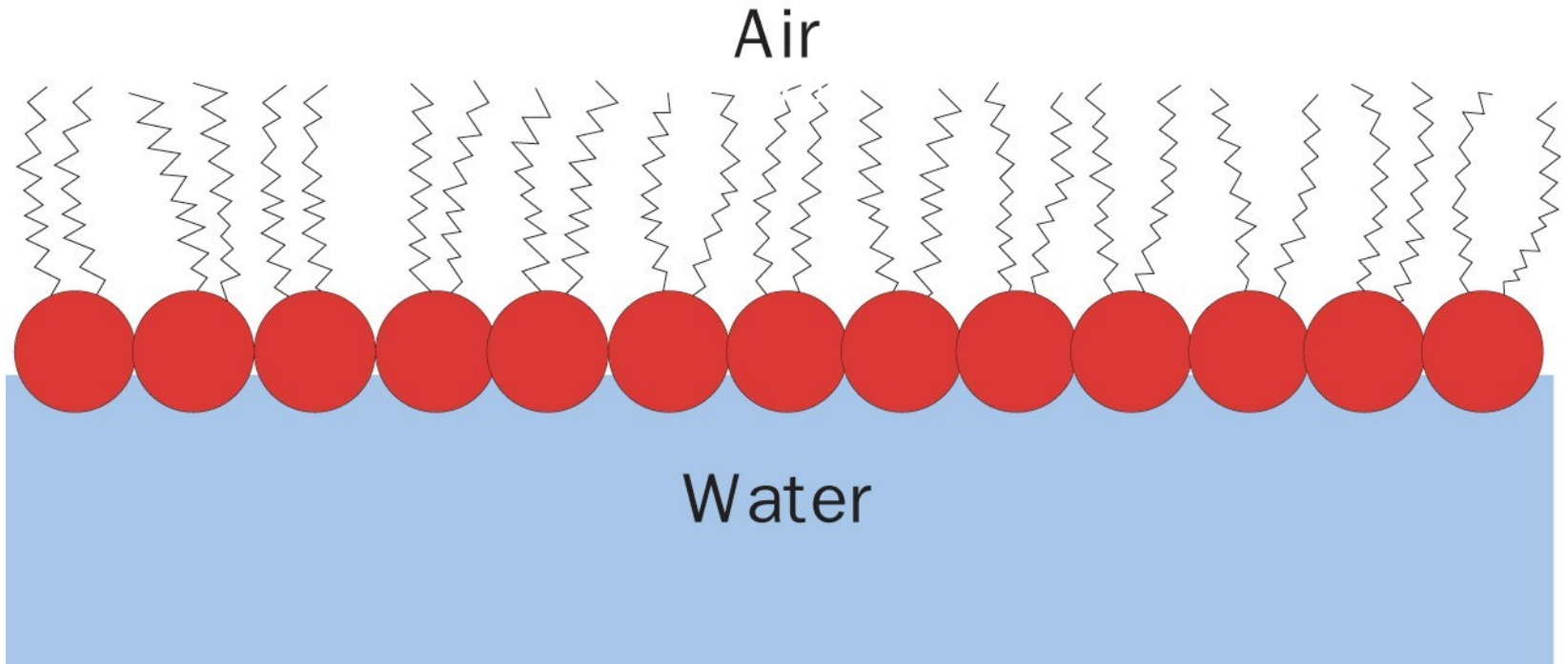


↔



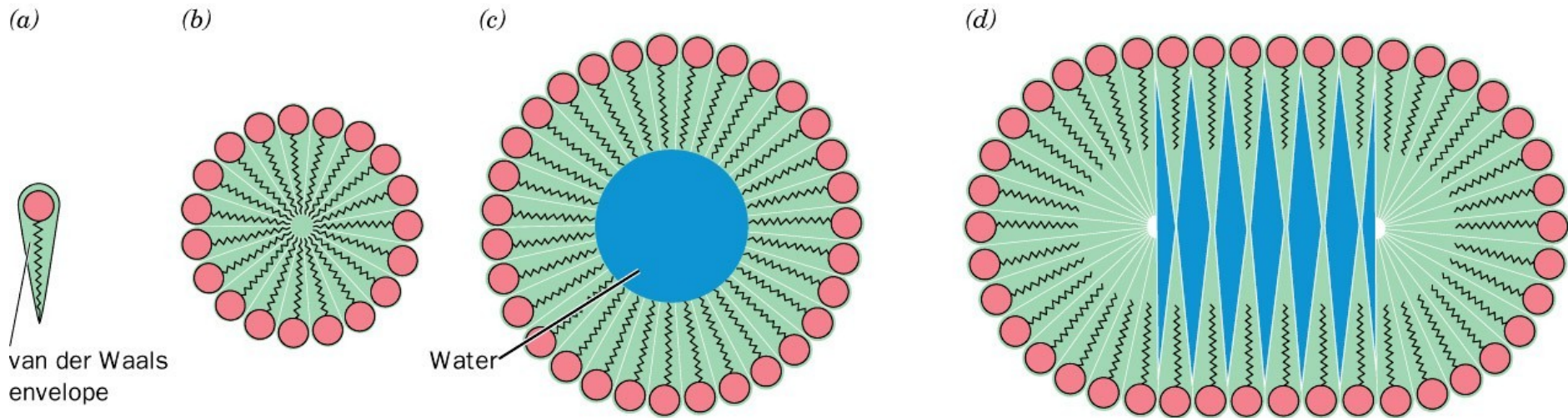
kalciferol

Membrány



Membrány

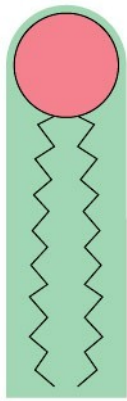
detergenty, tenzidy,



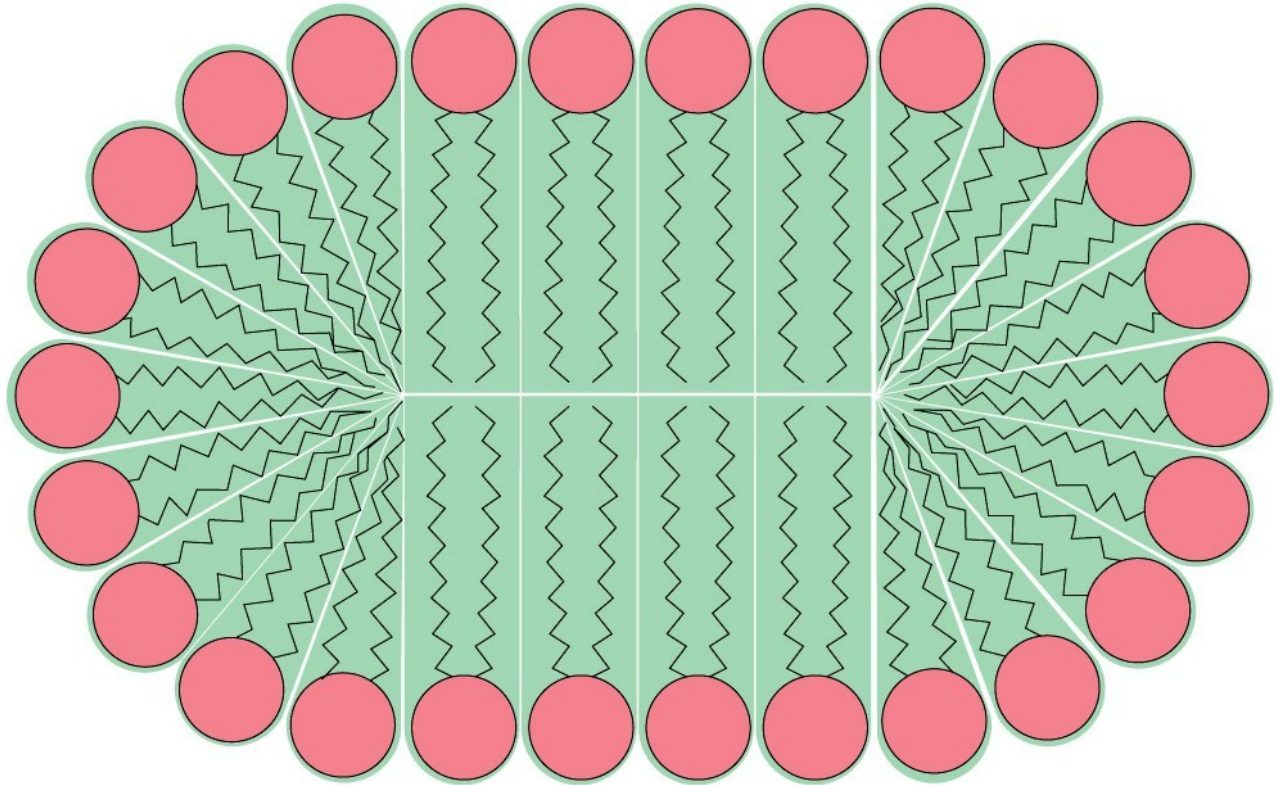
Membrány

fosfolipidy

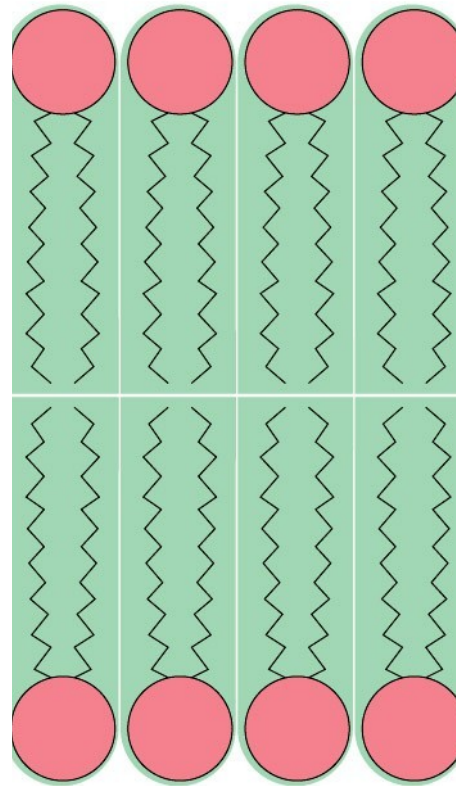
(a)



(b)



Membrány



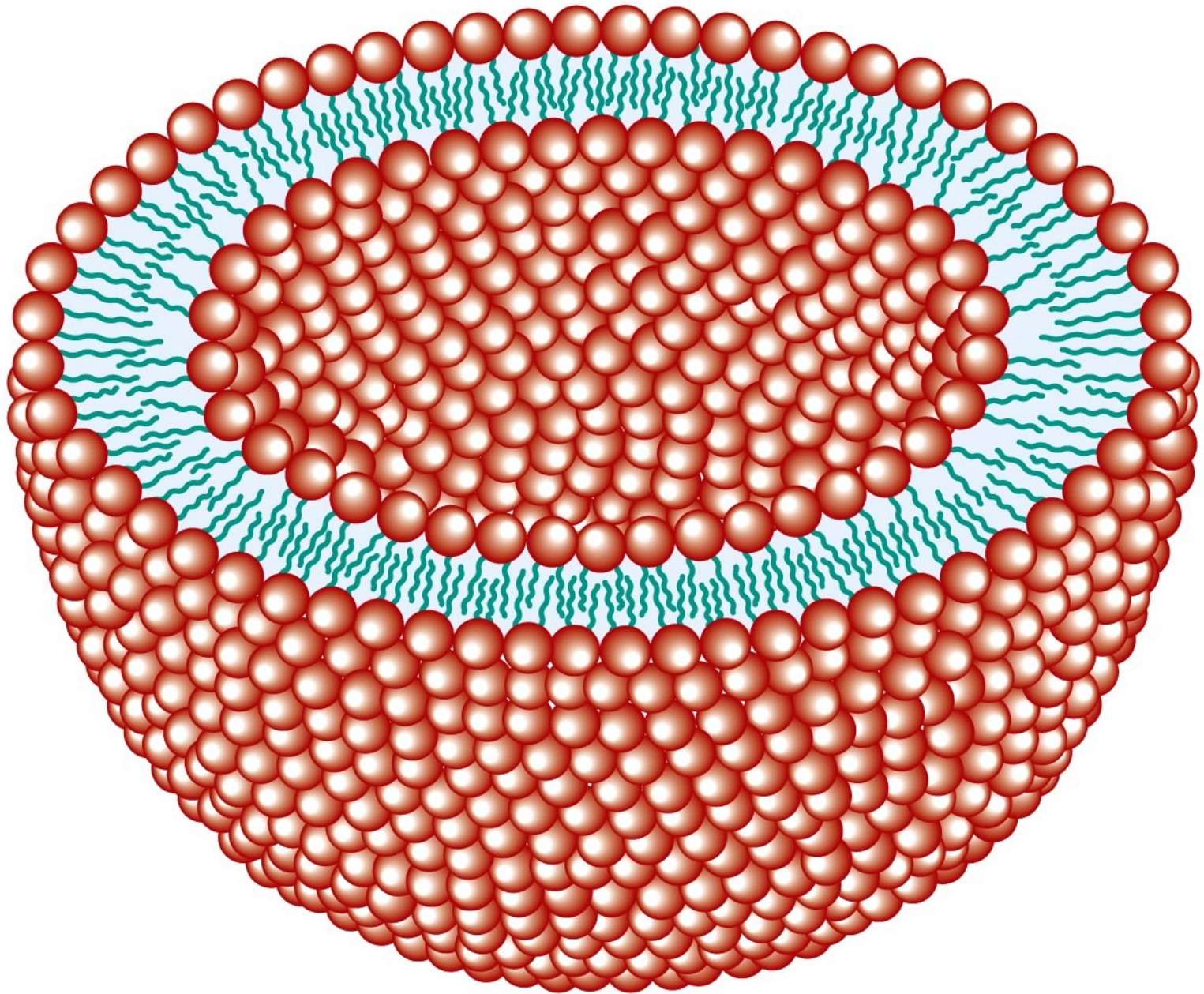


Figure 9-1b Concepts in Biochemistry, 3/e
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Biomembrány : agregované formy biolipidů

Význam biomembrán - transport

- kompartmentace

- komunikace

Biomembrány : agregované formy biolipidů

Molekulové složení membrán

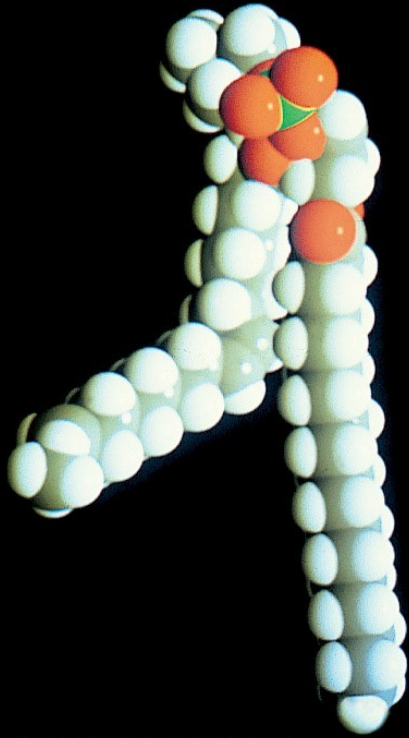
Membrána	proteiny %	lipidy %	sacharidy %
cytoplazmatická	49	43	8
jaderná	59	35	2
mitochondriální vnější	52	46	2
mitochondriální vnitřní	76	23	1
myelinová	18	79	3

- *Lipidy* - fosfolipidy, cholesterol

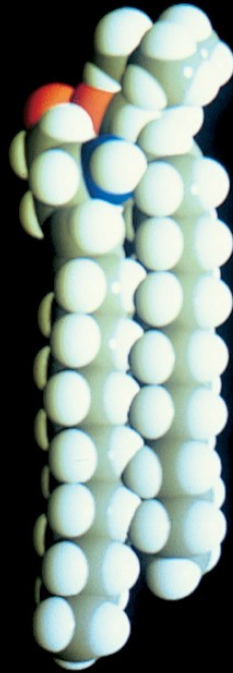
funkce - strukturní

Lipid (%)	erythrocyt	myelin	mitochondrie	E.coli
fosfatidylcholin	19	10	39	0
fosfatidylethanolamin	18	20	27	65
fosfatidylglycerol	0	0	0	18
kardiolipin	0	0	23	12
sfingomyelin	18	9	0	0
glykolipidy	10	26	0	0
cholesterol	25	26	3	0

Fosfolipid, sfingomyelin, gangliosid, cholesterol



Courtesy of Richard Pastor, FDA, Bethesda, Maryland



Courtesy of Richard Pastor, FDA, Bethesda, Maryland



Courtesy of Richard Venable, FDA, Bethesda, Maryland



Courtesy of Richard Pastor, FDA, Bethesda, Maryland

- *Bílkoviny* - integrální, periferní

funkce - enzymy

přenašeče

receptory

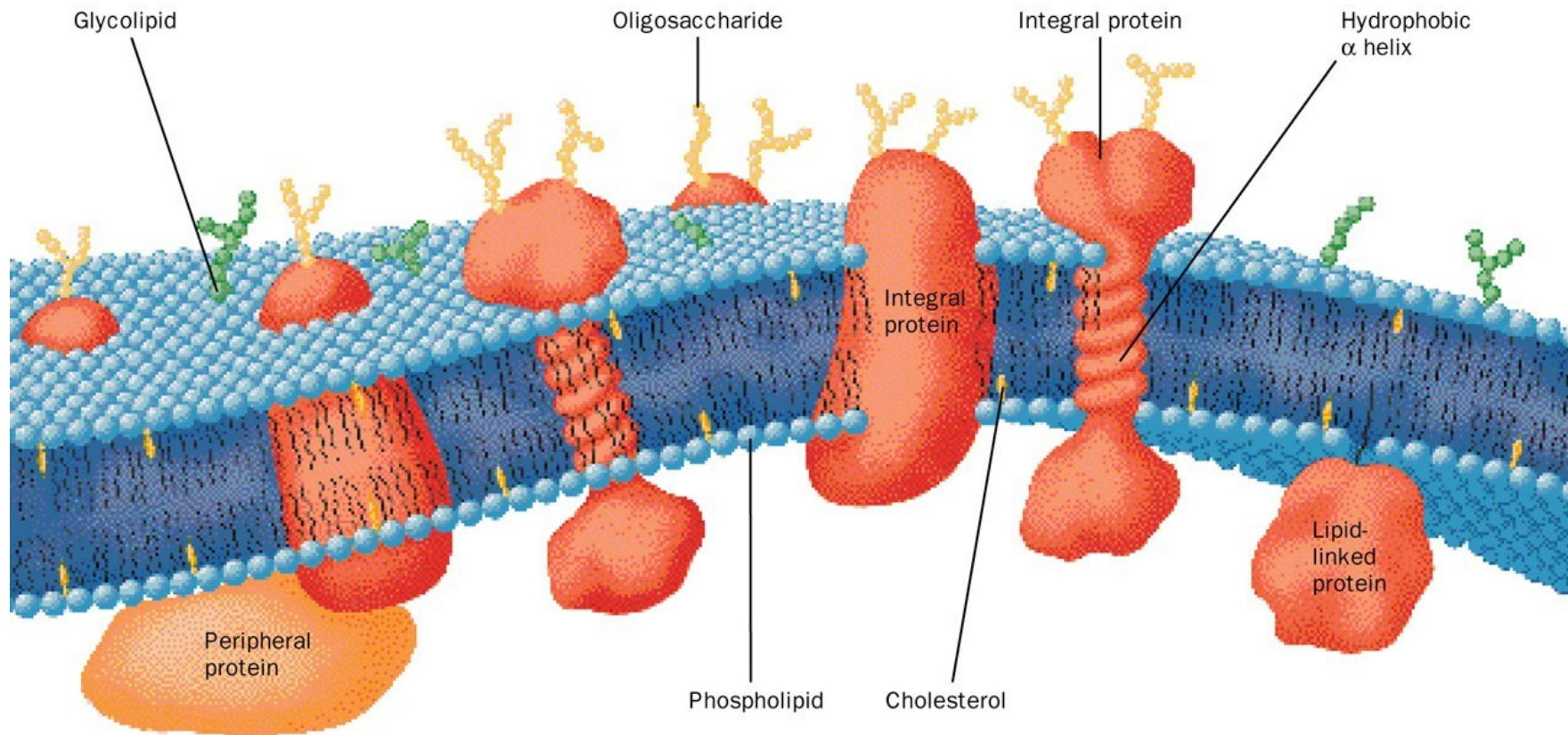
strukturní

- *Sacharidy* - glykolipidy, glykoproteiny

funkce - kotvení glykolipidů a glykoproteinů

v membránách

- rozpoznávací



Membránově vázané bílkoviny

Membránové bílkoviny

interagují

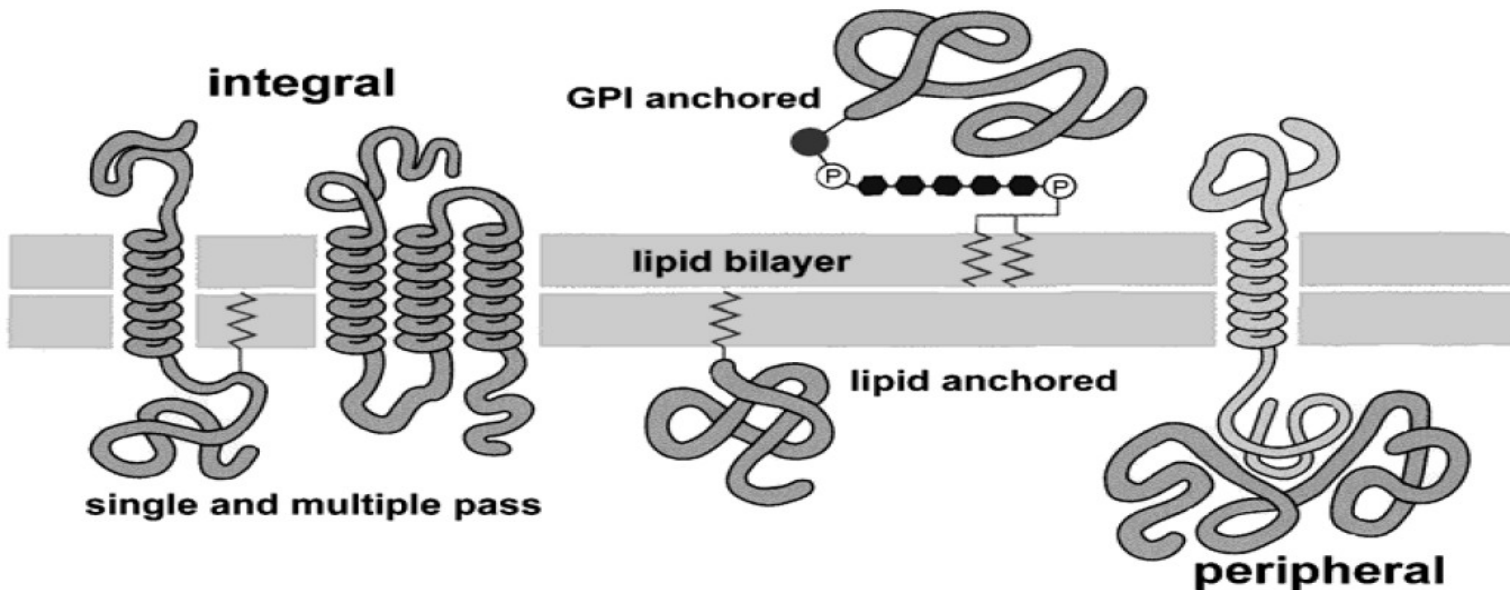
integrální

elektrostaticky

hydrofobně

zaměřené

transmembránové

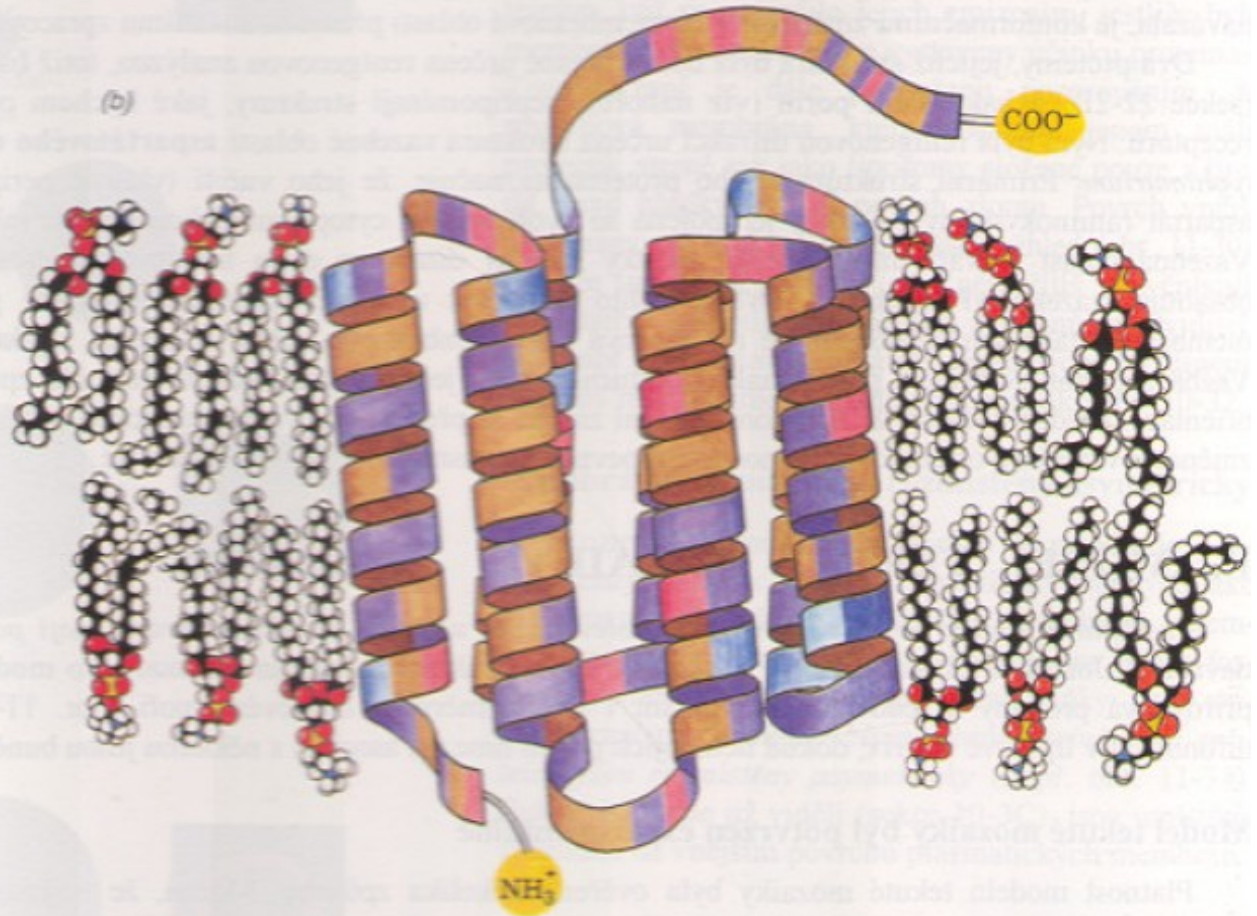


Bakteriorhodopsin

(a)



(b)



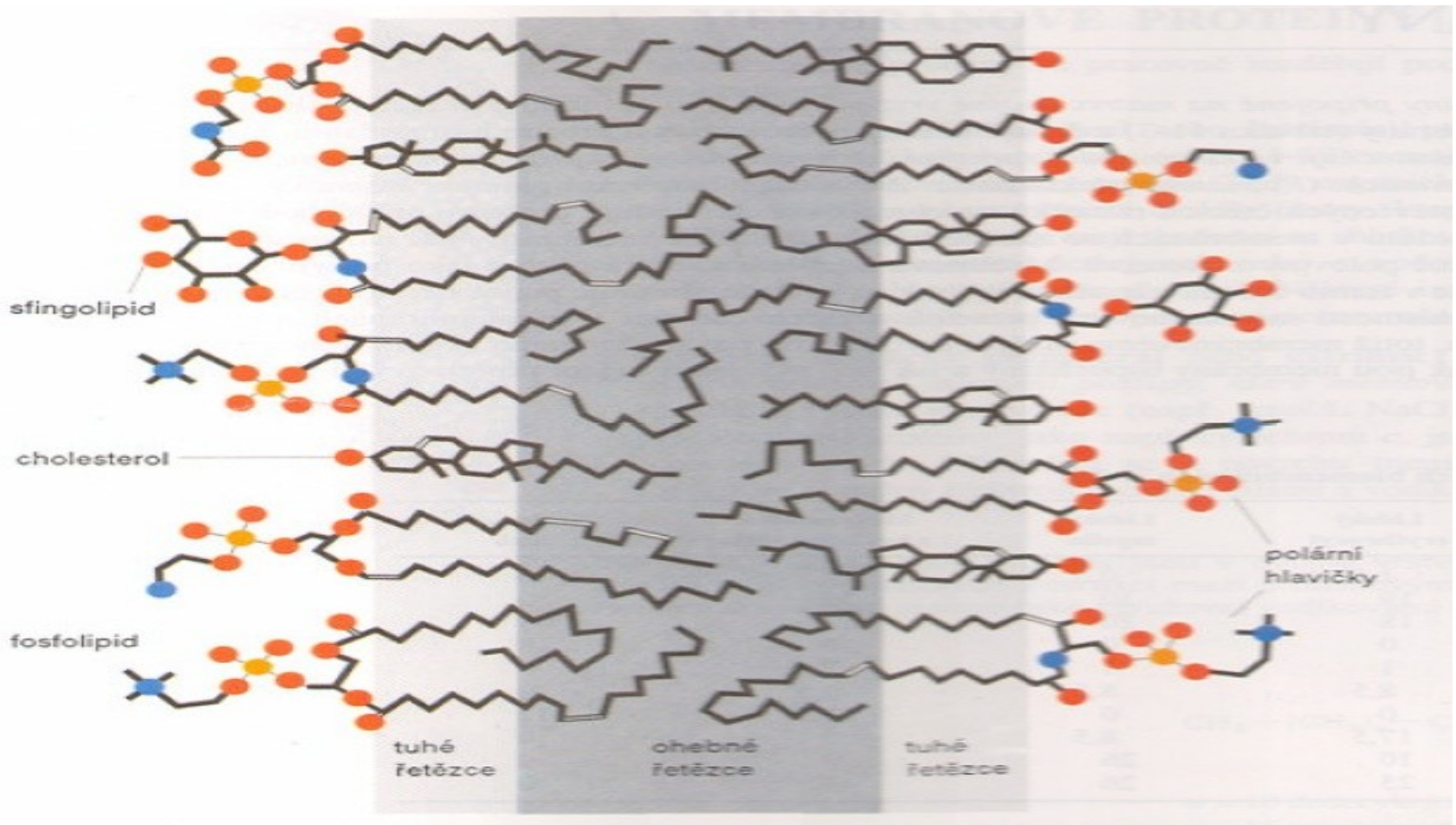
Modely membrán :

GORTER a GRENDL (1925) - Lipidová dvojvrstva

SINGER a NICHOLSON (1972) - Model tekuté mozaiky

Lipidická dvojvrstva

5 – 7.5 nm



Model tekuté mozaiky

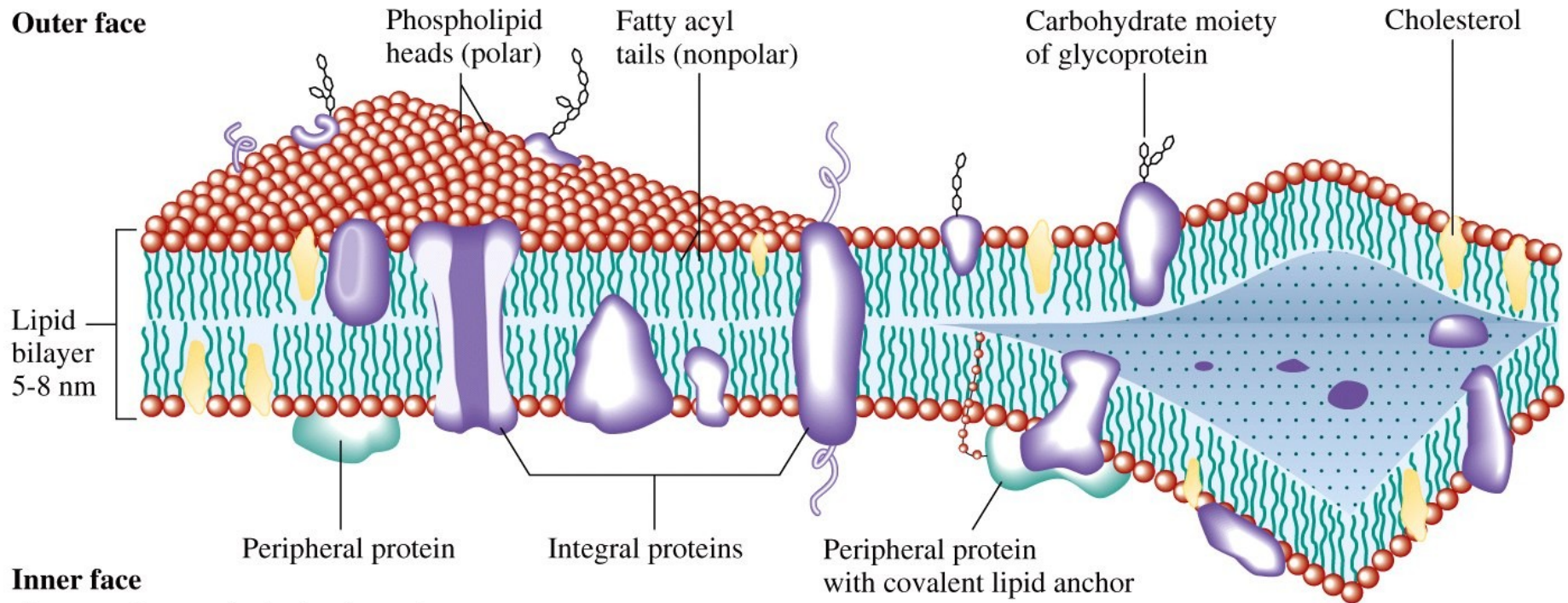
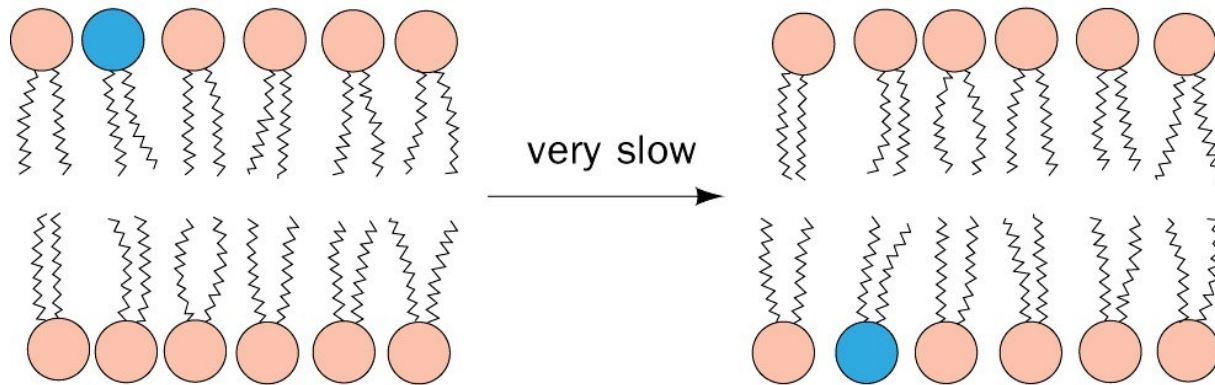


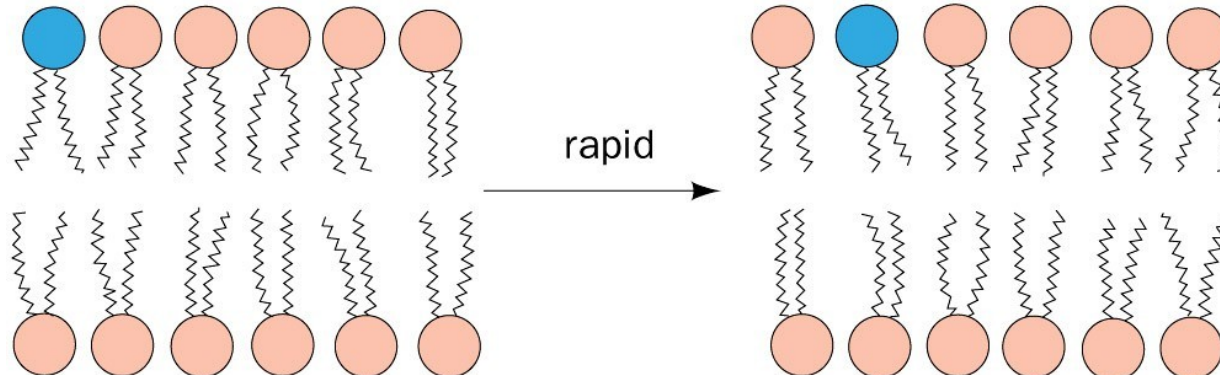
Figure 9-6 Concepts in Biochemistry, 3/e
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Difuze lipidů v membráně

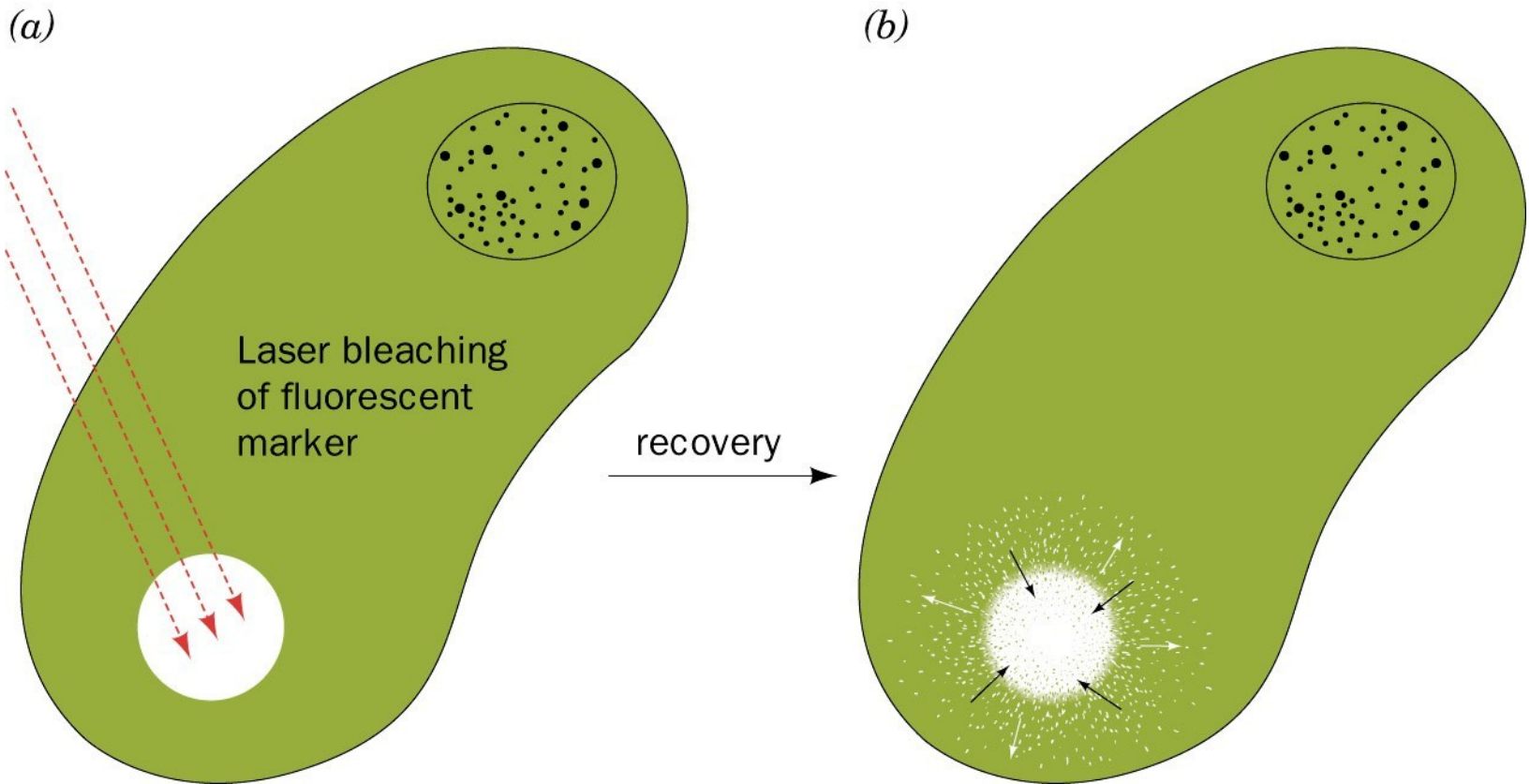
(a) Transverse diffusion (flip-flop)



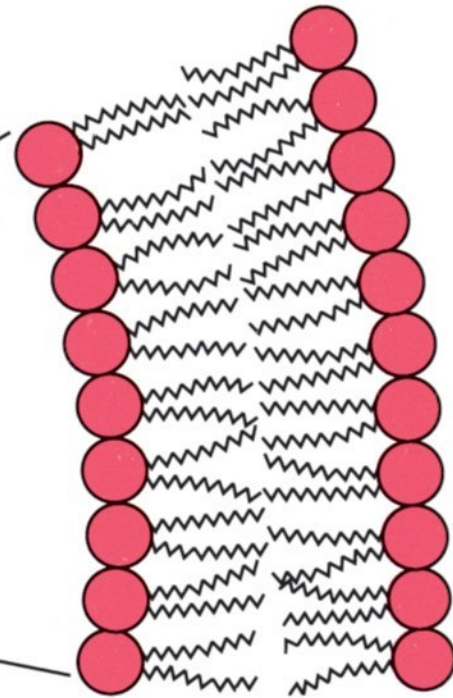
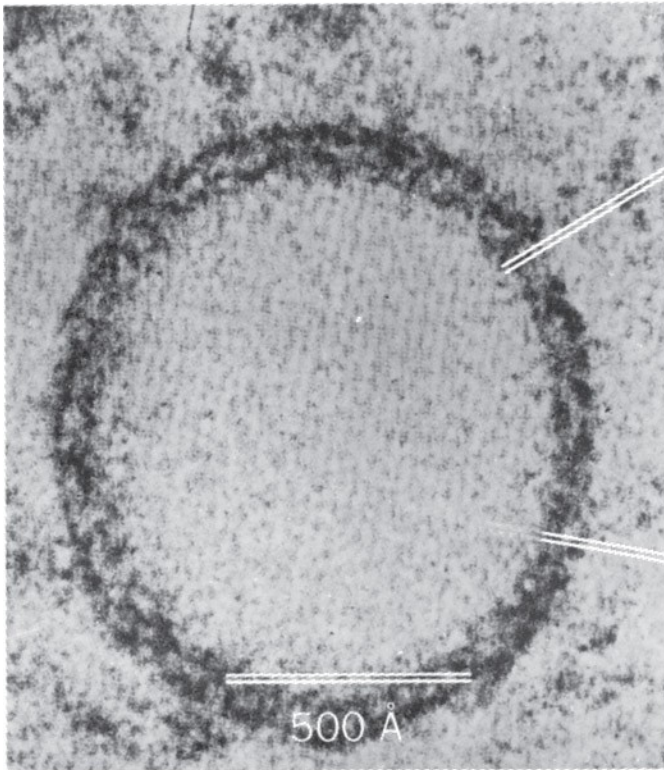
(b) Lateral diffusion



Difuze lipidů v membráně

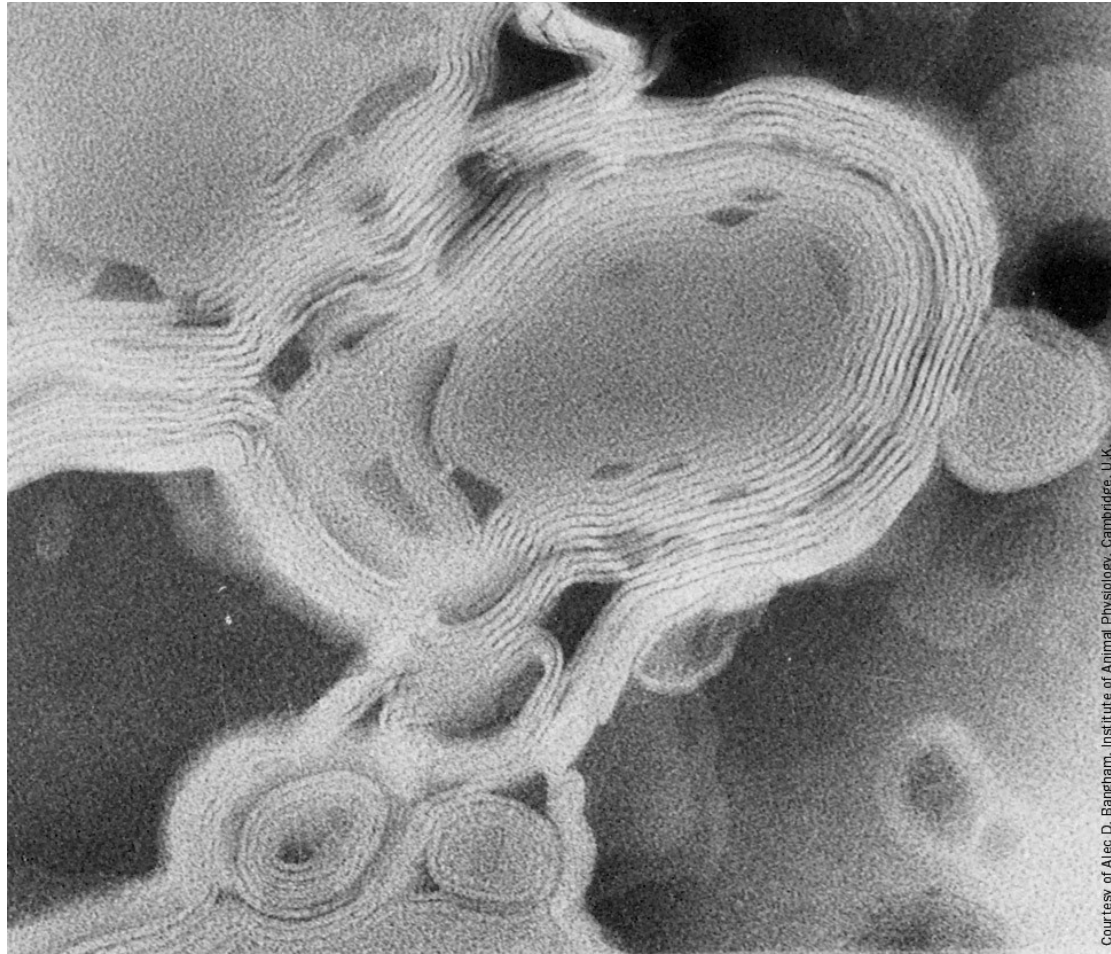


Liposomy



Courtesy of Walter Stoeckenius, University of California at San Francisco

Liposomy



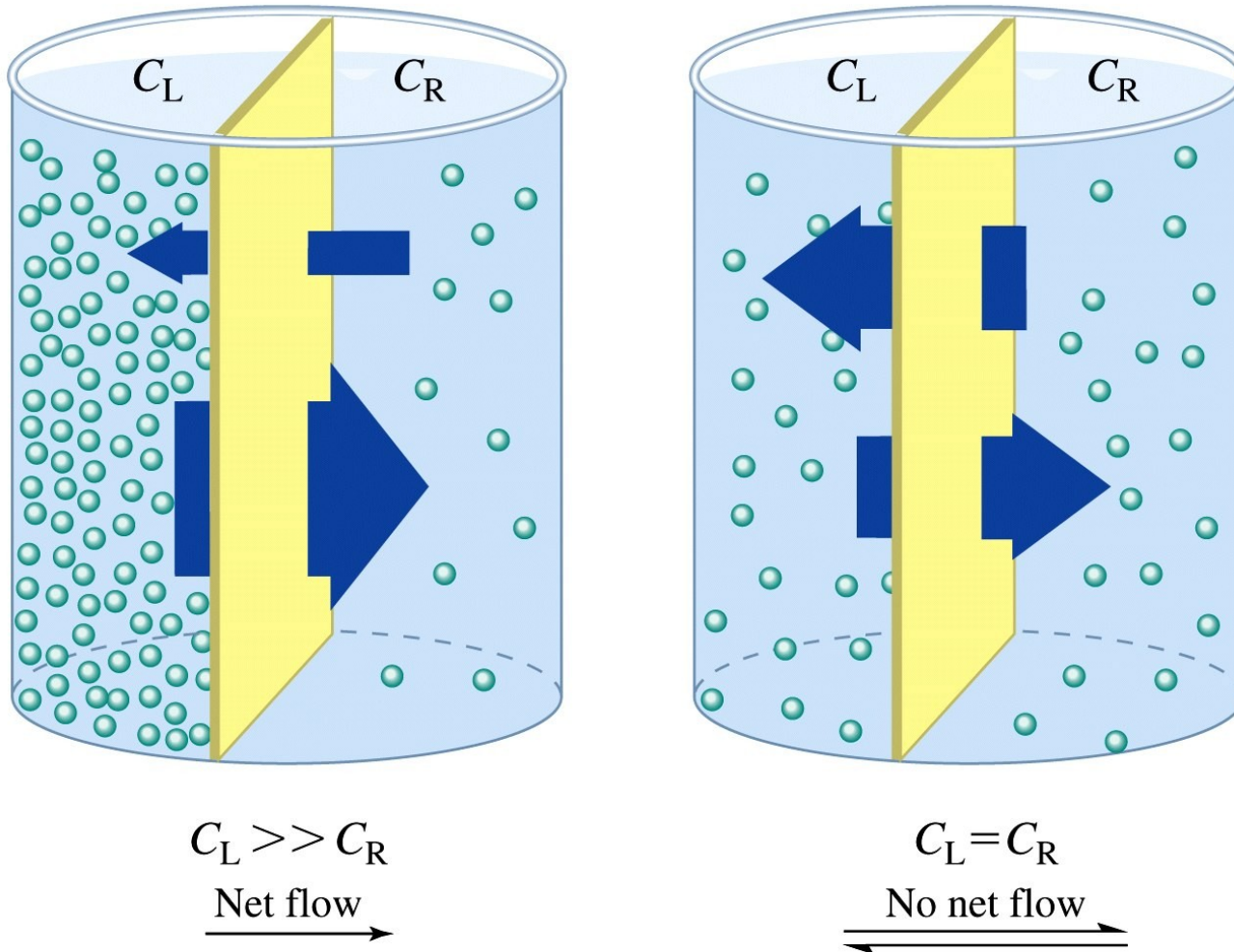
Transport

- Přísun živin
- Odstraňování odpadních látek
- Udržení osmotické rovnováhy
- Udržování potřebných chemických a elektrochemických rovnováh

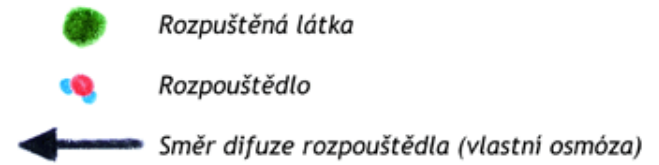
Transport látek membránami :

- Nespecifická permeace **Bez přenašeče**
- Specifický přenašečový systém - pasivní transport - usnadněná
S přenašečem - bílkovina a výměnná
difuze
- aktivní transport
- Pinocytóza - **Endocytóza**
- **Exocytóza**

Prostá difuze



Osmóza

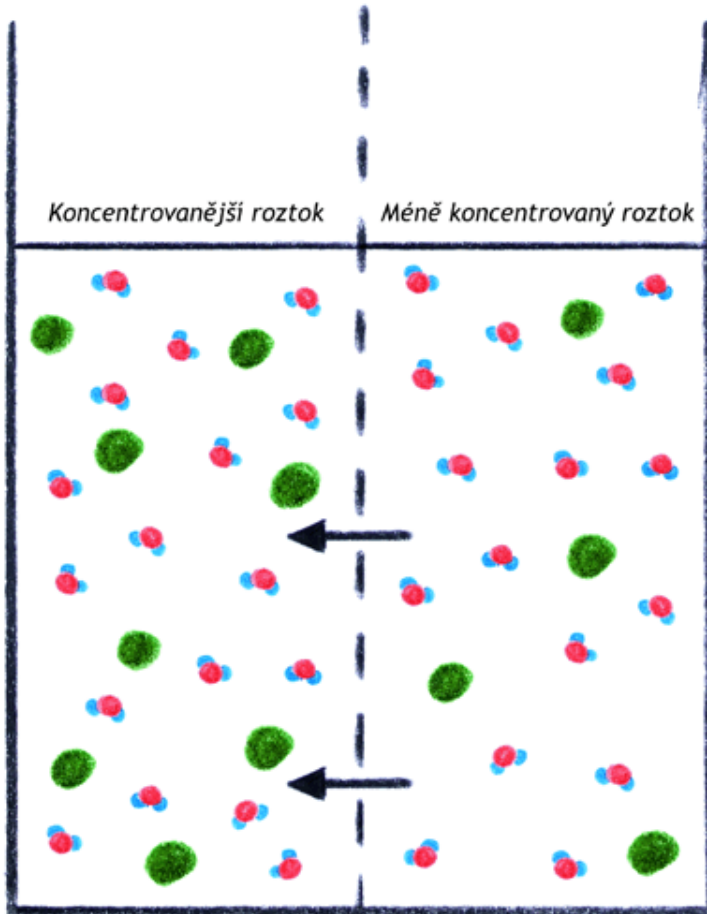


STAV 1

Polopropustná
membrána

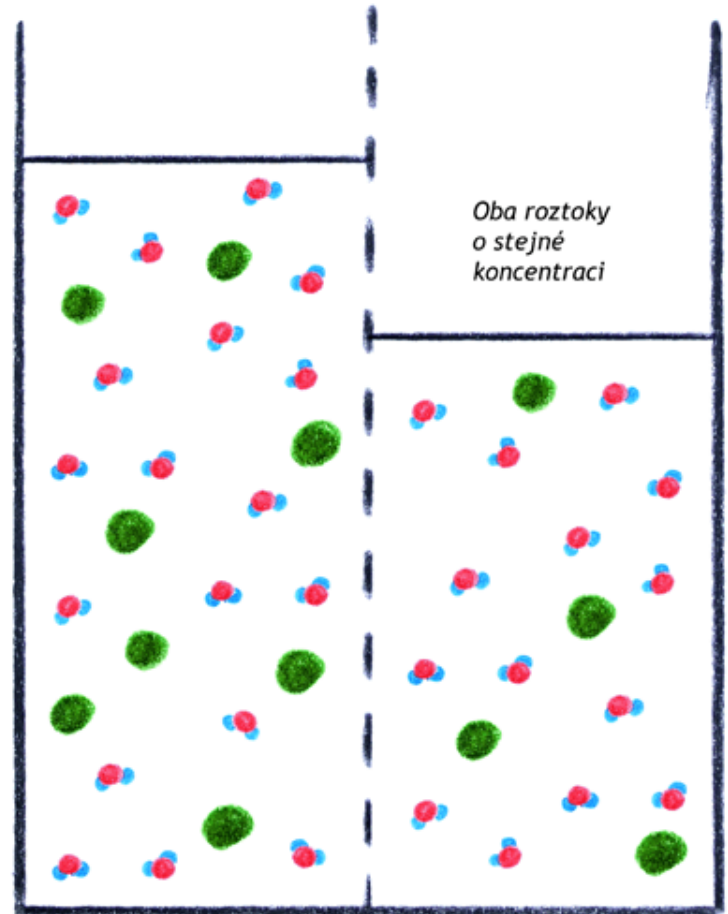
Koncentrovanější roztok

Méně koncentrovaný roztok



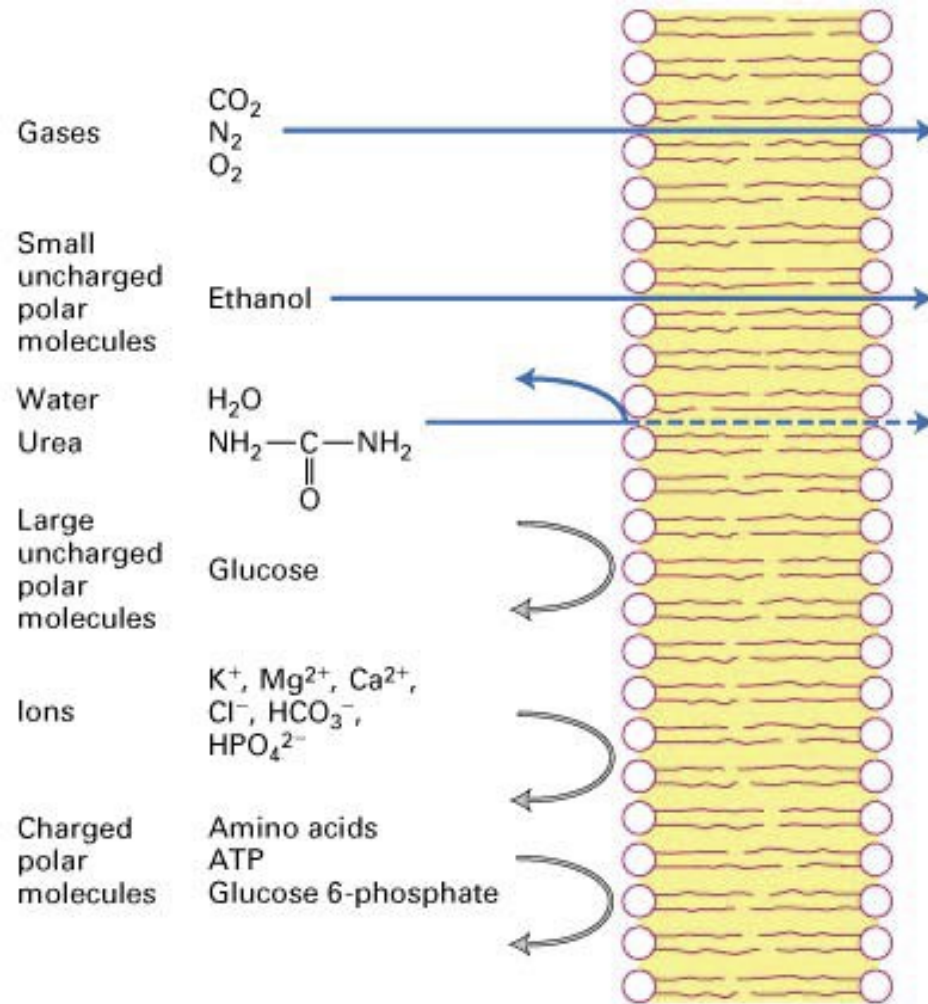
STAV 2

Oba roztoky
o stejné
koncentraci

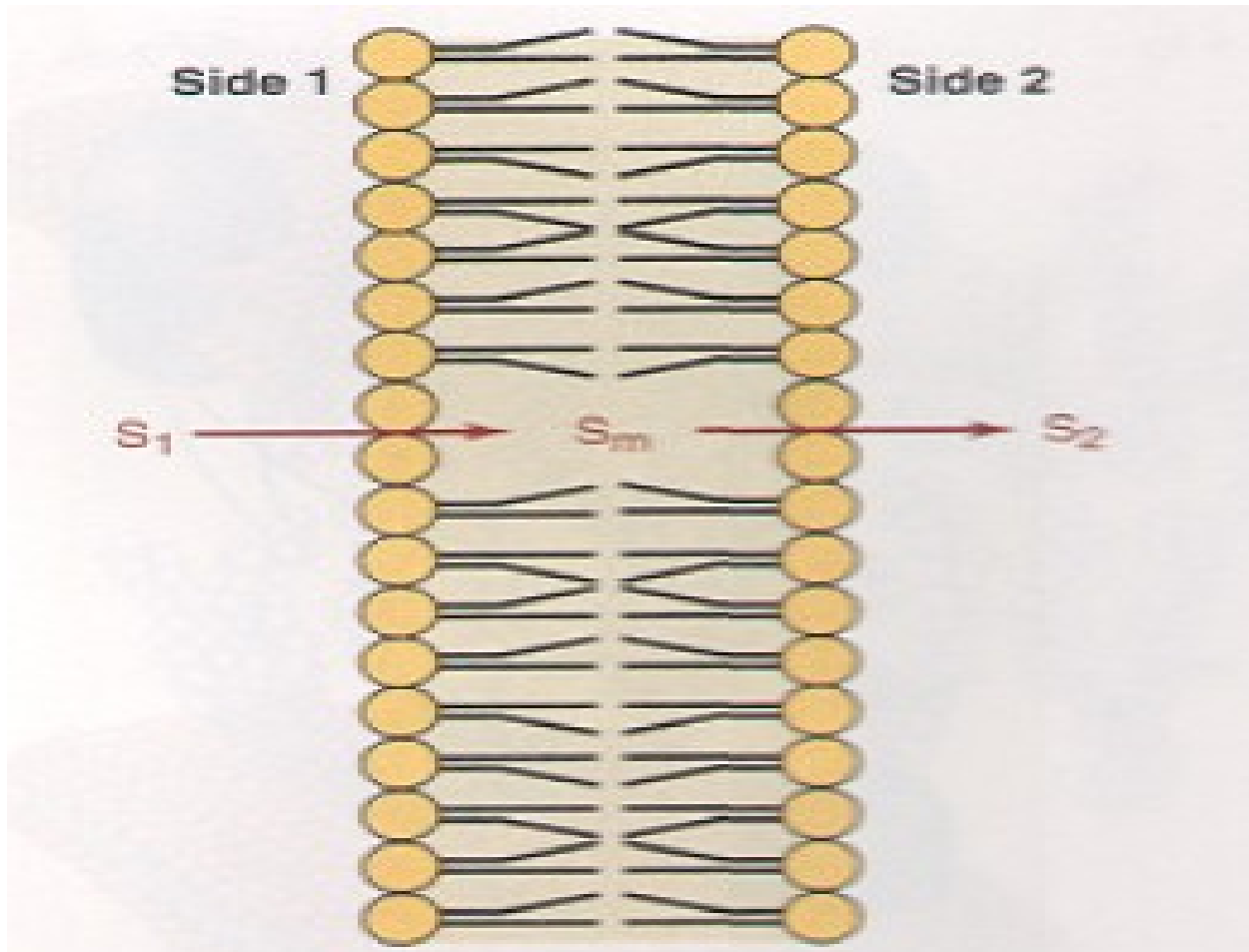


Nespecifický transport

- Rozpuštěním v membránových lipidech – plyny, organické látky
- Nepravidelnostmi v uspořádání lipidů – H_2O
- Póry

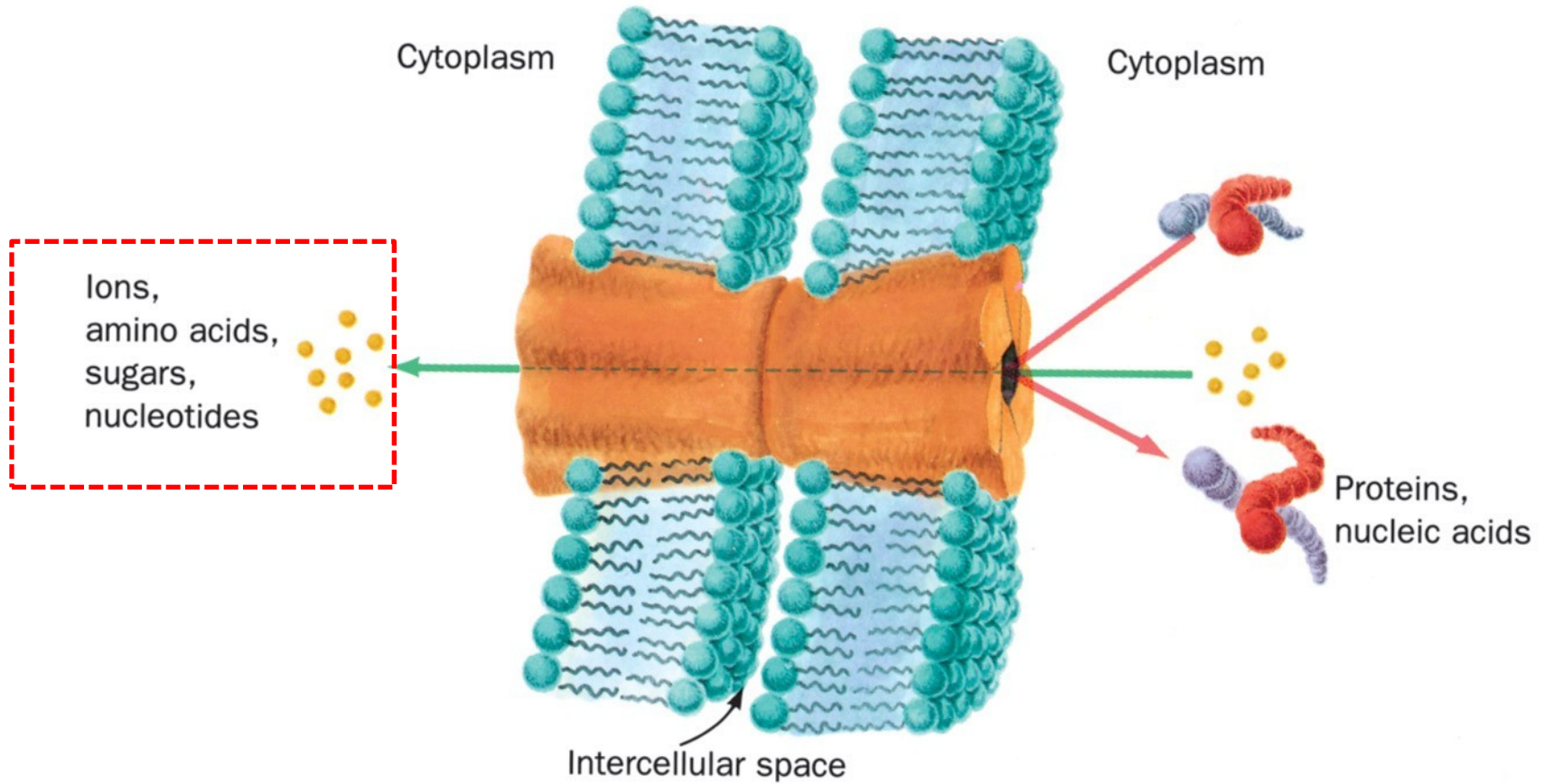


Prostá difuze - pory

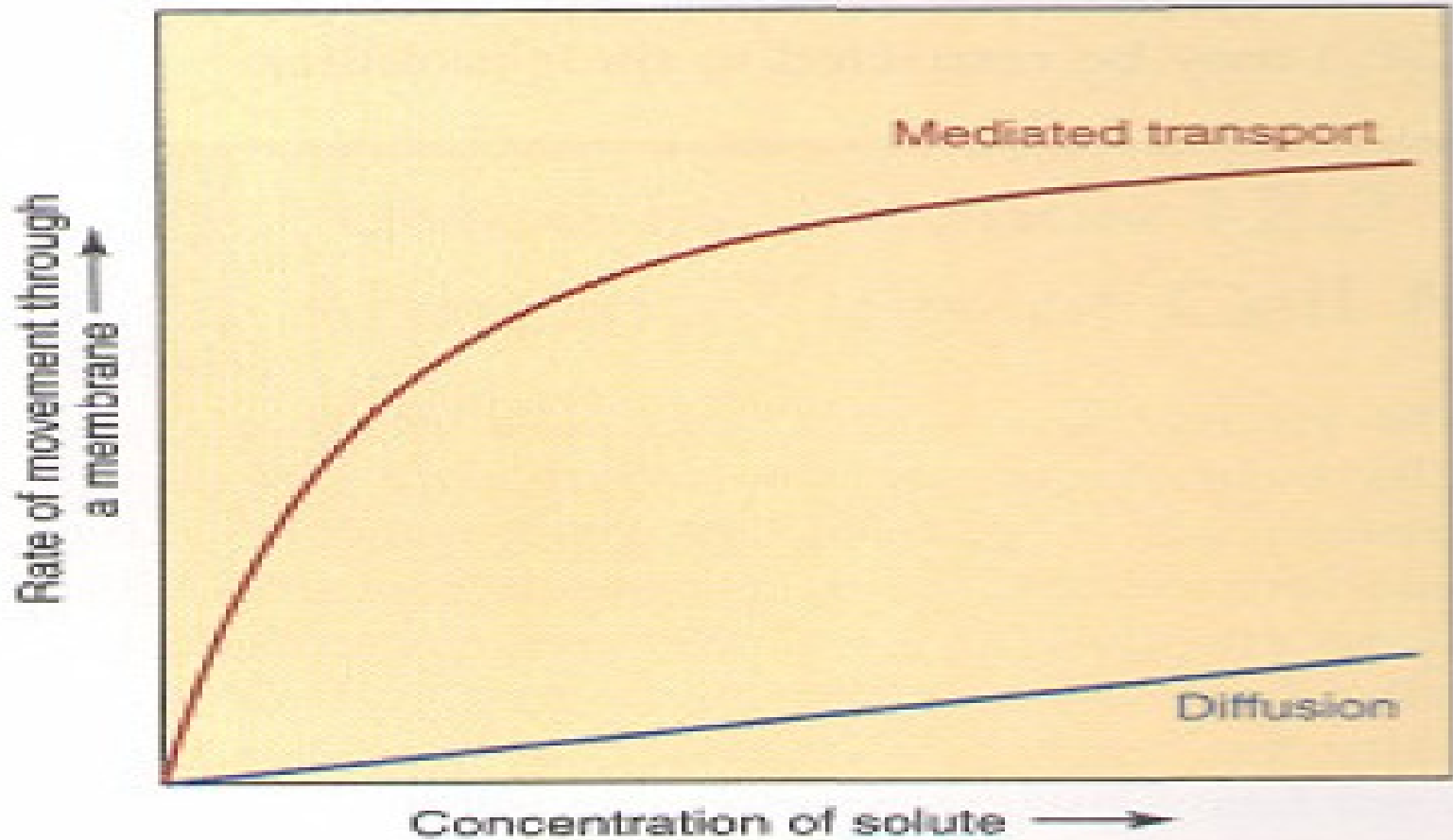


- Rozpuštěním v membránových lipidech – plyny, organické látky
- Nepravidelnostmi v uspořádání lipidů – H_2O
- Póry
- Hydrofilními kanálky

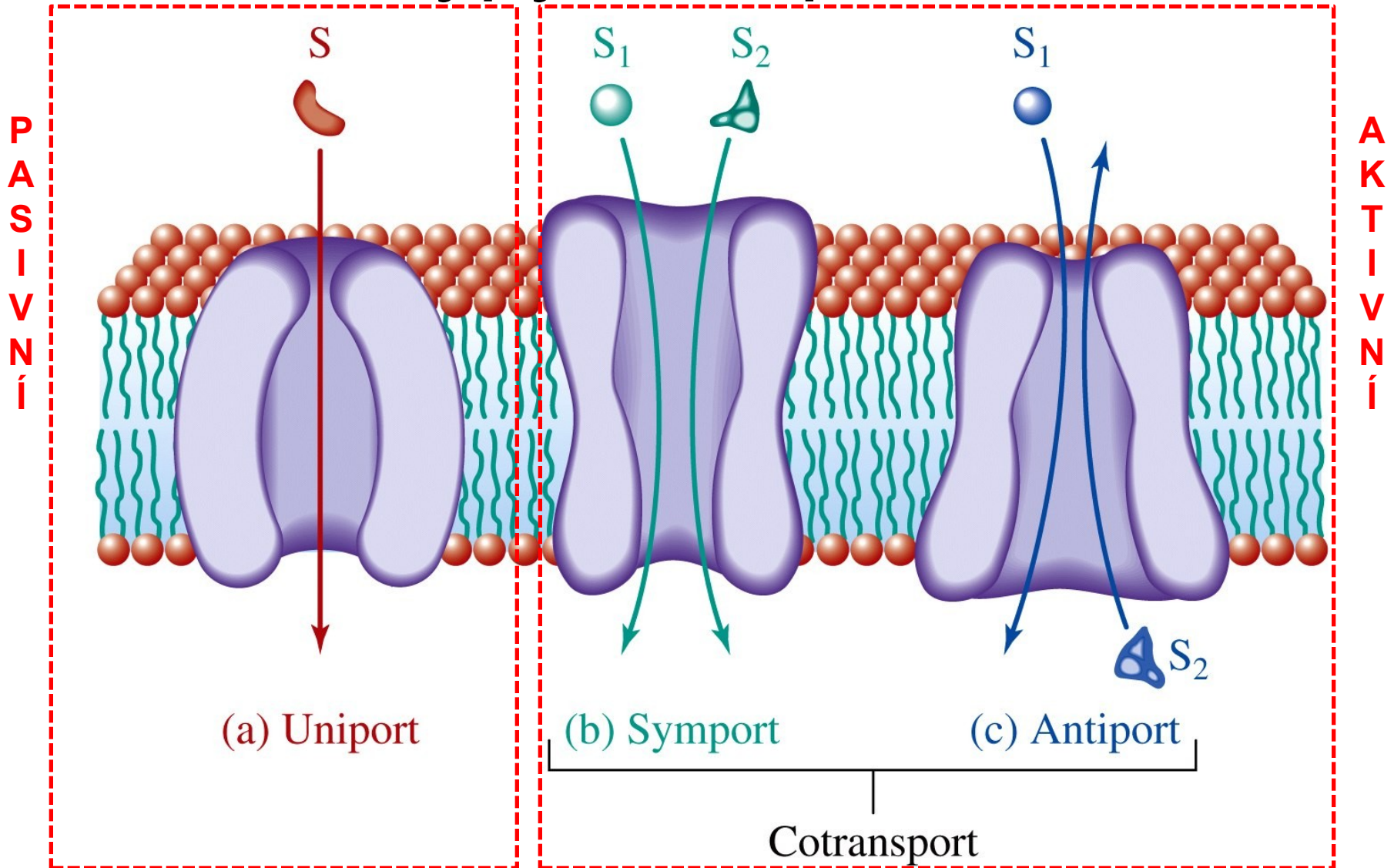
Mezerový spoj - konexin



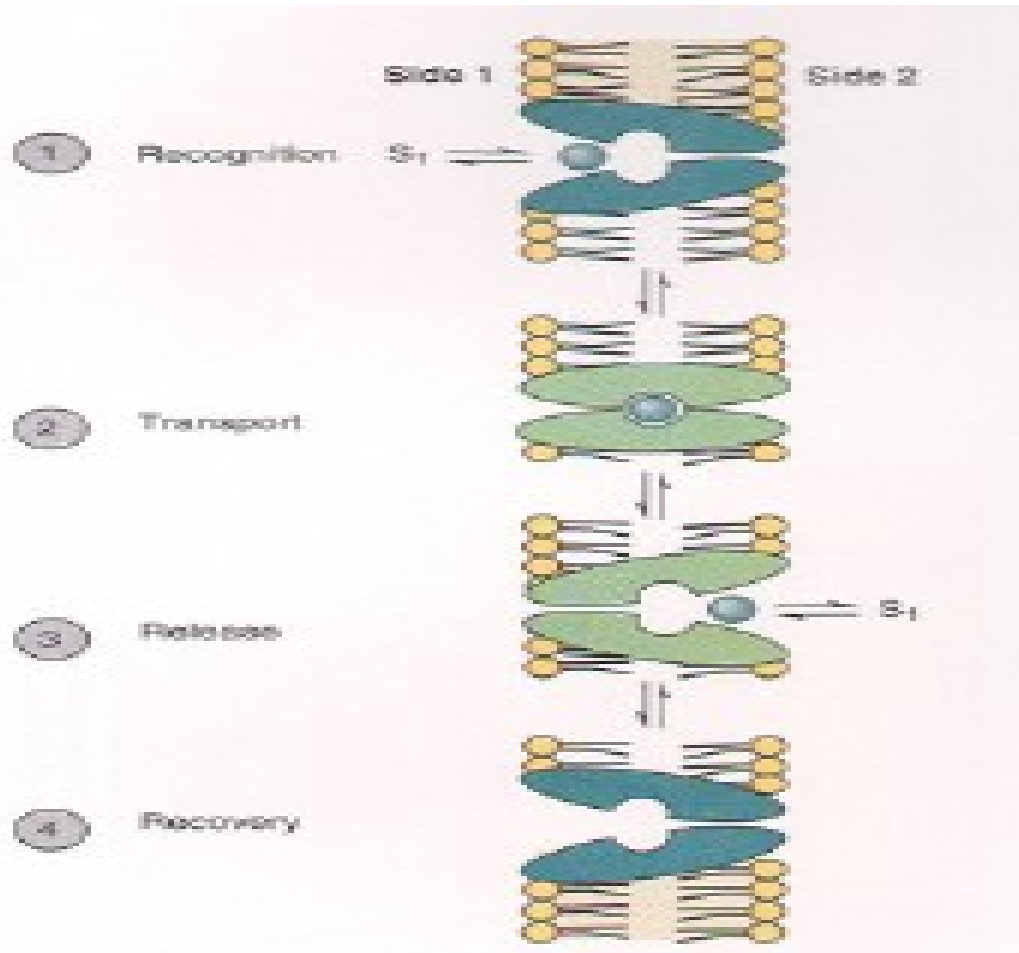
Difuze prostá versus usnadněná



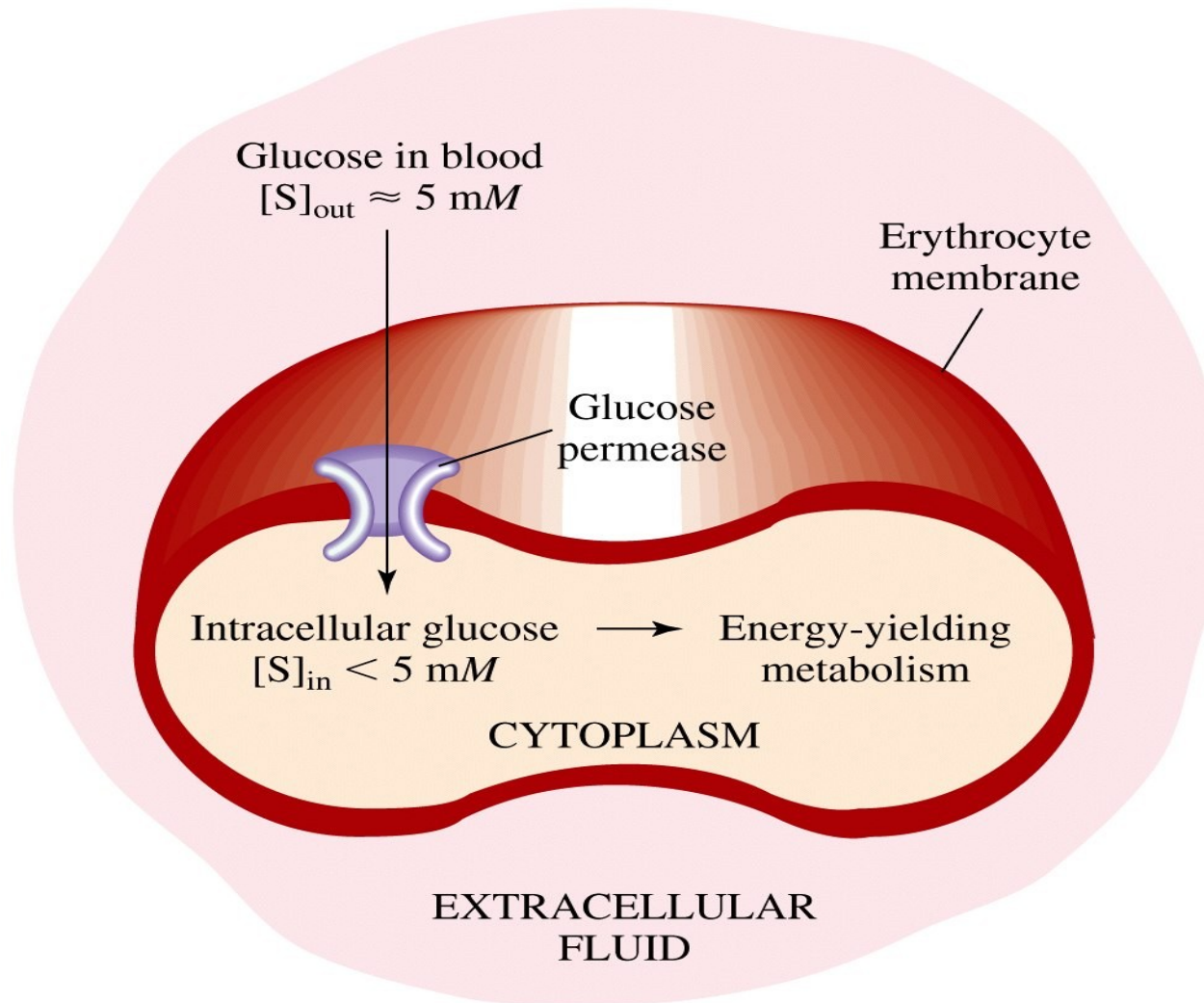
Typy transportu



Pasivní transport – usnadněná difuze



Usnadněná difuze



Aktivní transport

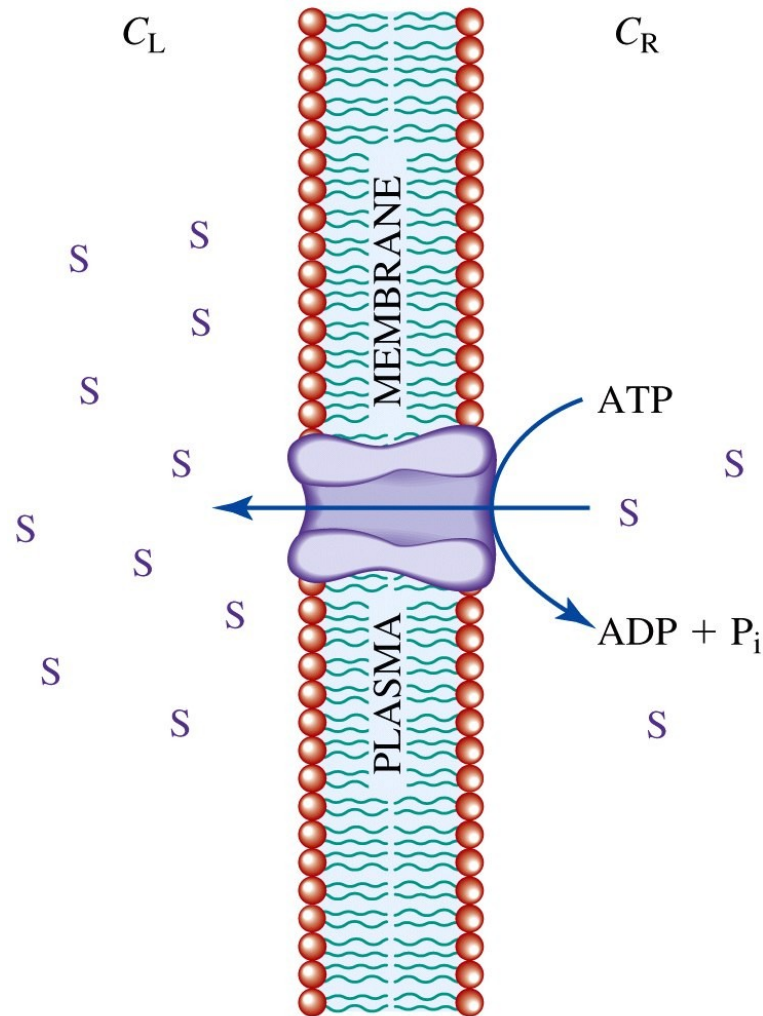
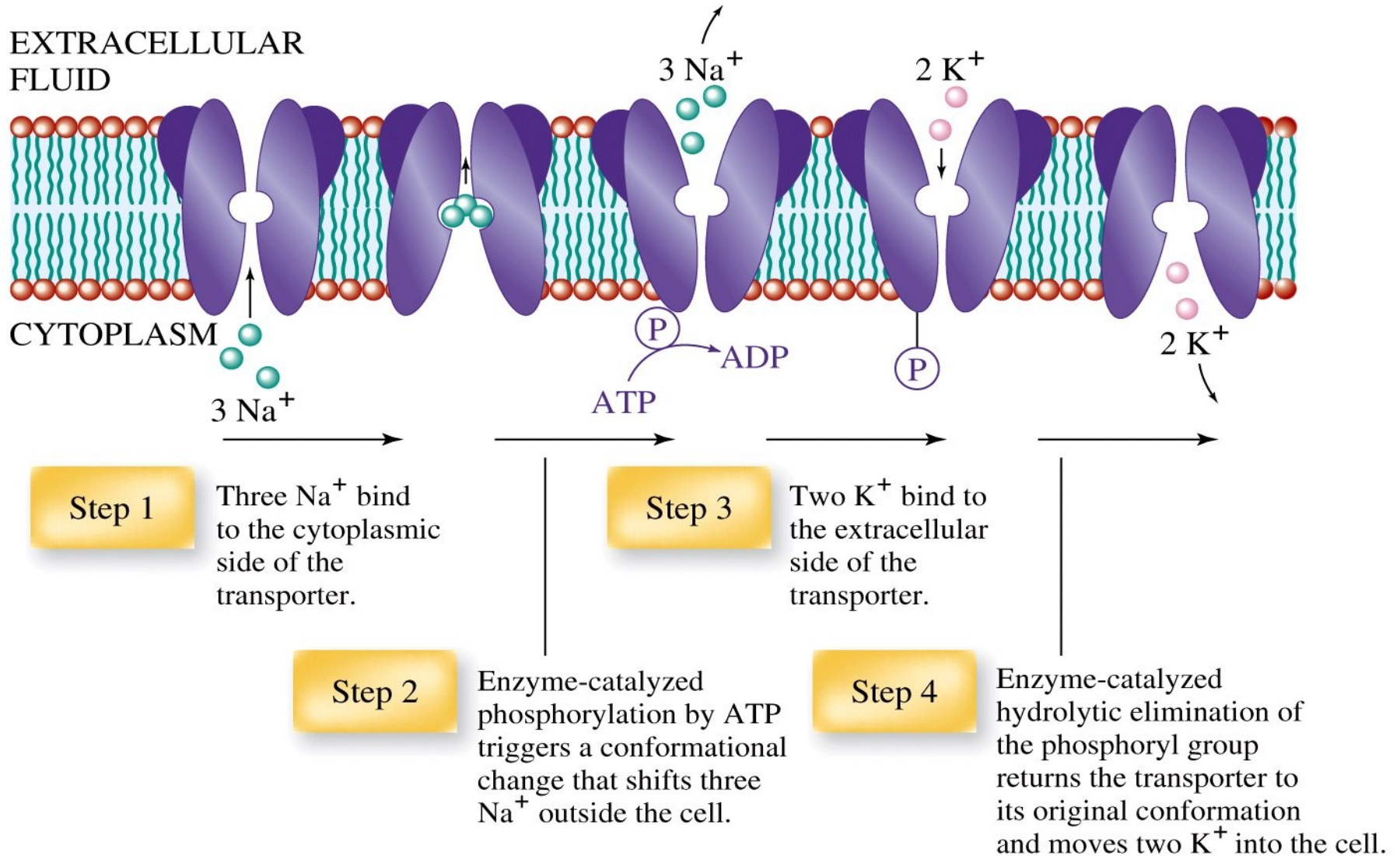
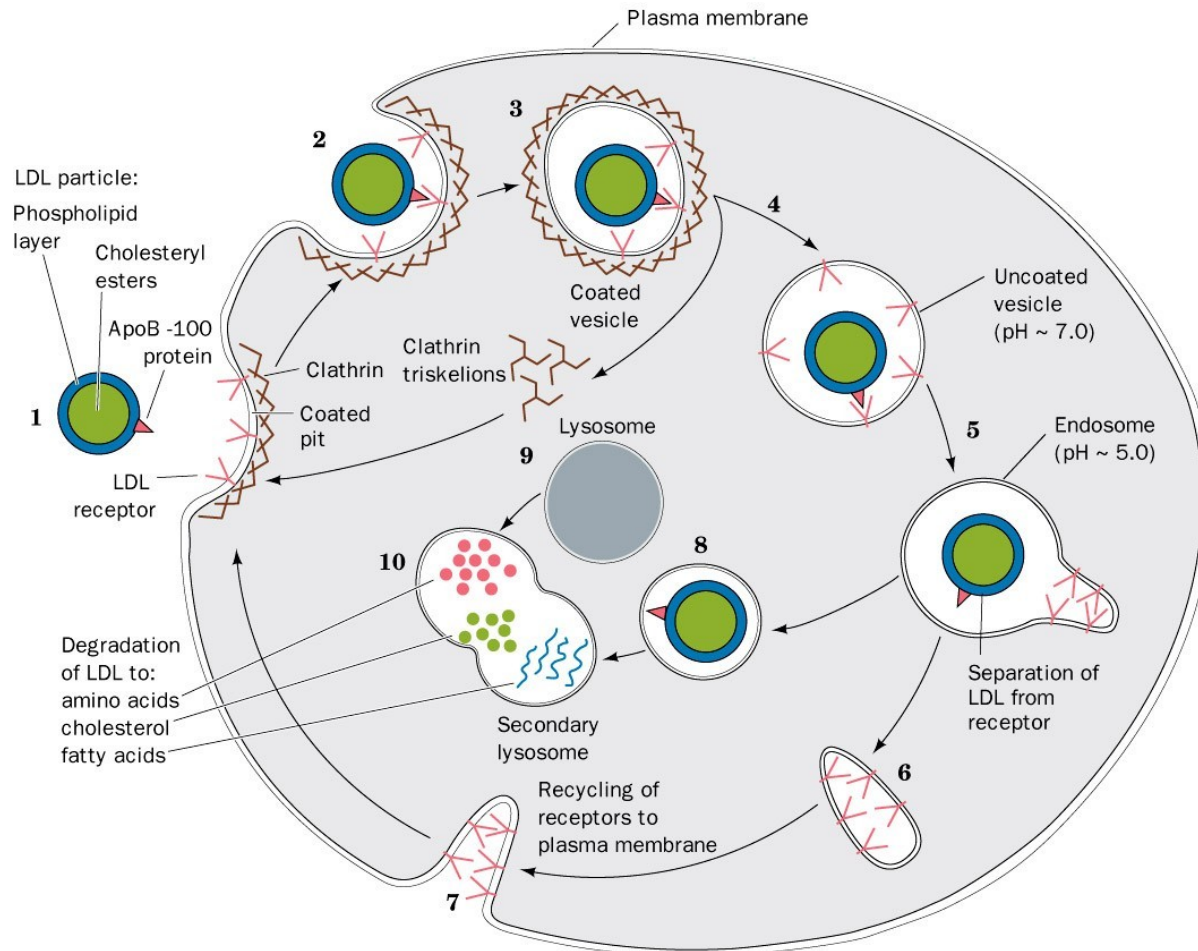


Figure 9-9 Concepts in Biochemistry, 3/e
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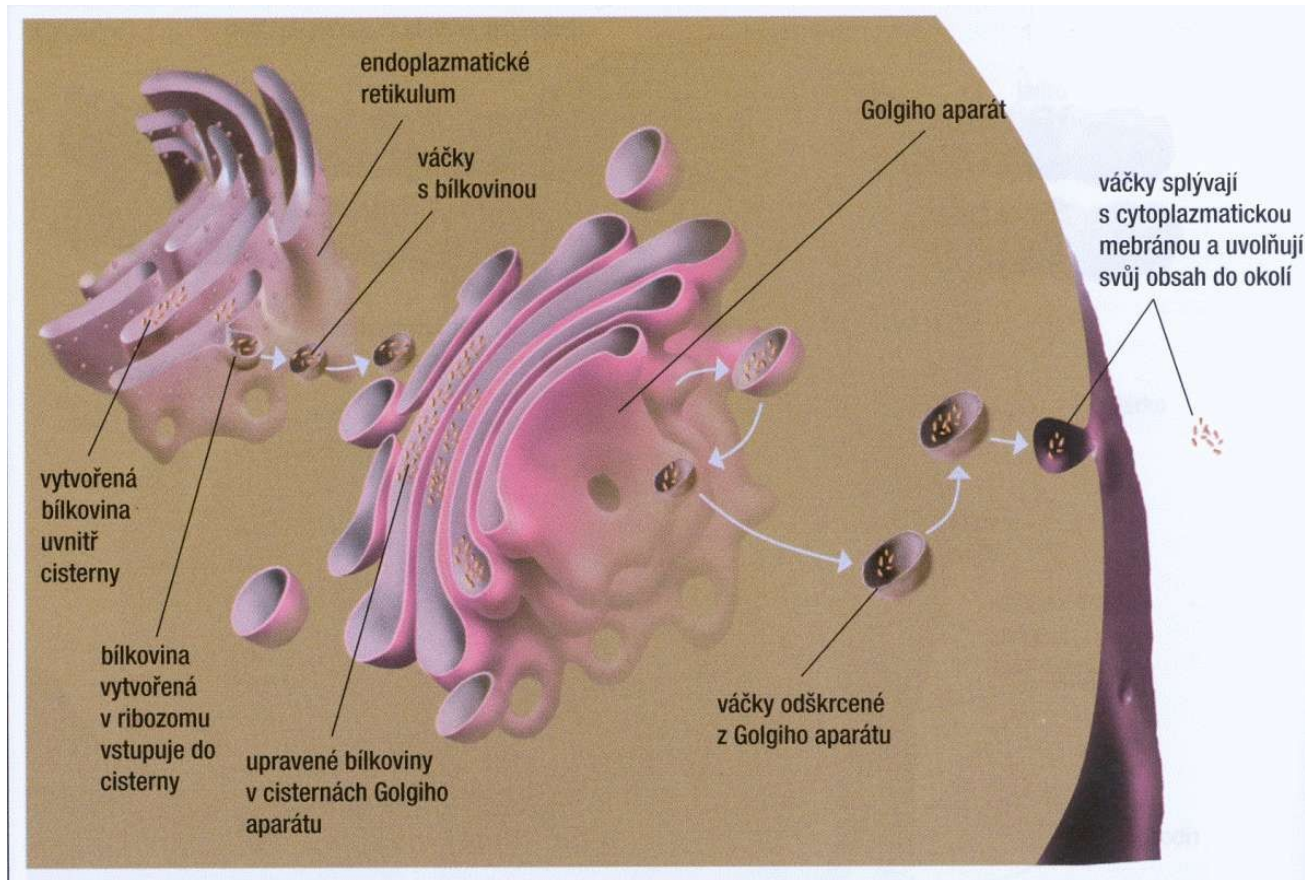
Na⁺ ATPase



Pinocytoza - endocytoza



Pinocytoza - exocytoza



Plazmatické lipoproteiny

Charakteristiky hlavních tříd lipoproteinů v lidské plasmě

Třída lipoproteinů	Hlavní lipidy ^a	Apoproteiny	Hustota g / mL	Průměr částice nm
Chylomikrony a zbytky	triacylglyceroly v dietě	A-I,A-II,B-48, C-I,C-II,C-III, E	<0,95	80–500
	Transport triacylglycerolů do jater			
VLDL	endogenní triacylglyceroly, estery cholesterolu, cholesterol	B-100,C-I,C-II	0,95–1,006	30–80
	Transport triacylglycerolů do tkání			
IDL	estery cholesterolu, triacylglyceroly, cholesterol	B-100,C-III,E	1,006–1,019	25–35
LDL	estery cholesterolu, cholesterol, triacylglyceroly,	B-100	1,019–1,063	18–28
	Transport cholesterolu do tkání - špatný			
HDL	estery cholesterolu, cholesterol	A-I,A-II,C-I,	1,063–1,210	5–12
	Transport cholesterolu do jater - dobrý			

Plazmatické lipoproteiny

