snímek 1

SACHARIDY

Sacharidy - *saccharum - cukr*

Synonyma : cukry - glycidy - uhlohydráty *carbohydrates* - $(CH_2O)_n$

Funkce - zdroj energie
zásobní látky
stavební a podpůrná funkce
složky nukleotidů, koenzymů, glyko-proteinů, -lipidů
prekurzory aminokyselin, lipidů
antigenní determinanty buněk

snímek 2

MONOSACHARIDY
↓
DI, TRI, ...OLIGOSACHARIDY
↓
POLYSACHARIDY

Monosacharidy :

chemicky - polyhydroxyaldehydy
- polyhydroxyketony

snímek 3

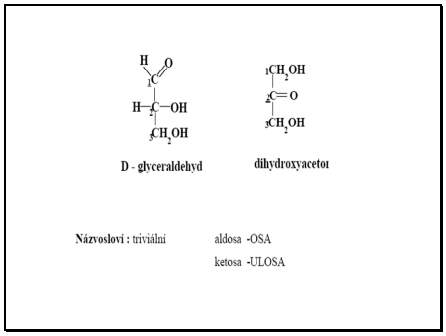
Rozdělení

A. podle povahy karbonylové skupiny → **ALDOSY**, **KETOSY**

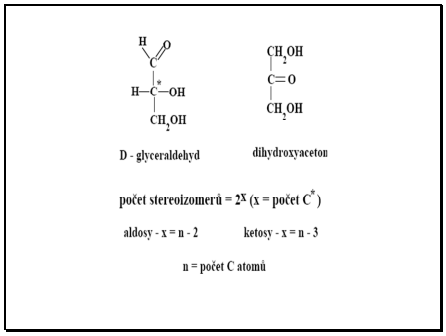
B. podle počtu uhlíkových atomů - **TRIOSY, TETROSY, PENTOSY, HEXOSY, HEPTOSY,**

ALDOHEXOSA

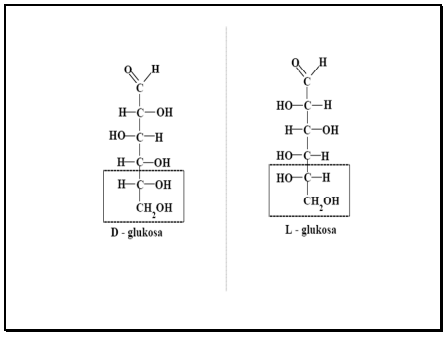
snímek 4



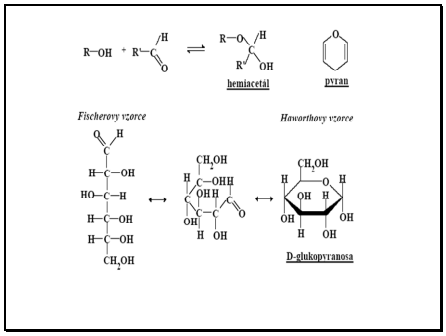
snímek 5



snímek 6

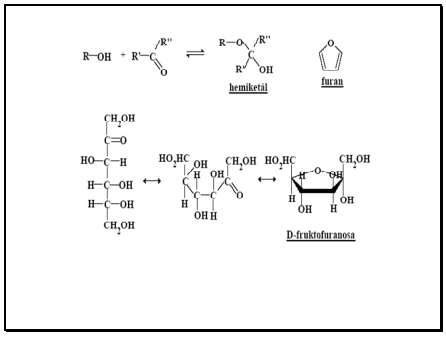


snímek 7



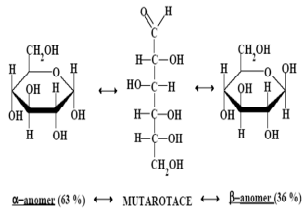
snímek 8

snímek 9

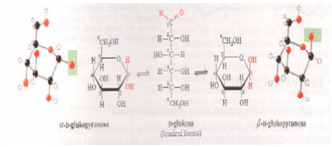


snímek 10

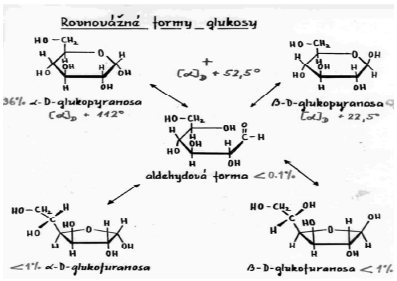
snímek 11



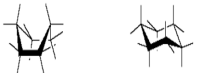
snímek 12



snímek 13



snímek 14



vaničková židličková

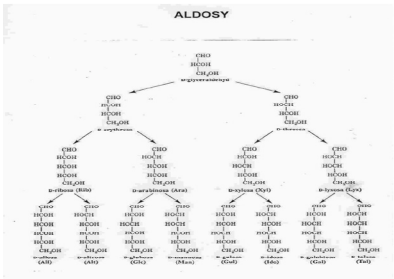
KONFORMACE

snímek 15

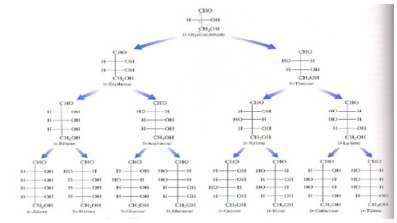
Přehled

Triosy	-	glyceraldehyd, dihydroxyaceton
Tetrosy	-	threosa, erythrosa
Pentosy	-	ribosa, deoxyribosa
Hexosy	-	glukosa, manosa, galaktosa
		fruktosa
Heptosa	-	sedoheptulosa

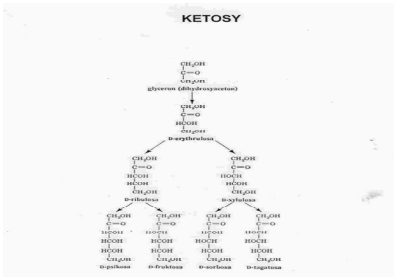
snímek 16



snímek 17

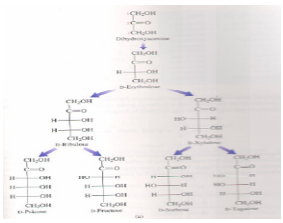


snímek 18



snímek 19

Ketosy

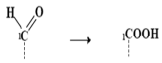


snímek 20

Deriváty monosacharidů

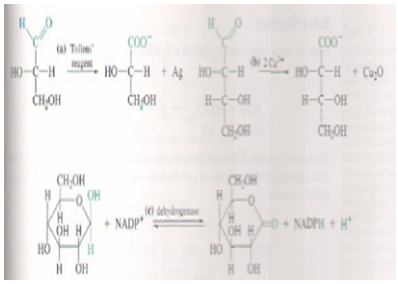
Oxidace :

A. Mírná ⇒ aldehydická skupina → karboxylovou skupinu

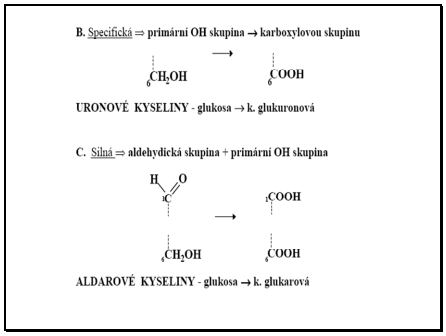


ALDONOVÉ KYSELINY - glukosa → k. glukonová

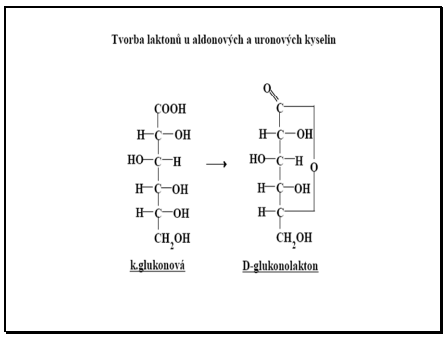
snímek 21



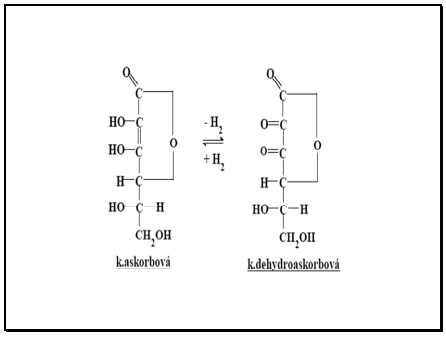
snímek 22



snímek 23



snímek 24

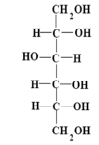


snímek 25

Redukce :

mírná ⇒ **karbonylová skupina** → **hydroxy skupinu**

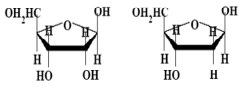
POLYHYDROXYALKOHOLY - ALDITOLY -itol



GLUCITOL - SORBITOL

snímek 26

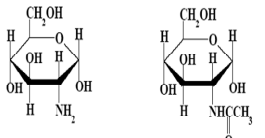
Deoxycukry - OH skupina nahrazena H



RIBOSA **DEOXYRIBOSA**

snímek 27

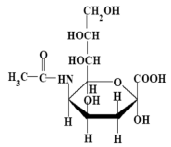
Aminocukry - OH skupina nahrazena NH_2 skupinou



GLUKOSAMIN **N-ACETYLGLUKOSAMI**

snímek 28

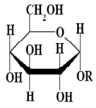
Sialové kyseliny - kondenzace N-acetylmanosaminu + pyruvátu



K. SIALOVÁ

snímek 29

Glykosidy :



O-glukosid

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

snímek 30

Glykosidy
- homoglykosidy - složen ze sacharidů
- heteroglykosidy - sacharid + aglykon (genin)

Glykosidy
- galakotosid
- glukosid
- ribosid

snímek 31

Disacharidy :

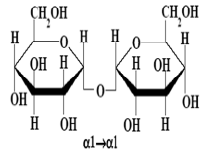
A. Neredukující - trehalosový typ - yl - id

O - α -D - glukopyranosyl (1→1) - α - D - glukopyranosid

B. Redukující - maltosový typ - yl - osa

O - α -D - glukopyranosyl (1→4) - α - D - glukopyranosa

snímek 32

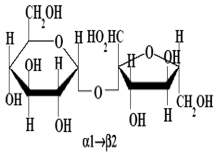


α1→α1

TREHALOSA

O - α -D - glukopyranosyl (1→1) - α -D - glukopyranosid

snímek 33

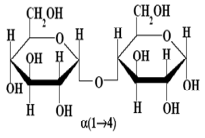


α1→β2

SACHAROSA

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

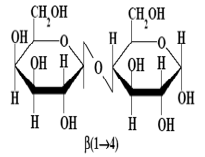
snímek 34



MALTOSA

O - α -D - glukopyranosyl (1→4) - α -D - glukopyranosa

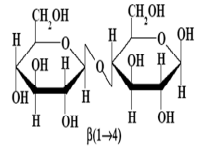
snímek 35



LAKTOSA

O - β -D - galaktopyranosyl (1→4) - β -D - glukopyranosa

snímek 36



CELLOBIOSA

O - β -D - glukopyranosyl (1→4) - β -D - glukopyranosa

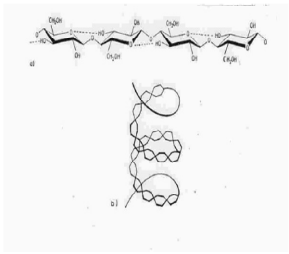
snímek 37

Polysacharidy :

Polysacharidy — homopolysacharidy
Polysacharidy — heteropolysacharidy

Funkce - stavební
- zásobní

snímek 38



snímek 39

HOMOPOLYSACHARIDY

Stavební homopolysacharidy :

CELULOSA - glukosa (celobiosa)

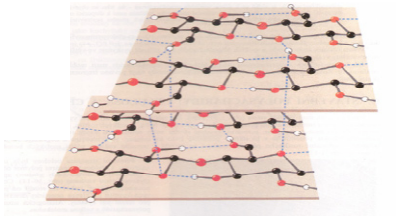
CHITIN N acetylglukosamin

AGAROSA - galaktosa + 3, 6 - anhydrogalaktosa

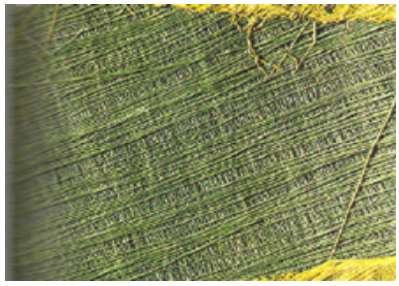
PEKTINY - galakturonová kyselina

snímek 40

Celulosa



snímek 41



snímek 42

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)

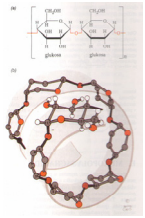
GLYKOGEN - glukosa - α (1→4) + α (1→6)

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

INULIN - fruktosa β(1→)

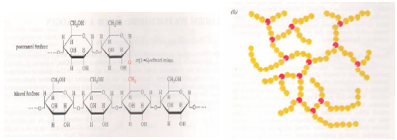
snímek 43

Amylosa



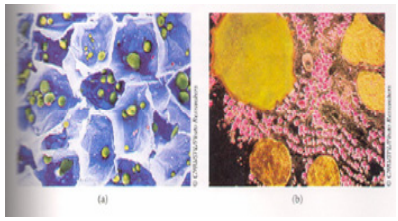
snímek 44

Amylopektin

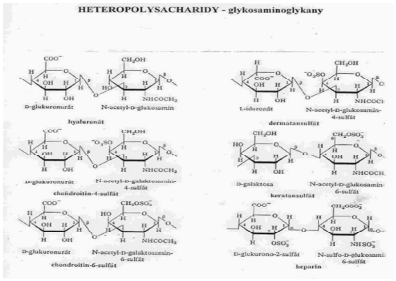


snímek 45

Škrob (a) a glykogen (b)

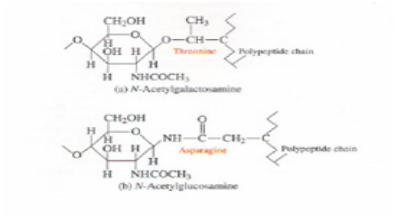


snímek 46



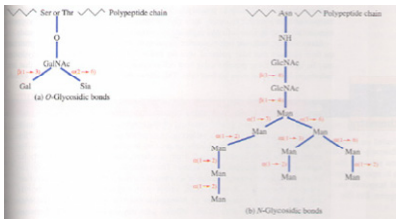
snímek 47

Glykoproteiny

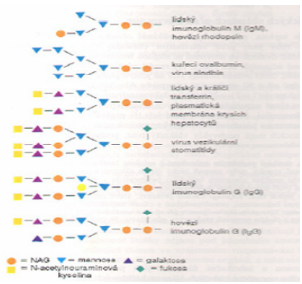


snímek 48

Glykoproteiny

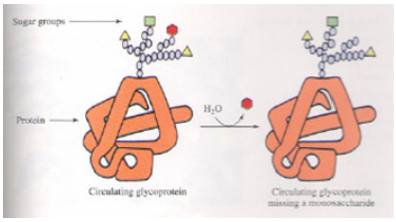


snímek 49



snímek 50

Glykoproteiny



snímek 51

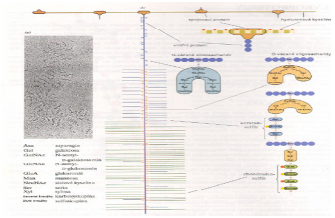
Krevní skupiny

Struktura antigenních determinantů A, B a H v erythrocytech

Typ	Antigen
H	Galβ(1→4)GlcNAc ↑1,2 L-Fuc α
A	GalNAc α(1→3)Galβ(1→4)GlcNAc ↑1,2 L-Fuc α
B	Galα(1→3)Galβ(1→4)GlcNAc ↑1,2 L-Fuc α

snímek 52

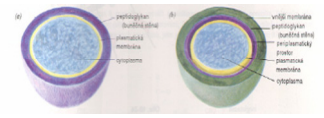
Proteoglykany



snímek 53

Buněčná stěna bakterií

grampozitivní(a) a gramnegativní(b)



snímek 54

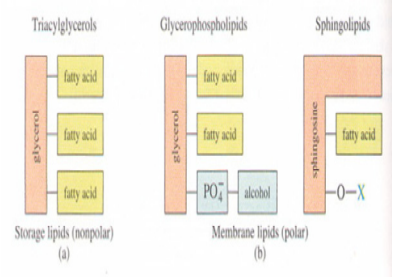
LIPIDY

Lipos - tuk

Funkce : **zdroj a reserva energie**
strukturní funkce
ochranná a izolační funkce
různé biologické funkce

Lipidy — **jednoduché**
složené
izoprenoidní

snímek 55

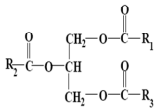


snímek 56

Jednoduché lipidy :

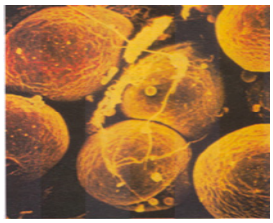
chemicky - estery mastných kyselin a alkoholů

ACYLGLYCEROLY - triglyceridy - estery mastných kyselin a glycerolu

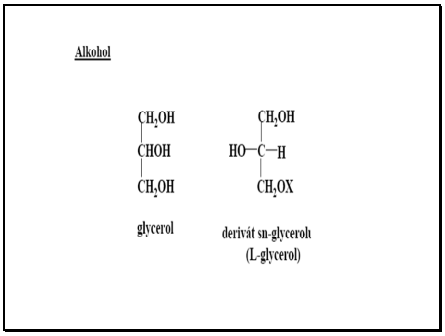


snímek 57

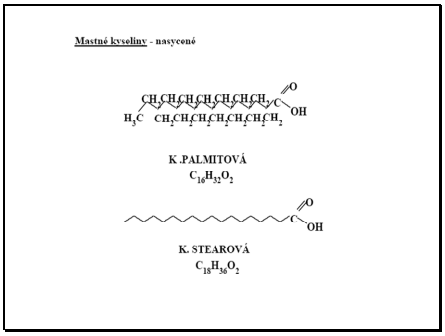
Adipocyty



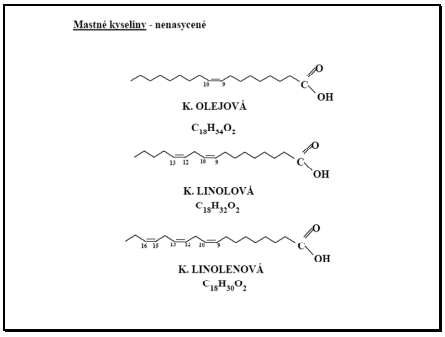
snímek 58



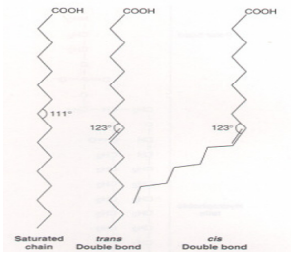
snímek 59



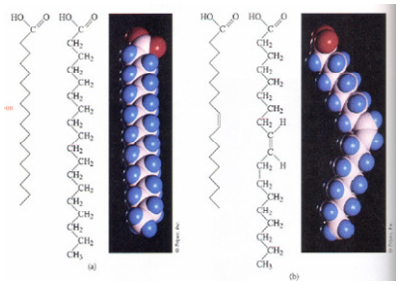
snímek 60



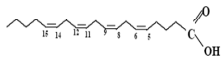
snímek 61



snímek 62



snímek 63

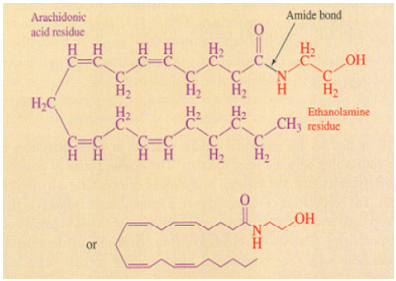


KARACHIDONOVÁ

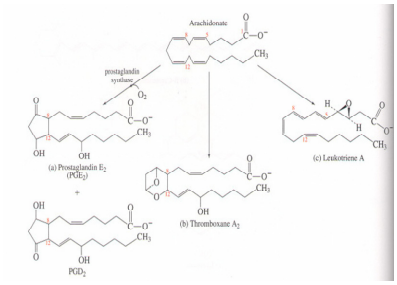
$C_{20}H_{32}O_2$

Prostanoidy
- prostaglandiny
- tromboxany
- leukotrieny

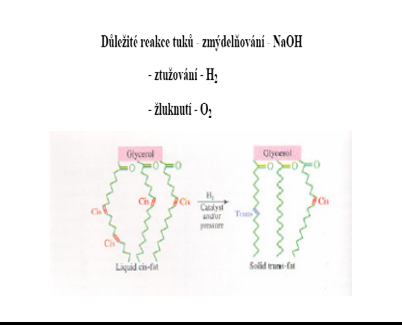
snímek 64



snímek 65



snímek 66



snímek 67

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

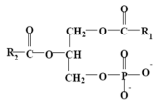
karnaubský vosk

snímek 68

Složené lipidy :

FOSFOLIPIDY

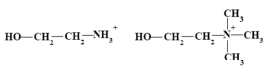
A. **Fosfoacylglycerolv** - fosfatidy



K. FOSFATIDOVÁ

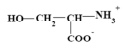
1,2-diacyl-glycerol-3-fosforečná k.

snímek 69

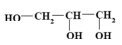


ETHANOLAMIN

CHOLIN



SERIN



GLYCEROL

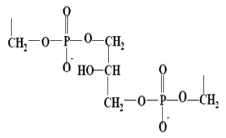
INOSITOL

snímek 70

Fosfatidylcholin - lecitiny

Fosfatidylethanolamin - kefaliny

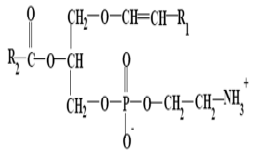
Bisfosfatidylglycerol - kardiolipin



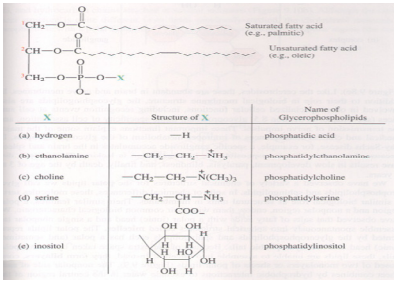
Fosfatidylinositol

snímek 71

Plazmalogeny

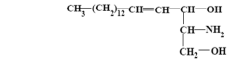


snímek 72

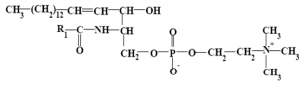


snímek 73

B. Sfingomyeliny - sfingofosfolipidy



SFINGOSIN

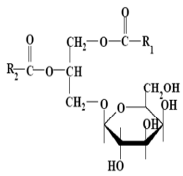


SFINGOMYELIN

snímek 74

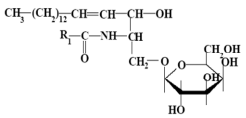
GLYKOLIPIDY

A. Glycerolglykolipidy



snímek 75

B. Cerebrosidy



galaktocerebrosidy - mozek

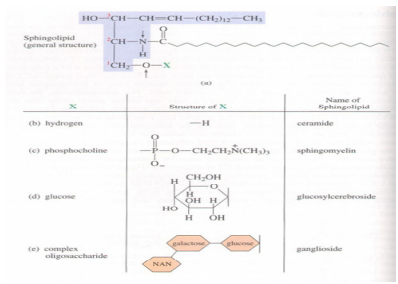
sulfatidy

glukocerebrosidy - ostatní tkáně

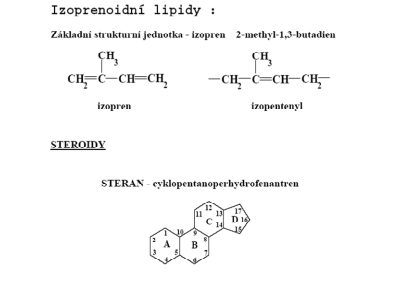
C. Glykosfingolipidy

gangliosidy - sialová kyselina - ganglie nervových buněk

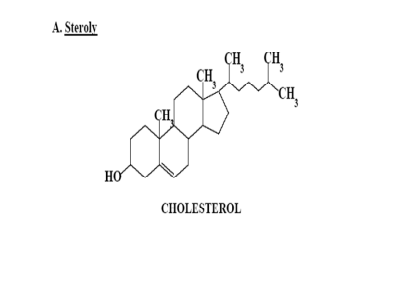
snímek 76



snímek 77



snímek 78



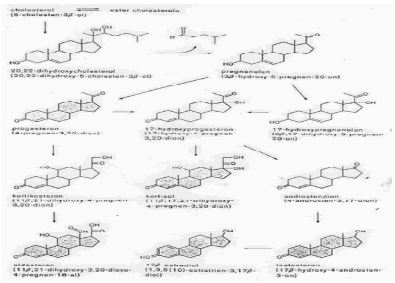
snímek 79

Steroidní hormony

cholesterol
(C 27)
↓
pregnenolon
(C 21)
↓
gestageny
(C 21)
↓
glukokortikoidy (C 21) | **mineralkortikoidy** (C 21) | **androgeny** (C 19) → **estrogeny** (C 18)

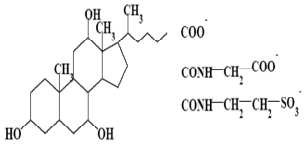
Glukokortikoidy - **kortisol, kortikosteron - kůra nadledvinek**
Mineralkortikoidy - **aldosteron - kůra nadledvinek**
Androgeny - **testosteron - varlata**
Estrogeny - **estron, estradiol, estratriol - vaječníky**
Gestageny - **progesteron - vaječníky**

snímek 80

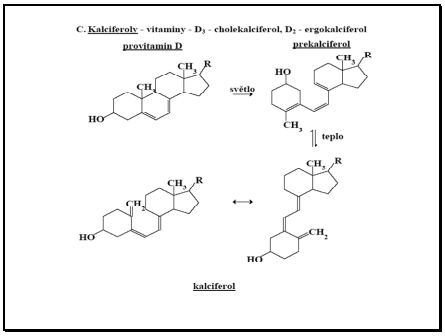


snímek 81

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



snímek 82



snímek 83

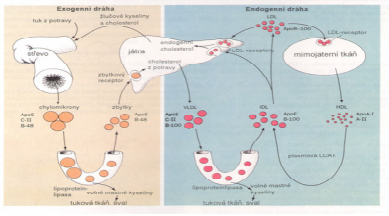
Plazmatické lipoproteiny

Charakteristiky hlavních tříd lipoproteinů v lidské plasmě

Třída lipoproteinů	Hlavní lipidy [1]	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
VLDL	endogenní triacylglyceroly, estery cholesterolu, cholesterol	B-100,C-I,C-II	0,95–1,006	30–80
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
HDL	estery cholesterolu, cholesterol	A-I,A-II,C-I,	1,063–1,210	5–12

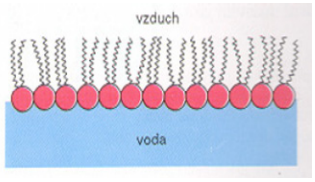
snímek 84

Plazmatické lipoproteiny



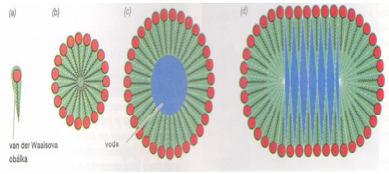
snímek 85

Membrány



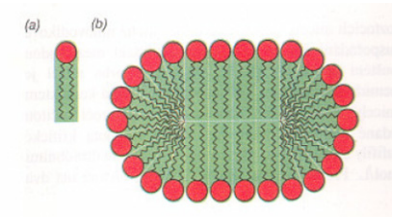
snímek 86

Membrány



snímek 87

Membrány



snímek 88

Membrány

snímek 89

Biomembrány : agregované formy biolipidů

Význam biomembrán - transport
- kompartmentace
- komunikace

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

snímek 90

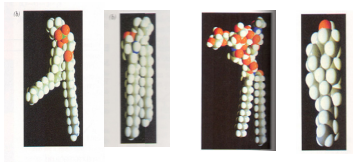
- *Lipidy* - fosfolipidy, cholestorol

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

snímek 91

Fosfolipid, sfingomyelin, gangliosid, cholesterol



snímek 92

- *Bílkoviny* - integrální, periferní

  funkce - enzymy

  přenašeče

  receptory

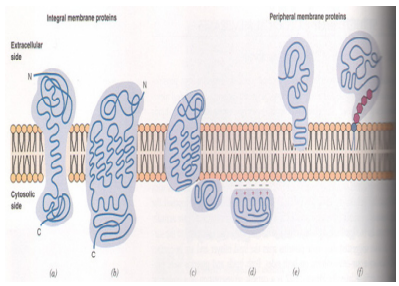
  strukturní

- *Sacharidy* - glykolipidy, glykoproteiny

  funkce - kotvení glykolipidů a glykoproteinů v membránách

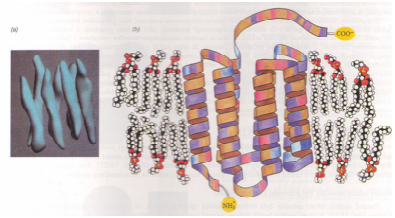
  - rozpoznávací

snímek 93



snímek 94

Bakteriorhodopsin



snímek 95

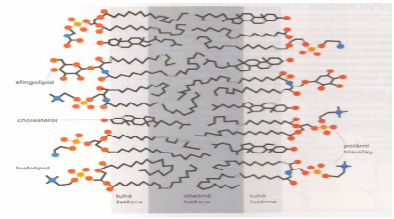
Modely membrán :

GORTER a GRENDL (1925) - Lipidová dvojvrstva

SINGER a NICHOLSON (1972) - Model tekuté mozaiky

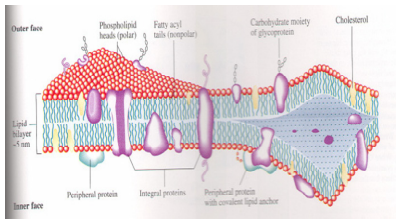
snímek 96

Lipidická dvojvrstva



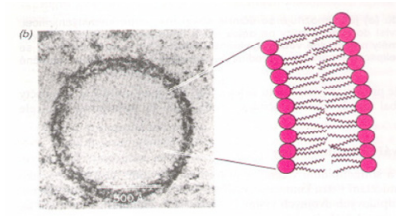
snímek 97

Model tekuté mozaiky



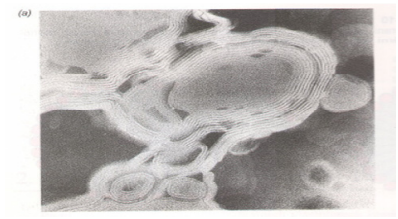
snímek 98

Liposomy



snímek 99

Liposomy



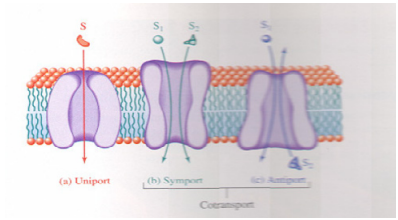
snímek 100

Transport látek membránami :

- Nespecifická permeace
- Specifický přenášečový systém - pasivní transport - usnadněná a výměnná difuze
  - aktivní transport
- Pinocytóza

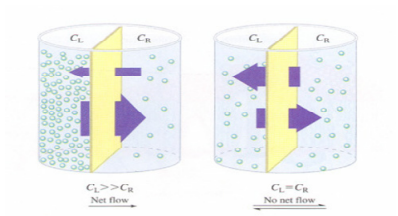
snímek 101

Typy transportu



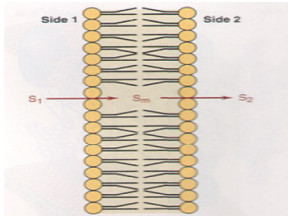
snímek 102

Prostá difuze



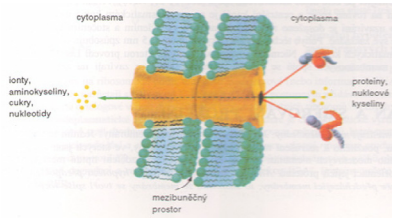
snímek 103

Prostá difuze



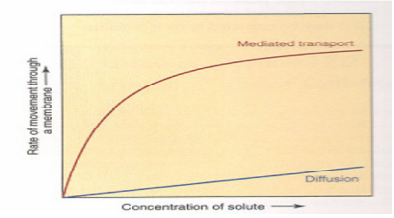
snímek 104

Mezerový spoj



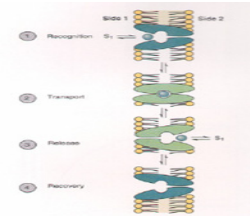
snímek 105

Difuze prostá versus usnadněná



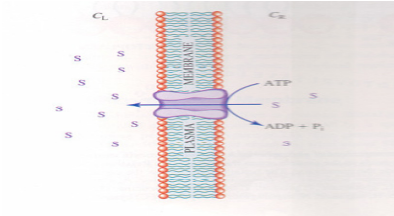
snímek 106

Usnadněná difuze



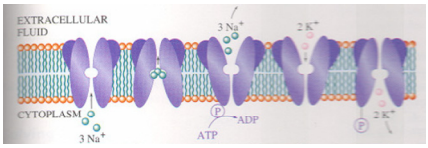
snímek 107

Aktivní transport



snímek 108

Na⁺ ATPasa



snímek 109

Pinocytoza