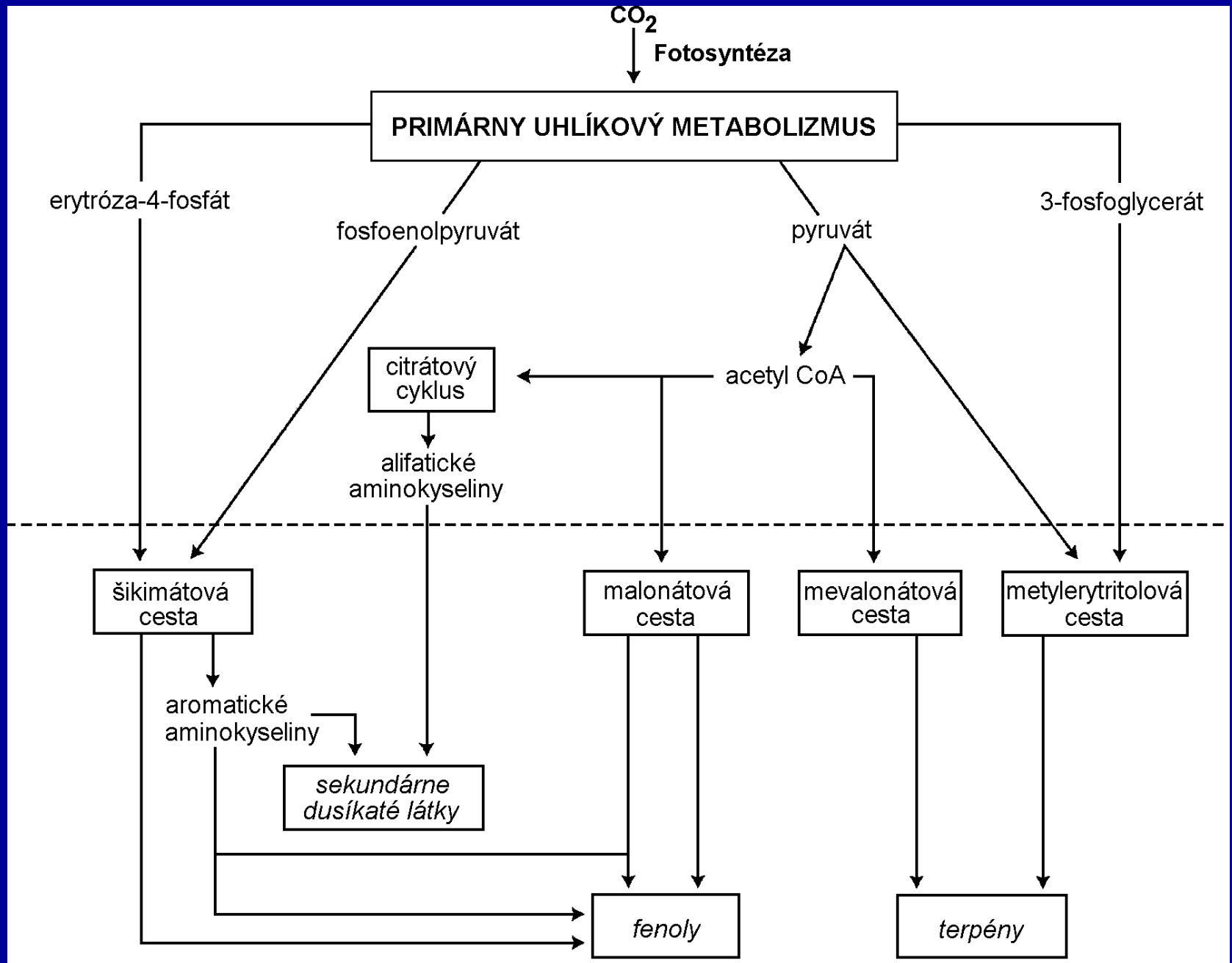
Sekundárny metabolizmus

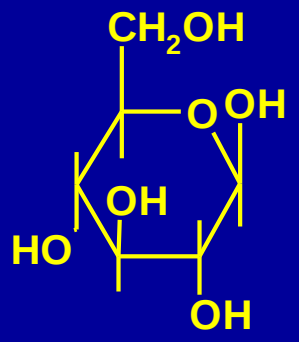
- Úvod
- Izoprenoidy. Biogenéza a prehľad terpenoidov, éterické oleje, fytosteroly
- Metabolity cesty kyseliny šikimovej (jednoduché fenoly, fenylpropány, flavonoidy, lignín)
- Látky odvodené od aminokyselín (alkaloidy a iné dusíkaté látky)
- Mechanizmy obrany rastlín



SEKUNDÁRNY UHLÍKOVÝ METABOLIZMUS

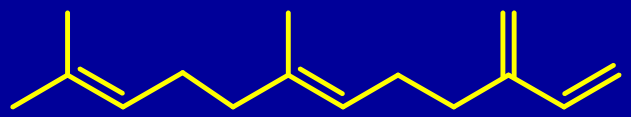
Primárny metabolizmus

- univerzálny
- uniformný
- konzervatívny
- nevyhnutný pre prežitie organizmu



Sekundárny metabolizmus

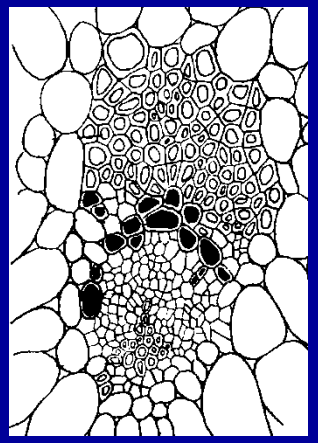
- jedinečný
- rozmanitý
- adaptívny
- individuálny
- potrebný pre rast a vývin



Syntéza a akumulácia sekundárnych látok

integrálna súčasť programov diferenciácie rastlín

- **priestorová kompartmentácia**
- **časové obmedzenie**



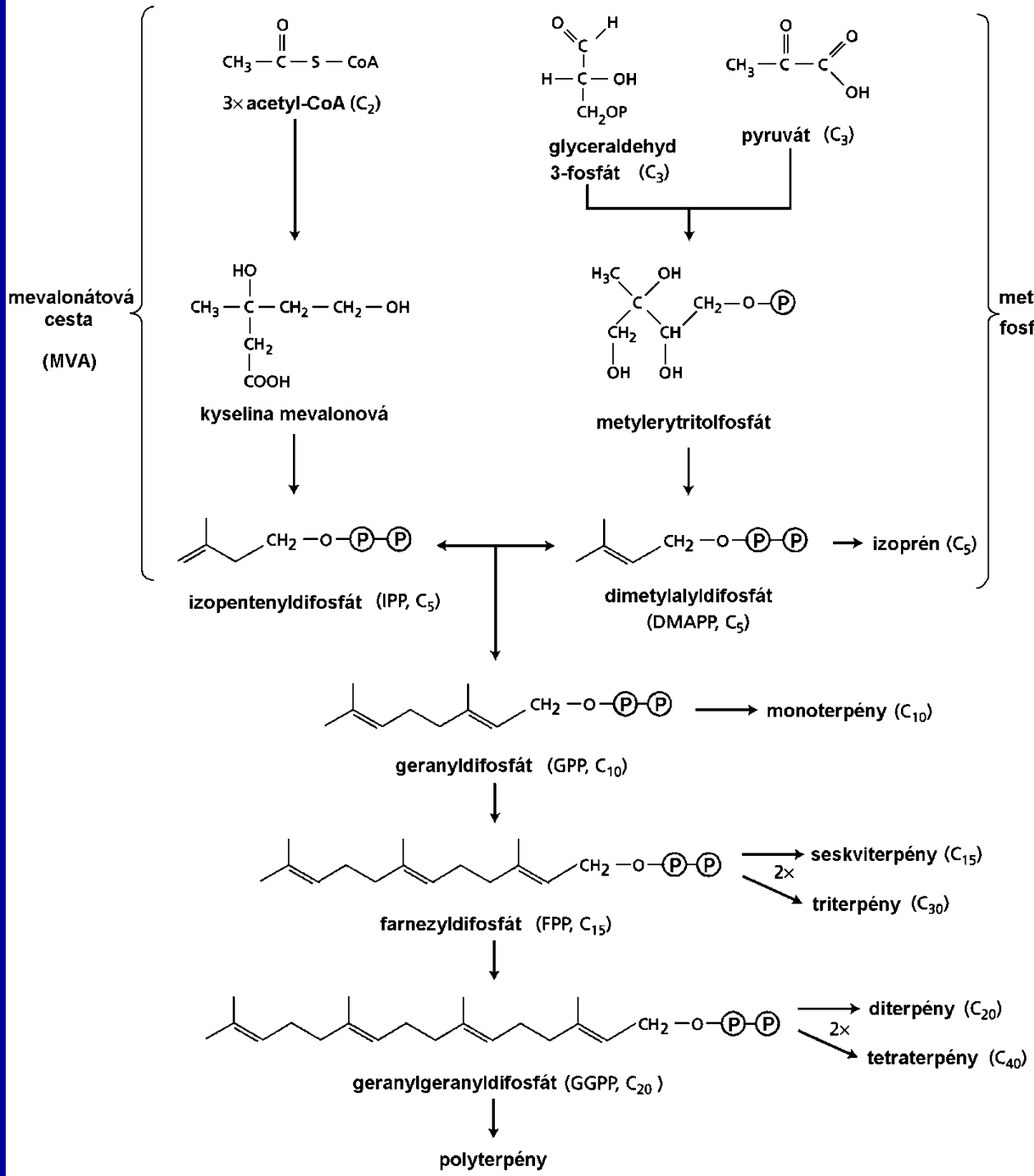
Ochranná funkcia sekundárnych metabolitov

ochrana povrchov

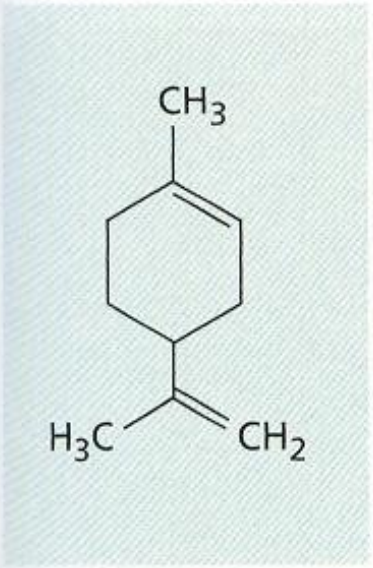
funkcie v komplexných interakciách

- **medzi rastlinami**
- **rastlina – mikroorganizmus (patogén)**
- **rastlina – živočích**

Biogenéza terpénov

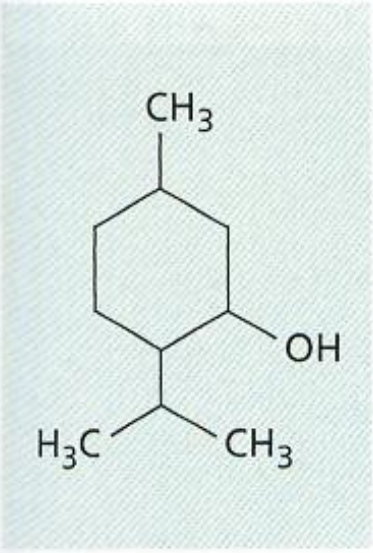


(A)



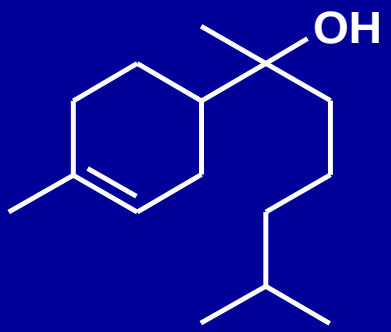
Limonene

(B)

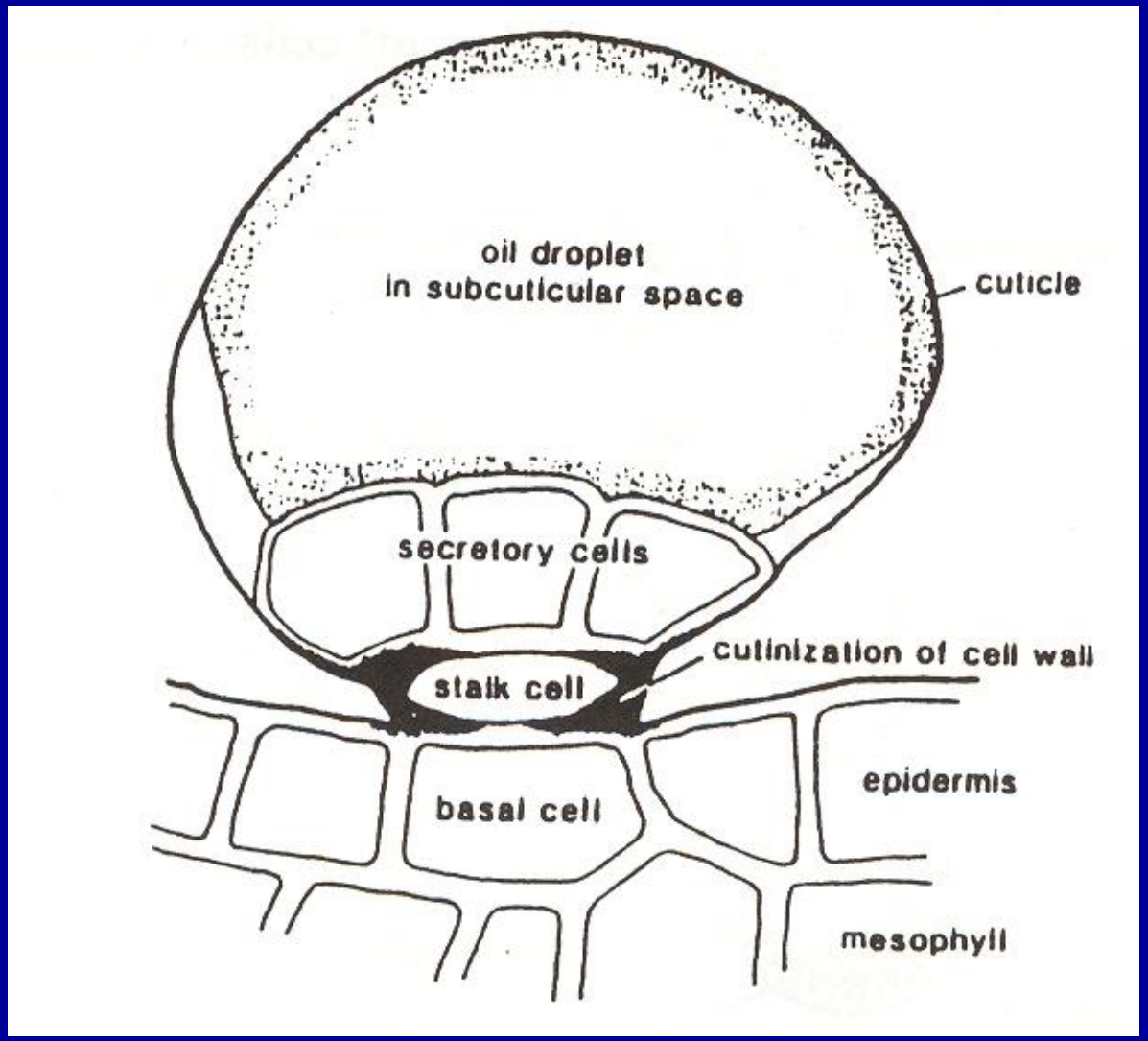


Menthol

monoterpény

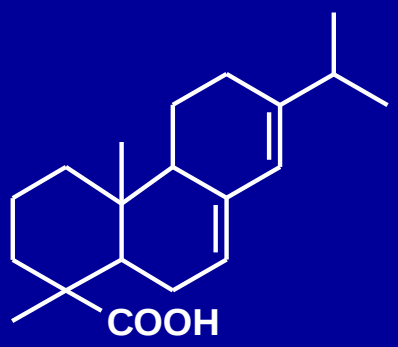


(-)-α-bisabolol
(seskviterpén)



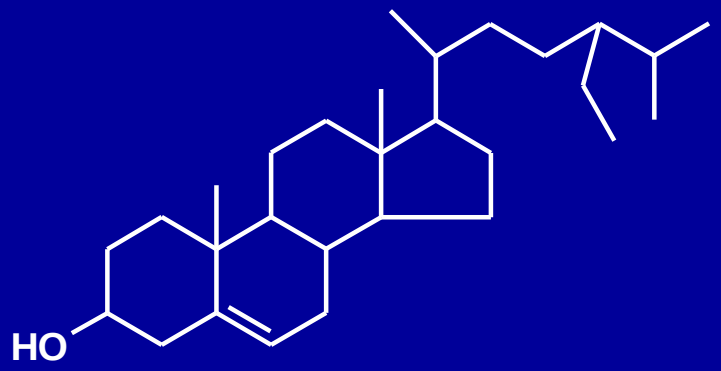
silicová nádržka

Diterpény (C20)



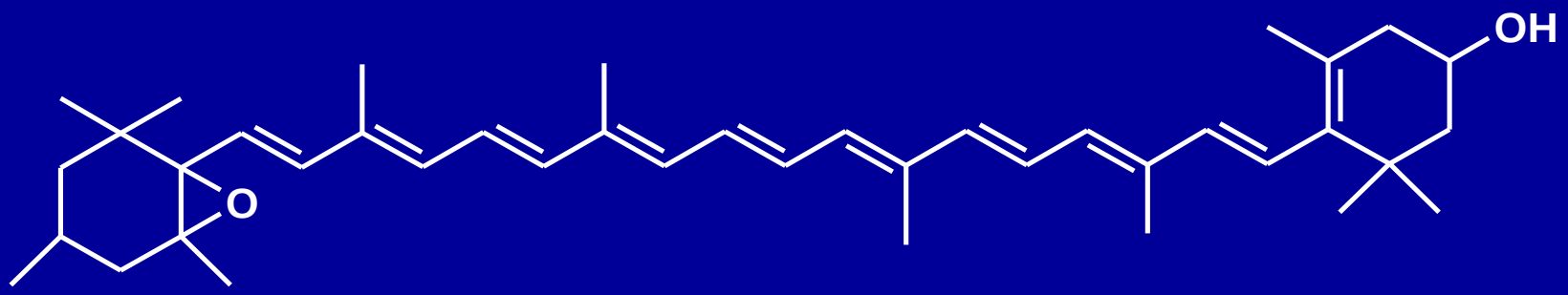
kyselina abietová

Triterpény (C30)



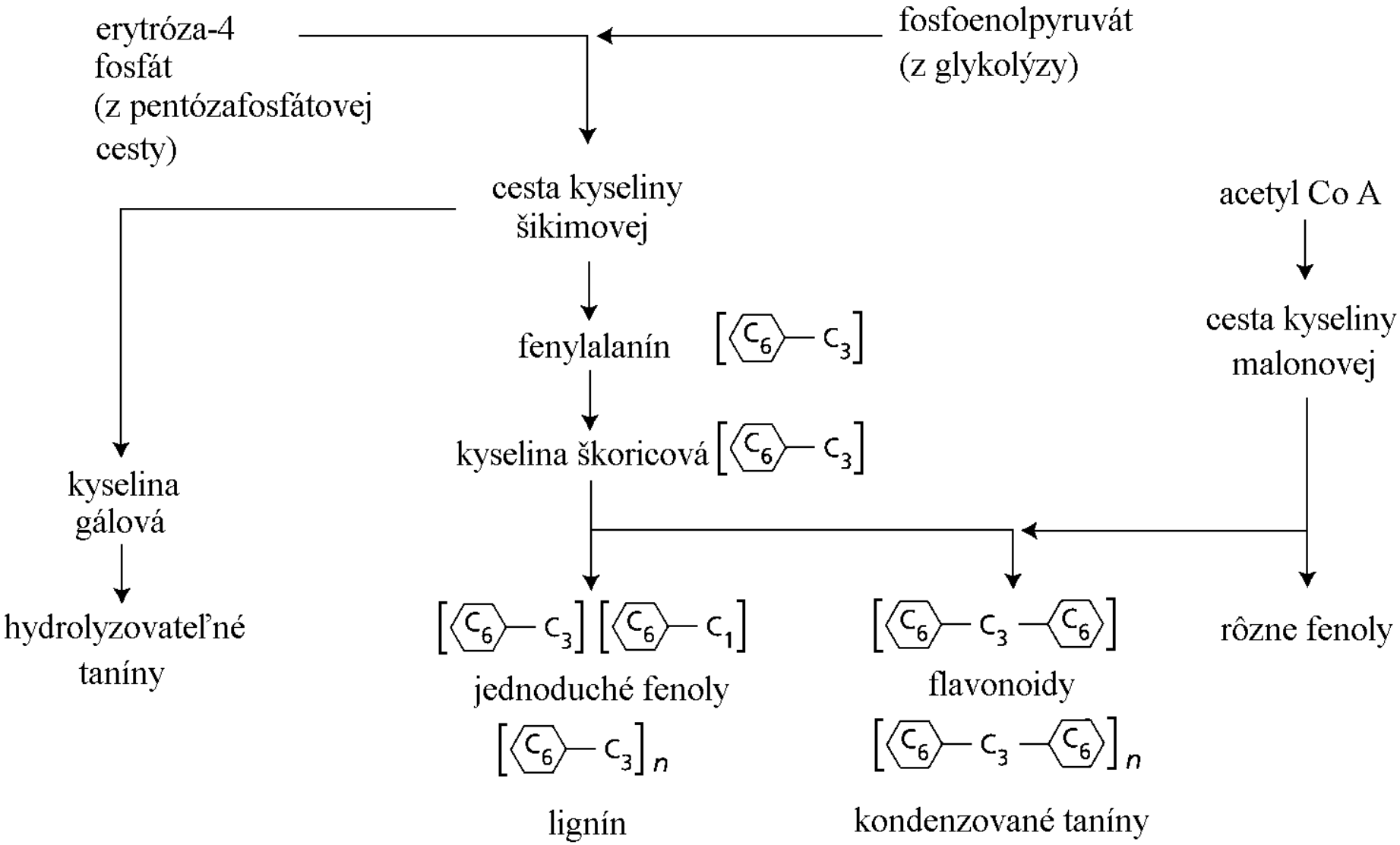
ß-sitosterol

Tetraterpény (C40)

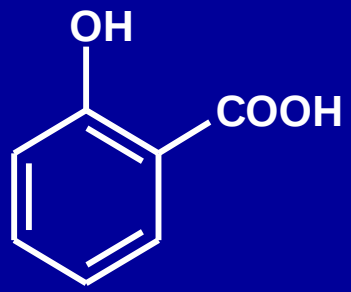


anteraxantín

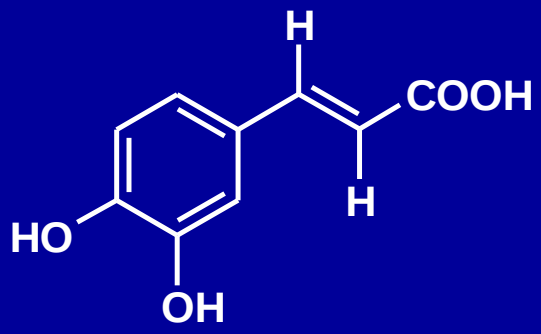
Hlavné skupiny fenolových látok



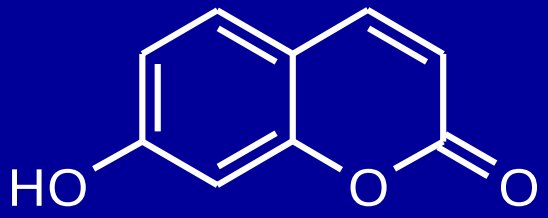
katechol



kyselina salicylová

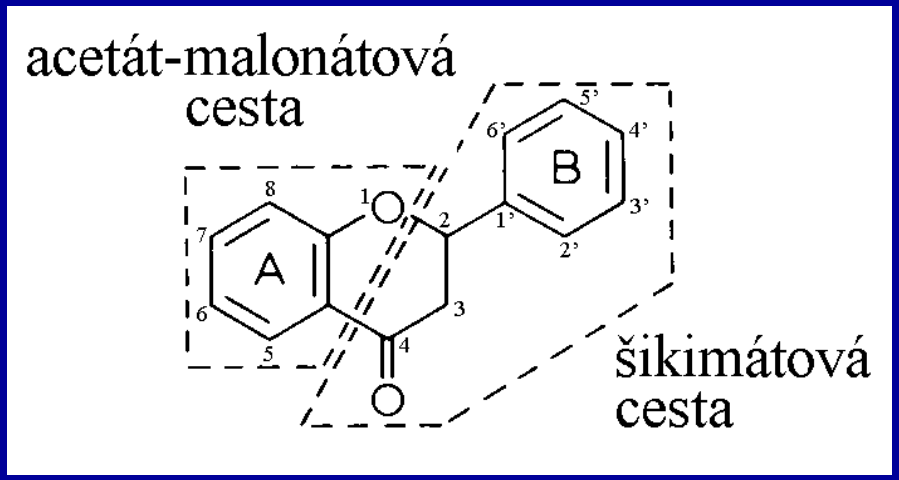


kyselina kávová

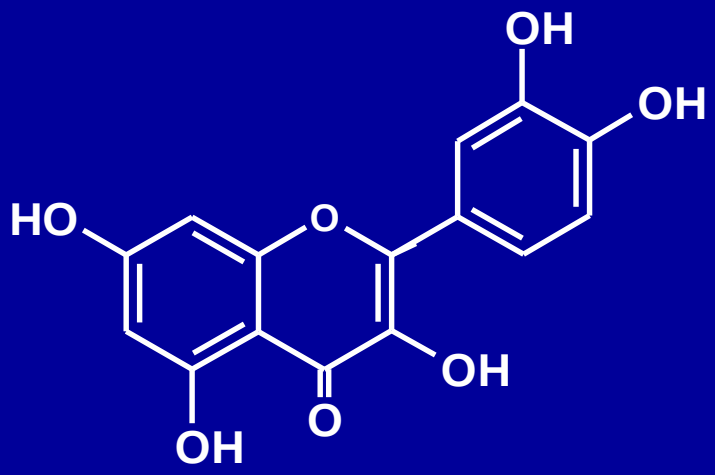


umbeliferón

flavonoidy

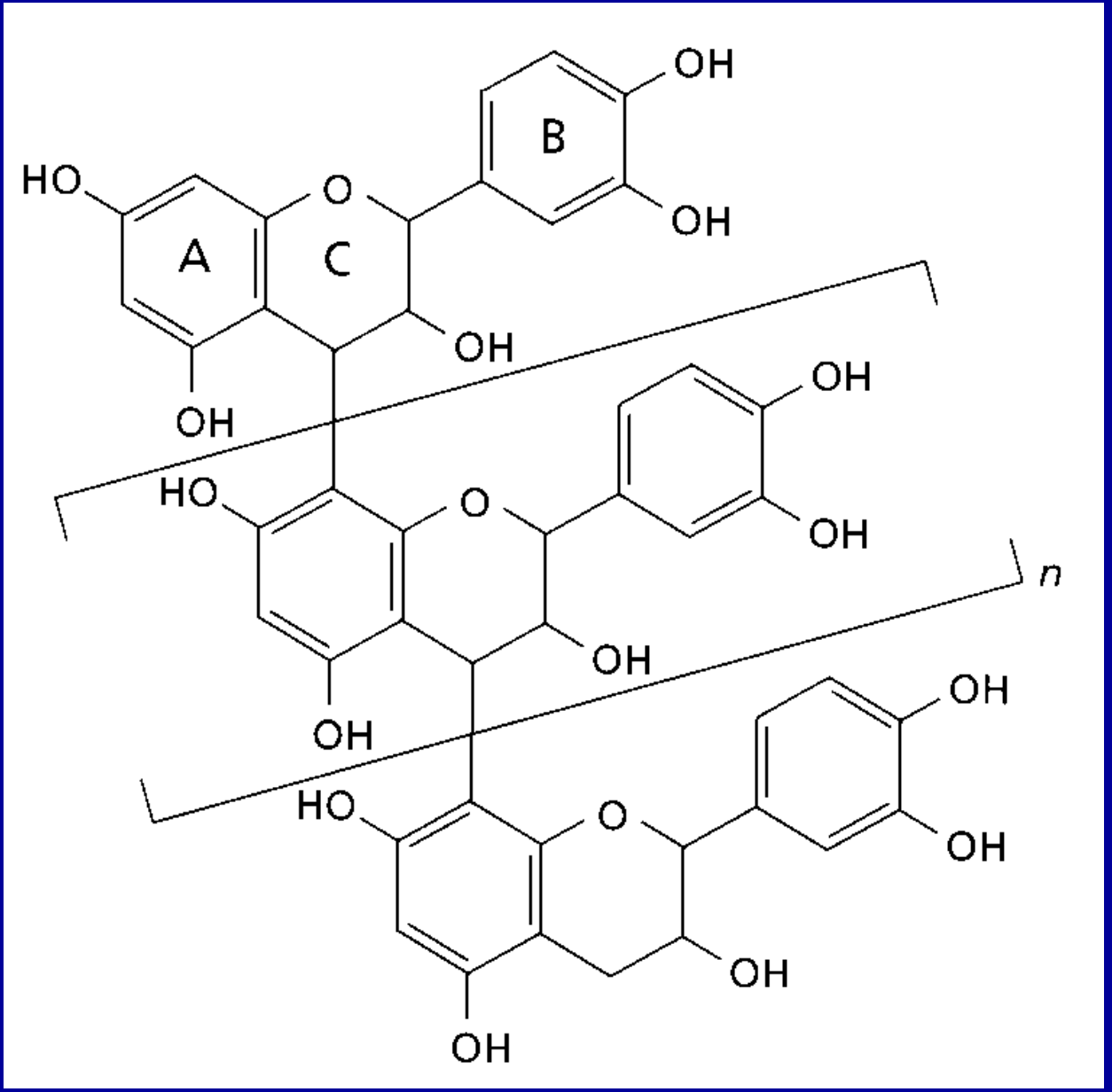


apigenín

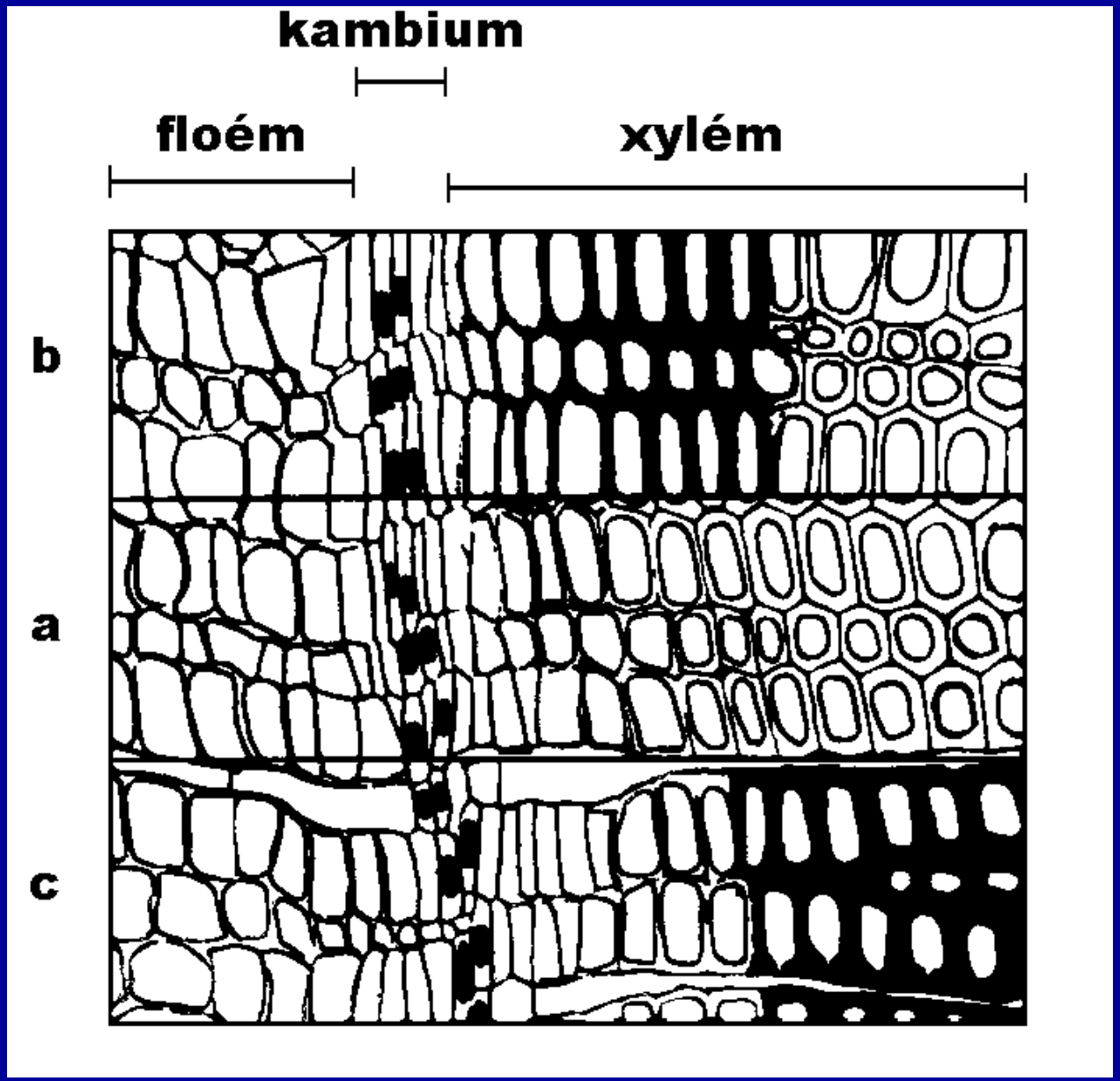


kvercetín

proantokyanidíny



lignifikácia

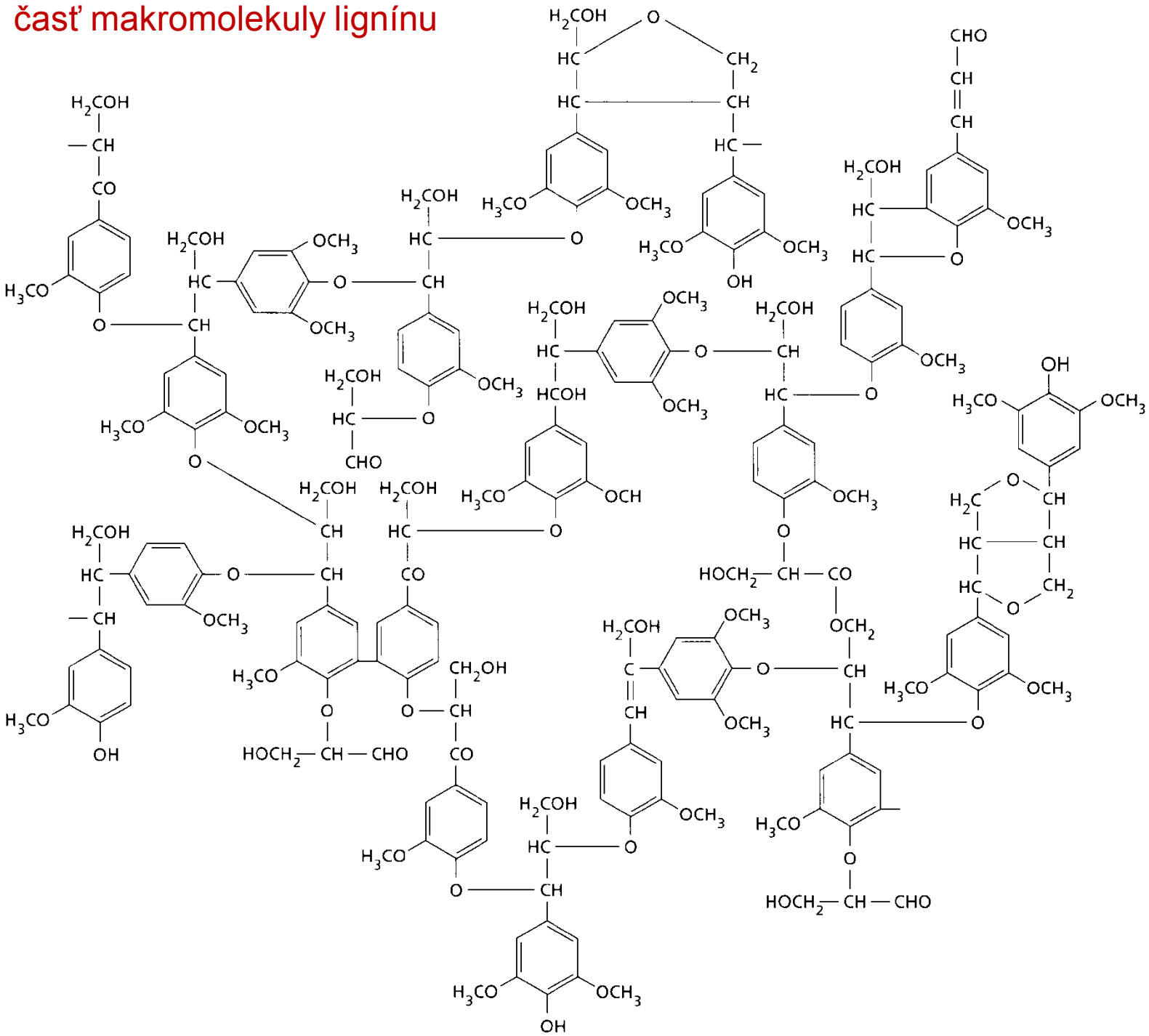


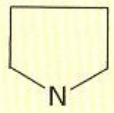
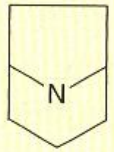
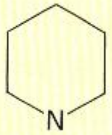
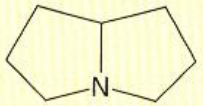
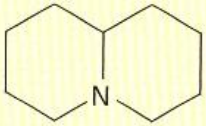
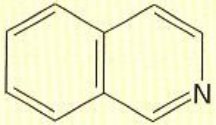
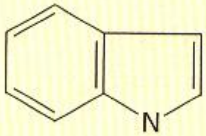
β – glukozidáza

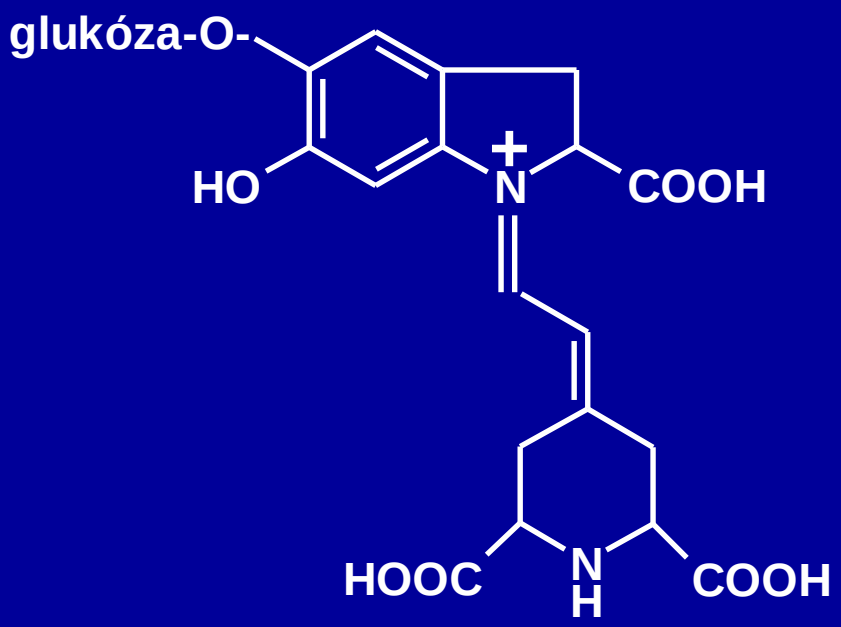
nefarbené

lignín

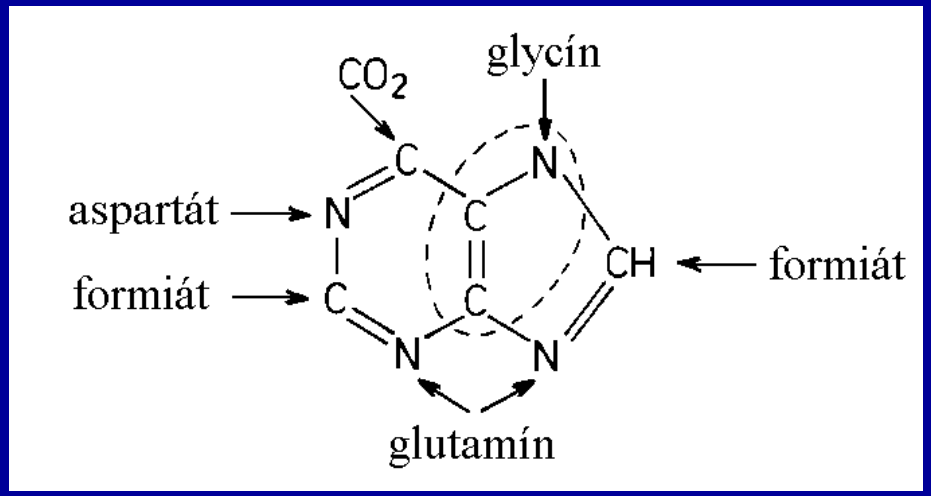
časť makromolekuly lignínu

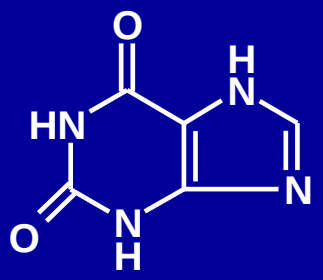


Alkaloid class	Structure	Biosynthetic precursor	Examples	Human uses
Pyrrolidine		Ornithine (aspartate)	Nicotine	Stimulant, depressant, tranquilizer
Tropane		Ornithine	Atropine	Prevention of intestinal spasms, antidote to other poisons, dilation of pupils for examination
			Cocaine	Stimulant of the central nervous system, local anesthetic
Piperidine		Lysine (or acetate)	Coniine	Poison (paralyzes motor neurons)
Pyrrolizidine		Ornithine	Retrorsine	None
Quinolizidine		Lysine	Lupinine	Restoration of heart rhythm
Isoquinoline		Tyrosine	Codeine	Analgesic (pain relief), treatment of coughs
			Morphine	Analgesic
Indole		Tryptophan	Psilocybin	Hallucinogen
			Reserpine	Treatment of hypertension, treatment of psychoses
			Strychnine	Rat poison, treatment of eye disorders

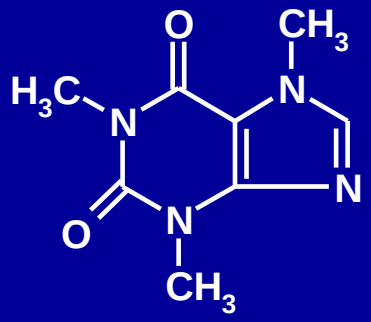


betanín



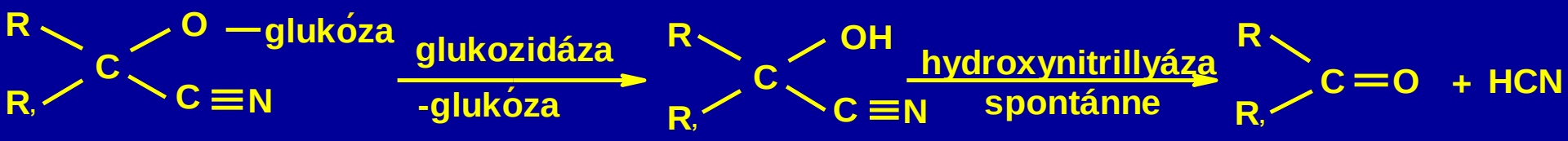


xantín



kofeín

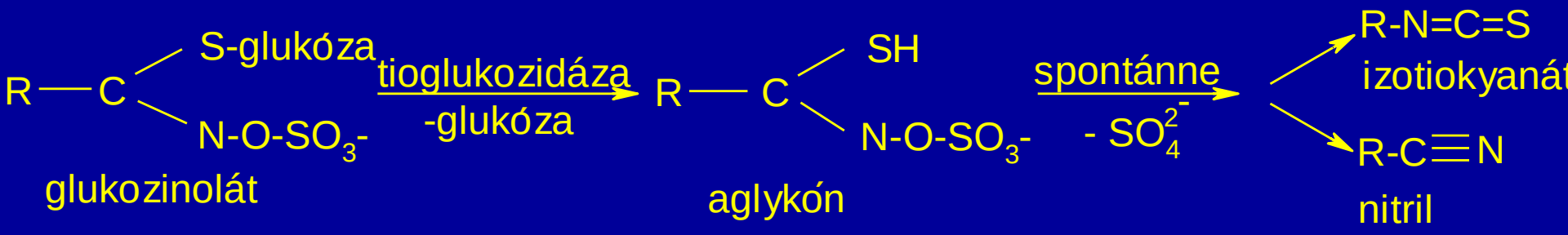
teobromín

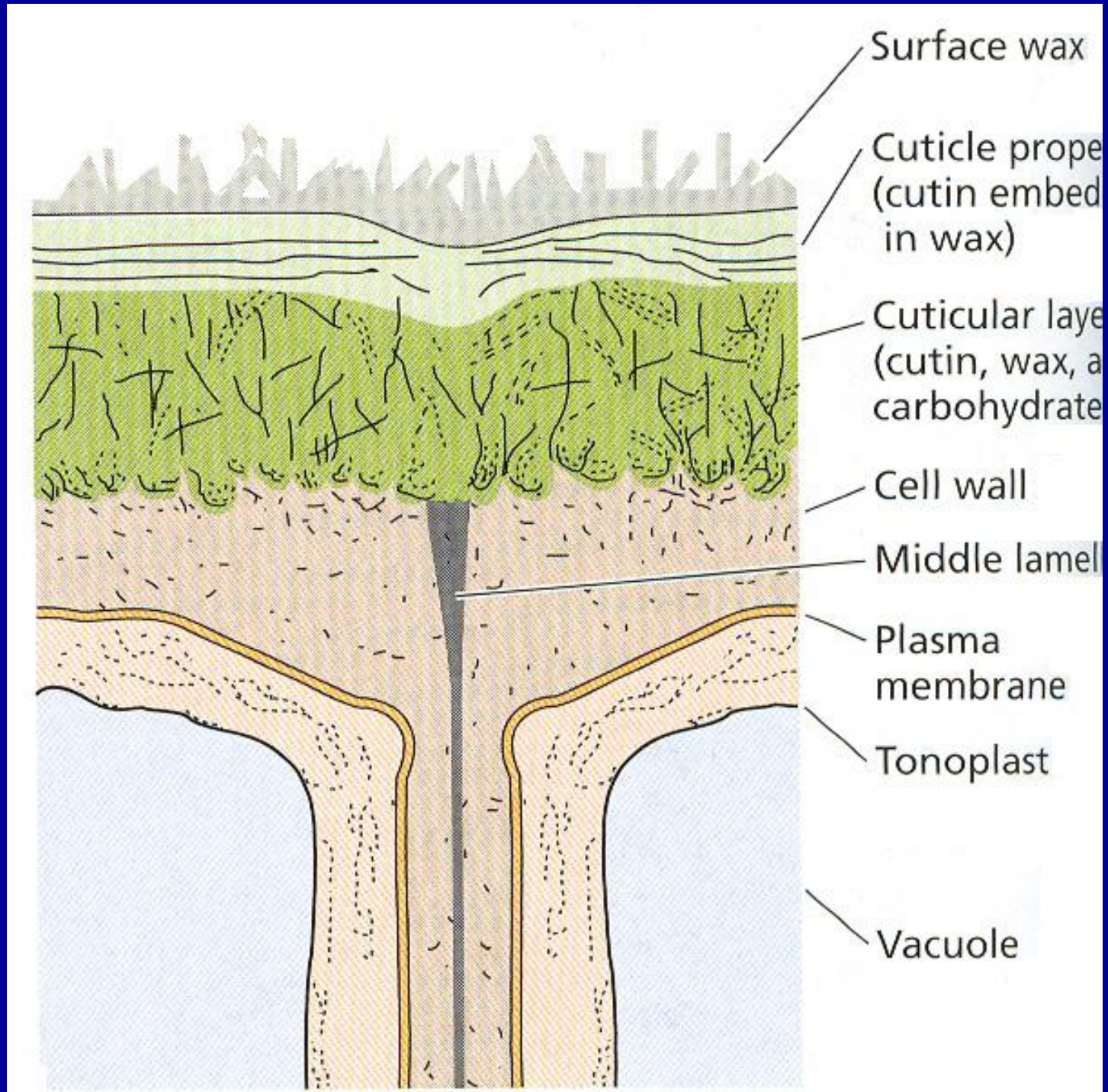


kyanogénny glukozid

kyanohydrín

ketón


R
C
S-glukóza
N-O-SO3-
glukozinolát
tioglukozidáza
-glukóza
R
C
SH
N-O-SO3-
aglykón
spontánne
- SO4 2-
R-N=C=S
izotiokyanát
R-C≡N
nitril


Surface wax
Cuticle prope
(cutin embed
in wax)
Cuticular laye
(cutin, wax, a
carbohydrate
Cell wall
Middle lamel
Plasma
membrane
Tonoplast
Vacuole

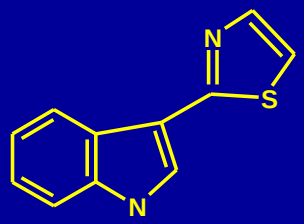
Sekundárne metabolity a stres

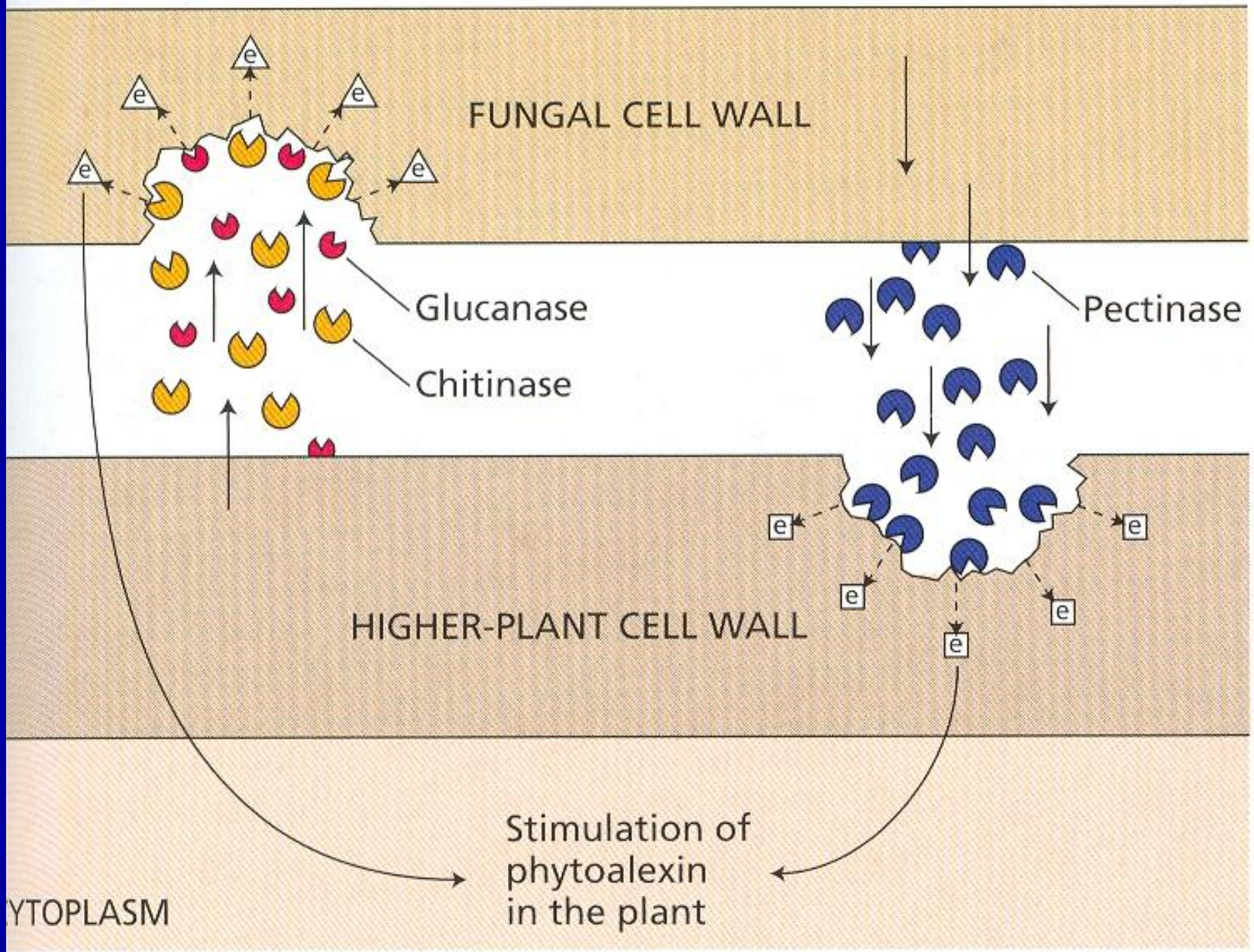
Fytoanticipíny

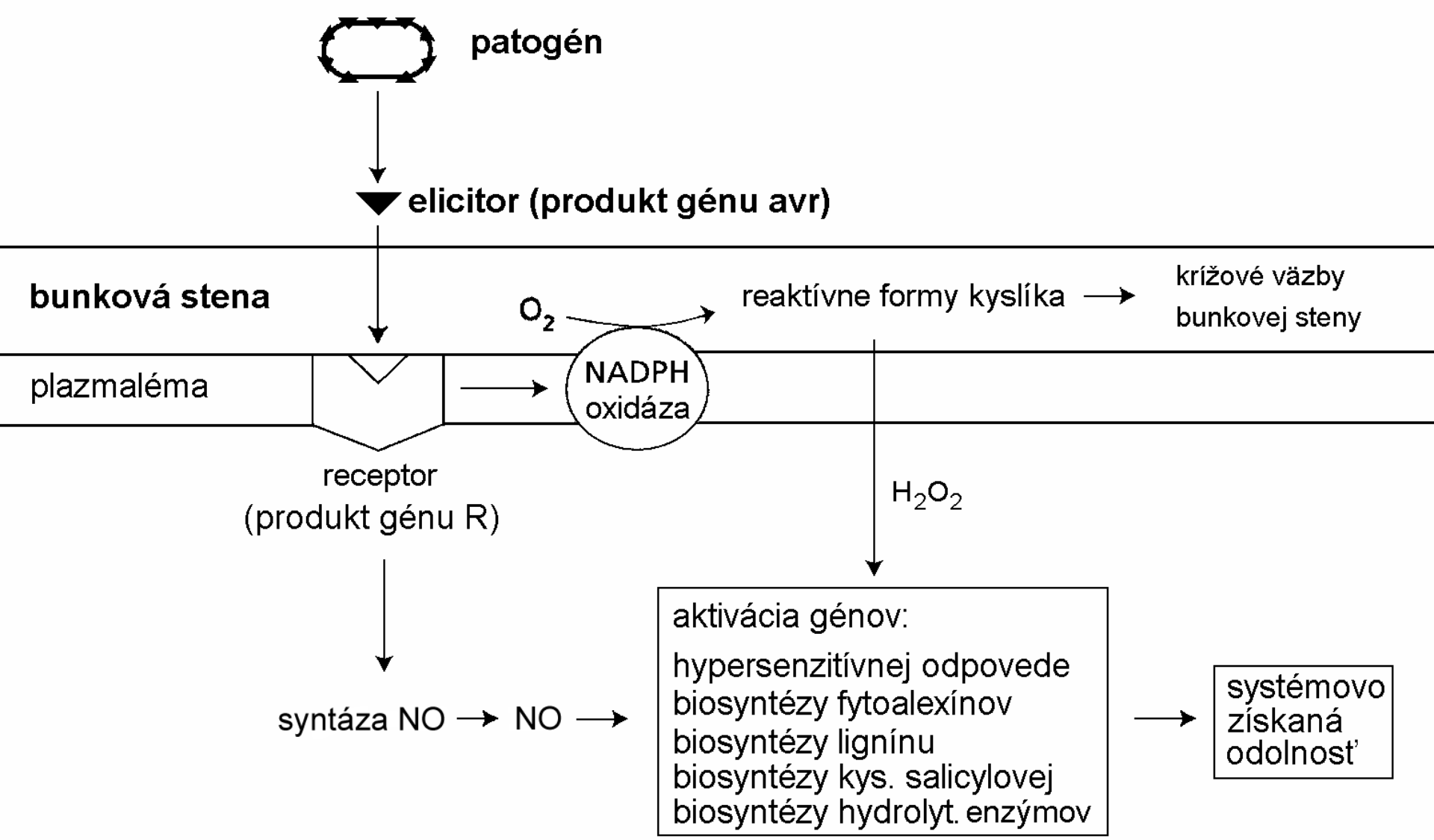
- trvale prítomné (konštitutívne)
- netoxické glykozidy vo vakuole
- aktivácia po strese
- antibiotická aktivita

Fytoalexíny

- tvorba *de novo* expresiou genómu po strese
- antibiotická aktivita




FUNGAL CELL WALL
Glucanase
Chitinase
Pectinase
HIGHER-PLANT CELL WALL
e
Stimulation of
phytoalexin
in the plant
YTOPLASM


patogén
elicitor (produkt génu avr)
bunková stena
plazmaléma
receptor
(produkt génu R)
O2
NADPH
oxidáza
reaktívne formy kyslíka
krížové väzby
bunkovej steny
H2O2
syntáza NO
NO
aktivácia génov:
hypersenzitívnej odpovede
biosyntézy fytoalexínov
biosyntézy lignínu
biosyntézy kys. salicylovej
biosyntézy hydrolyt. enzýmov
systémovo
získaná
odolnosť