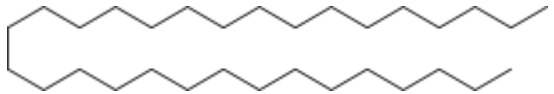
Fette und Lipide

Klassifizierung: Wachse, Sphingolipide, Terpene, Steroide

Stoffklassen

A. nicht hydrolysierbar

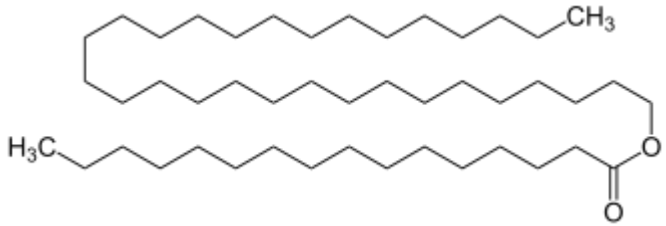
Langkettige Alkane, Carotinoide, Vitamine
Terpene, Steroide
Fettalkohole >C10
Fettsäuren >C10



Paraffine: z.B.
Hentriacontan $C_{31}H_{64}$

B. hydrolysierbar

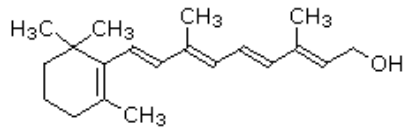
Fette (Fettsäure + Glycerin)
Waxe (Fettsäure + Fettalkohol)
Sterolester (Fettsäure + Cholesterin)



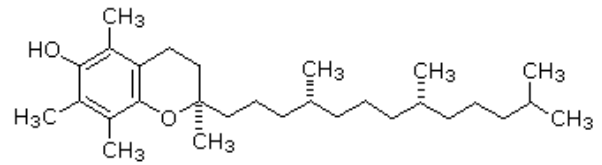
Palmitinsäuremyricylester

nicht hydrolysierbar

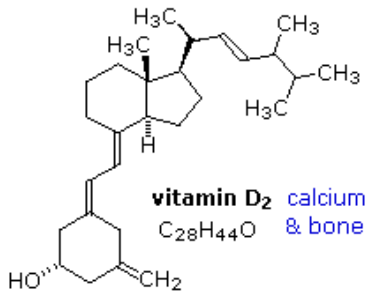
Lipid Soluble Vitamins



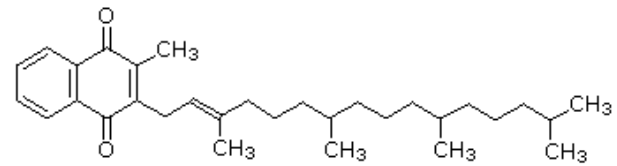
vitamin A
$C_{20}H_{30}O$ part of the visual pigment



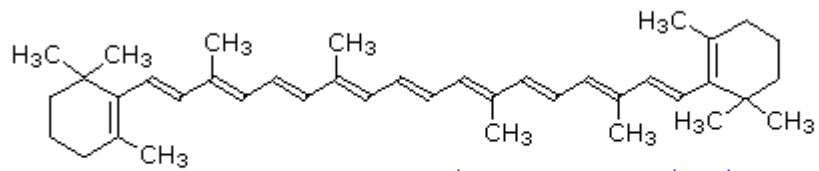
$C_{29}H_{50}O_2$ **vitamin E** an antioxidant



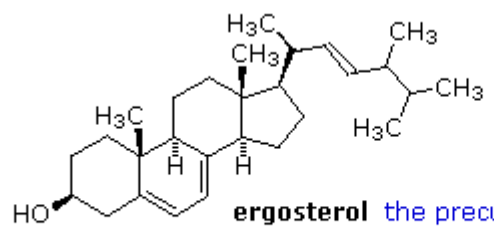
vitamin D_2 calcium metabolism
$C_{28}H_{44}O$ & bone growth



vitamin K_1 a blood clotting factor
$C_{31}H_{46}O_2$



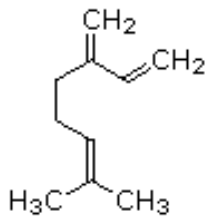
β-carotene the precursor to vitamin A

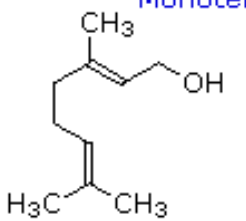


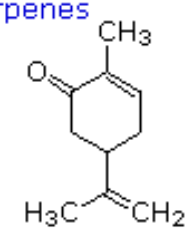
ergosterol the precursor to vitamin D_2

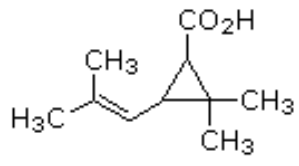
nicht hydrolysierbar

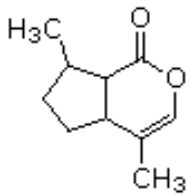
Monoterpenes

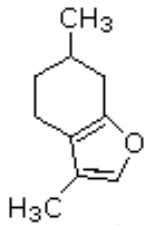

myrcene

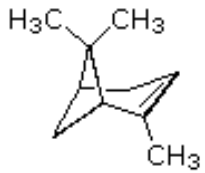

geraniol

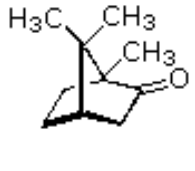

carvone


chrysanthemic acid

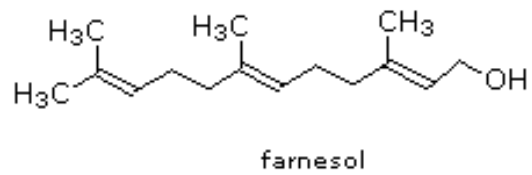

nepetalactone

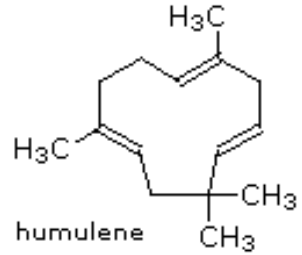

menthofuran


α-pinene

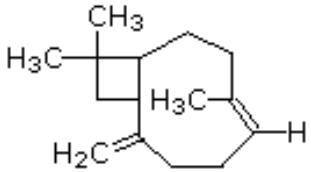

camphor

Sesquiterpenes

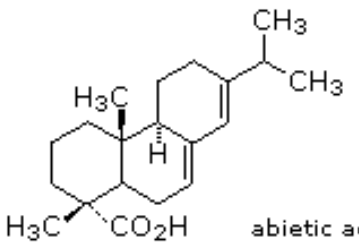

farnesol

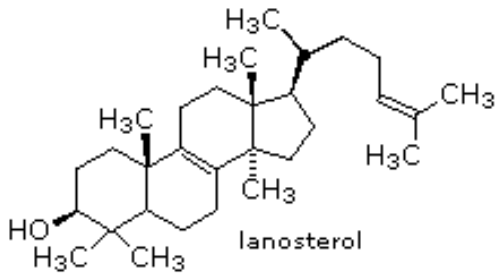

humulene

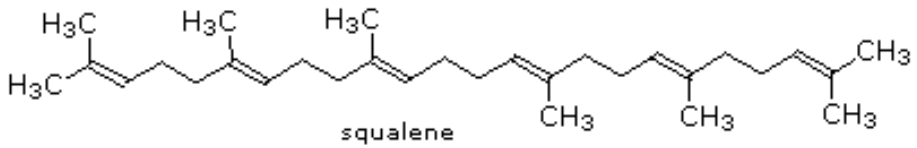

ngaione

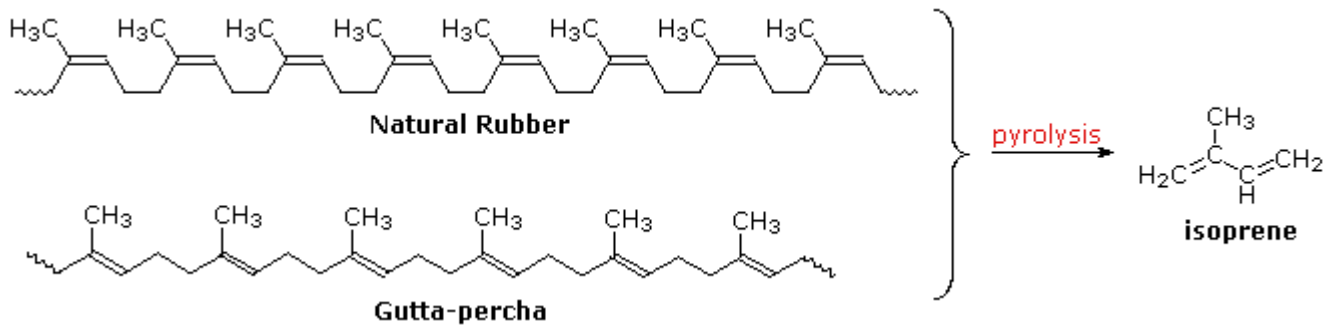

caryophyllene

Diterpenes & Triterpenes

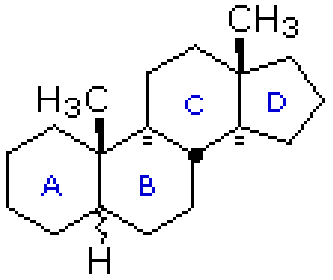

abietic acid


lanosterol


squalene

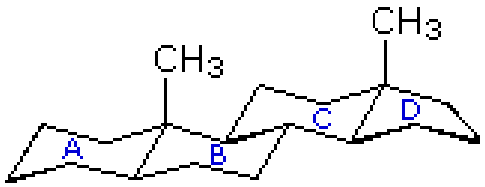


nicht hydrolysierbar
Steroide

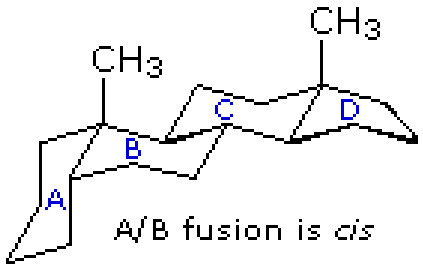


A/B ring fusion
may be *cis* or *trans*

The B/C & C/D ring fusions are *trans*

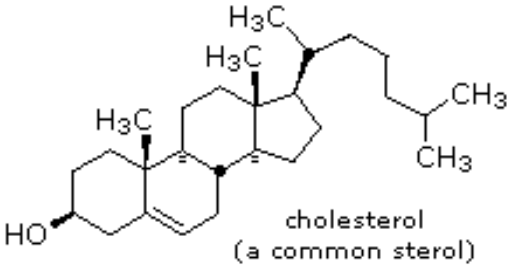


A/B fusion is *trans*

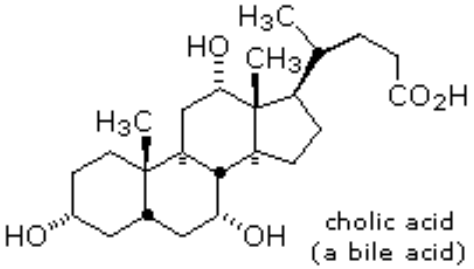


A/B fusion is *cis*

Common Steroid Conformations

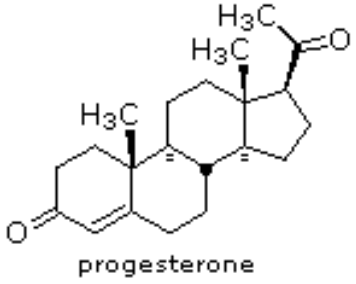


cholesterol
(a common sterol)

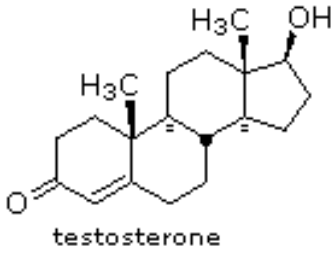


cholic acid
(a bile acid)

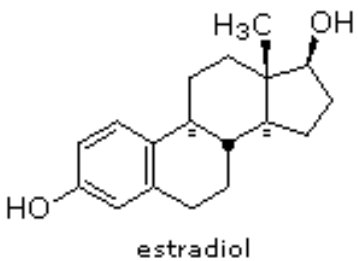
Typical Animal Steroids



progesterone

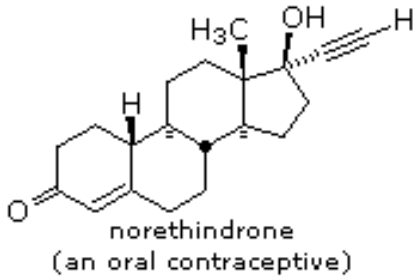


testosterone

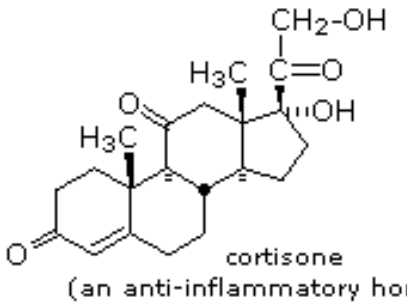


estradiol

Steroid Sex Hormones



norethindrone
(an oral contraceptive)

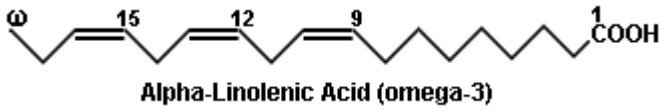


cortisone
(an anti-inflammatory hormone)

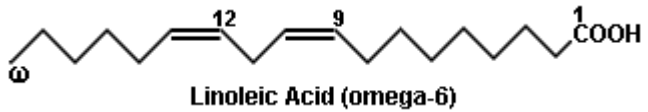
Medicinally Useful Steroids

Common Fatty Acids

Chemical Names and Descriptions of some Common Fatty Acids				
Common Name	Carbon Atoms	Double Bonds	Scientific Name	Sources
Butyric acid	4	0	butanoic acid	butterfat
Caproic Acid	6	0	hexanoic acid	butterfat
Caprylic Acid	8	0	octanoic acid	coconut oil
Capric Acid	10	0	decanoic acid	coconut oil
Lauric Acid	12	0	dodecanoic acid	coconut oil
Myristic Acid	14	0	tetradecanoic acid	palm kernel oil
Palmitic Acid	16	0	hexadecanoic acid	palm oil
Palmitoleic Acid	16	1	9-hexadecenoic acid	animal fats
Stearic Acid	18	0	octadecanoic acid	animal fats
Oleic Acid	18	1	9-octadecenoic acid	olive oil
Vaccenic Acid	18	1	11-octadecenoic acid	butterfat
Linoleic Acid	18	2	9,12-octadecadienoic acid	safflower oil
Alpha-Linolenic Acid (ALA)	18	3	9,12,15-octadecatrienoic acid	flaxseed (linseed) oil
Gamma-Linolenic Acid (GLA)	18	3	6,9,12-octadecatrienoic acid	borage oil
Arachidic Acid	20	0	eicosanoic acid	peanut oil, fish oil
Gadoleic Acid	20	1	9-eicosenoic acid	fish oil
Arachidonic Acid (AA)	20	4	5,8,11,14-eicosatetraenoic acid	liver fats
EPA	20	5	5,8,11,14,17-eicosapentaenoic acid	fish oil
Behenic acid	22	0	docosanoic acid	rapeseed oil
Erucic acid	22	1	13-docosenoic acid	rapeseed oil
DHA	22	6	4,7,10,13,16,19-docosahexaenoic acid	fish oil
Lignoceric acid	24	0	tetracosanoic acid	small amounts in most fats



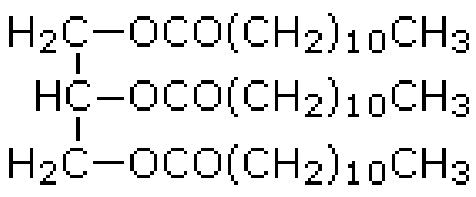
Alpha-Linolenic Acid (omega-3)



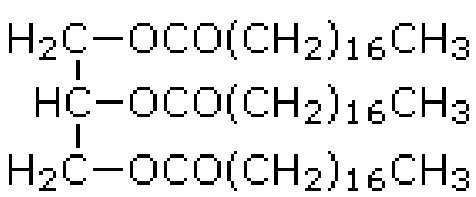
Linoleic Acid (omega-6)

hydrolysierbar

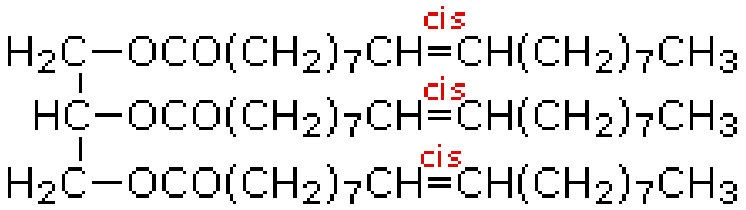
Fette (Fettsäure + Glycerin)
Wachse (Fettsäure + Fettalkohol)
Sterolester (Fettsäure + Cholesterin)



trilaurin
mp 45° C



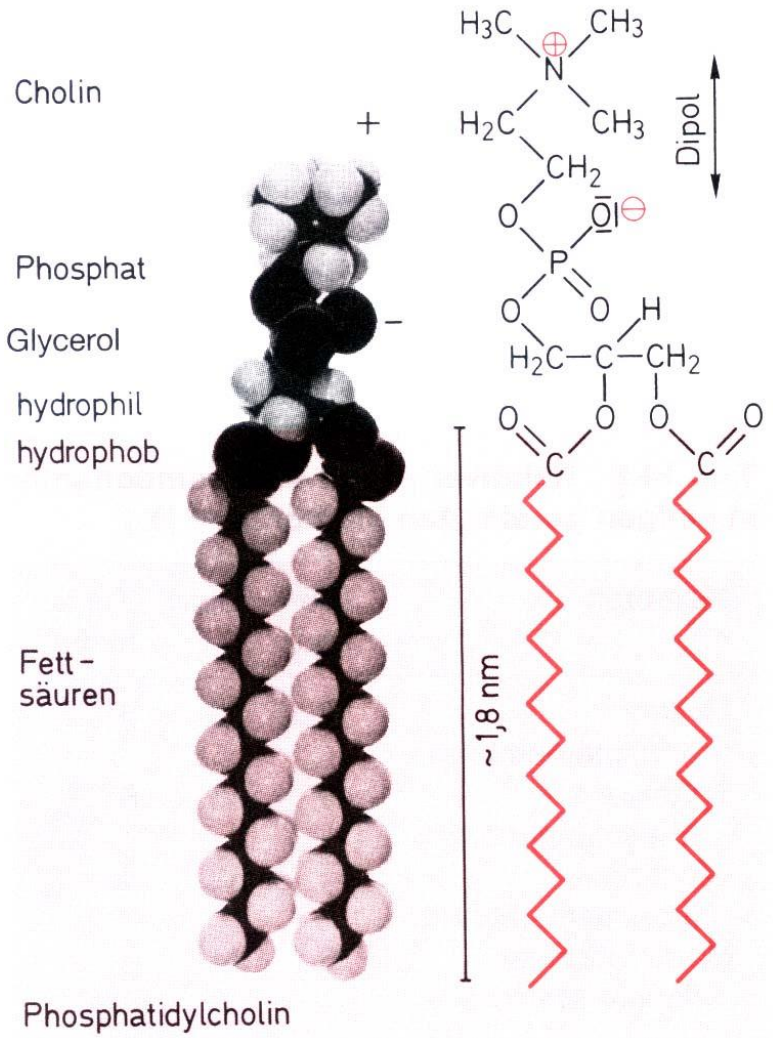
tristearin
mp 71° C

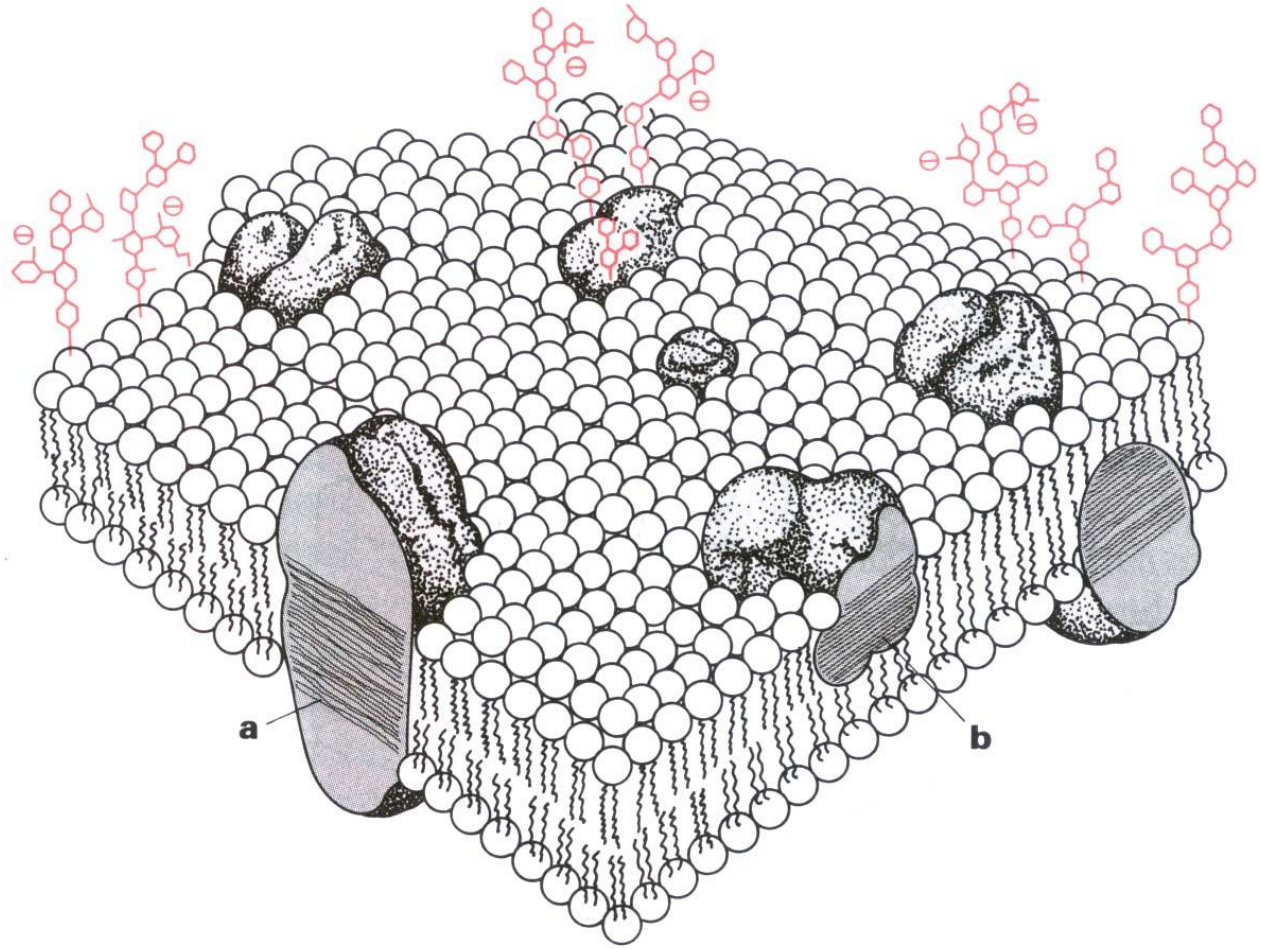


triolein
mp -4° C

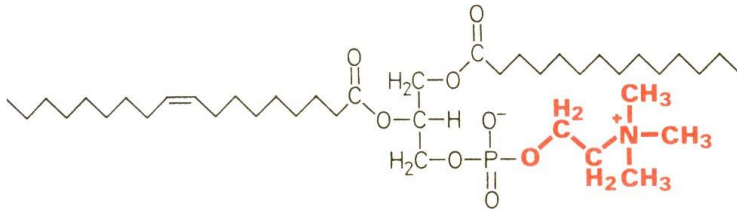
spermaceti: $CH_3(CH_2)_{14}CO_2\text{-}(CH_2)_{15}CH_3$
beeswax: $CH_3(CH_2)_{24}CO_2\text{-}(CH_2)_{29}CH_3$
carnuba wax: $CH_3(CH_2)_{30}CO_2\text{-}(CH_2)_{33}CH_3$

Membranen

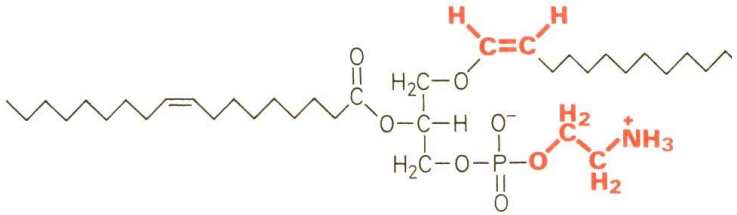

Cholin
+
Phosphat
Glycerol
–
hydrophil
hydrophob
Fett-
säuren
~1,8 nm
Dipol
Phosphatidylcholin


a
b

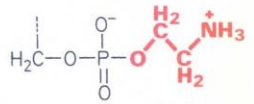
Phospholipide



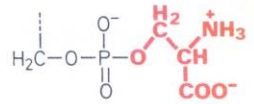
Phosphatidylcholin (Lecithin)



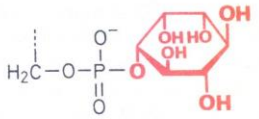
Plasmalogen, Plasmenylethanolamin
[1-(1-Alkenyl)-2-acyl-*sn*-glycerol-3-phospho-ethanolamin]



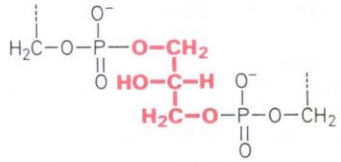
Phosphatidylethanolamin



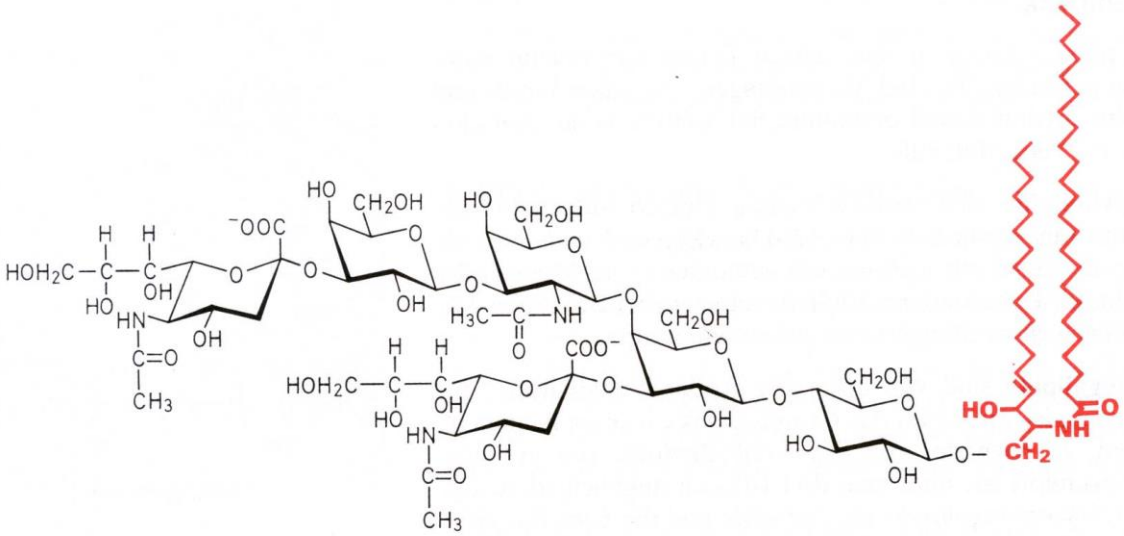
Phosphatidylserin



Phosphatidylinositol



Bisphosphatidylglycerol
(Cardiolipin)

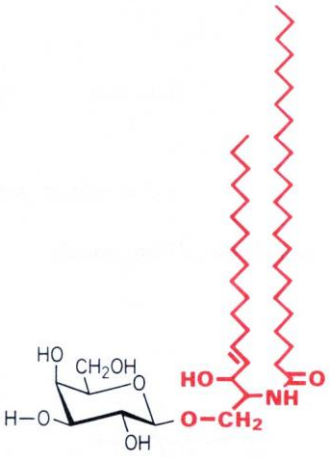


Galactose — *N*-Acetylgalactosamin — Galactose — Glucose — Sphingosin

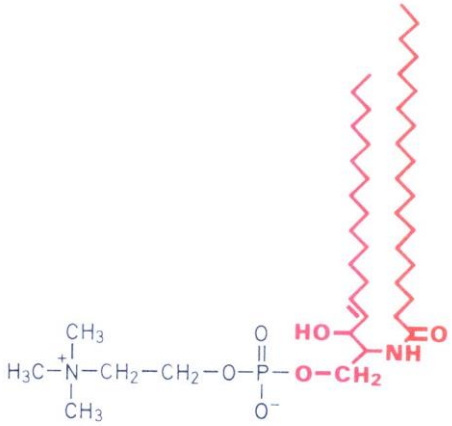
Fettsäure

N-Acetylneuraminsäure

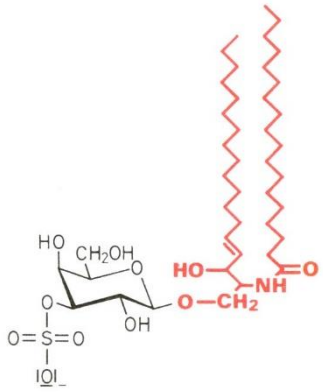
N-Acetylneuraminsäure



Cerebrosid



Sphingomyelin



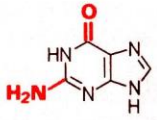
Sulfatid

Nucleinsäuren, Purin-, Pyrimidinbasen, Nucleoside, Nucleotide, DNA, RNA

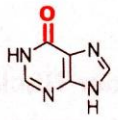
Purin-Derivate

Basen:

Adenin (Ade)

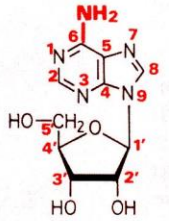


Guanin (Gua)

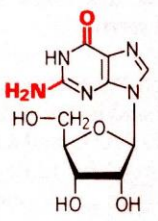


Hypoxanthin (Hyp)

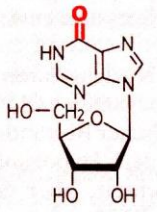
Nucleoside:



Adenosin (A)



Guanosin (G)

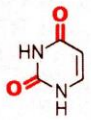


Inosin (I)

Pyrimidin-Derivate

Basen:

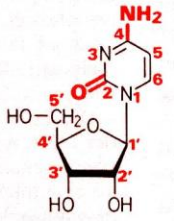
Cytosin (Cyt)



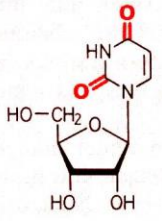
Uracil (Ura)

Thymin (Thy)

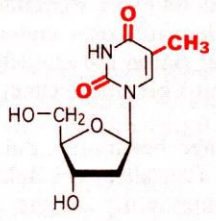
Nucleoside:



Cytidin (C)

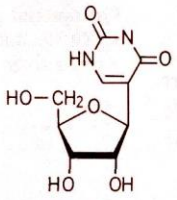


Uridin (U)

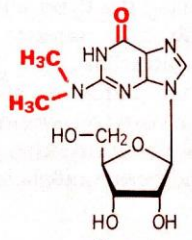


Thymidin (dT)

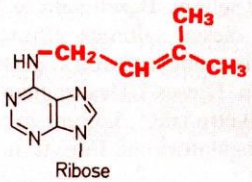
Seltene Nucleoside:



Pseudo-uridin (ψ)

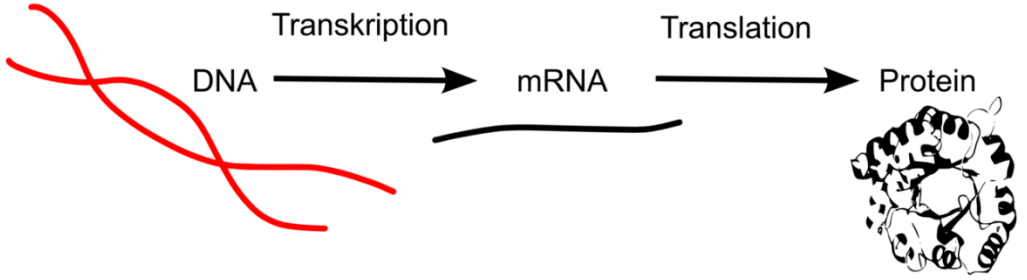


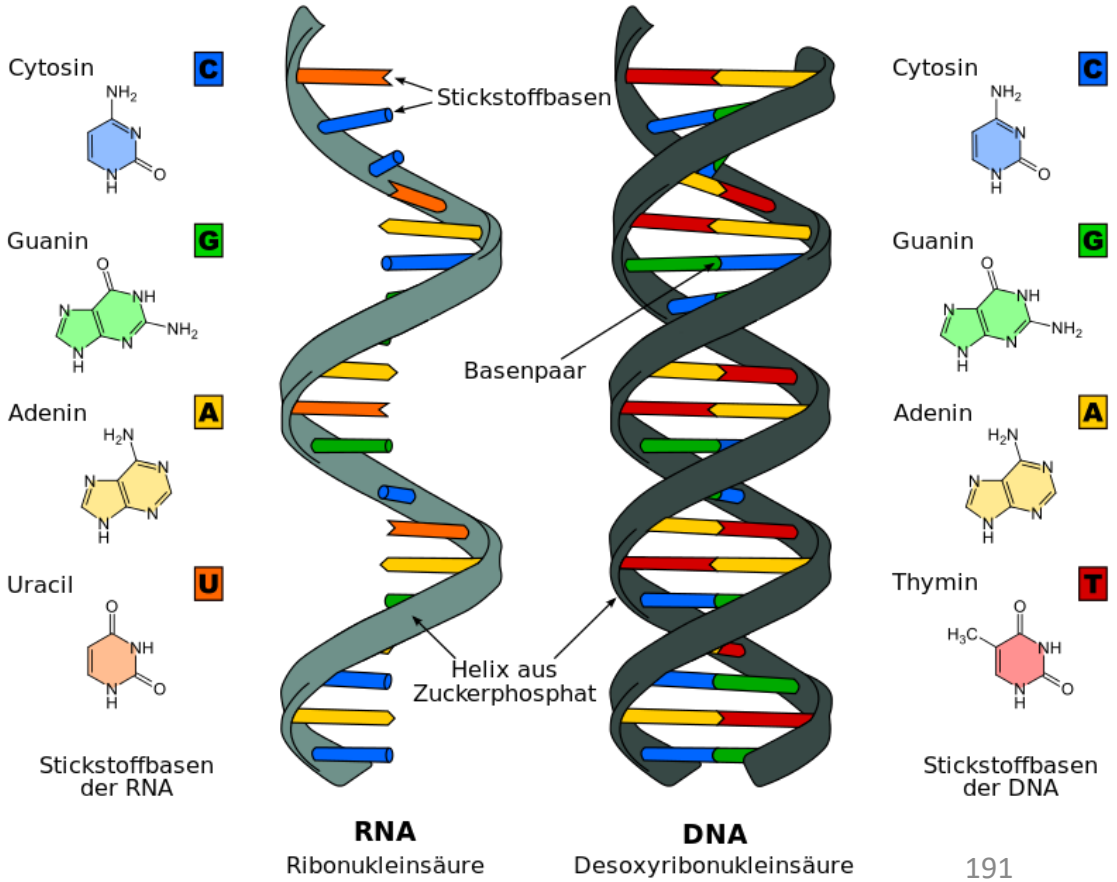
N^2-Dimethyl-guanosin (m^2_2G)



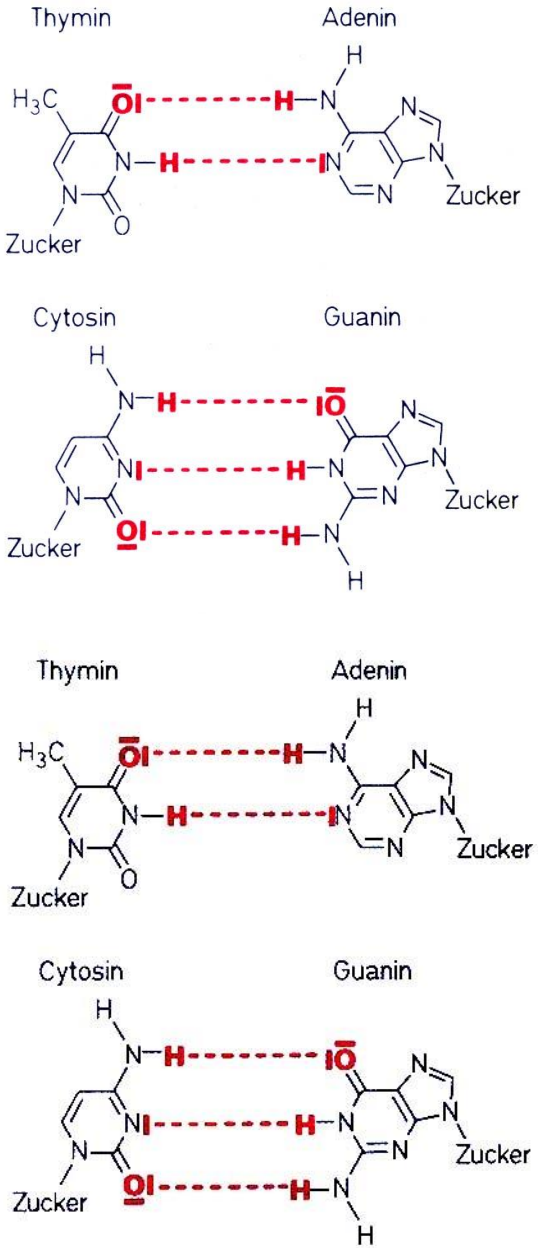
Ribose

N^6-Isopentenyl-adenosin



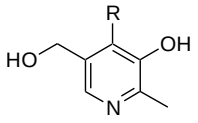


Basenpaarung / genetischer Code

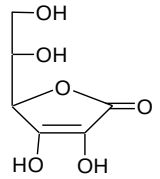


1. Base	2. Base				3. Base
	U	C	A	G	
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	*„Stop“*	„Stop“	A
	Leu	Ser	*„Stop“*	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gin	Arg	A
	Leu	Pro	Gin	Arg	G
A	lie	Thr	Asn	Ser	U
	lie	Thr	Asn	Ser	C
	lie	Thr	Lys	Arg	A
	Met (*Start*)	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

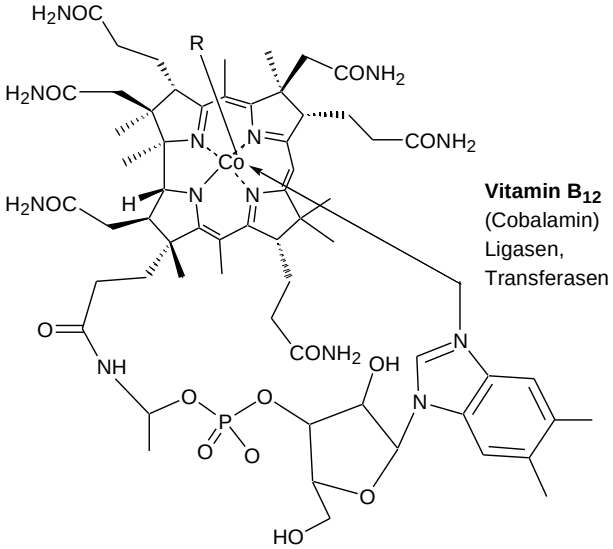
Vitamine, Alkaloide, Hormone, Antibiotika



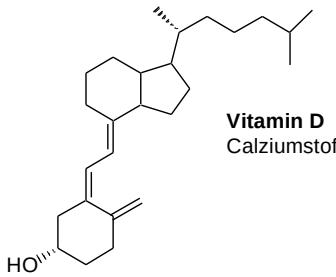
Vitamin B_6
Aminosäurestoffwechsel
R = CH_2OH Pyridoxol
R = CHO Pyridoxal
R = CH_2NH_2 Pyridoxamin



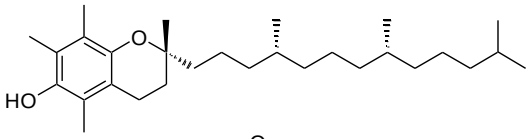
Vitamin C (Ascorbinsäure)
Radikalfänger
Immunsystem



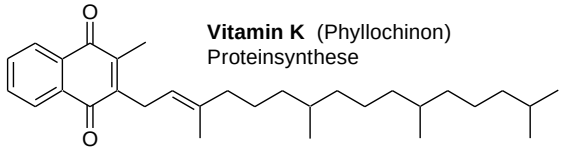
Vitamin B_{12}
(Cobalamin)
Ligasen,
Transferasen



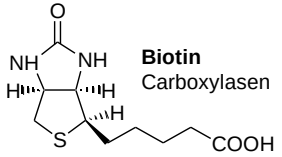
Vitamin D (Calciferol)
Calziumstoffwechsel



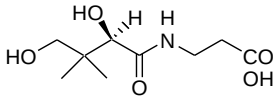
Vitamin E (Tocoferol)
Antioxidans



Vitamin K (Phyllochinon)
Proteinsynthese

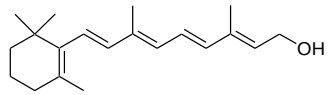


Biotin
Carboxylasen

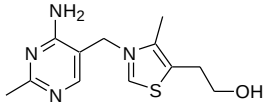


Pantothensäure
Coenzym A

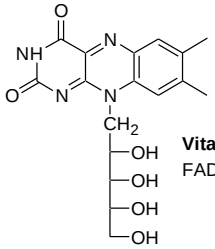
Vitamine



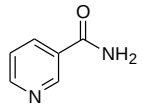
Vitamin A (Retinol)
Sehpigment, Immunsystem



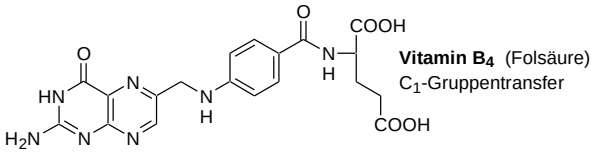
Vitamin B_1 (Thiamin)
Vorstufe für Coenzyme
Decarboxylasen



Vitamin B_2 (Riboflavin)
FAD für Oxidoreduktasen

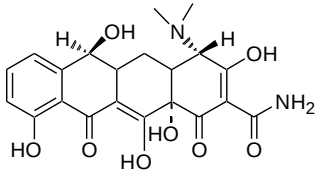


Vitamin B_3 (Nicotinamid)
NAD für Oxidoreductasen

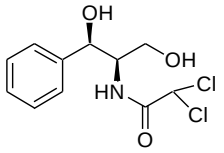


Vitamin B_4 (Folsäure)
C_1-Gruppentransfer

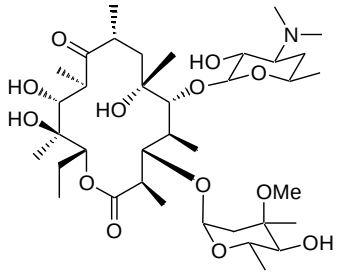
Antibiotika



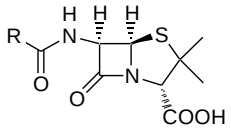
Tetracycline



Chloramphenicol



Erythromycin



Penicilline

Vitamine, **Alkaloide**, Hormone, Antibiotika

Alkaloide

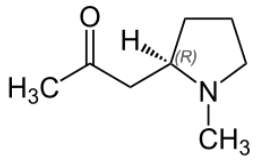
Wortbildung aus arabisch *al qualja*: „Pflanzenasche“ und griechisch *-oides*: „ähnlich“) sind natürlich vorkommende, chemisch heterogene, meist basische, stickstoffhaltige organische Verbindungen des Sekundärstoffwechsels, die auf den tierischen oder menschlichen Organismus wirken. Über 10000 verschiedene pflanzlichen, tierische oder von Mikroorganismen produzierte Substanzen werden dieser Stoffgruppe zugeordnet.

Einteilung nach chemischer Struktur

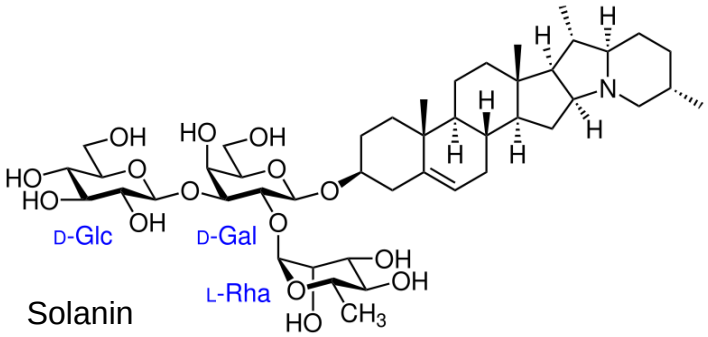
Die in der Literatur am häufigsten verwendete Einteilung der Alkaloide ist die Kategorisierung entsprechend ihrer chemischen Struktur. Namensgebend ist der Teil des Moleküls, der einen Stickstoff enthält.

Alkaloide mit heterocyclischem Stickstoff

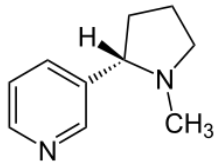
Pyrrolidin-Alkaloide: z. B. Hygrin
Steroid-Alkaloide: z. B. Solanin
Pyridin-Alkaloide: z. B. Nicotin, Anabasin
Tropan-Alkaloide: z. B. Hyoscyamin, Scopolamin, Cocain
Chinolin-Alkaloide: z. B. Chinin, Chinidin
Isochinolin-Alkaloide: z. B. Morphin, Codein, Papaverin, Berberin, Tubocurarin
Indol-Alkaloide: z. B. Ajmalin, Ergotamin, Yohimbin, Reserpin, Strychnin
Purin-Alkaloide: z. B. Coffein, Theophyllin, Theobromin
Alkaloide mit acyclischem Stickstoff: z. B. Ephedrin, Mescalin



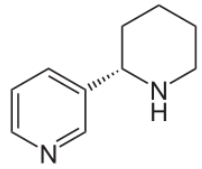
Hygrin



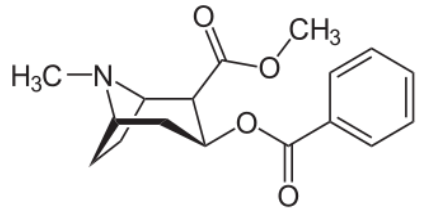
Solanin



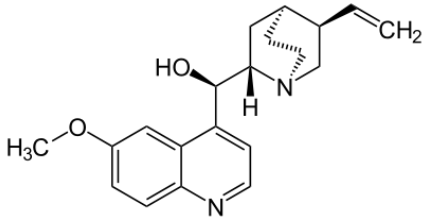
Nikotin



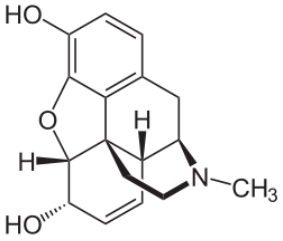
Anabasin



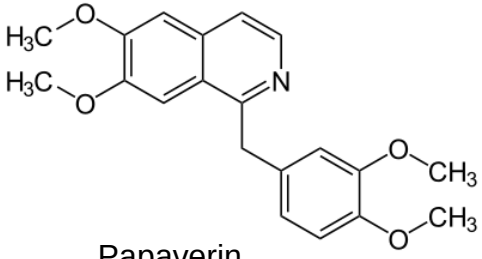
Cocain



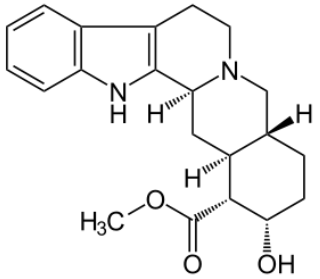
Chinin



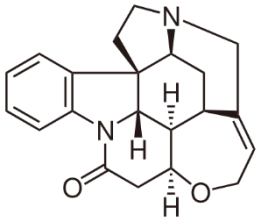
Morphin



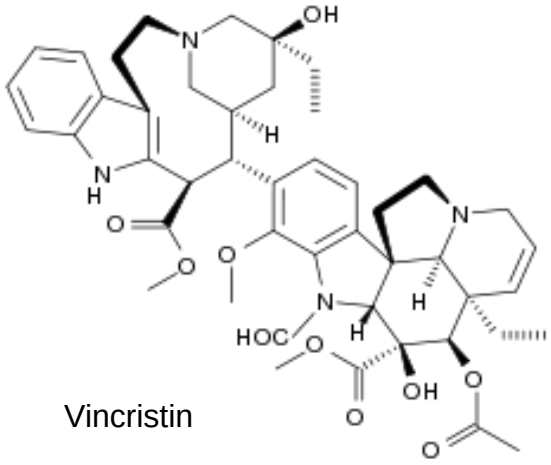
Papaverin



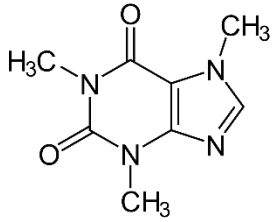
Yohimbin



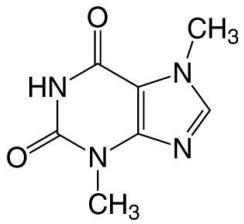
Strychnin



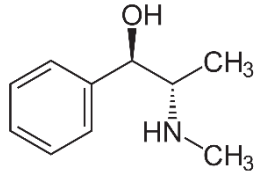
Vincristin



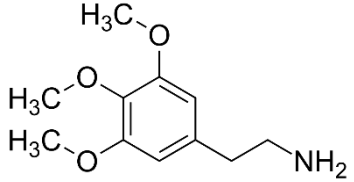
Coffein



Theobromin



Ephedrin



Mescalin