

Kapitel 10 Heterocyclen

Wichtige Heterocyclen

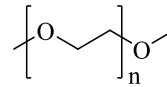


Ethylenoxid
Oxiran

Substanzgruppe:
Epoxide

Darstellung:
Alken+Persäure

Polyethylenglycol (PEG):



Thiiran

Substanzgruppe:
Episulfide



Aziridin

Substanzgruppe:
Aziridine



Tetrahydrofuran
THF



Furan

Substanzgruppe:
Furane



Thiophen

Substanzgruppe:
Thiophene

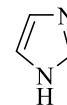


Pyrrolidin

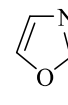


Pyrrol

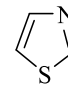
Substanzgruppe:
Pyrrole



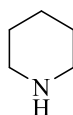
Imidazol



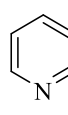
Oxazol



Thiazol

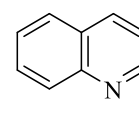


Piperidin

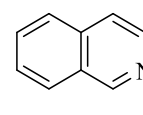


Pyridin

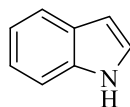
Substanzgruppe:
Piperidine



Chinolin

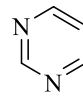


Isochinolin

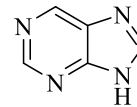


Indol

Bestandteil von
Tryptophan



Pyrimidin

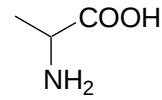


Purin

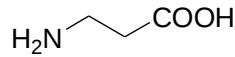
Bestandteil
von DNA

Kapitel 11 Naturstoffe

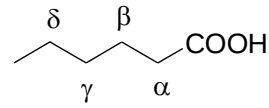
Aminosäuren



α -Alanin (chiral)

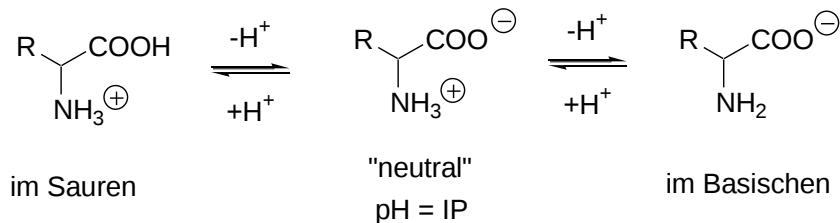


β -Alanin (achiral)



Chemische Eigenschaften

Aminosäuren sind meist kristalline Feststoffe und liegen als Zwitterionen vor. Den pH-Wert, bei dem eine Aminosäure in der (nach außen ungeladenen) zwitterionischen Form vorliegt wird Isoelektrischer Punkt (IP) genannt. Der IP ist für jede Aminosäure charakteristisch.



Einteilung der Aminosäuren:

Chiralität:

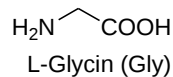
In der Natur fast ausschließlich L-AS

Proteinogene Aminosäuren: Aminosäuren, die in Proteine eingebaut werden.

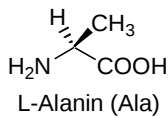
Essentielle Aminosäuren: Aminosäuren, die mit der Nahrung aufgenommen werden müssen (Mensch).

L-Valin, L-Leucin, L-Isoleucin, L-Phenylalanin, L-Threonin, L-Methionin, L-Tryptophan, L-Lysin

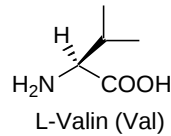
a) AS mit unpolarem Rest:



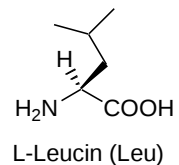
L-Glycin (Gly)



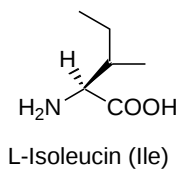
L-Alanin (Ala)



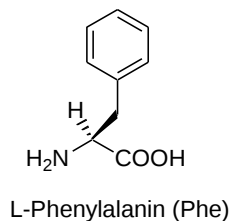
L-Valin (Val)



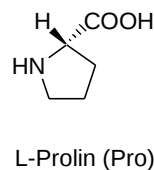
L-Leucin (Leu)



L-Isoleucin (Ile)

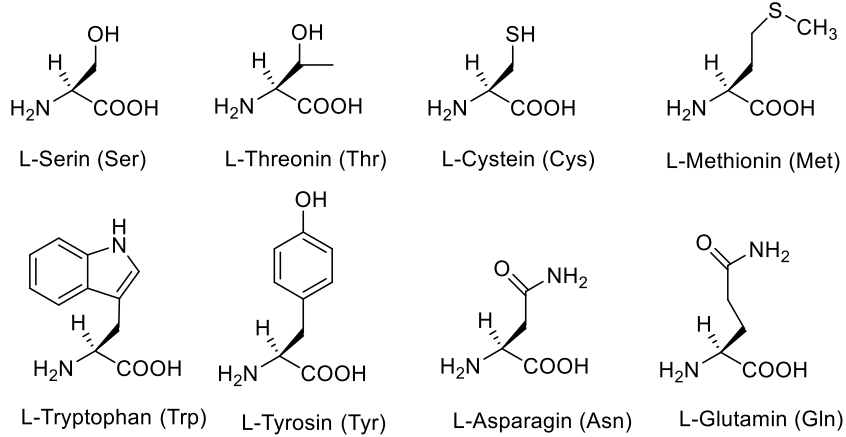


L-Phenylalanin (Phe)

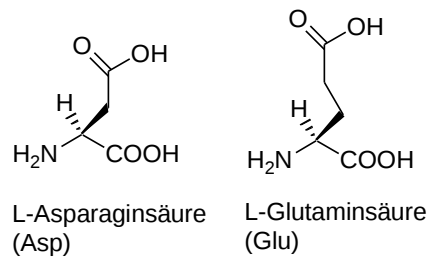


L-Prolin (Pro)

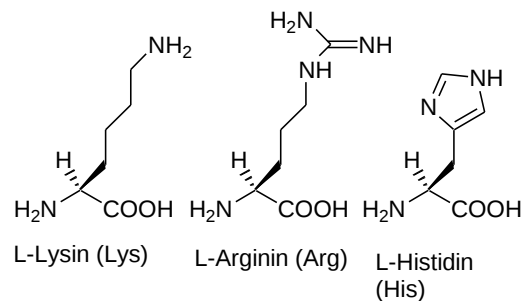
b) AS mit polarem, nicht ionisierbarem Rest:



c) polare saure AS mit ionisierbarem Rest:



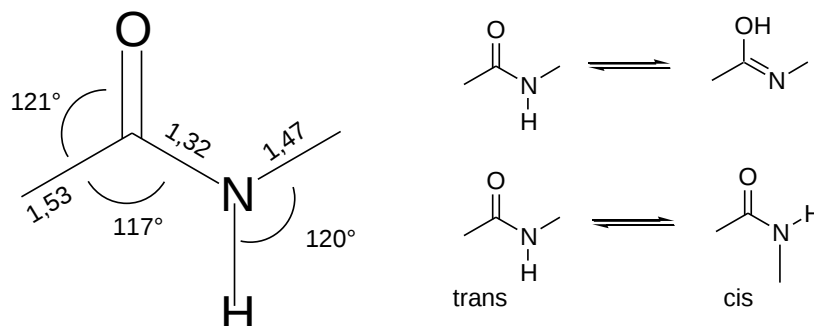
d) polare basische AS mit ionisierbarem Rest:



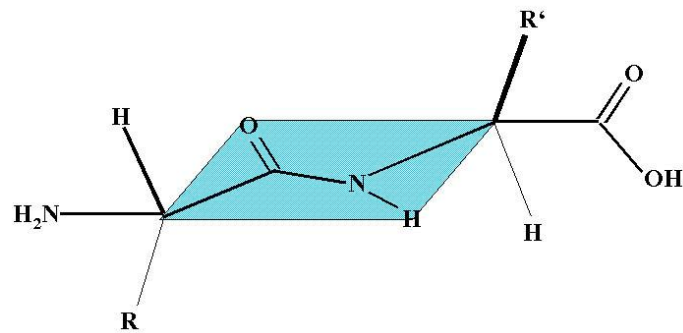
Peptide, Proteine

Eigenschaften, Basizität, Konformation, Bildung und Hydrolyse

Peptidbindung: Peptide sind Amide aus zwei Aminosäuren:



Die Peptidgruppe ist fast eben gebaut.



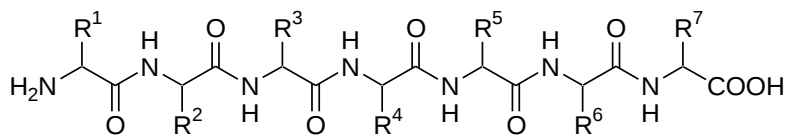
Proteine

Die Bezeichnung Protein kommt aus dem Griechischen: (proteuo) = „ich nehme den ersten Platz ein“

Einteilung: Skleroproteine (faserartig, Stützstrukturen, wasserunlöslich)
z.B.: Keratin (Fingernägel)

Sphäropoteine (sphärisch gebaut, wasserlöslich, denaturierbar) z.B.: Eiklarproteine

Chemische Struktur



□ □ □

β-Faltblatt (antiparallel oder parallel), α-Helix

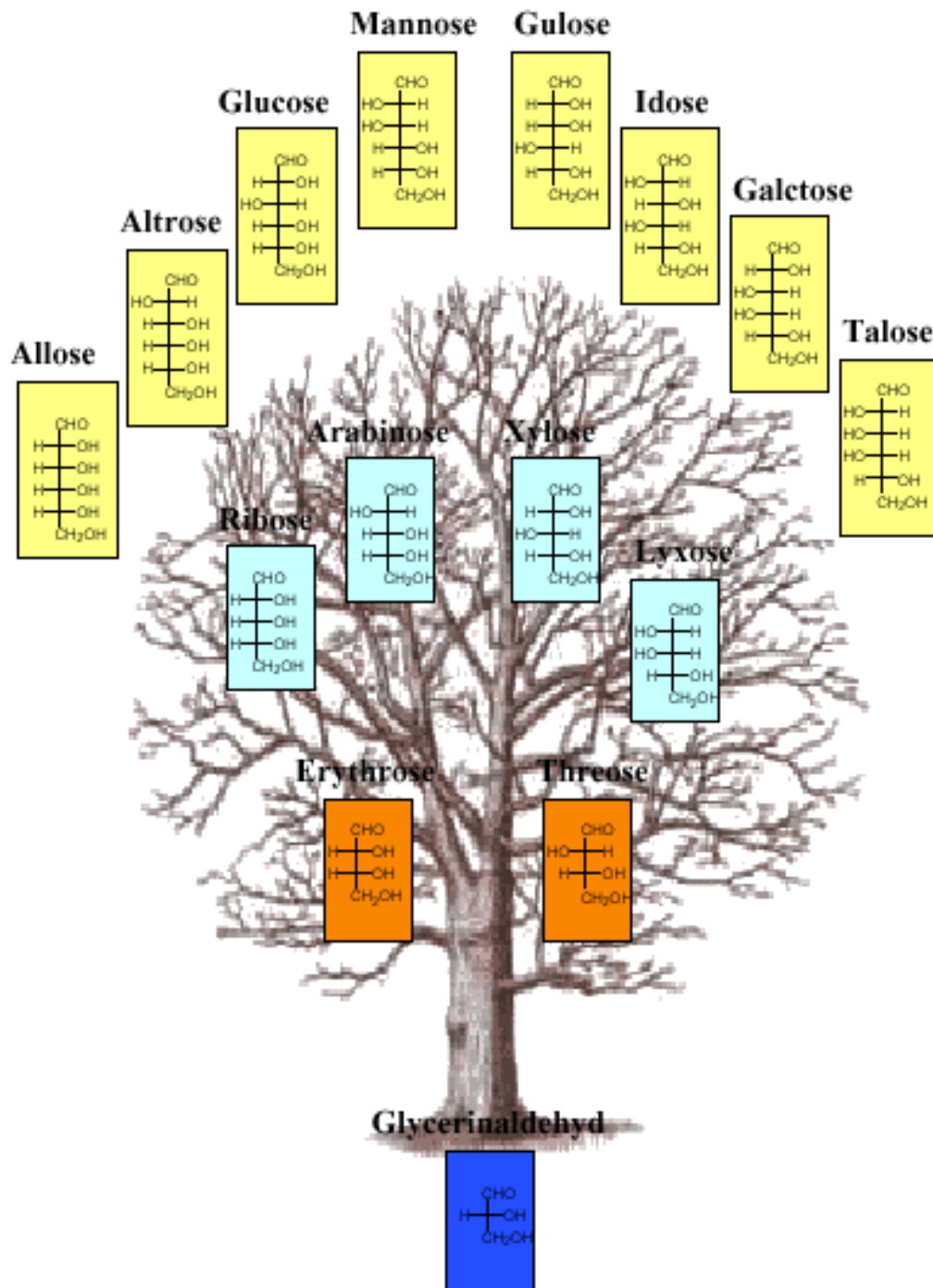
Strukturen von Proteinen:

1. Primärstruktur: Aminosäuresequenz
2. Sekundärstruktur: räumliche Anordnung der Kette (Flatblatt, Helix)
nur peptidisches Rückgrat, nicht räuml.
Anordnung der AS Seitenketten
3. Tertiärstruktur: Gestalt des Proteins (räuml. Anordnung aller Atome)
4. Quartärstruktur: Aggregate aus mehreren Proteinen (Dimere, Trimere, etc.)

Kohlenhydrate

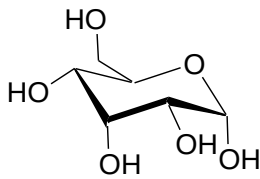
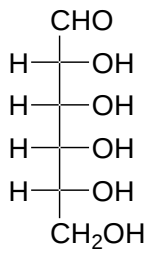
Triosen, Tetrosen, Pentosen, Hexosen,
Aldosen, Ketosen,
Pyranosen, Furanosen,
Aminozucker, Anomere, Onsäuren, Uronsäuren,

Schreibweisen: Fischer, Haworth, sterische Schreibweise, Konformation

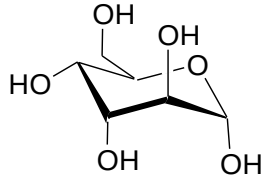
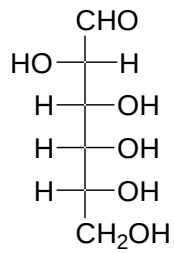


Hexosen

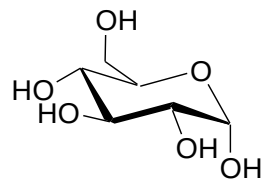
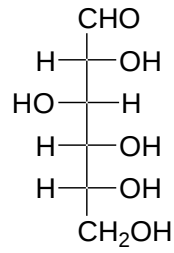
D-Allose



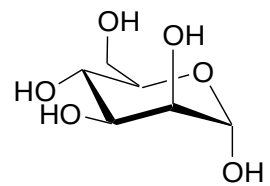
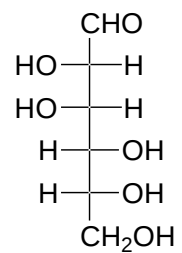
D-Altrose



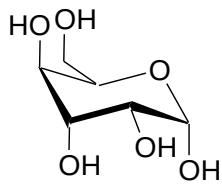
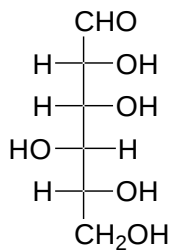
D-Glucose



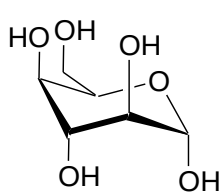
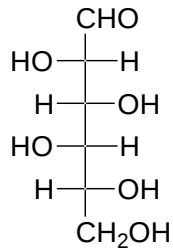
D-Mannose



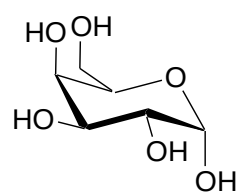
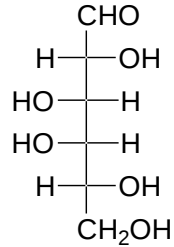
D-Gulose



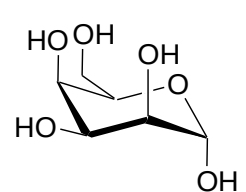
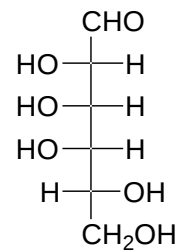
D-Idose



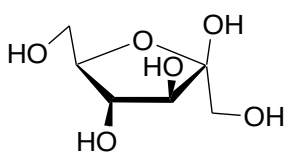
D-Galactose



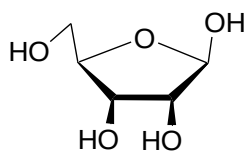
D-Talose



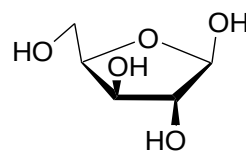
Furanosen



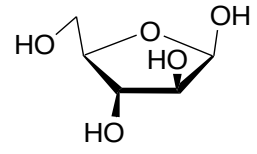
Fructose



Ribose



Xylose



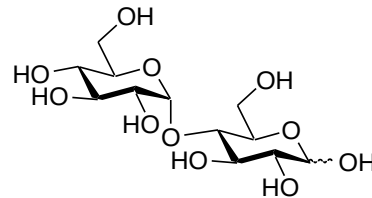
Arabinose

Saccharide, Glycoside

1,4-, 1,6-Verknüpfung, Saccharose, Lactose, Maltose, Isomaltose, Cyclodextrine, Bildung und Hydrolyse von Sacchariden

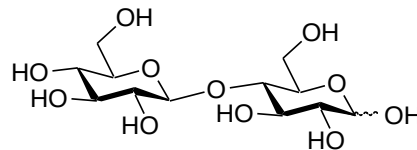
Maltose

4-O-(α -D-Glucopyranosyl)-D-glucopyranose



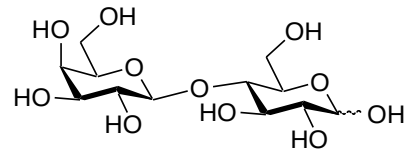
Cellobiose

4-O-(β -D-Glucopyranosyl)-D-glucopyranose

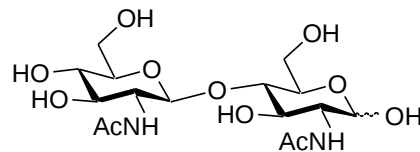


Lactose (Milchzucker)

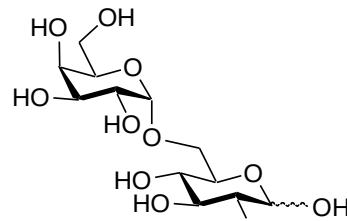
4-O-(β -D-Galactopyranosyl)-D-glucopyranose



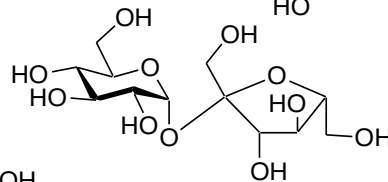
Chitobiose (Chitin)



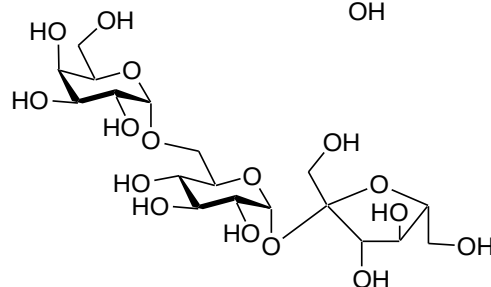
Melibiose



Saccharose (Rohrzucker)



Raffinose (Rübenzucker)



Fette und Lipide

Klassifizierung: Wachse, Sphingolipide, Terpene, Steroide

Stoffklassen

A. nicht hydrolysierbar

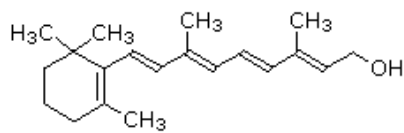
Langkettige Alkane, Carotinoide, Vitamine

Terpene, Steroide

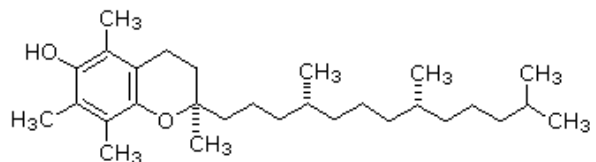
Fettalkohole >C10

Fettsäuren >C10

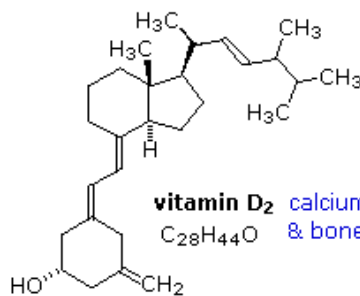
Lipid Soluble Vitamins



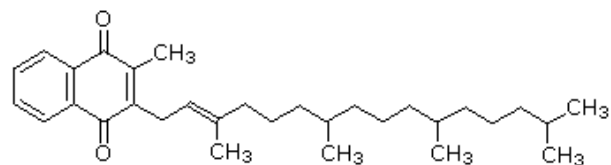
vitamin A
 $C_{20}H_{30}O$ part of the visual pigment



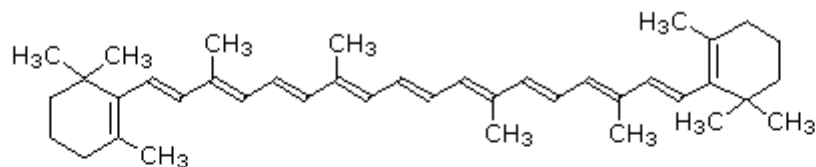
$C_{29}H_{50}O_2$ **vitamin E** an antioxidant



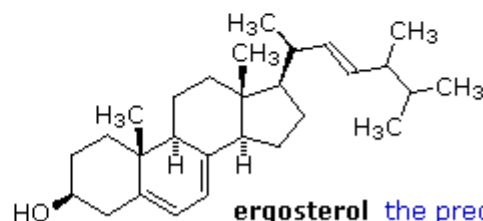
vitamin D2 calcium metabolism
& bone growth
 $C_{28}H_{44}O$



vitamin K1 a blood clotting factor
 $C_{31}H_{46}O_2$

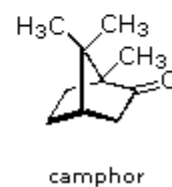
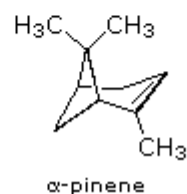
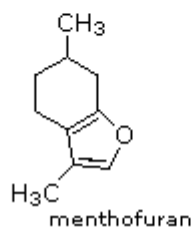
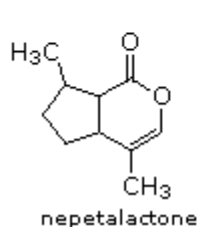
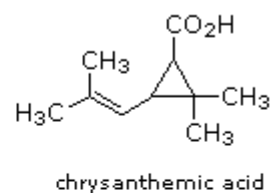
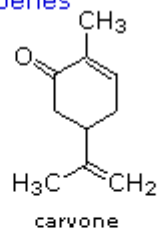
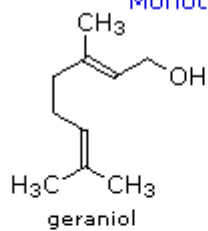
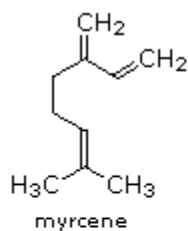


β-carotene the precursor to vitamin A

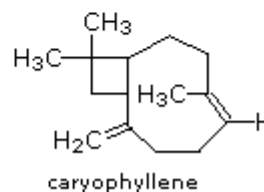
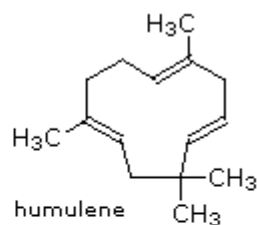
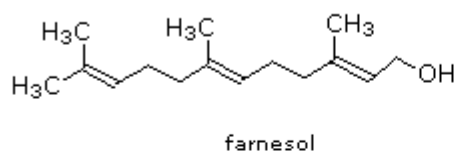


ergosterol the precursor to vitamin D2

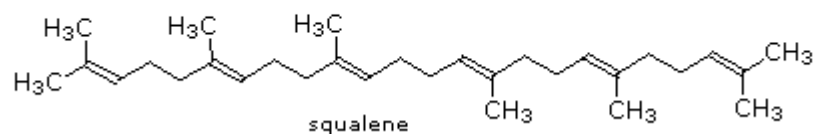
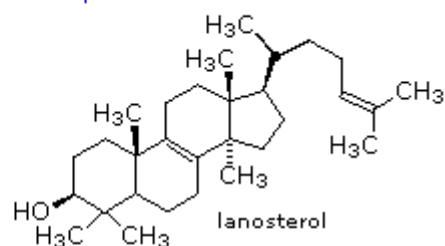
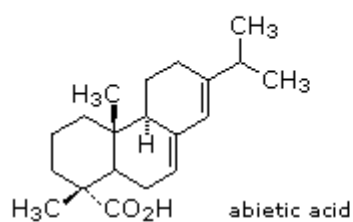
Monoterpenes

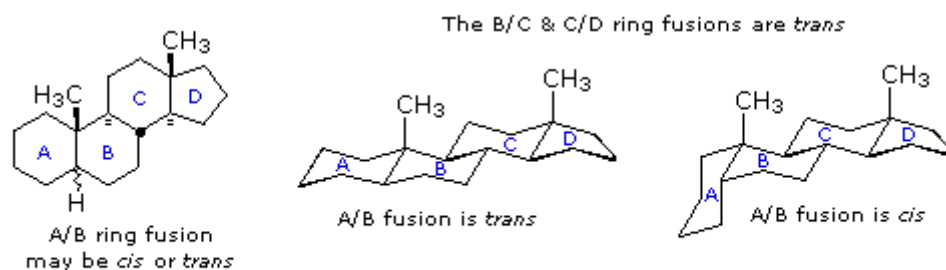
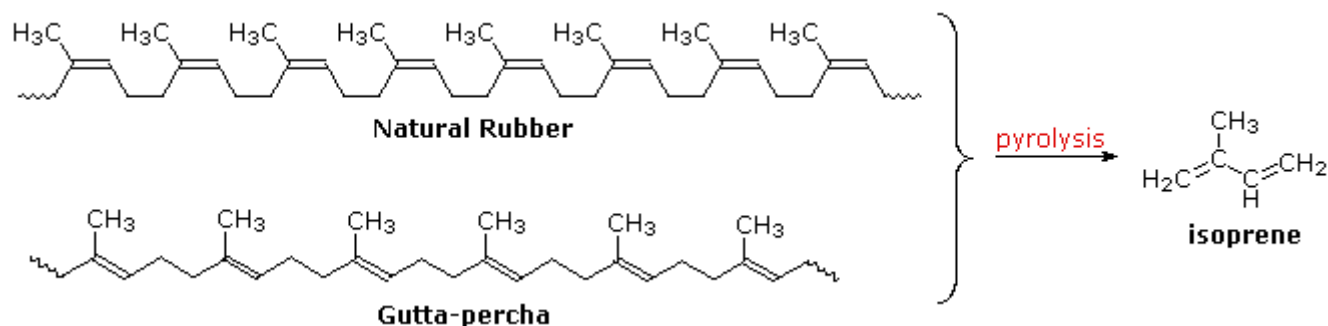


Sesquiterpenes

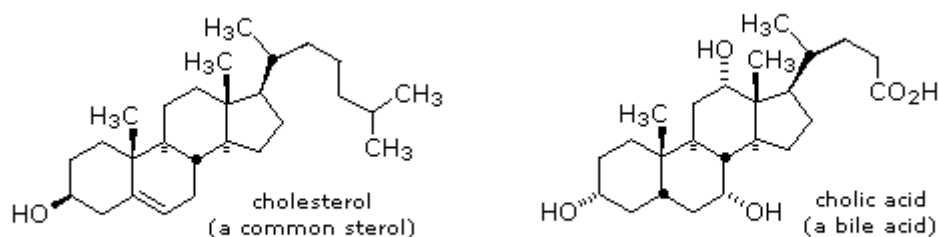


Diterpenes & Triterpenes

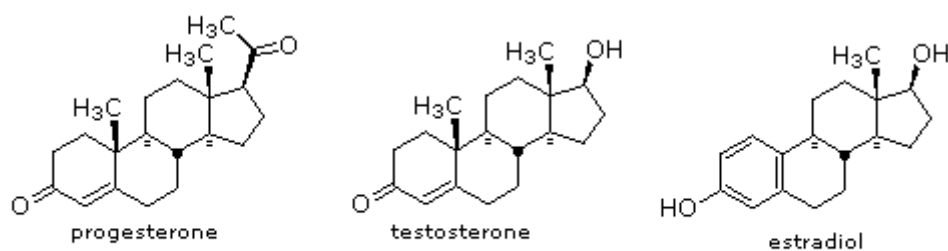




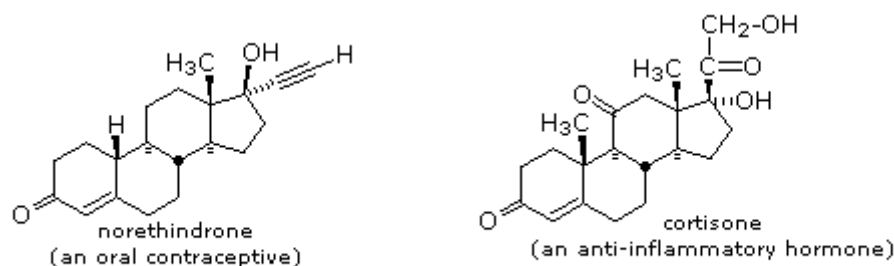
Common Steroid Conformations



Typical Animal Steroids



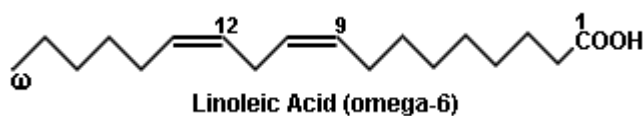
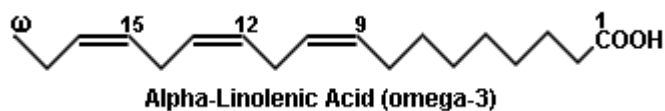
Steroid Sex Hormones



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

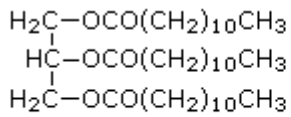


B. hydrolysierbar

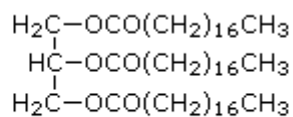
Fette (Fettsäure + Glycerin)

Waxe (Fettsäure + Fettalkohol)

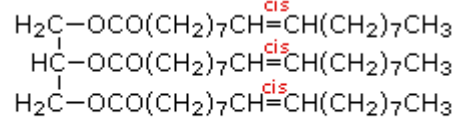
Sterolester (Fettsäure + Cholesterin s.o.)



trilaurin
mp 45° C



tristearin
mp 71° C



triolein
mp -4° C

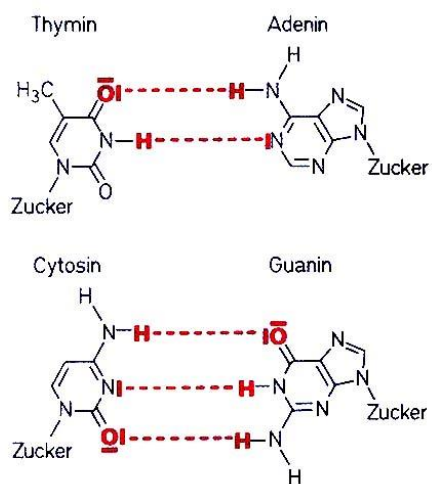
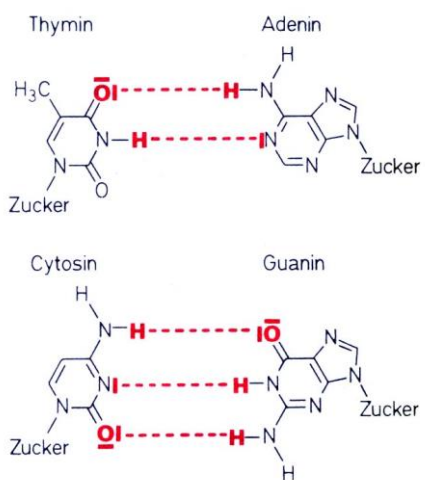
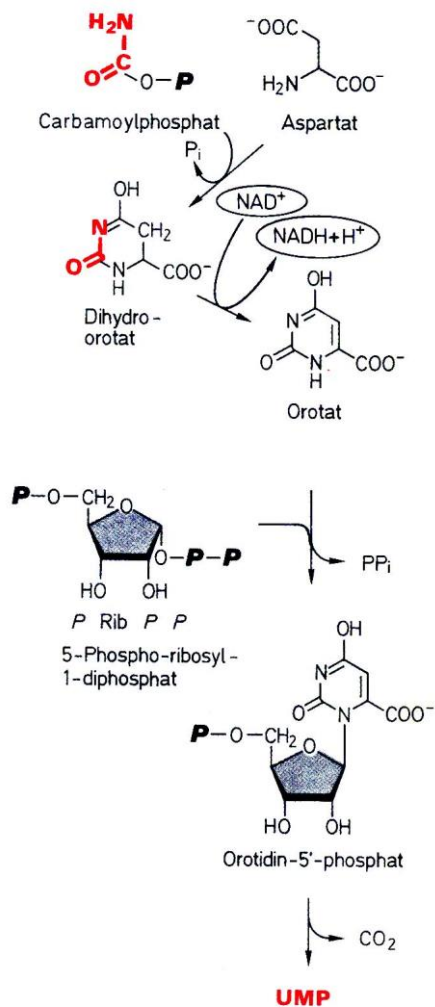
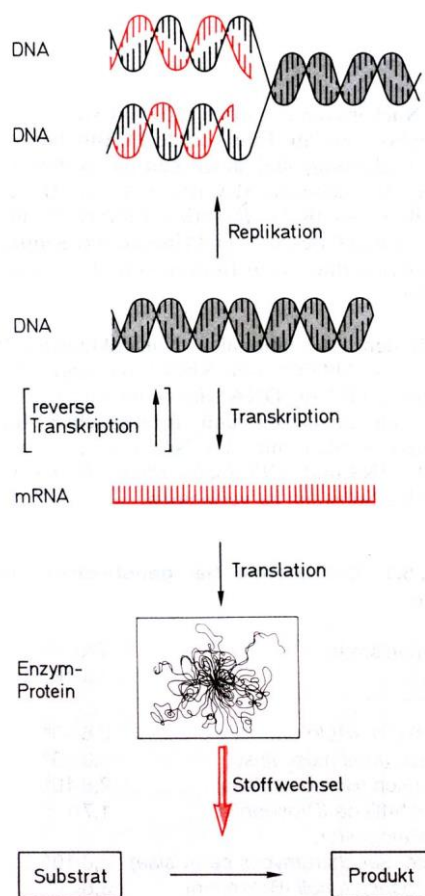
spermaceti: $\text{CH}_3(\text{CH}_2)_{14}\text{CO}_2-(\text{CH}_2)_{15}\text{CH}_3$

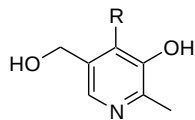
beeswax: $\text{CH}_3(\text{CH}_2)_{24}\text{CO}_2-(\text{CH}_2)_{29}\text{CH}_3$

carnuba wax: $\text{CH}_3(\text{CH}_2)_{30}\text{CO}_2-(\text{CH}_2)_{33}\text{CH}_3$

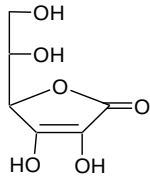
Nucleinsäuren, Purin-, Pyrimidinbasen, Nucleoside, Nucleotide, DNA, RNA

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 G)	Ribose N ⁶ -Isopentenyl- adenosin

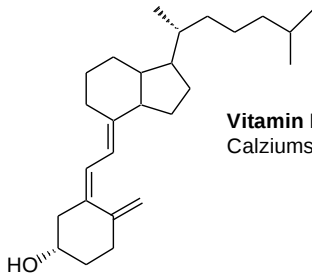




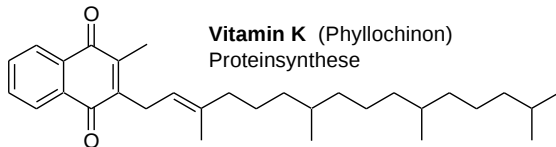
Vitamin B₆
Aminosäurestoffwechsel
R = CH₂OH Pyridoxol
R = CHO Pyridoxal
R = CH₂NH₂ Pyridoxamin



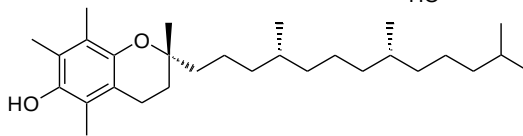
Vitamin C (Ascorbinsäure)
Radikalfänger
Immunsystem



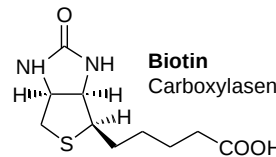
Vitamin D (Calciferol)
Calciumstoffwechsel



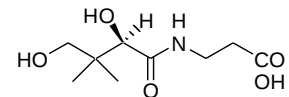
Vitamin K (Phyllochinon)
Proteinsynthese



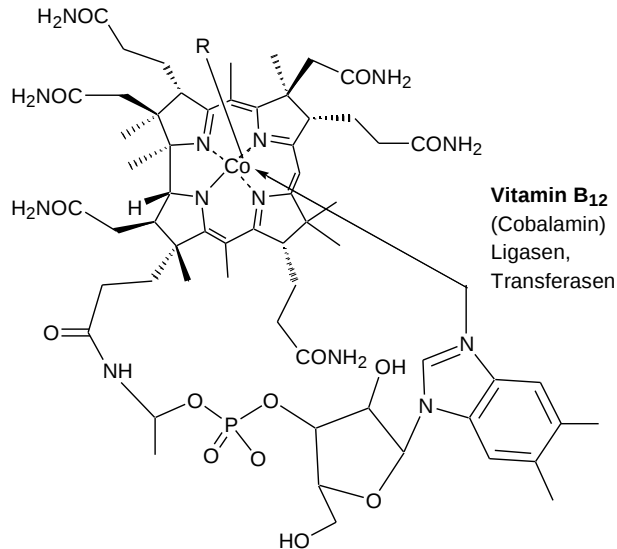
Vitamin E (Tocopherol)
Antioxidans



Biotin
Carboxylasen

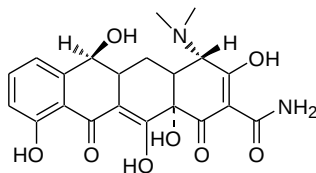


Pantothensäure
Coenzym A

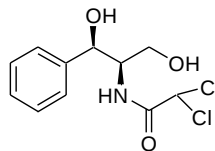


Vitamin B₁₂
(Cobalamin)
Ligasen,
Transferasen

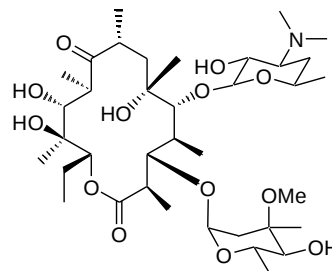
Antibiotika



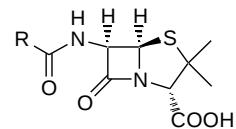
Tetracycline



Chloramphenicol



Erythromycin



Penicilline

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

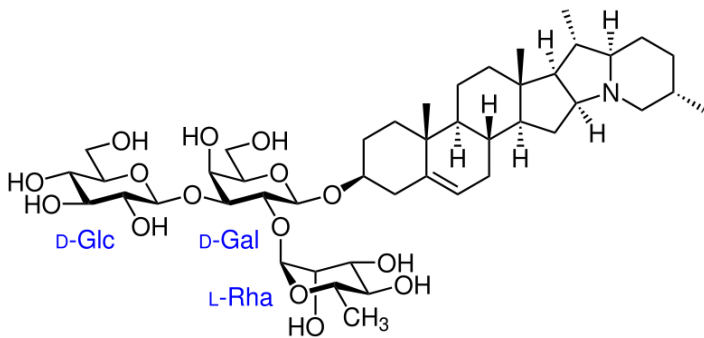
Chinolin-Alkaloide: z. B. Chinin, Chinidin

Isochinolin-Alkaloide: z. B. Morphin, Codein, Papaverin,
Berberin, Tubocurarin

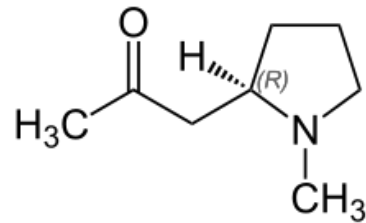
Indol-Alkaloide: z. B. Ajmalin, Ergotamin, Yohimbin, Reserpin,
Strychnin

Purin-Alkaloide: z. B. Coffein, Theophyllin, Theobromin

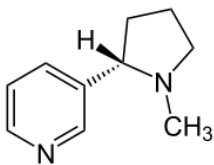
Alkaloide mit acyclischem Stickstoff: z. B. Ephedrin, Mescalin



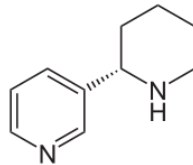
Solanin



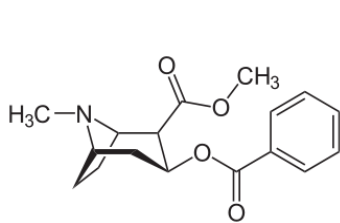
Hygrin



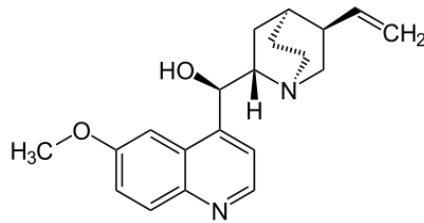
Nikotin



Anabasin



Cocain



Chinin

