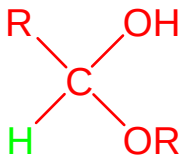
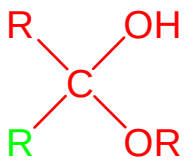
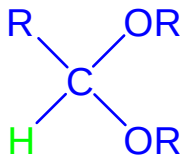
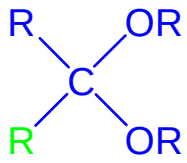
Kohlenhydrate, Proteine, Fette und Öle

Kohlenhydrate: Halbacetale oder Acetale von Aldehyden und Ketonen

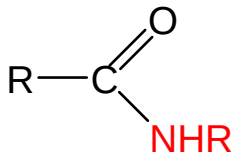




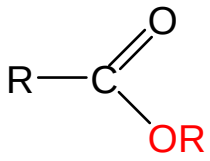




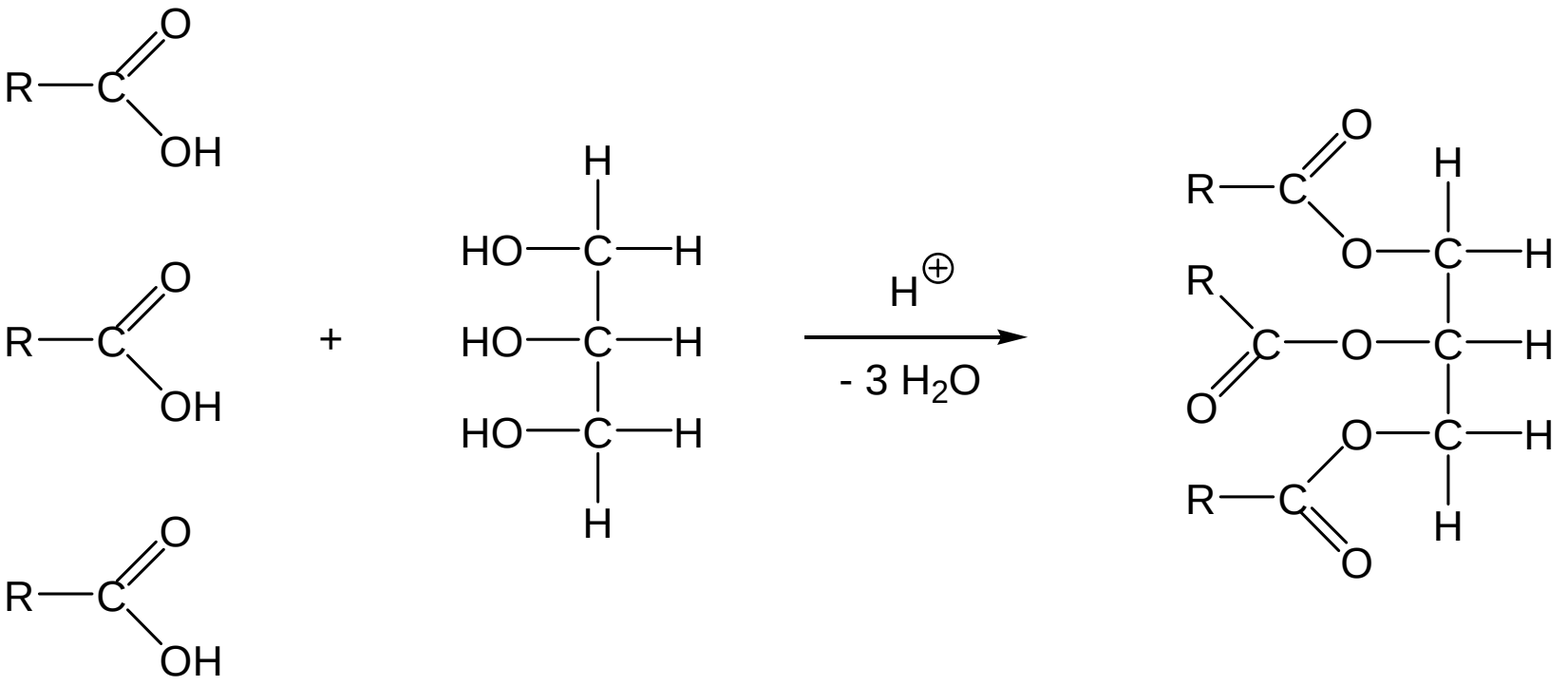
Proteine: Carbonsäureamide



Fette, Öle: Carbonsäureester



Fette und Öle – die Triester des Glycerins

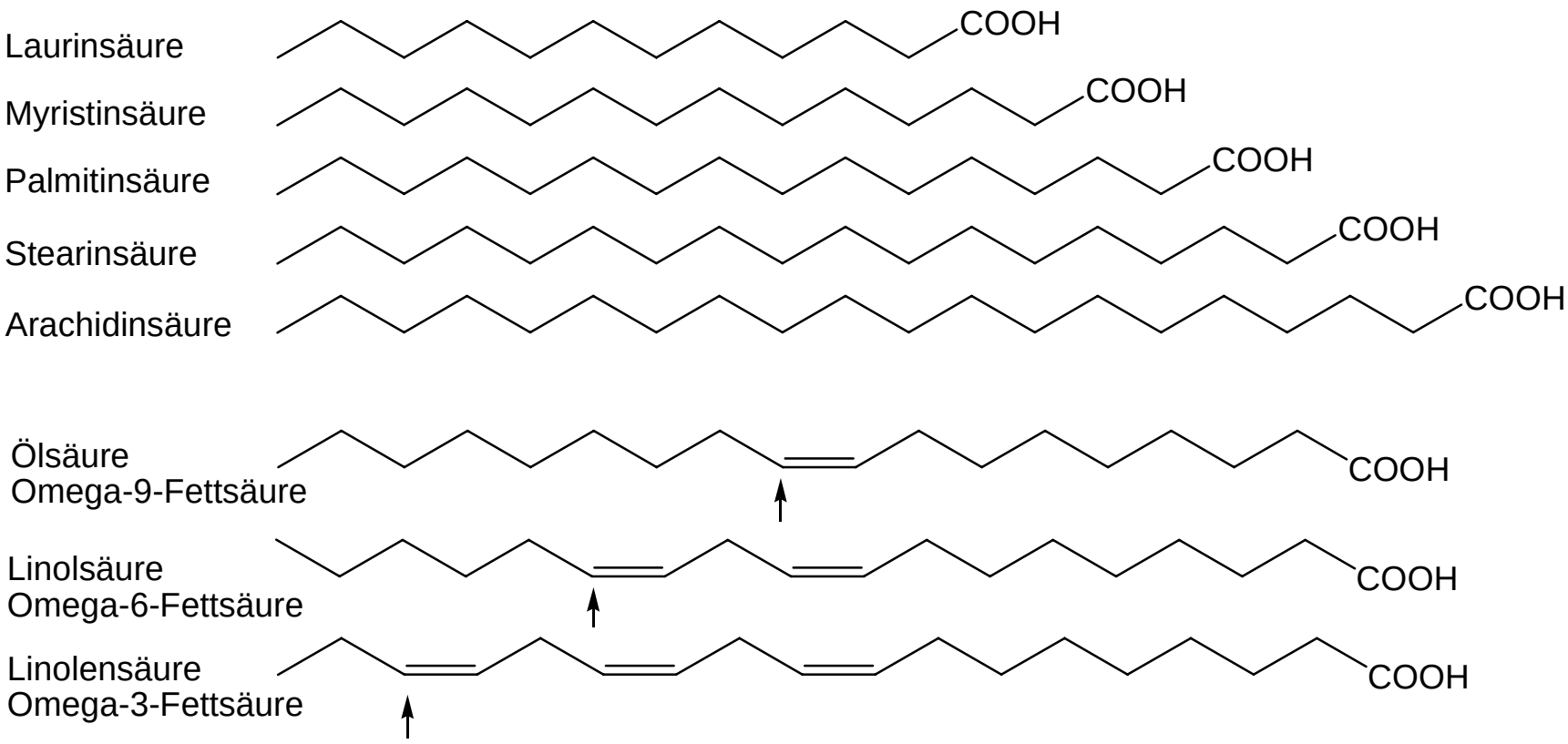


Fettsäure

Glycerin

Triglycerid (Fett, Öl)

Natürliche Fettsäuren



Natürliche Fettsäuren sind Z-Isomere (cis-Konfiguration).

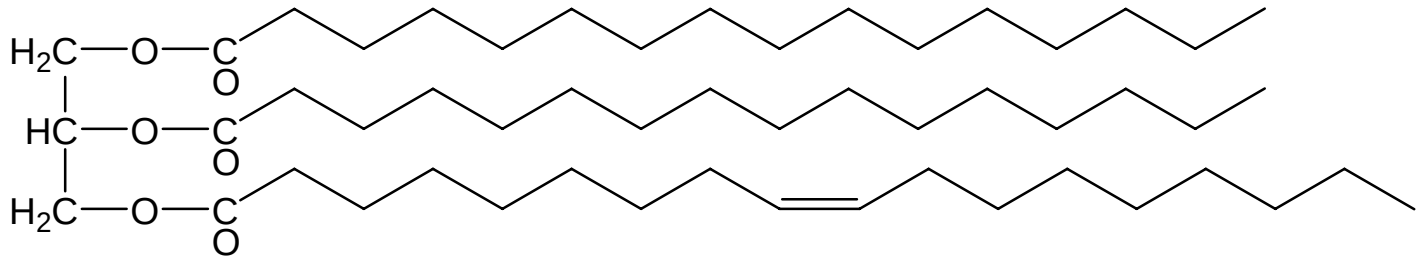
Zusammensetzung einiger Fette und Öle (Masse-%)

	P	St	Ö	L		Iz
Kokosfett	**4-10**	**1-5**	**2-10**	**0-2**	**45-51% Laurinsäure**	**10**
Butter	**23-26**	**10-13**	**30-40**	**5-11**		**35**
Schweineschmalz	**28-30**	**12-18**	**41-48**	**6-7**		**55**
Rinderfett (Talg)	**24-32**	**14-32**	**35-48**	**2-4**		**41**
Olivenöl	**5-15**	**1-4**	**69-84**	**4-12**		**84**
Rapsöl	**0-1**	**0-2**	**20-38**	**55-70**		**98**
Leinöl	**4-7**	**2-5**	**9-38**	**3-43**	**25-58% Linolensäure**	**185**
Lebertran	**10-16**	**1-2**	**-**	**-**	**80-90% ungesättigte C_{20}- und C_{22}-Säuren**	**165**

P = Palmitinsäure; St = Stearinsäure; Ö = Ölsäure; L = Linolsäure

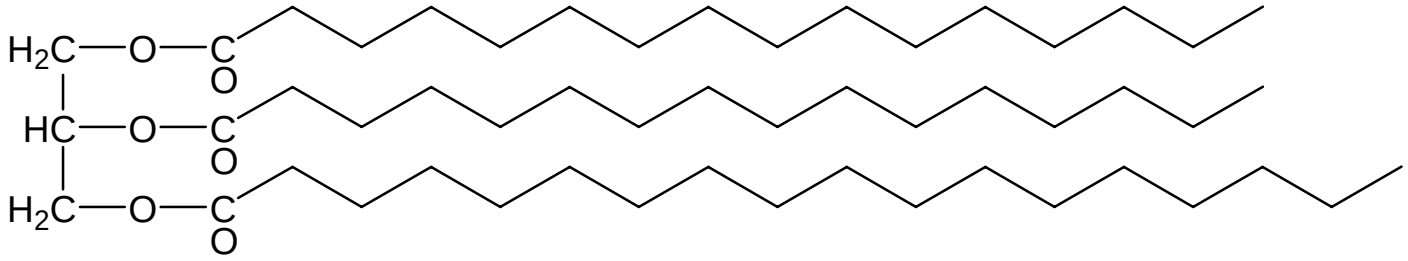
Iz = Iodzahl (Anzahl Gramm Iod, die an 100 g Fett addiert warden können)

Hydrierung pflanzlicher Öle – Fetthärtung



Dipalmityloleylglycerin (flüssig)

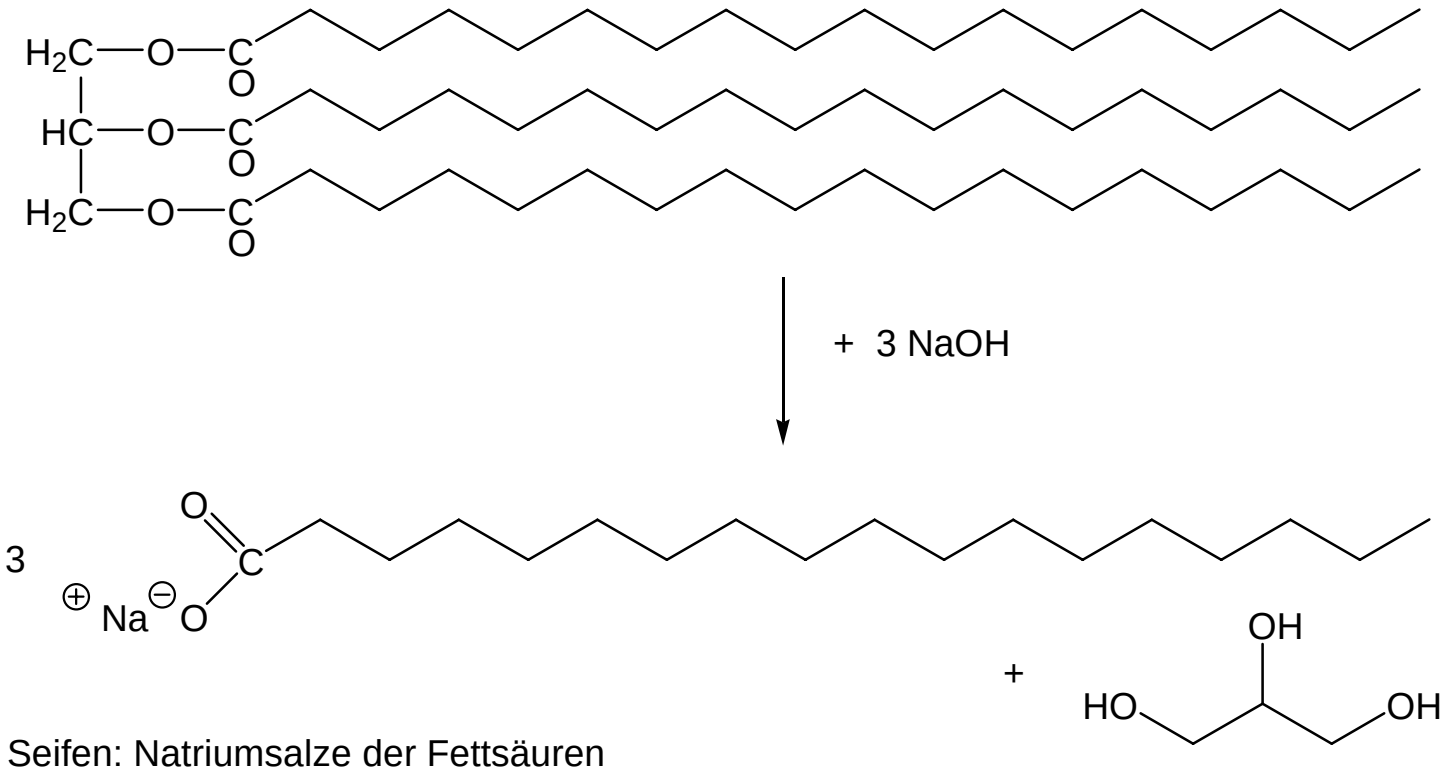
H_2 / [Ni]



Dipalmitylstearylglycerin (fest)

Margarine: Partiell hydrierte Pflanzenöle, Milch, Farbstoffe

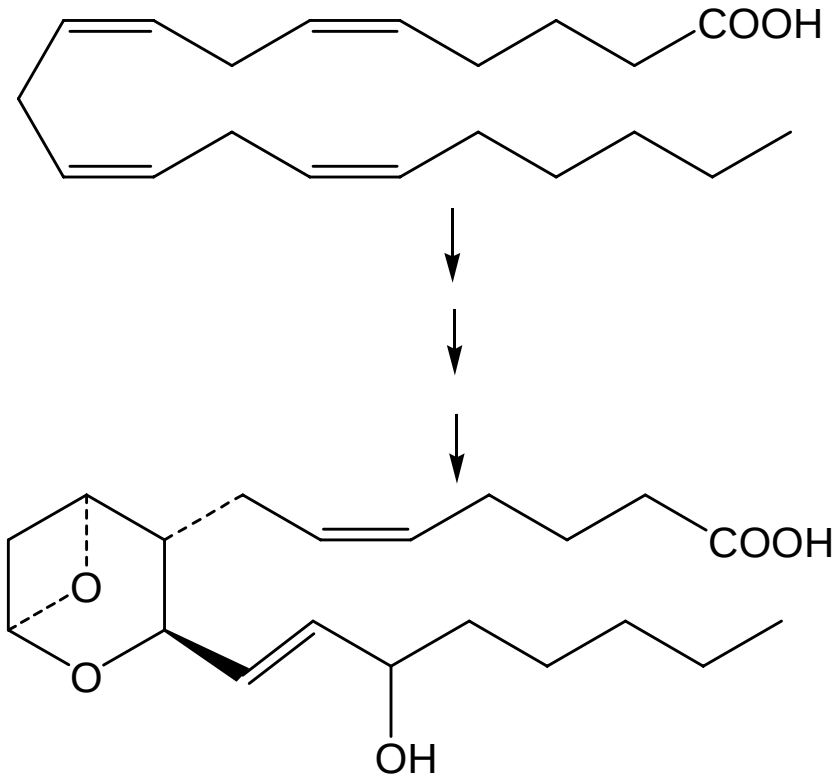
Verseifung von Fetten und Ölen



Seifen: Natriumsalze der Fettsäuren

Kaliumsalze sind wasserunlöslich und daher als Seifen ungeeignet.

Arachidonsäure – eine essentielle Fettsäure

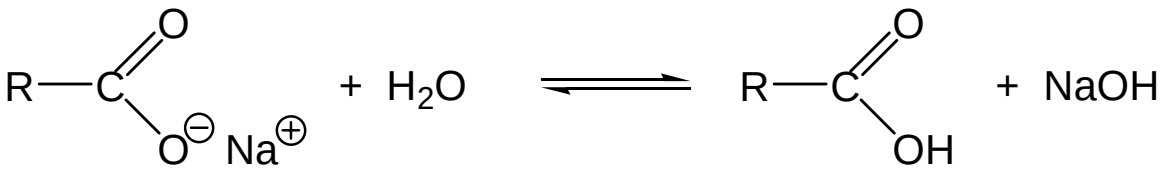


Thromboxan A_2 (fördert die Blutgerinnung)

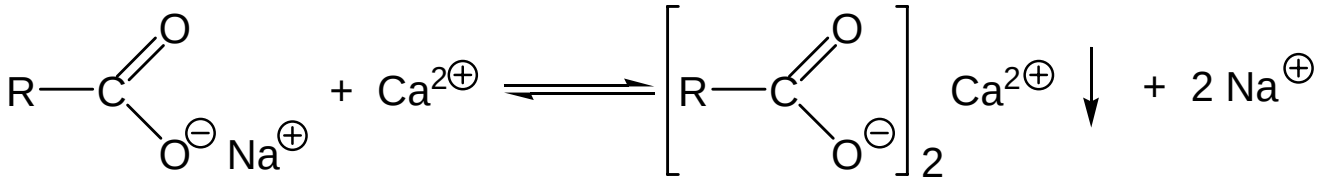
Synthetische Seifen (Anionische Tenside)

Nachteile natürlicher Seifen:

- alkalische Reaktion

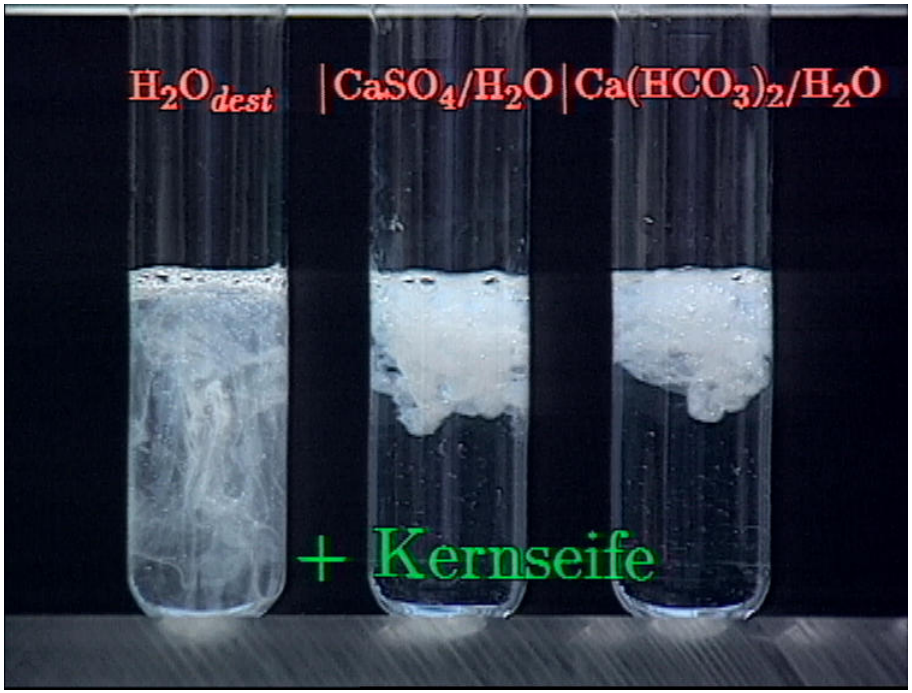


- Ca-, Mg- und Fe-Salze der Fettsäuren sind nicht wasserlöslich. In hartem Wasser fallen Fettsäuren daher als schwerlösliche Salze aus.



Mögliche Gegenmassnahmen: Enthärtung des Leitungswassers
Komplexierung störender Metallionen

Wasserhärte und Enthärtung des Wassers



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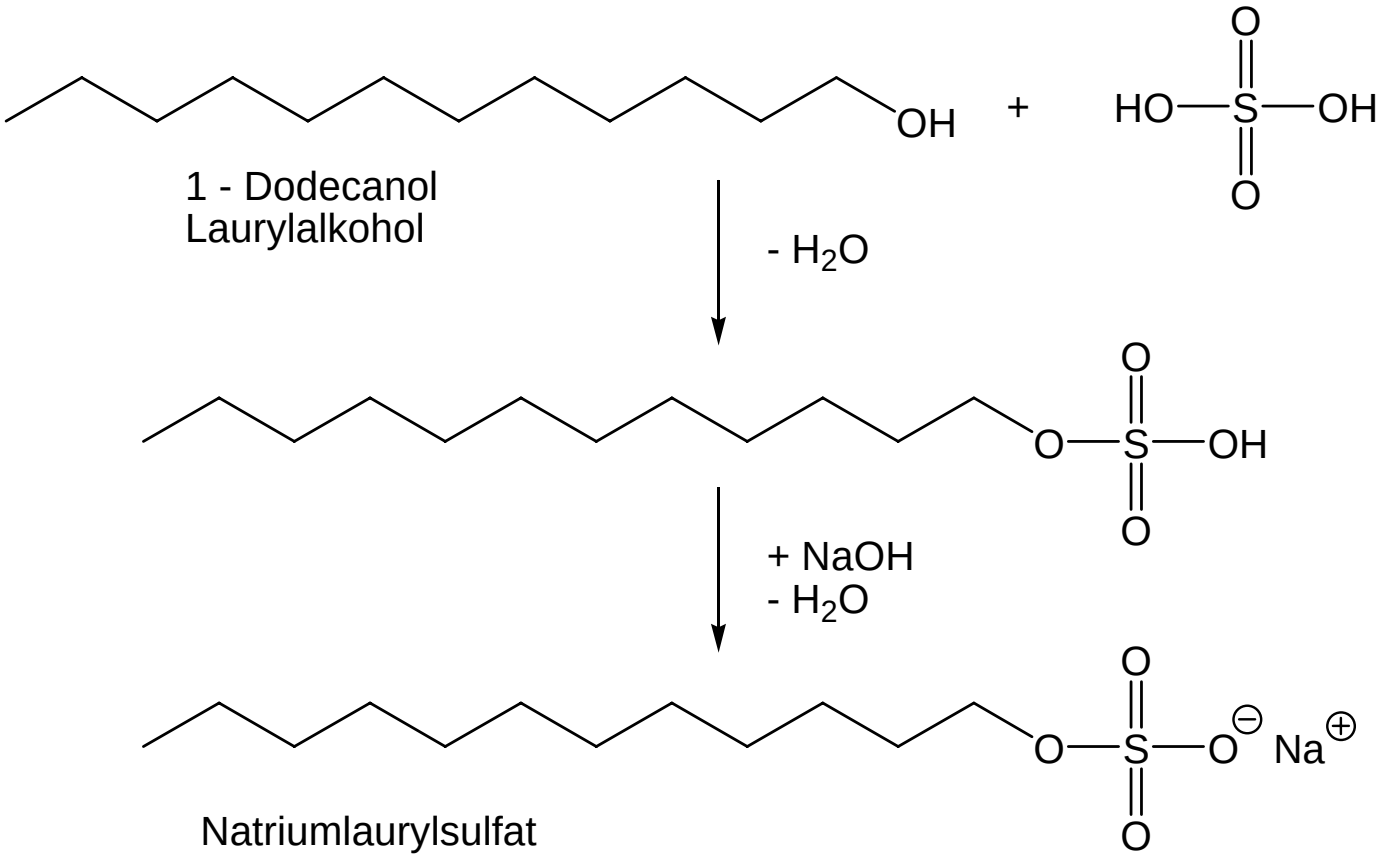
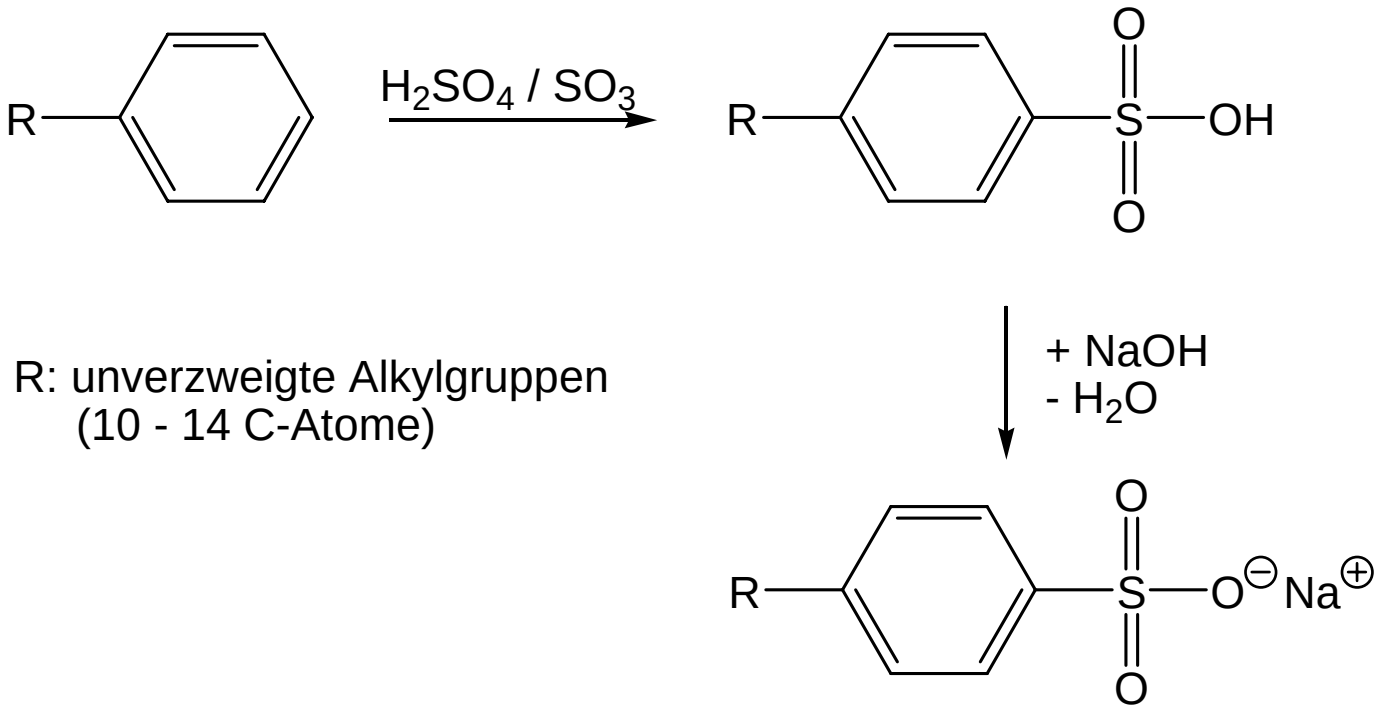
Natriumalkylsulfonate



Vorteile: wässrige Lösung reagiert neutral, Ca- und Mg-Salze sind wasserlöslich.

Natriumalkylbenzolsulfonate



R: unverzweigte Alkylgruppen
(10 - 14 C-Atome)

Alkylbenzolsulfonate sind biologisch durch Mikroorganismen abbaubar, wenn die Alkylsubstituenten R unverzweigt sind.

Kohlenhydrate

Allgemeine Summenformel: $C_n(H_2O)_m$ (Kohlenstoffhydrate)

Definition: Polyhydroxyaldehyde oder Polyhydroxyketone oder Verbindungen, die solche Produkte nach der Hydrolyse liefern.

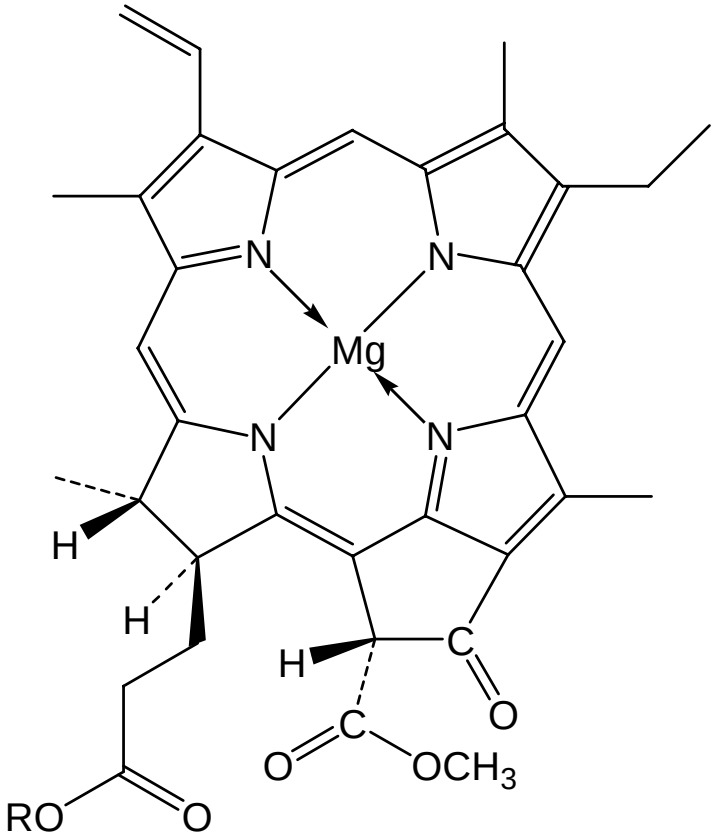
Einteilung: Polysaccharide, Oligosaccharide und Monosaccharide (*saccharum*, lat.: Zucker)

Wichtige Kohlenhydrate: Stärke, Glykogen, Cellulose, Rohrzucker (Saccharose), Traubenzucker (Glucose)

Photosynthese

$$6\ CO_2 + 6\ H_2O \xrightarrow{\text{Sonnenlicht}} C_6H_{12}O_6 + 6\ O_2$$

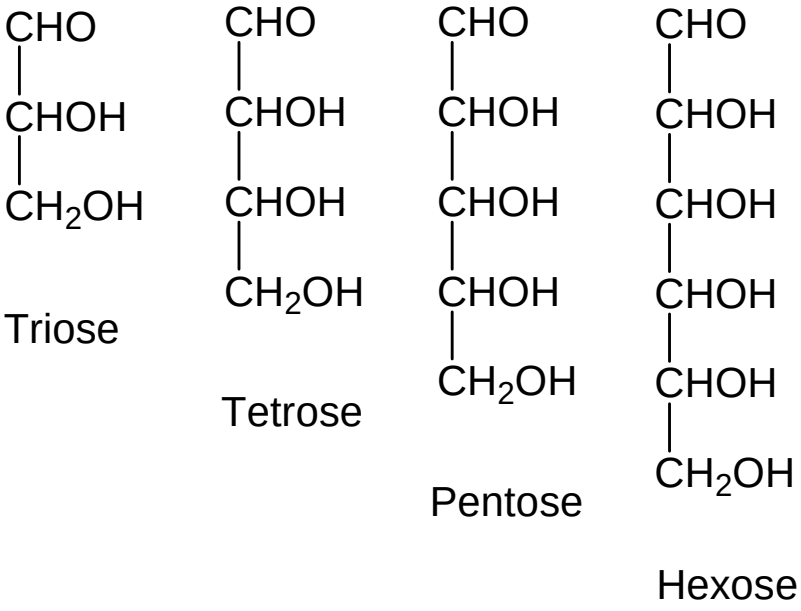
Katalysator: Chlorophyll a



Aldosen und Ketosen

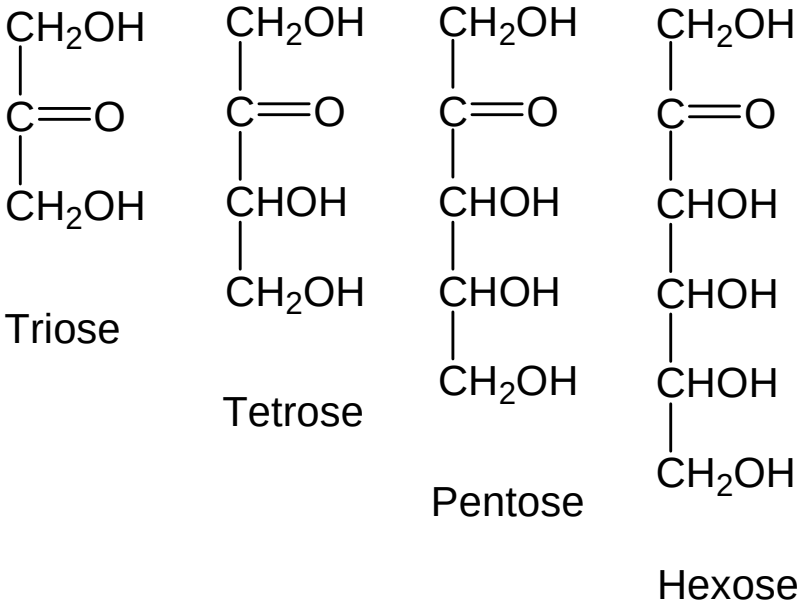
Aldosen

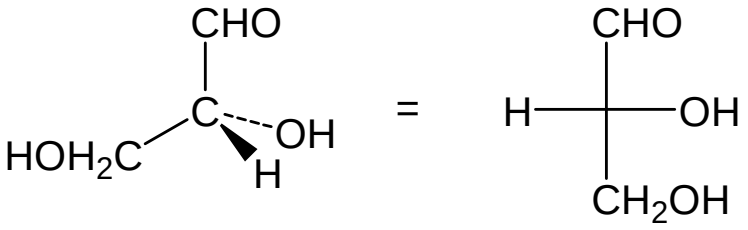
Stammverbindung: Glycerinaldehyd



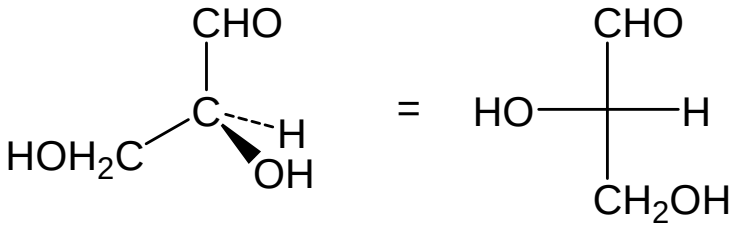
Ketosen

Stammverbindung: Dihydroxyaceton

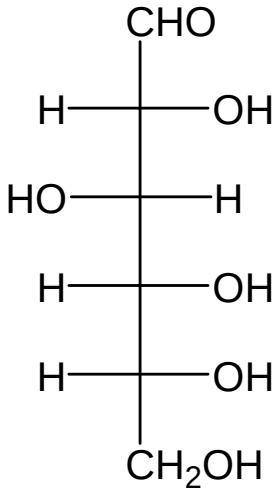




R- oder D-Glycerinaldehyd

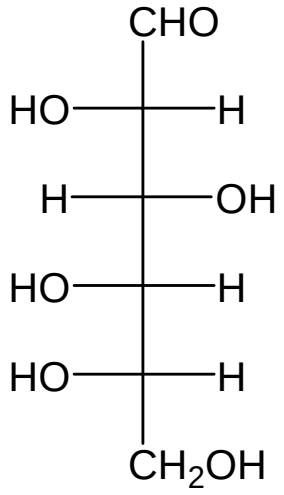


S- oder L-Glycerinaldehyd



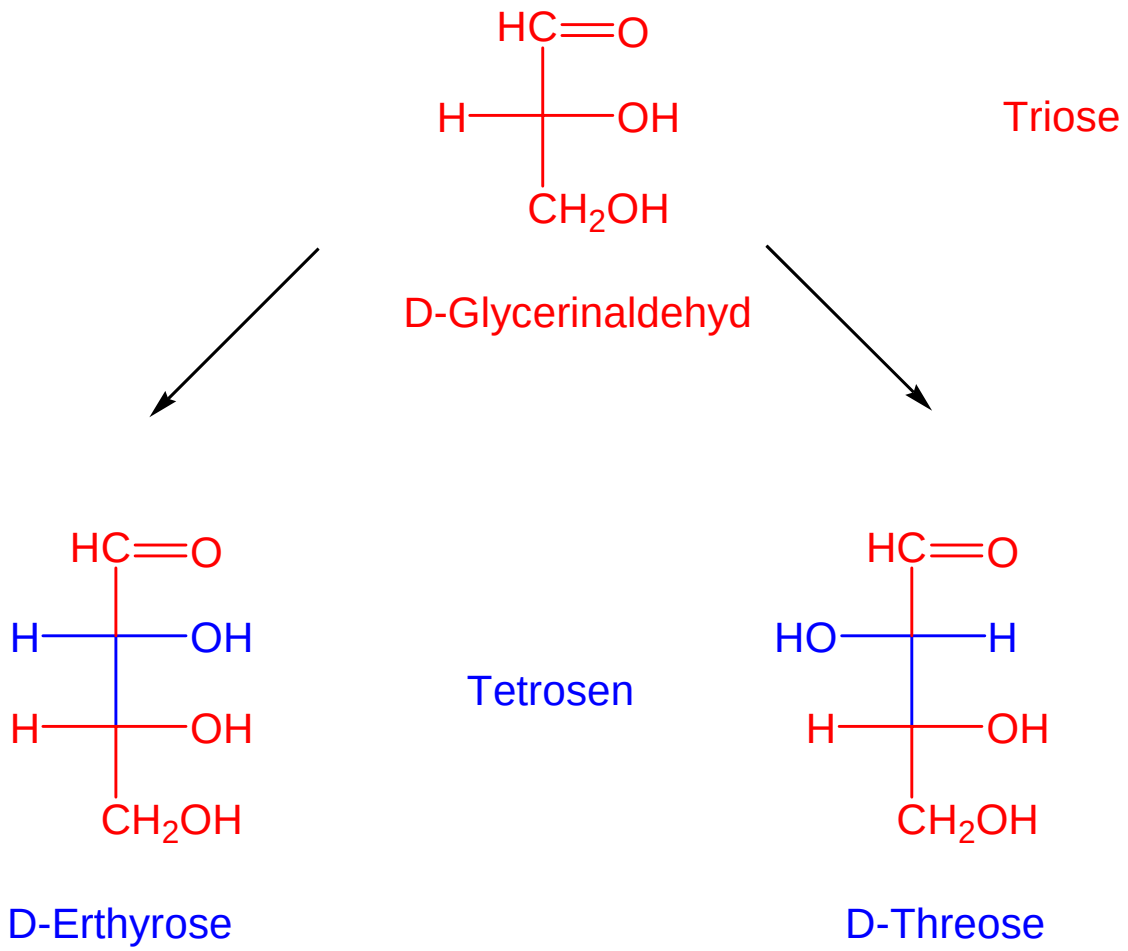
D-Glucose

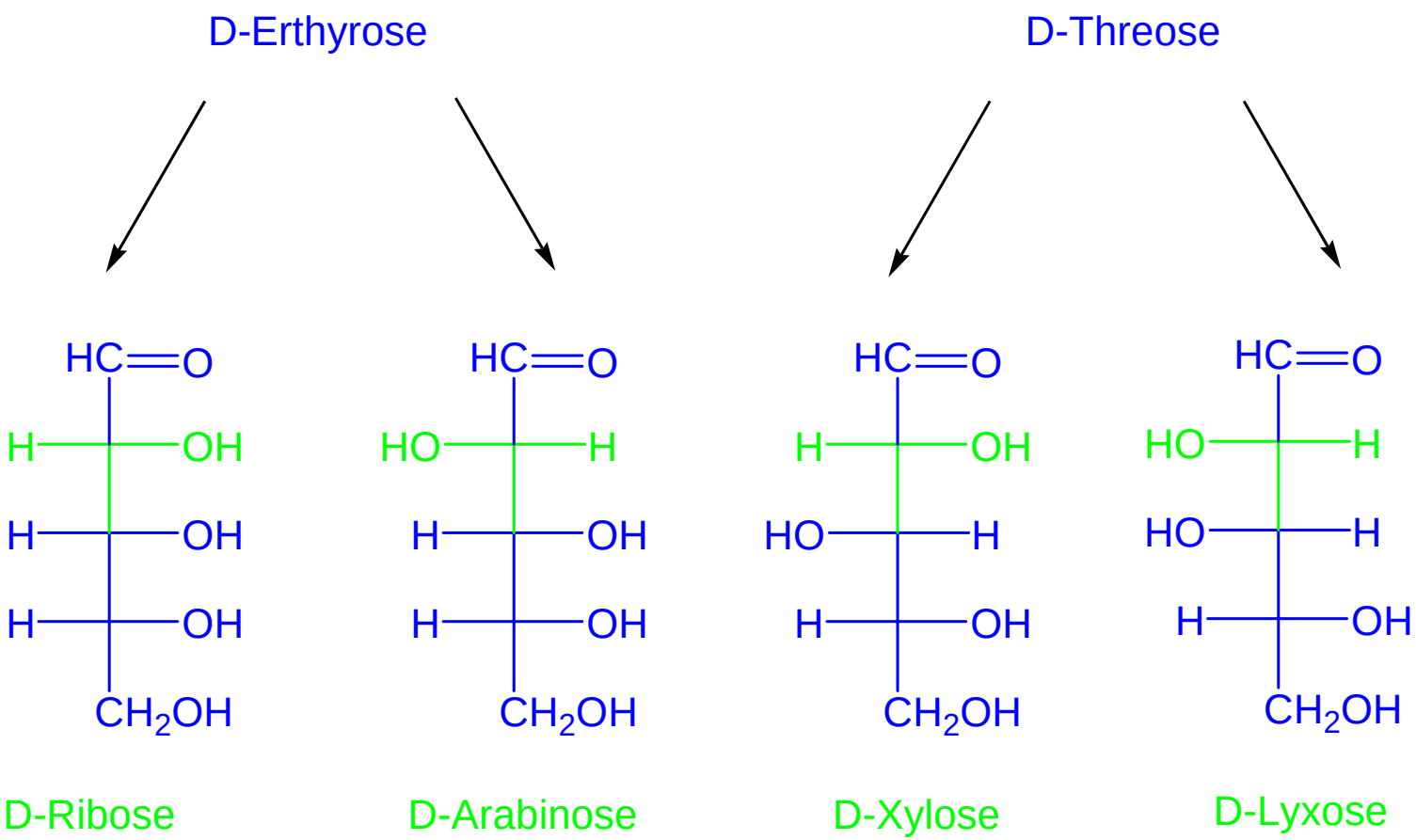
Spiegelebene

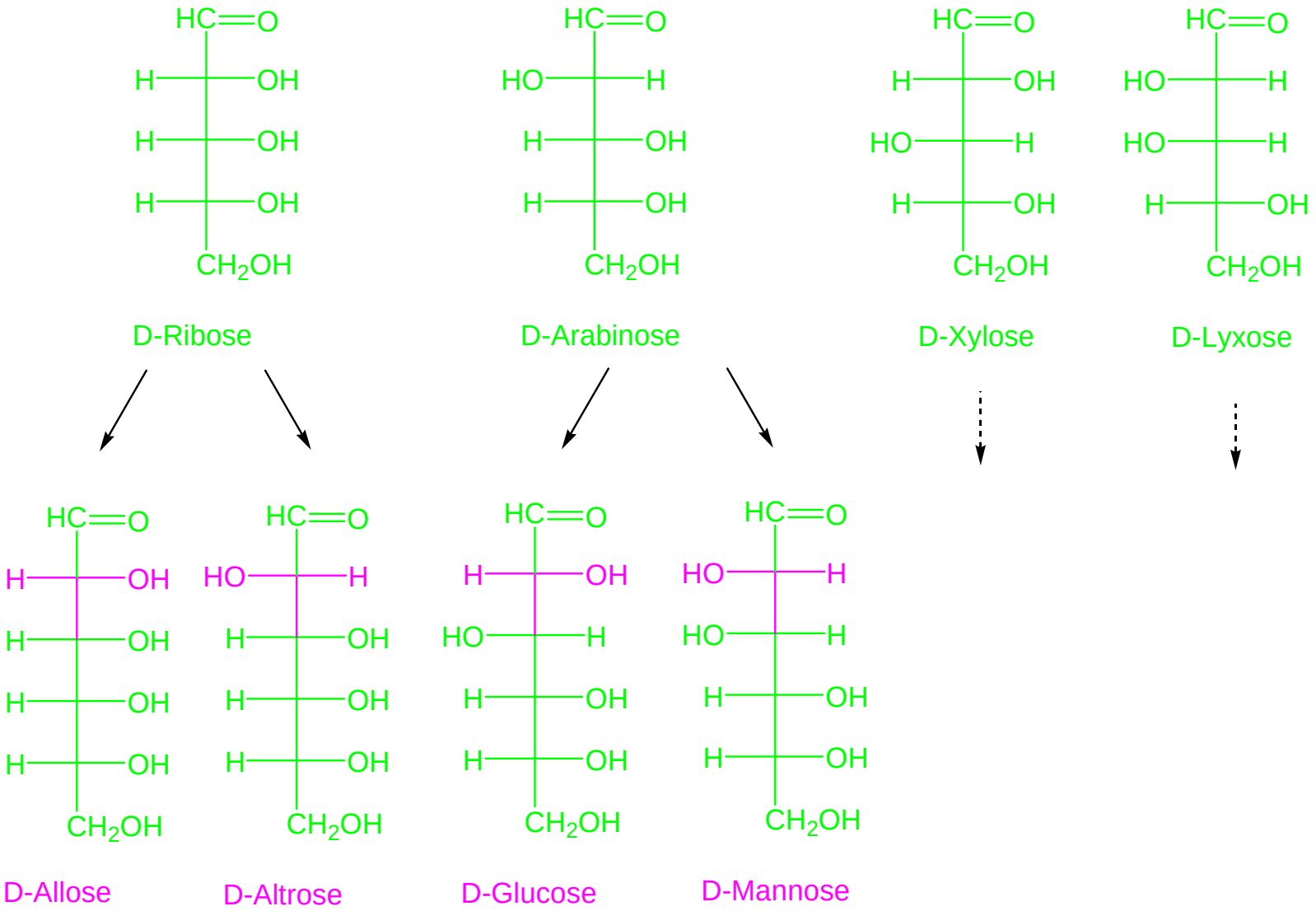


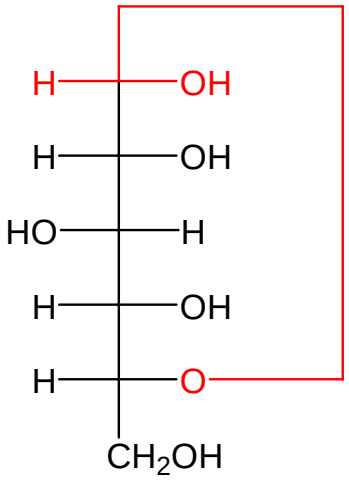
L-Glucose

Stammbaum der D-Aldosen

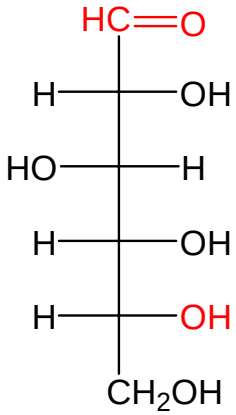



D-Erthyrose
D-Threose
HC=O
H–OH
H–OH
H–OH
CH2OH
D-Ribose
HC=O
HO–H
H–OH
H–OH
CH2OH
D-Arabinose
HC=O
H–OH
HO–H
H–OH
CH2OH
D-Xylose
HC=O
HO–H
HO–H
H–OH
CH2OH
D-Lyxose
Pentosen

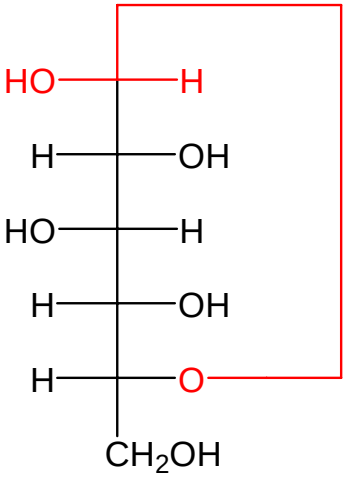

HC=O
H—OH
H—OH
H—OH
CH2OH
D-Ribose
HC=O
HO—H
H—OH
H—OH
CH2OH
D-Arabinose
HC=O
H—OH
HO—H
H—OH
CH2OH
D-Xylose
HC=O
HO—H
HO—H
H—OH
CH2OH
D-Lyxose
HC=O
H—OH
H—OH
H—OH
H—OH
CH2OH
D-Allose
HC=O
HO—H
H—OH
H—OH
H—OH
CH2OH
D-Altrose
HC=O
H—OH
HO—H
H—OH
H—OH
CH2OH
D-Glucose
HC=O
HO—H
HO—H
H—OH
H—OH
CH2OH
D-Mannose



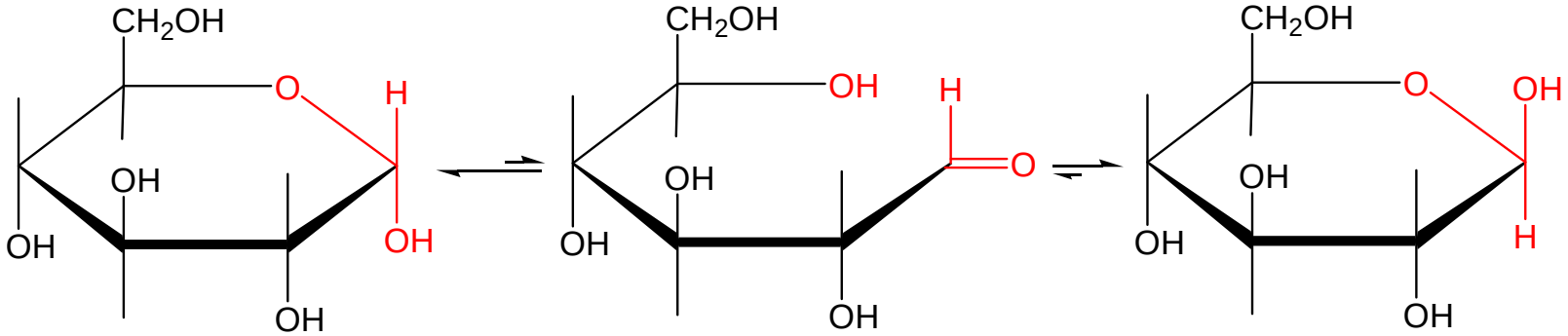
α-D-Glucose
Halbacetal



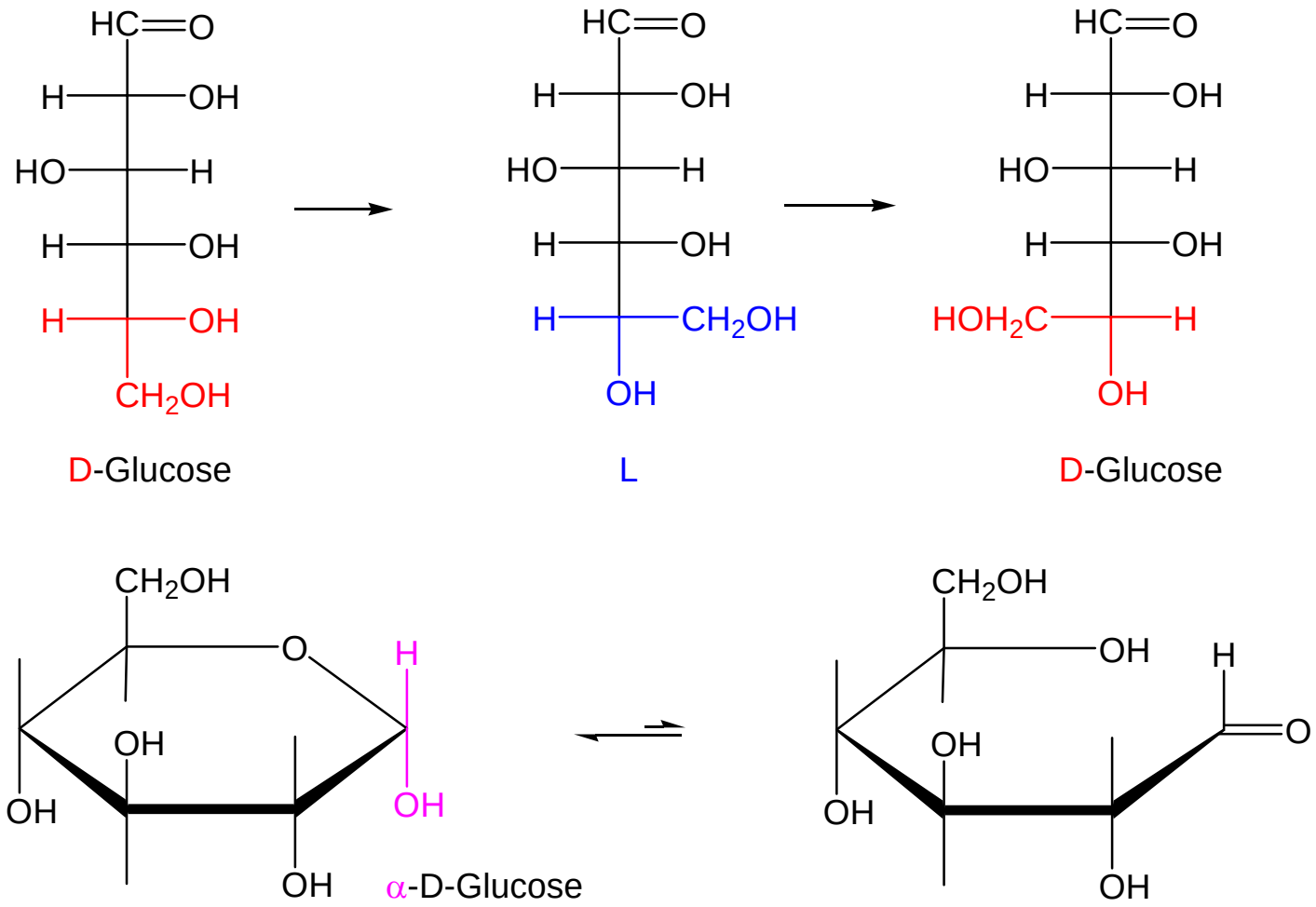
D-Glucose
Aldehydform



β-D-Glucose
Halbacetal

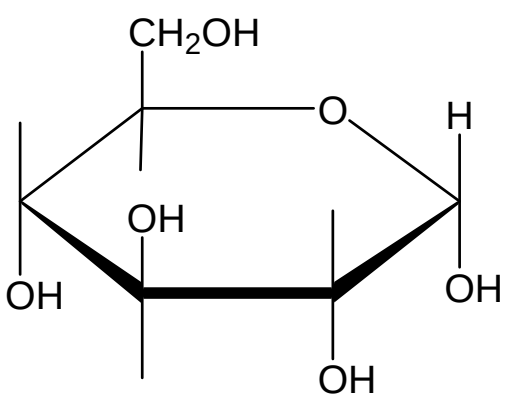


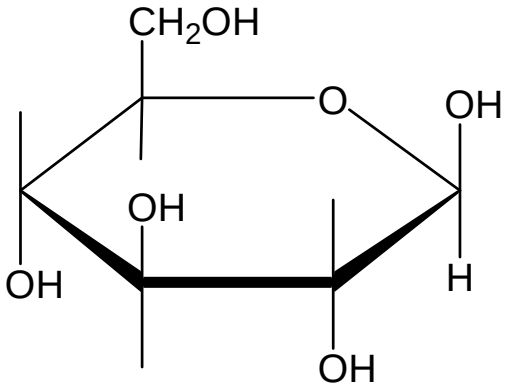
Haworth-Formeln



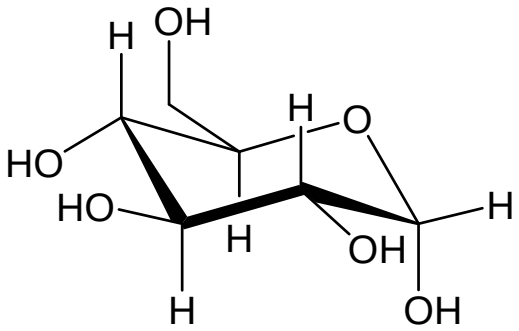
Alle Substituenten, die in der Fischerprojektion links stehen, stehen in der Haworth-Formel oben.

Haworth-Formeln: Vereinfachte Darstellung mit planarem Sechsring

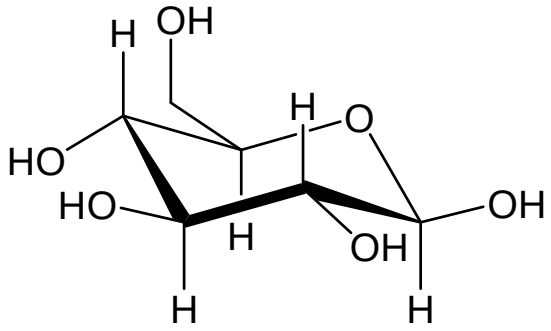




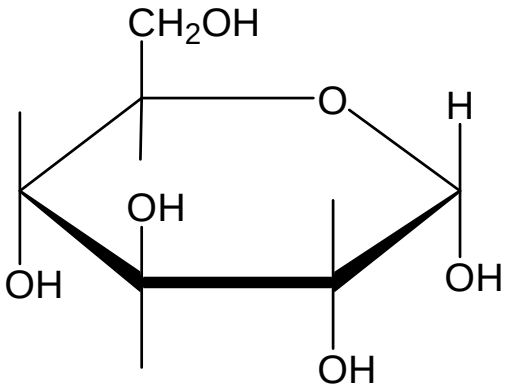
Konformationsformeln mit nichtplanarem Sechsring in Sesselform



α-D-Glucose

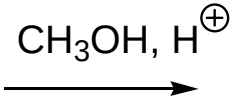


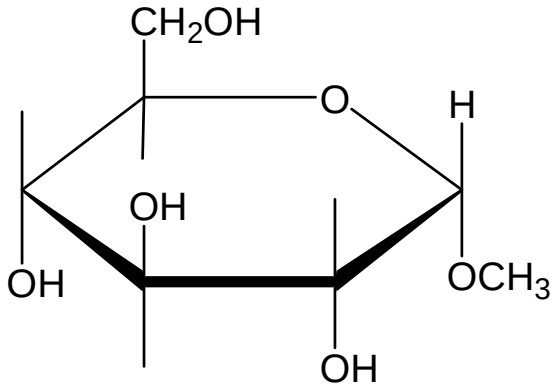
β-D-Glucose



α-D-Glucose

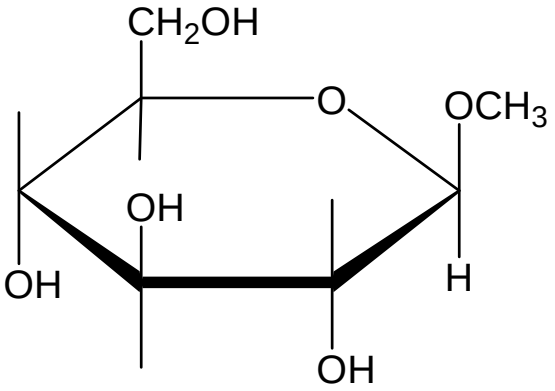
Halbacetal





Methyl-α-D-glucosid

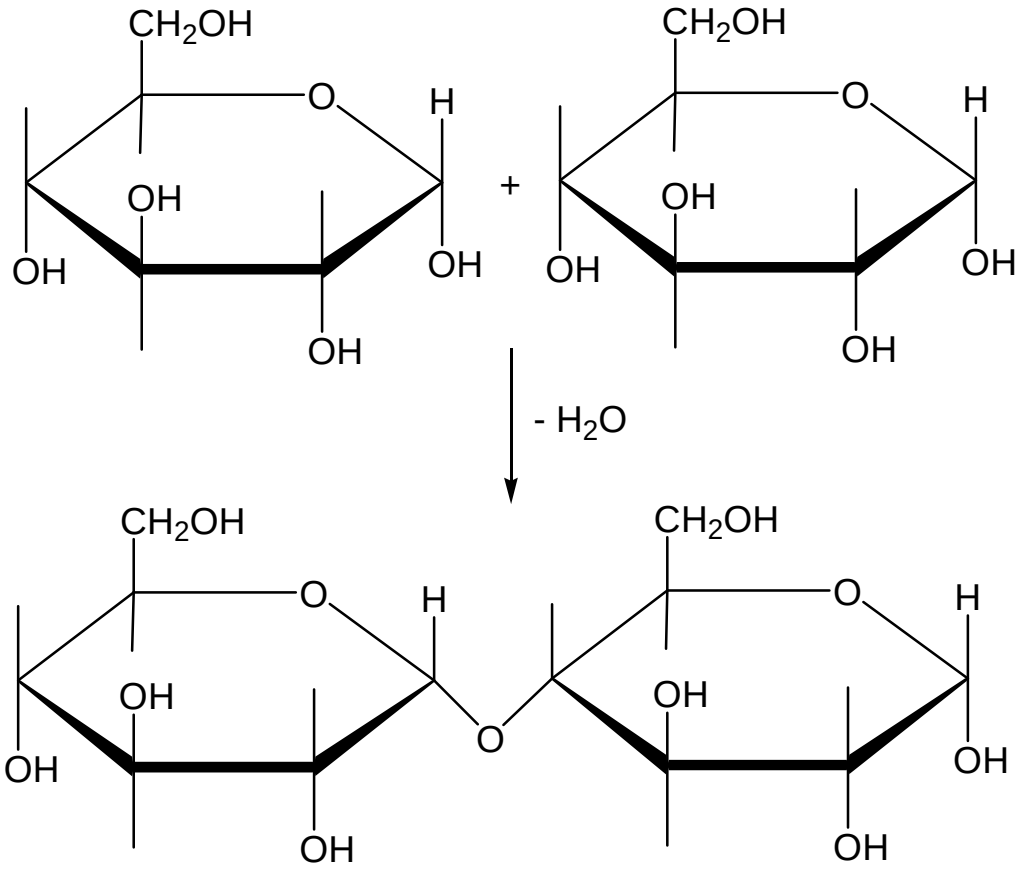
Acetale

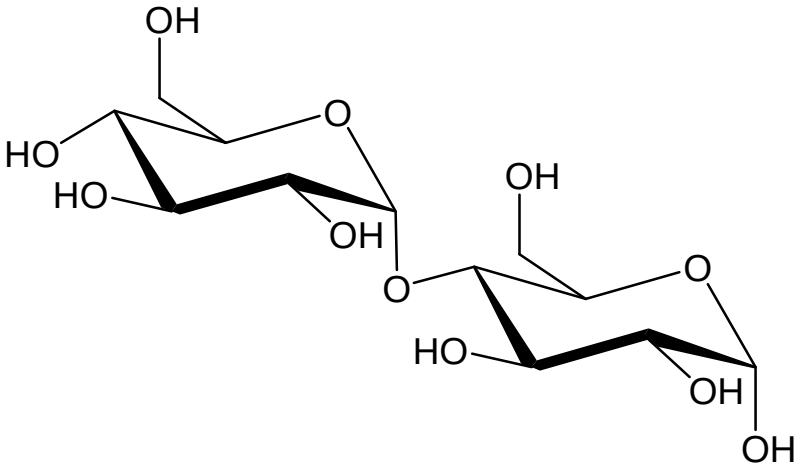


Methyl-β-D-glucosid

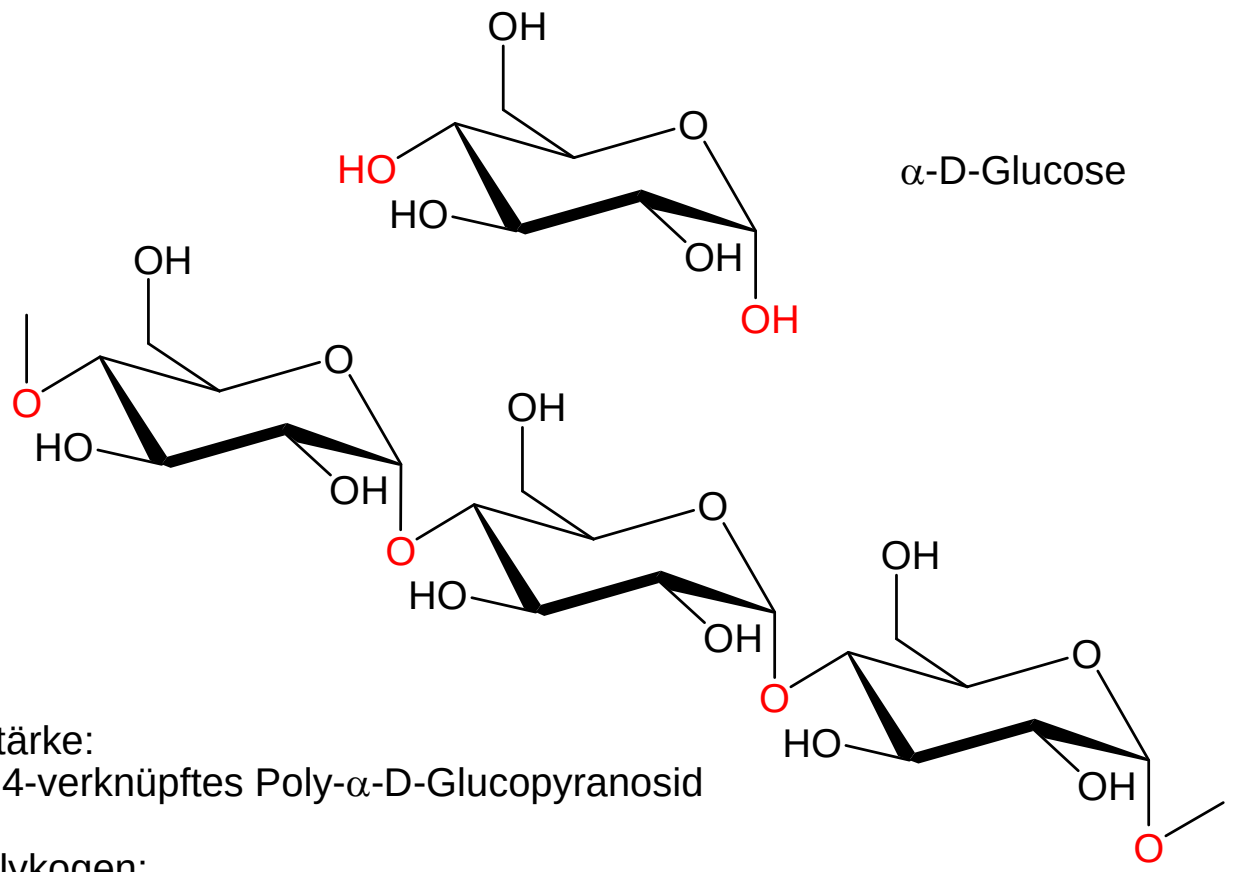
Glykoside sind acetalisierte Zucker.

α-Maltose (Malzzucker)





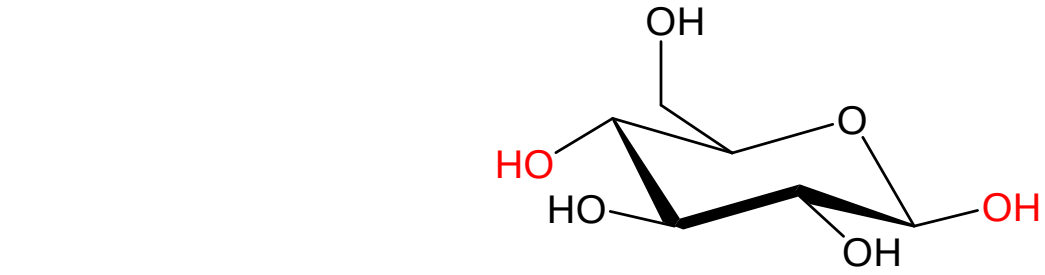
Stärke: Reservekohlenhydrat der Pflanzen
Glykogen: Reservekohlenhydrat (Energiespeicher) bei Tieren und Menschen



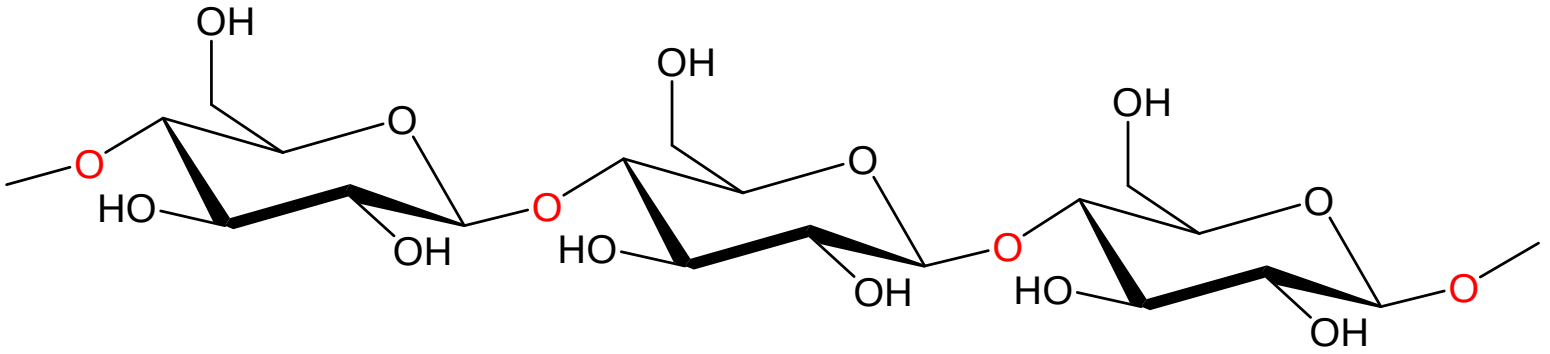
Stärke:
1,4-verknüpftes Poly-α-D-Glucopyranosid

Glykogen:
zusätzliche 1,6-Verknüpfung

Cellulose: Hauptbestandteil aller pflanzlichen Materie (Baumwolle, Holz, Stroh)
1,4-verknüpftes Poly-β-D-glucopyranosid (etwa 3000 Monomere, molare Masse ≈ 500 000)

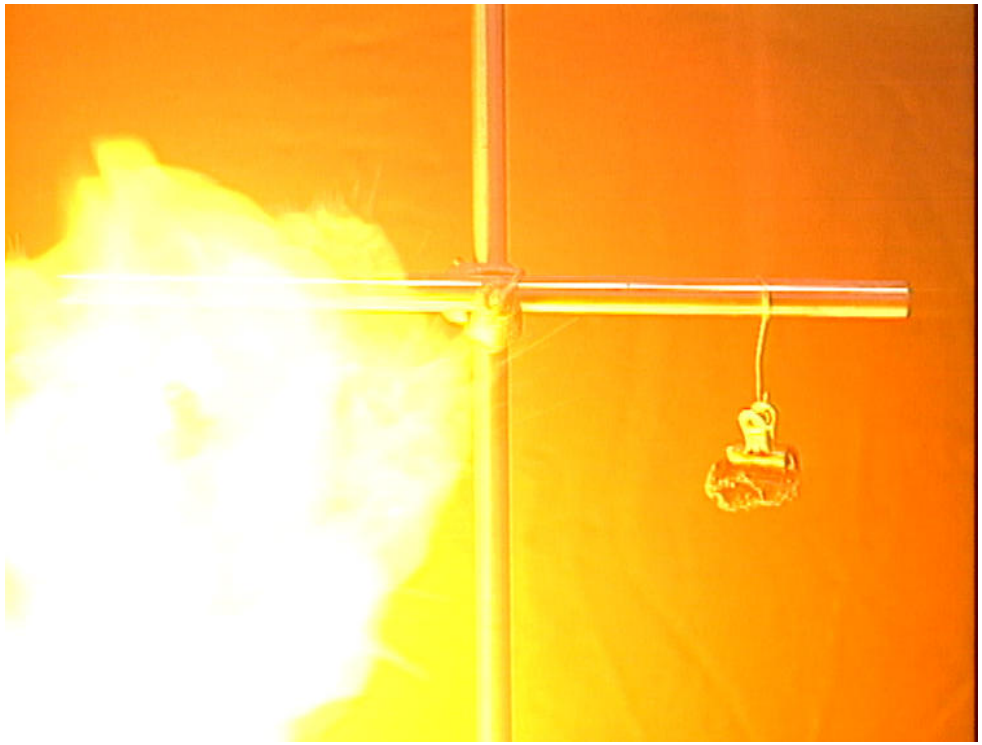


β-D-Glucose



Celluloseacetat: Kunstseide
Cellulosenitrat: Schiessbaumwolle

Herstellung und Verbrennung von Schiessbaumwolle



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