THE GLUCOSIDES

A Phytochemical Study

By

FRANK RABAK

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Contents:

Historical Introduction.

The origin of the word " Glucoside" dates back to the year 1856*, but who first used the term to designate this class of substances could not be ascertained. Evidently the term came into general use about this time owing to the fact that these substances which were previously known as " peculiar organic principles" yielded a sugar on hydrolysis, the sugar generally being glucose. In as much as glucose was the first sugar and the most common sugar that resulted uopn the hydrolysis of these compounds, which were then considered as complex sugar molecules, they were called glucosides.

The term glucoside is now applied to all compounds which on hydrolysis yield a sugar together with some other compound.

The first substance to come under this class was saponin which was discovered in 1808 by Schrader in the soap root, Saponaria officinalis. It was found to yield glucose and a compound called sapogenin on hydrolysis but nothing further was done to clear up the structure or the nature of the latter compound.

A few years later in 1818 Meissner, Vauquelin and

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* Jahresbericht der Pharmacie. 1856.

Braconnot isolated a glucosidal bitter principle, colocynthin from the fruit of Citrullus colocynthis or the bitter apple. This principle also hydrolyzed to form a sugar and another compound called colocynthein.

In 1820 Desfosses records the presence of solanin, an alkaloidal glucoside, in the berries of the black night shade, Solanum nigrum, L. and other species of Solanum. Upon hydrolysis with dilute acids glucose and the compound solanidin resulted.

In 1821 Pelletier and Caventou isolated from cinchona bark the glucoside chinovin or " Chinova Bitter" , which was hydrolyzed to sugar and chinovic acid.

In 1824 Pallota isolated the glucoside parillin or smilacin, from sarsaparilla root derived from a species of Smilax which broke up into glucose and parigenin.

None of the above glucosides were investigated further than to determine the two products of hydrolysis, the chemical nature of the "other substance" in each case was left uninvestigated, whereas the sugar in each case was called glucose because of its power to reduce alkaline copper solution.

The first glucoside of which the products of hydrolysis were investigated systematically, was hesperidin, a glucoside obtained from unripe oranges.

Hesperidin was isolated by Lebreton, Brandes and others in 1828. In addition to hesperitin this glucoside yields two sugars, namely, glucose and rhamnose. This was the first instance in which there was found more than one sugar on hydrolysis; the hexose glucose and the methyl pentose rhamnose being positively identified.

The compound hesperitin possessing the formula $C_{16}H_{14}O_6$ was investigated in regard to its chemical behavior and finally its structure was ascertained to be a di hydroxy phenyl ester of hydroxy methoxy cinnamic acid.

Soon after the isolation of hesperidin Robiquet and Boutron- Charlard in 1830 isolated the glucoside amygdalin from the seeds of the bitter almonds , Amygdalus communis.

It was found by Robiquet and Boutron-Charlard that upon the distillation of the bitter almonds with steam that bitter almond oil and prussic acid resulted and furthermore that the two compounds were not present as such in the bitter almonds but that a crystalline substance which was called amygdalin was present in the seed and ~~which~~ could be extracted with alcohol.

Liebig and Woehler in 1832 made an extensive research on bitter almond oil. They found that upon digestion of the bitter almonds at a temperature of 20 -40° ~~that~~ there resulted both prussic acid and bitter almond oil due to the

hydrolyzing action of the vegetable ferment termed emulsin upon the amygdalin.

They also found that by the action of caustic alkalies upon the amygdalin that ammonia was developed and that a benzoate of the alkali remained in the residue. The former observation confirms the fact that nitrogen is present in the molecule, while the latter infers that the amygdalin molecule possesses the bitter almond oil in a peculiar combination with other substances through whose destruction it partly or wholly changed into benzoic acid as was observed.

Liebig and Woehler further found that hydrocyanic acid and bitter almond oil were not the only compounds formed on hydrolysis of amygdalin for by a continued action of the emulsin on the amygdalin they observed that the odor of the hydrocyanic acid disappeared and on evaporating the solution it became syrupy and possessed a sweet taste which they later found to be due to glucose.

The three substances , glucose, hydrocyanic acid and bitter almond oil were now known to be formed on hydrolysis of amygdalin. A study of the constitution of the amygdalin molecule further verified the fact that the above three compounds could be obtained by the destruction of the molecule.

Leibig and Woehler then instituted an investigation of the bitter almond oil obtained by the hydrolysis of the

amygdalin. They succeeded in separating the hydrocyanic acid from the distilled oil and found the oil to be non poisonous and of the composition C_7H_6O. This liquid when exposed to the air took up oxygen and became solid and was found to be identical with benzoic acid, therefore proving without a doubt that the oil was benzaldehyde.

It was this classic research of Leibig and Woehler on amygdalin and its hydrolysis products , especially the bitter almond oil or benzaldehyde, that had such a powerful influence on the theories of chemical radicals. From their investigation the authors proved that bitter almond oil (benzaldehyde) and benzoic acid contained a group of atoms or a compound radical to which they attributed the name " benzoyl the termination "yl" being derived from the greek word meaning matter.

After Leibig and Woehler's important work on amygdalin and its products, other scientists undertook similar investigations upon glucosidal substances and from this time on the work on glucosides increased until at present the number of glucosides investigated reaches into the hundreds.

In order to show the development of the early work on glucosides a chronological tabulation has been compiled of some of the more important glucosides.

Name of glucoside.	Discussed by	When.
Saponin	Schrader	1808
Colocynthin	Meissner Vauquelin Braconnot	1818
Solanin	Desfosses	1820
Chinovin	Pelletier Caventou	1821
Parillin	Pallota	1824
Hesperidin	Lebreton	1828
Caincin	Francois Pelletier Caventou	1829
Amygdalin	Robiquet Boutron	1830
Aesculin	Minor	1830
Salicin	Leroux	1830
Phloridzin	De Koninck	1835
Phillyrin	Carboncini	1836
Myronic acid	Bussy	1840
Jalapin	Johnston	1840
Syringin	Meillet Bernays	1841
Rutin	Weiss	1842
Xanthorhamnin	Kane	1843
Digitalin	Homolle	1844
Convolvulin	Mayer	1844

Name of glucoside.	Discussed by	When.
Xylostein	Hirbschmann	1845
Gratiolin	Marchand	1845
Morindin	Anderson	1848
Frangulin	Binswanger	1849
Crocin	Quadrat	1851
Arbutin	Kawalier	1852
Helleborin	Bastick	1853
Indican	Schunk	1855
Fraxin	Salm- Horstmer	1856
Maringin	De Vrig	1857
Thujin	Kawalier	1858
Bryonin	Walz	1858
Daphnin	zwenger	1860
Robinin	Dronke	1861
Coniferin	Zwanger Hartig	1861
Coriamyritrin	Riban	1864
Rhinanthin	Ludwig	1868
Agoniadin	Peckolt	1870
Dulcamarin	Geiasler	1875
Valdivin	Tanret	1880
Picrocrocin	Kayser	1884

Definition and Synonyms.

The class of substances termed the glucosides occupy a very extensive field in the plant and vegetable kingdom, occurring very widely distributed, being found in nearly all plant families.

In general glucosides may be defined as a group of amorphous or crystalline substances occurring very widely distributed in the plant kingdom, and which by the action of a ferment, a dilute acid or an alkali, or even when heated with water break up or hydrolyze into some characteristic substance and glucose or some other sugar.

Glucosides are regarded as influential agents in the formation and disposition of the sugars. Chemically glucosides have the nature of complex ethers or ethereal salts of sugars or carbohydrates.

Although the word glucoside is generally applied to all these compounds which yield a sugar and some other compound on hydrolysis, the term " rhamnoside" has also been used in connection with these substances and especially in connection with those which on hydrolysis yield as a sugar "rhamnose" and the other compound.

Classification.

In as much as glucosides are of both botanical and chemical significance, a classification into each of these was deemed necessary.

The botanical classification as will be seen takes up the glucosides in accordance with the position of the family in the generally recognized system of classification, namely, the Engler system. Each natural order is taken up in succession and the genus and species name of each plant in that natural order which yields a glucoside, together with the name of the glucoside, the formula if known, and the products of hydrolysis.

The chemical classification resolves itself into two parts: on the one hand the sugars and on the other the "other substances". Each of theseis classified and discussed separately in accordance with methods of a strictly logical classification.

Botanical Classification.

(See next page)

POLYPODACEAE.

Polypodium	Vulgare L.	Glycyrrhizin	(See Leguminosae.)	
"	Semipinn-atifidium	"	"	

LYCOPODIACEAE.

Lycopodium	Chamaecy-parissus	Lycopodien Bitter	---	---

PINACEAE.

Abies Excelsa	Coniferin	$C_{16}H_{22}O_8$	$C_6H_{12}O_6$ + $C_{10}H_{12}O_3$ Glucose + Coniferyl Alc.
Abies Pectinata	Coniferin	"	" "
Pinus Strobus	"	"	" "
" Sylvestris	Pinipicrin	$C_{22}H_{36}O_{11}$	$C_{10}H_{16}O$ + Glucose. Ercinal.
" Picea	Picein	$C_{14}H_{18}O_4$	$C_6H_{12}O_6$ + $C_8H_8O_2$ Glucose + Piceol.
Larix Europaea	Coniferin	(See above)	
Thuja Occidentalis	Thujin	$C_{20}H_{22}O_{12}$	$C_6H_{12}O_6$ + $C_{14}H_{14}O_8$ Glucose + Thujetin.
" "	"	"	$C_6H_{12}O_6$ + $C_{14}H_{12}O_7$ Glucose + Thujigenin.
" " L.	Pinipicrin	(See above)	
---- ----	Glycolignose	$C_{30}H_{46}O_{21}$	$C_6H_{12}O_6$ + $C_{18}H_{26}O_{11}$ Glucose + Lignose.
Juniperus Sabina L.	Pinipicrin	(See above)	
Thuja Species	Quercitrin	$C_{27}H_{30}O_{16}$	$C_6H_{14}O_6$ + $C_{15}H_{10}O_7$ Rhamnose Quercetin.

GRAMINEAE.

Panicum Junceum	Saponin Substance	----	----	----
Lolium Temulentum	Loliin	----	----	----
Sorghum Vulgare	Durrhin	$C_{14}H_{17}O_7N$	Glucose+p-Oxy benz.ald + HCN.	
" "	Durrhinic acid	$C_{18}H_{18}O_9$	Glucose+ p-oxymandelic acid.	
	Lavosin or			
Grain Kernels	Cerosin	$C_{24}H_{44}O_{22}$	----	----
Phleum Pratense	Phlein	$C_{36}H_{62}O_{31}$	----	----
Baldingera Arundinacea				
Trisetum Alpestre				
Arrhenaterum Bulbosum	Graminin	$C_{36}H_{62}O_{31}$	----	----
Dracoena Australis				
Triticum Repens	Triticin	$C_{36}H_{60}O_{30}$	----	----

ARACEAE.

Acorus Calamus	Acorin	----	----	----
Arum Dioscoridis	Saponin	----	----	----
" Italicum	"			
" Maculatum	"			

LILIACEAE.

*Chamaelirium Luteum	Chamaelirin	$C_{36}H_{62}O_{18}$	Chamaelirnin + Gluc.
Aloe Barbadensis	Aloeglucoside	----	Glucose + Emodin.
" Capensis	"	----	" "
Scilla Maritima L.	Scillain	$(C_6H_{10}O_3)_x$	Isopropyl alc. + Butyric acid + Dextrose
Urginea Scilla	Scillain	"	" "
Yucca Filamentosa	Yucca-Saponin	$C_{40}H_{68}O_{17}$	---- ----
" Aloefolia	Convallarin	----	Convallaretin + Glu.
" Angustifolia	Saponin Substance		
" Baccata	"		
" Brevifolia	"		
" Filamentosa	"		
" Gloriosa	"		
Convallaria Majalis	Convallamarin	$C_{23}H_{44}O_{12}$	$C_6H_{12}O_6 + C_{20}H_{36}O_8$ Glucose + Convallameritin.
Paris Quadrifolia	Paristyphnin	$C_{38}H_{64}O_{18}$	Glucose + Paridin.
" "	Paridin	$C_{16}H_{28}O_7$	" + Paridol.
Smilax Medica	Sarsaparill glucoside	----	---- ----
" Officinalis	"		
" Syphilitica	"		
" Papyracea	"		
" Pseudosyphilitica	"		

*See Leguminosae.

LILIACEAE. (Continued)

Smilax Species (On preceding page)	Parillin	$C_{26}H_{44}O_{10}$	$C_6H_{12}O_6 + C_{14}H_{26}O_2$ (Glucose + Parigenin.)
	Smilasaponin	$5(C_{20}H_{32}O_{10})$	Glucose + $2(C_{14}H_{23}O_2)$ (Sapogenin.)
	Sarsaponin	$12(C_{22}H_{36}O_{10})$	$2C_6H_{12}O_6 + C_4H_4O_6 + C_{28}H_{46}O_4$ (Sarsapogenin.(?))
Smilax Glycyphilla	Glycyphyllin	$C_{21}H_{24}O_9$	$C_{15}H_{14}O_5 + C_6H_{12}O_6$ (Phloretin + Isodulcite.)
" Asprea	Parillin (See-above) Sarsaponin		
" Japecanga	Smilasaponin "		
Chloragalum Pomeridianum	Saponin Sub.	---	--- ---
Medeola Virginica	"		
Muscari Comosum	"		
" Moschatum	"		
" Racemosum	"		
Trillium Erectum	"		
" Irandifolium	"		
" Pendulum	"		
Sword Lily	Irisin	$C_{36}H_{52}O_{26}$	---- ----
Sea Onion	Scillin or Sinistrin	$(C_6H_{10}O_5)_n$	---- ----

AMARYLLIDEAE.

Fourcroya Cubensis	Saponin Substance	---	---	---
" Gigantea	" "			

DIOSCOREACEAE.

Dioscorea Villosa	Saponin Sub.	----	----	----

ORCHIDACEAE.

Eria Micrantha Lind	Saponin Sub.	----	----	----
" Retusa Endl.	" "			
(Cymbidium Javanicum) Pfitz.)	" "			
Paphiopedilum Javanicum Pfitz	" "			

IRIDACEAE.

Iris Florentina	Iridin	$C_{24}H_{26}O_{13}$	$C_6H_{12}O_6 + C_{18}H_{16}O_8$ Glucose + Irigenin.
Crocus Sativus L.	Crocin	$C_{44}H_{70}O_{28}$	$C_6H_{12}O_6 + C_{34}H_{46}O_9$ Glucose + Crocetin.
	Pikrocrocin	$C_{38}H_{66}O_{17}$	$C_6H_{12}O_6 + C_{10}H_{16}$ Glucose + Terpin.

AIZOACEAE.

Trianthema Monogyrum L.	Saponin	Sub.	----	---- ----
" Portulacastrum L.	"	"		

SALICACEAE.

Populus Tremula	Populin	$C_{20}H_{22}O_8$	Glucose + $C_7H_6O_2$ + $C_7H_8O_2$ / Benz.Ac. / Saligenin.
" Alba	"	$C_{20}H_{22}O_8$	$C_{13}H_{18}O_8 + C_7H_6O_2$ / Salicin + Benz.Ac.
" Graeca	"		
" Balsamifera	"		
Salix Helix L.	Salicin	$C_{13}H_{18}O_7$	$C_6H_{12}O_6 + C_7H_8O_2$ / Glucose + Saligenin.
" Purpurea L.	"	"	$C_6H_{12}O_6 + C_{14}H_{14}O_3$ / Glucose + Saliretin.
" Alba L.	"		
" Lambertina	"		
" Incana	"		
" Amygadalina	"		
" Fissa	"		
" Hastata L.	"		
" Praecox	"		
" Pentandra L.	"		
" Polyandra Bray.	"		
" Fragilis L.	"		
" Russeliana	"		

SALICACEAE. (Continued)

Salix Hippophaifolia Thuill	Salicin	(See above)	
" Phylicifolia L.	"		
" Rubra Huds.	"		
Popolus Nigra Spach	Salicin or Populin.		
" Fremonti S. Wats.	"		
Salix Discolor Muhl.	Salinigrin	$C_{13}H_{16}O_7$	$C_6H_{12}O_6 + C_7H_6O_2$ Glucose+ Meta hydroxy benzald.

JUGLANDACEAE.

Juglans Nigra	Glucoside	
Carya Tomentosa	Quercitrin	(See Fagaceae)

BETULACEAE.

Betula Lenta	Gaultherin	(See Ericaceae)

FAGACEAE.

Quercus Tinctoria W	Quercitrin	$C_{21}H_{22}O_{12}$	$C_6H_{14}O_6 + C_{15}H_{10}O_7$ Rhamnose + Quercetin.
Reseda Luteola L.	"	"	" "
Fagus Sylvatica	Glucoside ----	"	$C_6H_{12}O_6 + C_8H_8O_3$ Glucose + Methyl-salicylate
Castanea Species	Quercitrin (See above)		

MORACEAE.

Antiaris Toxicaria	Antiarin	$C_{27}H_{42}O_{10}$	$C_{21}H_{30}O_5 + C_6H_{12}O_6$ Antiarigenin + Antiarose
Streblus Asper	"	"	" "
Humulus Lupulus (Leaves)	Quercitrin (See Fagaceae)		

PROTACEAE.

Leucodendron Concinuum	Leucoglycodrin	$C_{27}H_{42}O_{10}$ $C_{27}H_{44}O_{10}$	Glucose + Non-crystallizable Subs.

URTICACEAE.

Pilea Pumila	Crystallizable Glucoside	---	---	---
Ficus Hispida L.	Saponin Subs.	---	---	---
" Hypogaea King.	"	---	---	---

SANTALACEAE.

Osyris Compressa	Osyritin ---- $C_{27}H_{30}O_{17}$	Glucose + Quercitin.	
Hamemalis Virginica	Tannic ac.----	----	----

POLYGONACEAE.

Polygonum Cuspidatum	Polygonin	$C_{21}H_{20}O_{10}$	$C_6H_{12}O_6$	+ $C_{15}H_{10}O_5$
			Glucose	+ Emodin.
Rumex Obtusifolias	Chrysophan	----	Chrysophanic acid.	
" Patientia	(Chrysophanic acid)	$C_{15}H_{10}O_4$	---	---
" Aquaticus	"			
" Maritimus	"			
" Palustris	"			
" Hydrolaphatum	"			
Rheum Pyramidale	"			
Polygonum Hydropiperoides Michx.	Saponin Subs.	---	---	---
Polygonum Tinctorium	Indican	(See Leguminosae)		
" Fagopyrum	Rutin	(See Rutaceae)		
Rhubarb	Tetrarin	$C_{32}H_{32}O_{12}$	$C_7H_6O_5$ +	$C_9H_8O_2$ +
			Gallic ac.	Cinnamic a
			$C_{10}H_{12}O_2$ +	$C_6H_{12}O_6$
			Rheosmin	+ Glucose

CHENIPODACEAE.

Beta Vulgaris	Coniferin	(See Pinaceae)
Chenipodium Mexicanum	Saponin	(See Sapotaceae)

PHYTOLACCACEAE.

Phytolacca Decandra	Bitter Glucoside ----,	---- ----
Pircunia Abyssinica	Saponin Subs.	(See Sapptaceae)
" Moq	"	
" Saponacea	"	

AIZOACEAE.

Trianthema Monogynum L.	Saponin Subs.	
(" Portulacastrum L.	"	"

CARYOPHYLLACEAE.

Hernaria Glabra	Herniarin	$C_{19}H_{30}O_{10}$	$C_{14}H_{22}O_3$ + C_6H_{12}	
			Oxysapogenin +	Glucose
" Hirsuta	"	"	"	"
Saponaria Rubra	Saporubrin	$C_{18}H_{28}O_{10}$	$(C_5H_8O_2)$ + $C_6H_{12}O_6$	
			Sapogenin +	Glucose
" Alba	Saponin (See Rosaceae)			
" Officinalis	Saporubrin (See above)			
" Ocimoides	Saponin Subs.			
Gypsophila Arrostii	Levant Saponotoxin	$C_{17}H_{20}O_{10}$	"	"
" Paniculata	"	"	"	"
Agrostemma Ghitago	Agrostemma Sapotoxin	$C_{17}H_{28}O_{11}$	$C_6H_{12}O_6$ + $C_5H_8O_2$	
				Agrostemma-sapogenin
Acanthophyllum C.A. Mey.	Saponin Substance			
" Squarosum	"			
Arenaria Serpyllifolia	"			
Dianthus Armeria	"			
" Barbatus	"			
" Caesius	"			
" Carthusianorum	"			
" Carophyllus	"			
" Hispanicus	"			

CARYOPHYLLACEAE. (Continued)

Dianthus	Plumarius	Saponin Substance
"	Prolifer	"
"	Sinensis	"
Gypsophila	Acutifolia	"
"	Altissima	"
"	Arostii	"
"	Cretica	"
"	Effusa	"
"	Elegans	"
"	Fastigiata	"
"	Paniculata	"
"	Struthium	"
"	Vaccaria	"
Lychnis	Calcedonica	"
"	Flos Cuculi	"
"	Dioica	"
Silene	Armeria	"
"	Nutans	"
"	Virginica	"
"	Viscisa	"
"	Vulgaris	"

RANUNCULACEAE.

Nigella Sativa L.	Melanthin	$C_{29}H_{30}O_{10}$	$C_6H_{12}O_6$ + $C_{14}H_{23}O_2$ Glucose + Melanthigénin.
" Damascena	Saponin Subs.		
Adonis Amurensis	Adonin	$C_{24}H_{40}O_9$	$C_6H_{12}O_6$ + Amorphous Sub.
" Vernalis L.	Adonidin	$C_{25}H_{40}O_{10}$	A substance which reduces Fehling's Sol.
" Cupániana	"		
" Aestivalis	"		
Helleborus Viridis	Helleborein	$C_{37}H_{56}O_{18}$	$C_{19}H_{30}O_5$ + $C_6H_{12}O_6$ Helleboretin + $C_2H_4O_2$ Acetic acid.
" Niger	Helleborin	$C_{36}H_{42}O_6$ $(C_6H_7O)_x$	$C_6H_{12}O_6$ + $C_{30}H_{38}O_4$ Helleboresin
" Foetidus	"	"	" "

Ficaria Ranunculoides Saponin Subs.

BERBERIDACEAE.

Berberis Aristata	Saponin Subs.		
Caulophyllum Thalictroides	"		
Leontice Leantopelatum	"		
Podophyllum peltatum	Podophyllin ----	Glucose + Other Sub	

MENISPERMACEAE.

Cascinium Blumeanum Miers.	Saponin.		
" Fenestratum Calebr.	"		
Diplochisia Macrocarpa Miers.	"		
Tiliacora Racemosa Colebr.	"		
" Acuminata Miers.	"		

MAGNOLIACEAE.

Magnolia Macrophylla	Crystallizable Glucoside			
Illicium Anisatum	Saponin			
" Floridanum A	Glucoside			

LAURACEAE.

Lindera Benzoin	Gaultherin (See Betulaceae)			

CALYCANTHACEAE.

Calycanthus Floridus L.	Calycanthin $C_{25}H_{28}O_{11}$	----	----	

CAPPARIDACEAE.

Capparis Species	Quercitrin (See Fagaceae)			
Capparis Spinosa	Rutin See Rutaceae.			

ANONACEAE.

Bocagea Dalfelli A Glucoside.

MONIMIACEAE.

Peumus Baldus, Mol. Boldo Gluc. $C_{30}H_{52}O_8$ $C_6H_{12}O_6 + CH_3Cl + C_{19}H_{28}O_3$ Syrupy Subs.

CRUCIFEREAE.

Brassica Napus Sinigrin $C_{10}H_{16}NS_2KO_9$ $C_6H_{12}O_6 + KHSO_4 + C_3H_5CNS$ Allyl Sulphocyanide.

" Rapa " " " "

Sinapis Juncea " " " "

Cochlearia Armoracia " " " "

Sinapis Alba Sinalbin $C_{30}H_{42}O_{15}N_2S_2$ $C_7H_7O.NCS +$ Sinalbin Sulphocy. $C_{16}H_{24}O_5NHSO_4 + C_6H_{12}O_6$ Sinapin acid Sulphate.

CRUCIFEREAE. (Continued)

Isatis Tinctoria,L.	Indican	$C_{52}H_{62}O_{34}N_2$	$C_6H_{12}O_6$ +	$C_{16}H_{10}N_2O_2$ Indogo Blue
Isatis Species	Chrysophanic Acid. (See Polygonaceae)			
Chiranthus Cheiri	Cheiranthin	---	---	---
Barbarea Praecox Nasturtium Officinale	Glyco-Nasturtium	$C_{15}H_{20}O_9NS_2K$	Glucose+ Phenylethyl mustard oil	$+KHSO_4$
Erysimum Aureum	Erysimin	$(C_4H_7O_2)_n$	----	----

RESEDACEAE.

Reseda Luteola,L.	Quercitrin	(See Fagaceae)

SAXIFRAGACEAE.

Ribes Rubrum	Glycobernstein acid.	----	----	----
" Grossularia	"			

SAXIFRAGACEAE. (Continued)

Hydrangea Arborescens	Hydrangin $C_{34}H_{25}O_{11}$	Brownish red subs. sol. in $CHCl_3$.
Dichroa Febrifuga Lour.	Dichroin.	

PITTOSPORACEAE.

Pittosporum Coriaceum	Saponin.	
" Undulatum	"	

ROSACEAE.

Quillaja Saponaria	Quillajic acid	$C_{19}H_{30}O_{10}$	$C_6H_{12}O_6+(C_7H_{14}O_2)_2$	Sapogenin.
" Brasiliensis	Saponin.			
" Sellowiana	"			
" Smegmadermos	"			
" Saponaria	Sapotoxin	$C_{17}H_{26}O_{10}$	$C_6H_{12}O_6+(C_5H_8O_2)_2$	Sapotoxin-sapogenin.
Barks and leaves of apple, pear, cherry and prune.	Phloridzin	$C_{21}H_{24}O_{10}$	$C_6H_{12}O_6+ C_{15}H_{14}O_5$	Phloretin
Pear	Gluco-drupose	$C_{24}H_{36}O_{16}$	$C_6H_{12}O_6+ C_{12}H_{20}O_8$	Drupose.
Fragaria Vesca	Fragiarin	----	Glucose + Amorphous Fragarin	
Rubus Villosus	Villosin	----	Glucose + Villosin acid.	
Amygdalus Communis				
Prunus Domestica	Amygdalin	$C_{20}H_{27}NO_{11}$	$C_7H_6O+ HCN+ C_6H_{12}O_6$	Benz. aldeh. + HCN
" Spinosa	"	"	$C_{14}H_{17}NO_6+ C_6H_{12}O_6$	Mandelnitril Glucoside.

Aesculin (See)

ROSACEAE. (Continued)

Prunus Armenica	Aesculin	(See Hypocastanaceae)	
" Avium	"		
" Cerasus	"		
" Cerasus Austera	Amygdalin	$C_{20}H_{27}NO_{11}$	$C_8H_8O_3 + C_6H_{12}O_6 + NH_3$ (Mandelic acid.)
" Chameacerasus	"		
" Laurocerasus	"		
" Padus	"		
" Mahaleb	"		
Persica Vulgaris			
Amygdalus Nana			
Pyrus Malus			
Cydonia Vulgaris			
Sorbus Aucuparia			
Cotoneaster Vulgaris			
Crateagus Oxycantha			
Mespillus Japonica			
Spiraea Filipendula	Saponin.		
" Ulmaria,L.	Salicin	(See Salicaceae)	
" "	Gaultherin	(See Betulaceae)	
Pygeum Species	Amygdalin	(See above)	

ROSACEAE. (Continued)

Gillenia Stipulacca Nutt.	Gillein	----	----	----
	Gillenin	----	----	----
Pittosporum Floribundun	Pittosporin	--	----	----
Spiraea Ulmaria	Gaultherin (See Betulaceae)			
" Filipendula	"			
" Palmata	"			
" Kamschatica	"			
" "	Spirain	----	----	----
" Ulmaria	"			
Geum Urbanum	Gein	----	----	-----

LEGUMINOSAE.

Cassia Acutifolia	Cathartin acid	$C_{30}H_{36}O_5N$	Glucose + Cathartogenin ac.
" Angustifolia	"	"	" "
" Tora	A glucoside	---	Glucose + Emodin.
Sophora Japonica	Sophorin	$C_{27}H_{30}O_{16}$	$C_6H_{12}O_5$ + $C_6H_{12}O_6$ + $C_{15}H_{10}O_7$ Sophoretin.
Baptisia Tinctoria	Baptisin	$C_{26}H_{32}O_{14}$	$C_{14}H_{12}O_6$ + $C_6H_{12}O_6$ Baptigenin + Rhamnose.
Gastrolobium Bilobum	Gastrolobin	---	--- ---
Cyclopia ----	Cyclopin	$C_{25}H_{28}O_{13}$	$C_{19}H_{22}O_{10}$ + $C_6H_{12}O_6$ Cyclopiarot.
"	Oxycyclopin	$(C_{25}H_{28}O_{15}+H_2O)$	--- ---
Lupinen Plants	Lupinid	$C_{29}H_{32}O_{16}.7H_2O$	$C_{17}H_{12}O_6$ + Lupigenin $C_6H_{12}O_6$
Ononis Spinosa,L.	Ononin	$C_{30}H_{34}O_{13}$	$C_{24}H_{22}O_7$ + $C_6H_{12}O_6$ Formonetin.
			$C_{29}H_{34}O_{12}$ + CH_2O_2 Onospin + Formic ac.
Wistaria Chinensis	Wistarin	-----	Res. Subs. + Ethereal oil + Glucose.
Robinia Pseudoacacia	Robinin	$C_{25}H_{30}O_{16}$	Quercitrin + Sugar.
Coronilla Scorpoides	Coronillin	$(C_7H_{12}O_5)_x$	$C_8H_{18}O_7$ + $C_6H_{12}O_6$

LEGUMINOSAE. (Continued)

Vicia Faba	Vicin	$(C_8H_{15}O_6N_3)_x$	Glucose + Divicin + Ammoniac.	
" Sativa	"	"	"	"
" Faba	Convicin	$(C_{10}H_{15}O_8N_3.H_2O)$	Alloxantin + Sugar.	
" Sativa	"	"	"	"
Butea Frondosa	Tesu-Glucoside.	$C_{15}H_{14}O_5$	---	---
Abbizzia Anthelmintica	Saponin.			
Abbizzia Latifolia	"			
" Lophanta Benth.	"			
" Procera				
" Saponaria				
" Stipulata				
Acacia Cincinna				
" " var. rugata				
" Cunninghami				
" Vera, Willd.				
Entada Scandens				
" Polystachya				
Enterolobium Timboowa				
Mezoneurum Sumatrunum				
Mimosa Saponaria, Roxb.				
Pithecolobium Bigeminum (?)				
" Cyclocarpum				

LEGUMINOSAE(Continued)

Pithecolobium Salutare

" Saman (?)

Prosopis Dubia,H.B. andK.

Tetrapleura Thonningii

Xylia Dolobriformis, Benth. = Mimosa acle BlancO.

Gleditschia sp. div.

" Ferox

" Orientalis

Gymnocladus Canadensis

Dolichos Speciosus, Hort. Bog.

Derris Uliginosa

Milletia Atropurpurea

" Pachycarpa

" Seriacea

Phaseolus (Brazilien)

Maracaibo (Westindian Soap-bark.)

Glycyrrhiza Glabra, L. Glycyrrhizin $C_8H_{12}O_3$

$C_{18}H_{20}O_7$

$C_{24}H_{36}O_7$

$C_{16}H_{24}O_6$

$C_{44}H_{62}(NH_4)NO_{18}$

$= C_{18}H_{26}O_4 + C_6H_{12}O_6$

Glycyrretin + Glucose.

LEGUMINOSAE. (Continued)

Glycerrhiza Echinata, L.	Glycerrhizin	Glycerrhizic acid. $C_{44}H_{63}NO_{18}$	$C_{32}H_{43}NO_4 + C_6H_{10}O_8$ Glycerretin + p-Saccharic acid
Andira Inermis	Andirin.		
Indigofera Tinctoria, L.	Indican	$C_{52}H_{62}O_{34}N_2$	$C_6H_{12}O_6 + C_{16}H_{10}N_2O_2$ Indigo Blue.
" Anil	"		
" Argentia	"		
" Disperma	"		
Baptisia Species	Quercitrin (See Fagaceae)		
Lotus Arabicus	Lotusin	$C_{22}H_{19}NO_{10}$	$C_{15}H_{10}O_6 + HCN +$ Lotoflavin $C_6H_{12}O_6$ Glucose:
Borodichia Major	Achornin	----	---- ----
" Virgiloides	"		
Milletia Atropurpurea Benth.	Saponin Glucoside.		
Baptisa Tinctoria	Pseudo-baptisin	$C_{27}H_{30}O_{14}$	$C_6H_{14}O_6 + C_6H_{12}O_6 +$ Rhamnose + Glucose $C_{15}H_{10}O_5$ Pseudobaptigenin.

TROPAEOLACEAE.

Tropaeolum Majus	Glucotropeaclin $C_{14}H_{18}O_9KNS_2$	---		----
Saccharomyces Mycoderma	Glykotropaeolin ----	----		----

LINACEAE.

Linum Usitatissimum	Linamarin ----		Sugar + HCN.

ERYTHROXYLACEAE.

Erythroxylon Coca Gaultherin (See Betulaceae.)

ZYGOPHYLLACEAE.

Balanites Roxburghii Planchon	Saponin.
Guajacum Officinale	Guaiac Saponinic acid. Neutral Guaijac Saponin.

RUTACEAE.

Ruta Graveolens	Rutin	$C_{27}H_{32}O_{16}$	$C_6H_{12}O_6$ + $C_{15}H_{10}O_7$ Rhamnose + Quercitrin
Barosma Crenulata	Barosinin	----	Sugar + A chocolate colored subs.
" Betulina	"		
" Serratifolia	"		
Cusparia Trifoliata	Angusturin	$C_8H_{12}O_6$	--- ---
Skimmia Japonica	Skimmin	$C_{15}H_{16}O_8$	$C_6H_{12}O_6$ + $C_9H_6O_3$ Skimmetin
Murraya Exotica, L.	Murrayin	$C_{18}H_{22}O_{10}$	$C_6H_{12}O_6$ + $C_{12}H_{12}O_5$ Murrayetin.
Citrus Decumana, L.	Naringin	$C_{23}H_{28}O_{12}$	$C_6H_{12}O_6$ + $C_{15}H_{12}O_5$ Naringenin
Orange Peels	Aurantiamarin	----	---- ----
Citrus Aurantium R.	Hesperidin	$C_{50}H_{60}O_{27}$	$C_6H_{14}O_6$ + $C_6H_{12}O_6$ + Rhamnose + Glucose $C_{16}H_{14}O_6$ Hesperitin.
" Limonum R.	"		
" Limetta R.			
" Vulgaris			
" Chinensis			
" Longifolia			
" Mandarin			

RUTACEAE. (Continued)

Xanthoxylum Scandens, Bl.	Saponin.			
" Pentamone	"			
Esenbeckia Febrifuga	Chinovin	(See Rubiaceae)		
Empleurum Serrulatum	Glucoside	---	----	----
Rabelaisia Phillipinensis	Rabelaisin	---	----	----
Xanthoxylon Caribaeum	Glucoside	---	----	----
Citrus Limonum	Limmetin	----	----	----

SIMARUBIACEAE.

Simaba Valdivia Planch.	Valdivin	($C_{36}H_{48}O_{20}\cdot 5H_2O$)	---	---
" Cedron Aubl.	Cedrin	($C_{36}H_{48}O_{20}\cdot 5H_2O$)	---	---
Samadra Indica	Samaderin	----	---	---
Balanites Aegyptiaca	Saponin.			
" Africana	"			
Simaba Waldivia	Waldivin	----	---	---

MELIACEAE.

Trichilia, L.	Saponin.		
Walsura Piscidia (?)	"		

POLYGALACEAE.

Polygala Senega	Senegin	----	Glucose+	Sapogenin Subs.
" "	Polygalic acid	----	"	"
" Alba	Saponin.			
" Amara	"			
" Angulata	"			
" Boykinii	"			
" Chamaebuxus	"			
" Latifolia	"			
" Major	"			
" Mönnina	"			
" Monticola	"			
" Paniculata	"			
" Purpurea	"			
" Sanguinea	"			
" Tenuifolia	"			
" Venonosa	"			

POLYGALACEAE.(Continued)

Monnina Polystachia	Saponin.			
" Salicifolia	"			
Polygala Species (P. Senega,P. baldwini,P. variabilis,P. oleifera,P. javana,P. serpillacea,P. calcarea,P. depressa, P. vulgaris.)	Gaultherin (See Ericaceae)			

EUPHORBIACEAE.

Mallotus Philippinensis	Bitter Glucoside	----	----	----
Rattlra Tinctoria Roxb.	Bitter Glucoside			
Euphorbia Lathyris	Aesculetin (?)			

CORIARIACEAE.

Coriaria Myrtifolia	Coriamyrtin	$C_{30}H_{36}O_{10}$	Sugar + Two or more indefinite subs.
Coriaria Ruscifolia " Thymofolia " Angustissima	Tutin	$C_{17}H_{20}O_7$	

ANACARDIACEAE.

Rhus Cotinus	Fustin	$C_{36}H_{26}O_{14}$	$C_6H_{14}O_6$ + $C_{15}H_{10}O_6$	Rhamnose + Fisetin.
Rhus Rhodanthema	-----	$C_{36}H_{30}O_{16}$	$C_6H_{14}O_6$ + $C_{15}H_{10}O_6$	
Rhus Species	Quercitrin	(See Fagaceae)		

AQUILIFOLIACEAE.

Ilex Paragiumensis	Coffee Tannic acid	$C_{15}H_{18}O_8$	----	----

CORYNOCARPYACEAE.

Corynocaepus Laevigata	Karakin	----	----	----

CELASTRACEAE.

Eunymus Atropurpureus	Evonymin	----	----	----
Pleurostylia Wightii, W.	Quercitrin	(See Fagaceae)		
Celastrus Paniculatus Willd	Saponin.			
Lophopelatum Toxicum	"			

HYPPOCASTANACEAE.

Aesculus Hippocastanum	Aesculin	$C_{15}H_{16}O_9$	$C_9H_6O_4$ + $C_6H_{12}O_6$	
			Aesculetin.	
" "	Argyrascin	$C_{27}H_{42}O_{12}$	$C_{21}H_{30}O_6$ + $C_6H_{12}O_6$	
			Argyrascetin.	
" "	Aphrodascin	$C_{52}H_{82}O_{23}$	$C_4H_8O_2$ + $C_{24}H_{40}O_{12}$	
			Butyric ac. + Aescinic ac.	
" "	Rosskastanien Saponin	----	----	----
" "	Kastanienquercitrin	$C_{25}H_{20}O_7$	----	----

HYPPOCASTANACEAE. (Continued)

Aesculus Pavia	Saponin.	
Aesculus Species	Fraxin	(See Oleaceae)
Pavia Species	Fraxin	"

SAPINDACEAE.

Sapondus Saponaria	Saponin	(See Rosaceae)	
" "	Sapindus Sapotoxin	$C_{34}H_{54}O_{21}$	$C_6H_{12}O_6+(C_5H_8O_2)_2H_2O$ Sapindus-sapogenin.
" Acuminatus	Saponin.		
" Balicus	"		
" Manatensis	"		
" Marginatus	"		
" Mukorossi	"		
" Oahuensis	"		
" Rarak	"		
" Trifoliatus	"		
" Vitiensis	"		
Serjania Piscatoria	"		
Blighia Sapida	"		
Cardiospermum Haliccabum	"		

SAPINDACEAE. (Continued)

Dodonaea Viscisa	Saponin.
Dialopsis Africana	"
Ganophyllum Falcatum	"
Harpullia Arborea	"
Harpullia Cupanoides	"
Magonia Pubescens	"
Magonia Glabrata	"
Nephelium Longana, Comb.	"
Sapindus Rarak	Sapotoxin (See above)

MELIANTHACEAE.

Arillus von Bursama	Saponin.
Bersama Fresen	" "
Chamaelirium Luteum	Chamaelirnin $C_{36}H_{62}O_{14}$ Chamaelirin+ Glucose

RHAMNACEAE.

Rhamnus Infectoria	Xantho-rhamnin	$C_{48}H_{66}O_{29}$	Rhamnose + $C_{16}H_{12}O_7$ Rhamnetin.
" Tinctoria	"		
" Oleoides	"		
" Amygdalina	"		
" Saxatilis	"		
" Purshiana	"		
" Infectoria	Rhamnin Glucoside ---		Glucose + $C_{17}H_{14}O_7$ Rhamnazin.
" Tinctoria	"		
" Frangula,L.	Frangulin	$C_{21}H_{20}O_9$	Rhamnose + $C_{15}H_{10}O_5$ Emodin.
" Cathartica,L.	"		
" Purshiana,L.	Frangulic acid---		Glucose + Pseudo-frangulin.
" Frangula,L.	Avornin	----	---- ----
" Utilis			
" Chlorofora	Lokain	$C_{42}H_{48}O_{27}$	Lokaose + $C_{36}H_{36}O_{21}$ Lokanic acid.
Colletia Spinosa	Saponin.		
Colubrina Asiatica	"		
" Reclinata	"		
Zizyphus Soaserio	"		
Gouania Tomentosa	"		

RHAMNACEAE. (Continued)

Ziziphus Species	Bitter Glucoside ----	----	----

VITACEAE.

Vitis Vinifera	Grape coloring matter glucoside	----	Glucose+ Coloring matter.
Vitis Species	Quercitrin(See Fagaceae)		

TILIACEAE.

Linde	Tiliacin	----	Glucose+ Tiliacetin

MALVACEAE.

Gossypium Herbaceum	Gossypium glucoside	-----	---- ----
" "	Gossypetin $C_{16}H_{12}O_8$ (?)		

STERCULIACEAE.

Cola Species	Quercitrin (See Fagaceae)			

THEACEAE.

Thea Chinensis	Assamin	$C_{18}H_{28}O_{10}$	Glucose +Sapogenin	
Camellia Theifera	"			
Thea Chinensis	Assamic ac.	---	----	----
	Quercitrin (See Fagaceae)			
Thea Assamica	Saponin (See Rosaceae)			
Camellia Japonica	Camellin	$C_{53}H_{84}O_{9}$	Glucose+ Unknown body.	
" Oleifera	Saponin			
" Sasangua	"			
" Thea	Tea Saponin Tea Sapponic acid.			
Schima Noronhae	Saponin			
Stewartia Pseudo-camellin	"			

CISTACEAE.

Helianthemum Annuum	Helianthemum Glucoside	----	----	----
" Canadense	Glucoside	----	----	----

VIOLACEAE.

Viola Tricolor	Viola Quercitrin	$C_{27}H_{30}O_{16}$	$C_6H_{14}O_6 + C_6H_{12}O_6 + C_{15}H_{10}O_7$	Violaquercetin
Jonidium Suffruticosum	"			

PASSIFLORACEAE.

Carica Papaya	Sapohin.			

CARICACEAE.

Carica Papaya	Carposid	----	----	----

CACTACEAE.

Cereus Gummosus Englm.	Cerein acid	----	----	----

DISTACEAE.

Datisca Cannabina	Datiscin	$C_{21}H_{24}O_{11}$	$C_6H_{14}O_6$ + $C_{15}H_{12}O_6$ Rhamnose + Datiscetin

THYMELIACEAE.

Daphne Mezereum, L.	Daphnin	$C_{15}H_{16}O_9$	$C_6H_{12}O_6$ + $C_9H_6O_4$ Glucose + Daphnetin.
Daphne Alpina, L.	Aesculin Isomers	----	---- ----

LYTHRACEAE.

Lawsonia Inermis, L.	Hennotannic acid	----	----	----

PUNICACEAE.

Punica Granatum	Tannic acid ---	Glucose+ Ellagic ac+ +Gallic acid

LECYTHIDACEAE.

Barringtonia Insignis,Miq.	Saponin.
" Vriesei,P.etB.	"
" Insignis, Bl.	"
" Speciosa Gaertn.	"

COMBRETACEAE.

Terminalia Chebula	Tannic acids ----	Glucose+ Ellagic acid+ Gallic acid.

MYRTACEAE.

Eucalyptus Macrorhyncha	Myrticolo-rin	$C_{27}H_{28}O_{16}$	$C_6H_{12}O_6$+ $C_{15}H_{10}O_7$ Glucose+ Quercetin.

ARALIACEAE.

Aralia Spinosa,L.	Araliin	----	Glucose+ Araliretin
Aralia Montana	Saponin.		
Hedera Helix	Hedera Glucoside	$C_{32}H_{52}O_{10}$	$C_6H_{12}O_6$+ $C_{26}H_{40}O_4$
			Glucose+ Crystalline subs.
Hedera Helix	Helixin	----	---- ----
Heptapleurum Ellipticum	Saponin.		
Panax Fructicosum	"		
Polyscias Nodosa	"		
Trevesia Sundaica	"		
Epheu Species	Hederin	$C_{64}H_{104}O_{19}$	$C_6H_{14}O_6$+ $C_6H_{12}O_6$+
			Rhamnose+ Hederose $C_{26}H_{40}O_4$
			Hederidin.

MYRTACEAE. (Continued)

Barringtonia Insignis,Miq.	Saponin	---	---- ----
" Vriesei	"		
Baecka Frutescens	Glucoside	----	---- ----
Myrcia Nagi	Myricitrin	$C_{21}H_{22}O_{13}$	$C_6H_{14}O_6$+ $C_{15}H_{10}O_8$
			Rhamnose+ Myricitin

UMBELLIFEREAE.

Prangos Pabularia	Quercitrin (See Fagaceae)			
Apium Petroselinum L.	Apiin	$C_{27}H_{32}O_{16}$	$C_6H_{12}O_6$ + $C_{15}H_{10}O_5$	Glucose + Apigenin.
Apium Graveolens	"			
Anthriscus Cerefolium	"			
Ammi Wisnaga	Kellin	----	----	----

CORNACEAE

Aucuba Japonica	Aucubin	----	----	----

PIROLACEAE.

Monotropa Hypopitys Gaultherin (See Ericaceae)

ERICACEAE.

Ledum Palustre,L.	Ericolin	$C_{34}H_{56}O_{21}$	Glucose +Ericinol.
Arbutus Uva Ursi,L.	"	$(C_{10}H_{16}O)$	
Rhododendron Ferrugineum,L.	"		
Calluna Vulgaris	"		
Erica Herbacea	"		
Andromeda Japonica Thunb.	Asebotin	$C_{24}H_{28}O_{12}$	Glucose+ $C_{18}H_{18}O_7$ Asebogenin.
" "	Asebo-quercitrin	$C_{24}H_{16}O_{11}$	---- ----
Gaultheria Procumbens,L	Gaultherin	$C_{14}H_{18}O_8$	Glucose+ $C_6H_4OHCOOCH_3$ Methyl Salicylate.
Arctostaphylos Uva Ursi	Arbutin	$C_{12}H_{16}O_7$	Glucose+ $C_6H_4(OH)_2$ Hydrochinon.
Pyrola Umbellata	"	$C_6H_4{}^{O.C_6H_{11}O_5}_{OH}$	
" Rotondifolia	"		
" Chlorantha	"		
" Ellpitica	"		
Calluna Vulgaris	"		
Ledum Palustre	"		
Epigea Repens	"		
Gaultheria Procumbens	"		

ERICACEAE. (Continued)

Gaultheria Procumbens	Arbutin.			
Arctostaphylos Glauca	"			
Chimaphila Maculata	"			
Vaccinuum Vitis Idaea	"			
In all the above	Methyl Arbutin $C_6H_3O.C_6H_{11}O_5.OH\ CH_3$		Glucose+	Methyl Hydrochinon
Vaccinuum Myrtillus L.	Heidelbeerfarbstoff $C_{20}H_{24}O_{12}$		Glucose+	$C_{14}H_{44}O_7$
Gaultheria Species	Gaultherin			
	(G. Procumbens, G. fragantissima, G. punctata, G. leschenaulti, G. leucocarpa, G. odorata, G. serpyllifolia.			
Rhododendron Chrysanthemum	Rhododendrin $C_{16}H_{22}O_7$	----		----

MYRSINACEAE.

Embellia Ribes	Embelin	----	----	----
Aegiceras Majus	Saponin.			

PRIMULACEAE.

Anagallis Arvensis	Saponin	(See Rosaceae)
" Coerulea	"	
Cyclamin Coum.	"	
" Europaeum	"	
	Cyclamin ----	Glucose+ Cyclamer-itin.
" Graecum	Saponin	
" Hedereafolium	"	
" Naepolitanum	"	
" Persicum	Cyclamin.	
Primula Acaulis	Saponin.	
" Columnae	"	
" Elatior	"	
" Inflata	"	
" Officinalis	"	
Soldanella Alpina	"	
" Montana	"	
" Pusilla	"	

SAPOTACEAE.

Illipe Mac Clayana	Macleyin	$C_{17}H_{32}O_{10}$	Glucose+	Maclejetin
Prodascia Lactescens	Monesin	----	----	----
" "	Sapotin	(See below)		
Omphalocarpum Procerum	Saponin Sub.	---	----	----
Achras Sapota	Sapotin	$C_{22}H_{52}O_{20}$	Glucose+	$C_{17}H_{32}O_{10}$ Sapotiretin
Chrysophyllum Glycyphlaeum	Glycrrhizin	(See Leguminosae)		
Bassia Latifolia	Saponin. Subs.			
" Longifolia	"			
Chrysophyllum Cainito	"			
"Glycyphlaeum	"			
" Roxburghii	"			
Illipe Latifolia	"			
Mimusops Elengi	"			
" Kanki	"			
Palaquium Beauvisogei	"			
" Borneense	"			
Payena Leeri	"			
" Surigariana var. Junghuhniana	"			
Sideroxylon Baucanum	"			
" Indicum	"			

EBENACEAE.

Diospyros Dendro	Dambonite	$C_8H_{16}O_6$	---- ----
" "	Matezi(?)	$C_{10}H_{20}O_9$	$C_9H_{18}O_9$ + (?) Matezo dambose.

OLEACEAE.

Fraxinus Excelsior	Fraxin	$C_{16}H_{18}O_{10}$	Glucose+ $C_{10}H_8O_5$ Fraxetin.
Phillyrea Latifolia	Phillyrin	$C_{26}H_{32}O_{11}$	Glucose + $C_{20}H_{22}O_6$ Phillygenin.
" Angustifolia	"		
" Medica,L.	"		
Olea Fragans	"		
Forsythia Suspensa	"		
Syringia Vulgaris	Syringin	$C_{17}H_{24}O_9$	Glucose+ $C_{11}H_{14}O_4$ Syringenin.
Ligustrum Vulgare	"		
Chionanthus Virginica	Chionanthin	$C_{22}H_{28}O_{10}$	---- ----
Fraxinus Species	Quercitrin (SeeFagaceae)		

LOGANIACEAE.

Gelsemium Sempervirens	Aesculin	(See Hippocastanaceae)	
Strychnos Nux Vomica	Loganin	$C_{25}H_{34}O_{14}$	Glucose + Loganetin
" "	Coffee Tannic ac.	(See Rubiaceae)	

GENTIANACEAE.

Swertia Chirata	Chiratin	$C_{26}H_{48}O_{15}$	Ophelic acid + Chiratogenin.
Sabbatia Elliotti	Sabbatin	----	---- ----
Menyanthes Trifoliata	Menyanthin	$C_{33}H_{50}O_{14}$	Glucose+ Menyanthol.
Erythraea Centaurium	Erythrocentaurin	----	Glucose+ Erythrocentaurol.
Gentiana Lutea,L.	Gentiopicrin	$C_{20}H_{30}O_{12}$	Glucose+ $C_{14}H_{16}O_5$ Gentiogenin.

APOCYNACEAE.

Allamanda Catharticа	A Glucoside.			
Pottsia Cantoniensis H.& A.	"			
Aganosma Caryophyllata, G.Don.	"			
Beumontia Multiflora T.& B.	"			
Kickxia Arborea, Bl.	"			
Tabernanyhe Iboga, Bail.	"			
Apocynum Cannibinum L.	Apocynein	----	----	----
Carissa Ovata	Carissin	----	----	----
Strophanthus Combe	Strophanthin	$C_{31}H_{48}O_{12}$	Glucose+ Strophanthidin	$C_{26}H_{38}O_7$
" Hispidus	"			
Nerium Odorum	Neriodorein	---	----	----
Nerium Oleander, L.	Neriodorin	---	---	----
" "	Rosaginin	---	----	----
	Neriin	---	---	----
" "				
" "	Oleandrin Nerianthin	---	----	----
Acokanthera Ouabaio	Ouabain	$C_{30}H_{46}O_{12}$	$C_6H_{12}O_5$+ Rhamnose	$C_{24}H_{36}O_8$
Strophanthus Glaber	"			
Plumiera Acutifolia Pior.	Plumierid	----	----	----
" Lancifolia	Agoniadin	----	----	----

APOCYNACEAE. (Continued)

Cerbera Odallam Gaert.	Cerberin	$C_{27}H_{40}O_8$	Glucose+	$C_{19}H_{26}O_4$ Cerberetin.
Thevetia Neriifolia	Thevetin	$C_{54}H_{84}O_{24}$	Glucose+	$C_{48}H_{70}O_{17}$ Theveresin.
" Yccotli	Thevetosin	----	----	----
Urechitis Suberecta	Urechitin	$C_{28}H_{42}O_8$	----	----
	Urechitoxin	$C_{13}H_{20}O_5$	Glucose+	Urechitoxetin.
Vallaris Species	Saponin.	(See Rosaceae)		
Vinca Minor	Vincin Vincein	----	----	----
Adenium Boehmianum	Echujin	----	Dextro rotatory sub.	
Tanghinia Veninifera	Tanghinin	----	----	----
Nerium Timctorium	Indican	(See Crucifereae)		
Acocanthera Abessynica	Acocantherin	$C_{32}H_{50}O_{12}$	----	----

ASCLEPIADACEAE.

Cosmostigma Racemosum, Wight	Gluc. Resin		
Deamia Extensa ,R.Br	Bitter Gluc.		
Dregia Volubilis	Glucoside.		
Tylophora Tenerrima Wight	"		
Wattaka Viridiflora Hssk.	"		
Asclepia Tuberosa	Asclepiadin ----	Glucose + Asclepin.	
" Cornuti Decaisne	"		
" Currasavica	"		
" Incarnata	"		
Morrenia Brachystephana	"		
Conolobus Condurango	Conduranginc $C_{40}H_{74}O_6$	----	----
Gymnema Sylvestre	Gymneminic acid $C_{32}H_{55}O_{12}$	----	----
" Hirsutum	"		
" Montanum	"		
Periploca Graeca	Periplocin $C_{30}H_{48}O_{12}$	Glucose+ $C_{24}H_{34}O_5$ Periplogenin.	
Sarcolobus Narcoticus, Span.	Sarcolobid ---	----	----
Cynanchum Vincetoxicum	Vincetoxin $C_{16}H_{12}O_6$	----	----
Gymnema Species	Amygdalin (See Rosaceae)		

CONVOLVULACEAE.

Ipomoea Purga, Hayne	Convolvulin	$C_{54}H_{96}O_{27}$	$C_5H_{10}O_2$ + $C_{25}H_{46}O_{12}$ (Methyl ethyl acetic ac.) (Purgin acid.) + $C_{45}H_{50}O_{28}$ (Convolvu linic ac.) = Methyl ethyl aceti acid + Oxy pentadeanic acid + Glucose
Jalapa Orizabensis	(Scammonin)		
Convolvulus Scammonia, L.	Jalapin	$C_{34}H_{56}O_{16}$	Glucose + $C_{16}H_{30}O_3$ (Jalapinolic ac)
Ipomoea Panduratus Mayer.	Ipomoein	$C_{78}H_{132}O_{36}$	Glucose + Methyl crotonic acid + Ipomoeolic acid.
Ipomoea Turpethum R.B.	Turpethin	$C_{34}H_{56}O_{16}$ $C_{76}H_{128}O_{36}$	---- ----
Ipomoea Stimulans Hanb.	Tampicin	$C_{34}H_{54}O_{14}$	Glucose + $C_{16}H_{32}O_3$ (Tampicolic ac.)
Pharbitis Nil	Pharbitis glucoside	----	---- ----
Cuscuta Epithymum	Cuscutin	----	Glucose + Cuscuretin.

HYDROPHYLLACEAE.

Eriodictyon
Glutinosum,
Benth. Glucoside.

BORAGINEAE.

Ehretia Tenuifolia Glucoside.

Cordia Bantamensis
Bl. "

Cordia Grandis, Roxb. "

VERBENACEAE.

Lantana Hispida, Kth. Contain Glucosides.
Stachytarpheta Indica " "
Duranta Ellisa, L. " "
" Brachypoda " "
" Plumerii " "
" Rostrata " "
Premna Pubescens, Miq. " "
Premna Sambucina, Wall. " "
Premna Foetida, Rienw. " "
Gmelina Asiatica, L. " "
Verbena Urticifolia, L. " "
Vitex Species " "
Vitex Littoralis Vitexin-
Glucoside $C_{17}H_{16}O_8$ ---- ----
Baldingera Arundinacea Graminin $C_{36}H_{62}O_{31}$ ---- ----

LABIATAE.

Scutellaria Laterifolia	Glucoside.			
Lycopus Virginicus	"			
Teucrium Fructicans	Teucrin	$C_{21}H_{24}O_{11}$ $C_{21}H_{26}O_{11}$	Glucose+ acid.	
Orthosiphon Staminicus,Benth.	Orthosiphonin	----	----	----

SOLANACEAE.

Solanum Dulcamara	Dulcamarin	$C_{22}H_{34}O_{10}$	Glucose+	$C_{16}H_{26}O_6$ Dulcamaretin.
" Mammosum	Saponin	(See Rosaceae)		
" Sodomaeum	"			
Hyocyamus Niger,L.	Hyoscypikrin---		Glucose+ Hyoscyretin.	
Fabiana Imbricata	Fabiana Glycotanniod	$C_{16}H_{20}O_{10}$	Glucose+ Chrysatropic acid.	
" Indica	Crocin	(See Iridaceae)		
Scopolia Japonica Max.	Scopolin	$C_{24}H_{30}O_{15}$	Glucose+	$C_9H_5(CH_3)O_4$ Methyl aesculetin.
Solanum Nigrum	Solanin	$C_{43}H_{71}O_{16}N$	Glucose+Solanidin.	
" "	Saponin.	(SeeRosaceae)		
" Incertum	"			
" villosum	"			
" Verbascifolium	"			
Acnistus Arborescens	"			
Lycopersicum Esculentum	"			

SCROPHULARIACEAE.

Veronica Virginica	Leptandrin----	----	----
Picrorhiza Kurrooa Benth.	Picrorhizin ----	Glucose+ Picrorhizetin.	
Scrophularia Nodosa	Glucoside ----	----	----
Fabiana Indica	Crocin	(See Iridaceae)	
Curanga Amara, Juss.	Curangin	$C_{48}H_{47}O_{20}$	Glucose+ Curangaegenin.
Digitalis Purpurea	Digitalis Gluc. ----	----	----
" "	Digitalin	$C_{35}H_{56}O_{14}$	Glucose+ Digitaligenin+ Digitalose.
" Grandiflora	Saponin.	(See Rosaceae)	
" Lutea	"		
" Micrantha	"		
Digitalum Purum	Digitalin		
Digitalis Purpurea *	Digitonin ----	Glucose+ Digitogenin + Galactose.	
	Digitoxin	$C_{34}H_{54}O_{11}$	$C_6H_{12}O_4 + C_{22}H_{32}O_4$ Digitoxose+ Digitoxigenin.
" Ochrolenca	Saponin		
Gratiola Officinalis	Gratiolin	$C_{20}H_{34}O_7$	Glucose+ Gratioleretin+ Gratioletin.
	Gratiosolin	$C_{46}H_{84}O_9$	Glucose+ Gratiosoleretin + Hydrogratioleretin

* Secondary Glucosides.....Digitophyllin and Digitaline.

SCROPHULARIACEAE. (Continued)

Alectorolophus Hirsutis Reich.	Rhinanthin	$C_{29}H_{52}O_{20}$	----	----
" Major	"			
" Minor	"	$C_{64}H_{56}O_{40}$	Glucose+ $C_{12}H_{10}O_4$ Rhinanthogenin.	
Melampyrum Cristatum	"			
Euphrasia Odontites	"			
Pediculatis Palustris	"			
Antirrhinum Majus	"			
Leptandra Virginica	Saponin.			
Limosella Aquatica	"			
Verbascum Sinuatum	Saponin			

BIGNONACEAE.

Catalpa Bignonoides	Catalpin	----	----	----
Parmentiera Cerifera Seem.	Glucoside.	----	----	----

OROBANCHACEAE.

Epiphegus Virginiana Nutt.	Glucoside	----	----	----

GLOBULARIACEAE.

Globularia Alpyum, L.	Globularin	$C_{15}H_{20}O_8$	Glucose + C_9H_6O Globularetin.	
Globularia Vulgeris	"	"	"	"
Globularia Alpynum	Globularia citrin	$C_{27}H_{30}O_{16}$	$C_6H_{12}O_6$ + $C_6H_{14}O_6$ + Glucose + Rhamnose $C_{15}H_{10}O_7$ Quercitin.	

RUBIACEAE.

Gardemia Grandiflora	Crocin	(See Iridaceae)
Hymenodictyon Species	Aesculin	(See Hippocastanaceae)
" Excelsum	Saponin.	
Eriostoma Albicaulis Boiv.	Glucoside body.	
Exostemma Longiflorum	"	"
Laenberghia Oblongifolia, Karst.	Chinovin	$C_{30}H_{48}O_8$ Chinovose + Chinovic acid.
Cinchona Calisaya	"	

RUBIACEAE. (Continued)

Cinchona Barks	Cinchona tannic ac.	$C_{28}H_{20}O_{14}$	Glucose+ $C_{28}H_{22}O_{14}$ Chinarot.
Danais Fragrans	Danain	$C_{14}H_{14}O_5$	Glucose+ $C_{22}H_{20}O_6$ Danaidin.
Chiococca Anguifuga Mart.	Caincin	$C_{40}H_{64}O_{18}$	Glucose+ $C_{22}H_{34}O_3$ Caincetin.
" Racemosa, Jacq.	"		
" Brachiata	Saponin.		
Randia Dumetorum, Lam.	Randia-Saponin.	$C_{26}H_{50}O_9$	Glucose+ Randia-Sapogenin.
	Randic ac.	$C_{30}H_{52}O_{10}$	---- ----
Cephalanthus Occidentalis	Cephalanthin	$C_{22}H_{34}O_6$	Glucose+ $C_{16}H_{28}O_3$ Cephalanthein
" "	Cephalant-hus Saponin	---	Glucose+ Another Sub
Morinda Citrifolia	Morindin	$C_{28}H_{30}O_{15}$	Glucose+ $C_{15}H_{10}O_5$ Morindon.
" Tinctoria	"		
" Umbellata	"		
Rubia Tinctorium, L.	Ruberythrinic acid	$C_{26}H_{28}O_{14}$	Glucose+ $C_{14}H_8O_4$ Alizarin.
" Munjista	Munjistin	$C_{15}H_8O_6$ (?)	---- ----
" Cordifolia	Purpurin Glucoside	----	Glucose+ Purpurin

RUBIACEAE. (Continued)

Rubia Sikkimensis	Rubiadin Gluc. $C_{21}H_{20}O_9$	Glucose +	$C_{15}H_{10}O_4$ Rubiadin.	
Oldenlandia Umbellata	Ruberythrinic acid (See above)			
Remija Species	β Chinovin "			
Mitschella Repens	Saponin			
Musaenda Frondosa	"			
Randia Dumetorum	"			

CAPRIFOLIACEAE.

Lonicera Xylosteum	Xylostein ----	----	----	
Viburnum Sambucinum	Glucoside.----	----	----	

CURCURBITACEAE.

Ecballium officinale	Prophetin	$C_{23}H_{36}O_7$	Glucose+ $C_{20}H_{30}O_4$, Propheretin.
Cucumis Prophetorum	"		
Ecballium Elaterium A.Rich.	Elaternid ----		Glucose+ $C_{20}H_{28}O_5$ Elaterin.
(" Agreste)	"		
(Momordica Elaterium)	"		
Bryonia Alba	Bryonin	$C_{34}H_{50}O_9$	Glucose+ Formic acid + acetic ac.+ Butyric ac. +$C_{14}H_{20}O_2$ Bryogenin.
" Dioica	"	$C_{62}H_{93}O_{31}$	
Citrullus Colycinthis Schrad.	Colocynthin	$C_{56}H_{42}O_{23}$	Glucose+ Acetic ac.+ $C_{44}H_{32}O_{13}$ Colocynthein.
Echinocystis Californica	Megarrhizin ---		---- ----
(Megarrhiza Californoca)	Megarrhin ----		---- ----
Echinocystis Fabaceae	gaponin.		

COMPOSITAE.

Willughbeia Firma ,Bl.	Glucoside.			
" Javanica,Bl.	"			
Lappa Tomentosa	"			
Taraxacum Officinale	Taraxicin	----	----	----
Xanthium Strumarium	Xanthostrumarin	----	----	----
Arctium Tomentosum Schrank.	"			
Chrysanthemum Tanacetum	Tanacetum-tannic ac.	----	----	----
Eupatorium Laeve,DC.	"			
Scorzonera Hispanica	Coniferin (See Pinaceae)			
Adenostemma Ovatum Mig.	Glucoside.			
Veronoca Nigritiana Ol u Hirn.	Vernonin	$C_{10}H_{24}O_7$	Glucose+	$C_4H_{10}O_3$ Res. Sub.
Eupatorium Perfoliatum	Eupatorin	----	----	----
" Purpureum	Euparin	----	----	----
Helianthus Annuus,L.	Helianthic ac.	$C_{14}H_9O_8$	Glucose+	Violet coloring Matter.
Artemisia Absynthium	Absinthein	$C_{30}H_{40}O_8$	Glucose+	$C_{21}H_{26}O_6$ Resinous Sub.
Achillea Millefolium	Achillein	$C_{26}H_{38}O_{15}N_2$	Glucose+	$C_{11}H_{17}NO_4$ Achilletin.

COMPOSITAE. (Continued)

Achillea Moschata Jacq.	Achillein			
Carlina Gummifera Less	Atractylic acid	$C_{30}H_{54}O_{18}S_2$	Sugar +	Atractyligenin.
(Atractylis Gummifera)	"			
Eurybia Moschata	Eurybin	---	----	----
Cichorium Intybus,L.	Chicorium Glucoside	$C_{32}H_{34}O_{19}$	Glucose+	$C_{20}H_{14}O_9$ Cichoriigenin.
" " *				
Centaurea Cyanus	Cichorigenin.			
Grindelia Robusta	Saponin.			
Grindelia Squarosa	"			
Mutisia Vicieafolia	"			
Inula Helenium,L.	Inula Gluc.	----	----	----
Atractylis Dahlia	Inulin	$C_{36}H_{62}O_{31}$	----	----
Helianthus	Pseudo Inulin	$C_{95}H_{162}O_{81}$	----	----
Helianthus Species	Helianthenin	$C_{72}H_{126}O_{63}$	----	----
" "	Synanthrin Lavulin	$C_{48}H_{82}O_{41}$	----	----

* Secondary Glucoside ..... Cichorigenin.

Glucosides of the animal kingdom.

Wing covering of beetle
Crab shells
Cockchafers
Armor of Crustaceae
Spines and skin of silk worm

Chitin $C_{15}H_{26}N_2O_{11}$ $C_{17}H_{28}N_2O_{11}$ $C_9H_{15}NO_6$ $C_{15}H_{26}N_2O_{10}$ $C_{60}H_{100}N_8O_{38}$

= hydrolysis = $C_2H_4O_2$ + $C_6H_{13}NO_5$
acetic ac. glucosamine

= ammoniak + glucose.

Coccus cacti Order- Hemiptera Carminic acid $C_{17}H_{18}O_{10}$

CLASSIFICATION OF THE PRODUCTS OF HYDROLYSIS OF GLUCOSIDES.

Owing to the large number and great variety of compounds formed on hydrolysis of glucosides, no chemical classification of the glucosides themselves has been attempted nor is there, on account of their ether like character, any rational classification feasible but that which refers them to their products of hydrolysis. In as much as a considerable number of these products have been identified in recent years it was thought best to classify them strictly in accordance with a rational classification of the carbon compounds generally.

In the enumeration of the products of hydrolysis of the glucosides it has been the custom to think of them as belonging to two general classes of substances, namely, to the "Sugars" and the "Other Substances".

It is the classification of the latter that will be taken up first. Although in a strictly logical classification of the carbon compounds the sugars should not be grouped by themselves, their classification here will be taken up separately. This is done not so much for traditional reasons but for the fact that few of the socalled sugars are thus far involved in the study of the glucosides. As a matter of fact viewed broadly, the glucosides with the di and polysaccharides should be regarded merely as condensation products, true or aldol, of the simple or mono saccharides.

The"other compounds", i.e. those which have been chemically investigated, all fall under the following groups: Hydrocarbons, Phenols, alcohols, ketones, aldehydes, oxyacids and sulphur compounds. All of the compounds whether simple or complex may be referred back to the hydrocarbons which underlies them. By referring the compounds to the hydrocarbon s which underlie them peculiar relationships are brought out which could not otherwise be demonstrated. In addition the various glucosides which yield any one compound may be seen at a glance.

Glucosides being regarded as ether like condensation products of alcohols or related compounds one might expect to find no other classes of compounds represented among their products of hydrolysis. A few exceptions nevertheless occur which call for special explanation. In the classification, however, no special cognizance will be taken of the apparent exceptions, but they will be assigned their logical place.

It becomes apparent therefore that the products of hydrolysis of the glucosides are simple or poly atomic alcohols whatever else their nature. Under each formula of saturation of the underlying hydrocarbons, they will be referred to the mono, di,tri, or polyatomic alcohols from which they can readily be derived.

Besides the above classification a further subdivision was made into Sulphur compounds and Inorganic substances.

$C_n H_{2n+2}$ Series.

To the first formula of saturation, there belong a considerable number of compounds . Under the mono hydroxy substitution products occurs the iso propyl alcohol or di methyl carbinol, a secondary alcohol. This is the only instance in this series that an alcohol occurs as a hydrolysis product.

Under the dihydroxy substitution products, which would include ketones and aldehydes, none are found.

The trihydroxy substitution products or ortho acids (which on dehydration yield meta acids) include all the simple acids as high as five carbon atoms, namely, formic, acetic, propionic, butyric and valerianic acids.

Two acids of the tetra hydroxy and one of the hepta hydroxy substitution are found to occur. These latter are all oxy acids of a more or less complex nature.

$C_n H_{2n+2}$ Series.

Monohydroxy substitution products:

$CH_3 > CHOH$ (from Scillain.)
CH_3

Iso propyl alcohol.

Dihydroxy substitution products:

None.

Trihydroxy substitution products:

H-COOH	from	Bryonin.
Formic acid.		
CH_3-COOH	"	Helleborein.
Acetic acid.		Colocynthin.
CH_3-CH_2-COOH	"	Argyrascin.
Propionic acid.		
CH_3-CH_2-CH_2-COOH	"	Bryonin.
Butyric acid.		Scillain.
		Aphrodascin.
CH_3-CH_2-CH_2-CH_2-COOH	"	Atractylic acid.
Valerianic acid.		

$CH_3 - CH_2 - \underset{\underset{CH_3}{|}}{CH} - COOH$ from Convolvulin.

Methyl. ethyl acetic acid.

Tetrahydroxy substitution products:

$C_{15} H_{30} O_2$ from Convolvulin.

Oxy (?) Penta decanic acid.

$CH_3 \diagdown \atop C_2H_5 \diagup CH.CHOH. C_{10} H_{20} COOH$ from Jalapin.

Jalapinolic acid.

$C_{16} H_{32} O_3$ " Ipomoein.

Ipomeolic acid. (Same as above)

Tampicolic acid. (Same as above) " Tampicin.

Pentahydroxy substitution products:

Hexahydroxy substitution products:

Heptahydroxy " "

$CH_2 OH. CHOH. CHOH. COH \begin{matrix} \diagup CH_3 \\ \diagdown COOH \end{matrix}$ from Glycyrrhizic acid.

Para saccharic acid. (?)

C_nH_{2n} Series.

Only two compounds of this series are found as hydrolysis products. Of the monohydroxy products (alcohols) and the dihydroxy compounds (ketones and aldehydes) none are known. Of the trihydroxy substitution products one is known to occur namely, methyl crotonic acid. Tetra, penta , hexa etc. hydroxy compounds are not known.

One sulphur compound, allyl sulphocyanate occurs.

$C_n H_{2n}$ Series.

$CH_3.CH : C(CH_3) COOH$	from	Ipomoein.
Methyl crotonic acid.		
$C_3 H_5 CNS$	"	Sinigrin.
Allyl sulphocyanate.		

C_nH_{2n-2} Series.

This series of hydrocarbons or the acetylene series has no representatives occurring as products of hydrolysis of glucosides. The total absence of compounds in this series seems rather surprising since their presence in connection with other plant constituents is more or less of frequent occurrence, especially in the volatile oils. Possibly the difficulty with which these compounds condense with the sugar molecule may be an explanation. In all probability the condensation of a molecule of sugar with any of these compounds is not capable of being accomplished in the metabolism of the plant, the chemical nature of the compound and other conditions forbidding.

$C_{10}H_{17}OH$? from [illegible]. [illegible] not formula of saturation

$C_n H_{2n-4}$ Series.

$C_{10} H_{16}$ - from Picrocrocin.

" Terpene."*

Of this series only one compound is found, namely, the hydrocarbon" terpene", $C_{10} H_{16}$, resulting on the hydrolysis of picrocrocin.

This is the only instance in which a hydrocarbon occurrs as a product of hydrolysis of any of the glucosides and some doubt arises in regard to the truth of this assertion because of the very great difficulty with which a sugar condenses with a hydrocarbon if indeed such a condensation can be effected at all. The glucoside must necessarily consist of a combination of the two, three molecules of glucose with with two of terpene, since the formula is $C_{38}H_{60}O_{17}$. The hydrolysis is represented as taking place by the addition of one molecule of water, thus: $C_{38}H_{60}O_{17} + H_2O = 3C_6H_{12}O_6 + 2C_{10}H_{16}$.

The molecule of picrocrocin should accordingly be formed by condensing a molecule of water between the two molecules of terpene and the three molecules of sugar. How this could be done and still cause a union of the five molecules is not understood.

* Possibly a very unstable "terpene alcohol" results upon hydrolysis which upon liberation breaks up into "terpene" and "water".

C_nH_{2n-6} Series.

Compounds of the formula of saturation C_nH_{2n-6} which are formed on hydrolysis of glucosides are twelve in number. These may all be classified according to the general system, namely, into mono, di, tri, tetra, etc. hydroxy substitution products of the hydrocarbons.

Under the mono hydroxy substitution products none are known.

Of the di hydroxy substitution products which may be either alcohols, aldehydes or ketones, four compounds are known, namely, Saligenin or hydroxy bemzyl alcohol; Hydrochinon or dihydroxy 1,4, benzene; Methyl hydrochinon or methyl 1,hydroxy4,benzene; and benzaldehyde the dehydration product of benzal glycol.

The tri hydroxy substitution products which may be either alcohols or acids or aldehyde alcohols include three compounds: Phloroglucin or tri hydroxy 1,4,5, benzene; Benzoic acid the dehydration product of tri hydroxy toluene; and Meta hydroxy benzaldehyde.

The tetra hydroxy products are represented by two members as follows: Methyl salicylate or the methyl substitution product of hydroxy benzoic or salicylic acid; and Sinalbin sulphocyanate.

Penta hydroxy compounds- None.

Hexa hydroxy compunds are represented by but a single compound, namely, Gallic acid or tri hydroxy 2,3,4, benzoic acid.

Two other phenols that belong to this series of saturation, namely Piceol and Menyanthol are found as hydrolysis products but their structure is not known.

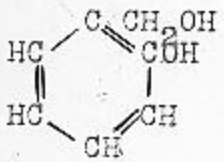
The sulphur compounds have one representative in this series, namely, Sinalbin Sulphocyanide.

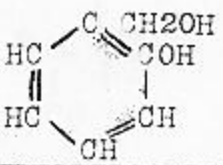
In order to show the relationship between the hydrolysis products and the hydroxy substitution products to which they may be referred, the corresponding hydroxy substitution products are written directly opposite the products of hydrolysis.

Mono hydroxy Substitution Products:

None.

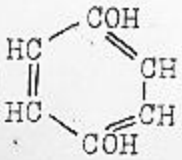
Di hydroxy Substitution Products:

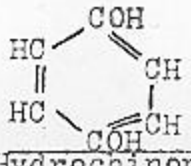




Saligenin from Populin.

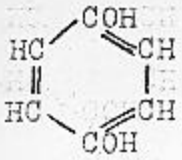
Salicin



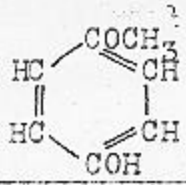


Hydrochinon from Arbutin.

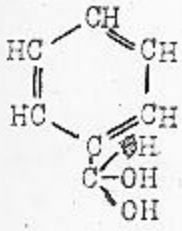
Hydroxy compound.

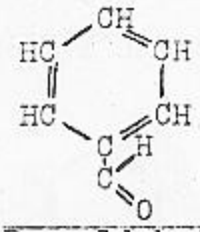


Compound.



Methyl Hydrochinon from Methyl Arbutin.

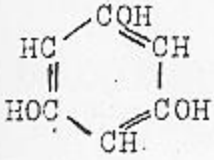




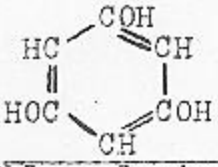
Benzaldehyde from Amygdalin.

Tri Hydroxy Substitution Products:

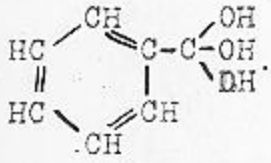
Hydroxy Compound.

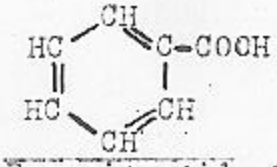


Compound.

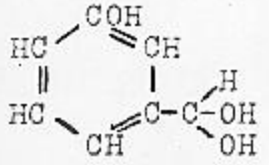


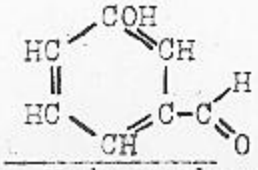
Phloroglucin from Phloretin.





Benzoic acid from Populin.

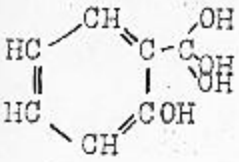


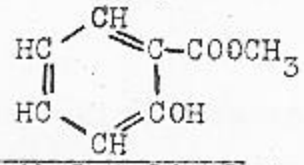


m- Hydroxy benzaldehyde from Salinigrin.

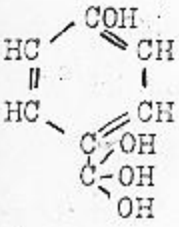
Tetra Hydroxy Substitution Products:

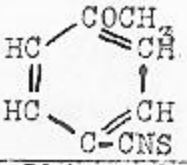
Hydroxy Compound. Compound.





Methyl Salicylate from Gaultheria



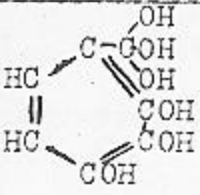


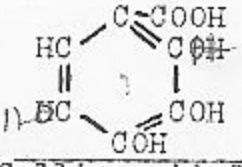
Sinalbin Sulpho cyanide
or
p- Methyoxy Benzyl Sulpho Cyanide
from Sinalbin.

Penta Hydroxy Substitution Products:

None.

Hexa Hydroxy Substitution Products:





Gallic acid from Tannic acids.

Unknown Structure:

$C_8H_8O_2$

Piceol from Picein.
C_8H_8O
Menyanthol " Menyanthin.

C_nH_{2n-8} Series.

Upon the hydrolysis of glucosides there are found a considerable number of compounds belonging to the formula of saturation C_nH_{2n-8}.

A striking peculiarity which presents itself in connection with these compoundsis that all of them may be referred to one hydrocarbon, namely, propene benzene.

In this group occur the first instances of lactones.

The lactones are compounds that are formed by the dehydration of hydroxy acids and as a general rule the dehydration takes place at either the γ or the position from the (COOH) group. In each and every instance the lactones in this series have been formed by the dehydration taking place in connection with the (OH) group in the position to the (COOH) group. On the other hand those compounds which contained the (OH) group in any otherposition than the position did not form lactones. The above relationship may be seen very clearly by referring to the tabulation of the compounds.

The same general method of classification is followed in this sreies as in all the other series,i.e. by classifying into the various hydroxy substitution products.

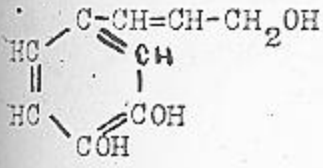
In order to show the relationship of the compounds to the hydroxy substitution products from which they have been derived, the hydroxy substitution products are written

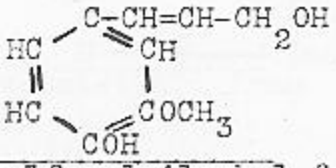
directly their respective compounds.

Mono and Di Hydroxy Substitution Products:

None.

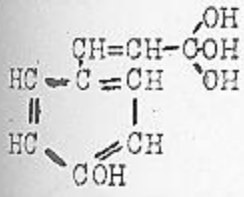
Tri Hydroxy Substitution Products:

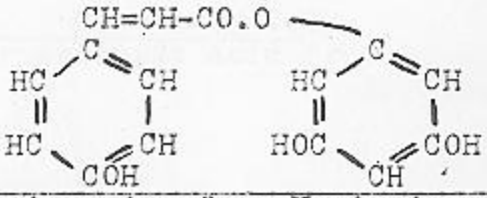




Coniferyl Alcohol from Coniferin

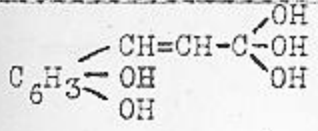
Tetra Hydroxy Substitution Products:

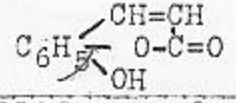




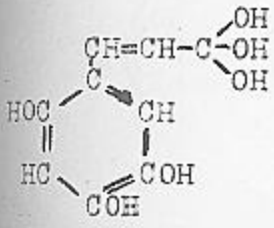
Naringenin from Naringin.

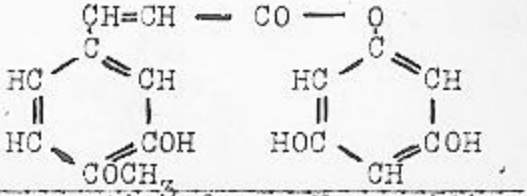
Penta Hydroxy Substitution Products:





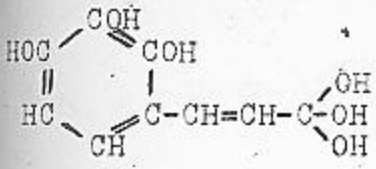
Umbelliferone from Skimmin.

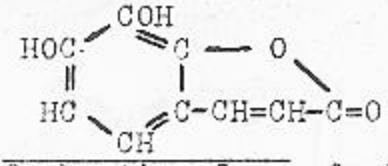




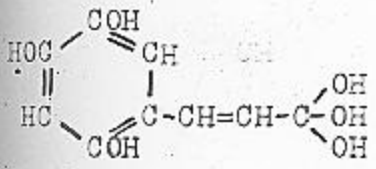
Hesperetin from Hesperidin.

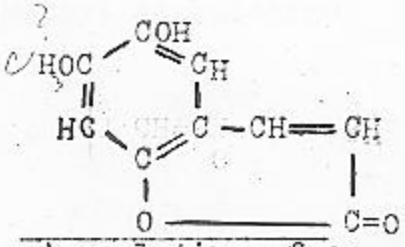
Hexa Hydroxy Substitution Products:



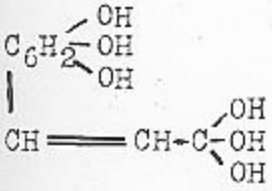


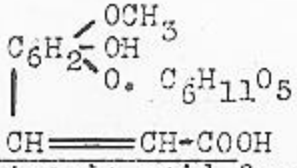
Daphnetin from Daphnin.



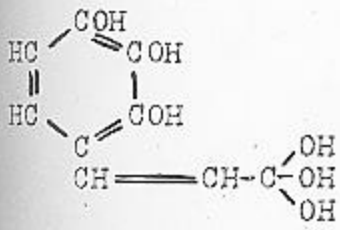


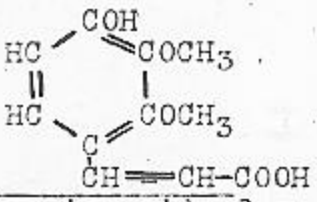
Aesculetin from Aesculin.





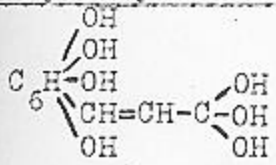
Chrysatropic acid from Fabiana Glycotannoid

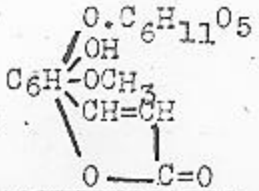




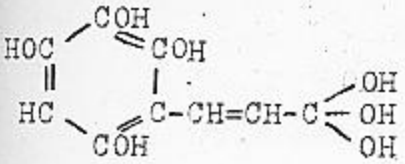
Sinapic acid from Sinalbin.

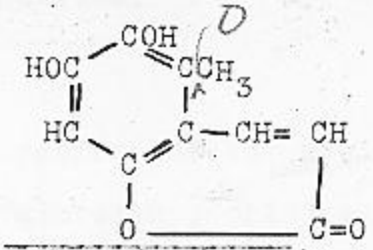
Hepta Hydroxy Substitution Products:





Fraxetin from Fraxin.





Scopoletin from Scopolin.

(Methyl Aesculetin)

7

C_nH_{2n-16} Series.

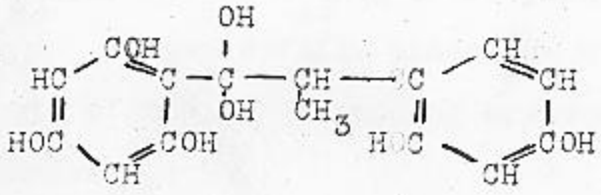
This series of saturation has but a single compound as a representative, namely, Phloretin , obtained by the hydrolysis of Phloridzin.

Phloretin posses a very complex molecule, much more so than any of the previous compounds. The hydrocarbon to which it is directly referrable is di phenyl propane , the phenyl radicals being introduced in positions (1) and (2) in normal propane.

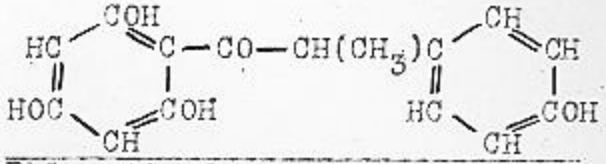
The compound is classified according to the system adopted as the hexa hydroxy substitution product of the hydrocarbon , di phenyl 1,2, propane.

The structural formula is as follows:

Hydroxy Compound:



Compound:



Phloretin from Phloridzin.

C_nH_{2n-14} Series.

Two compounds of a more or less complex nature occur in this series of saturation as hydrolysis products of glucosides.

They are Datiscetin and Irigenin from Datiscin and Iridin respectively, the former is a tricyclic compound two of the cycles being homo cyclic and one hetero cyclic and is directly referrable to the hydrocarbon $C_{13}H_{12}$ or di phenyl methane.

Datiscetin referred to the hydroxy substitution product of the hydrocarbon falls under the octa hydroxy derivatives.

Irigenin is a tetra cyclic compound consisting od t two homo cycles(benzene ring) and two hetero cycles(penta cyclic) with one oxygen atom in the ring and may be referred to the hydricarbon $C_{15}H_{16}$ or di phenyl 1,3, propane.

Irigenin falls under the undeca hyfroxy substitution products of the corresponding hydrocarbon.

Mono Hydroxy:

Di Hydroxy:

Tri Hydroxy:

Tetra Hydroxy: None.

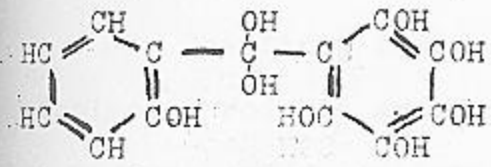
Penta Hydroxy:

Hexa Hydroxy:

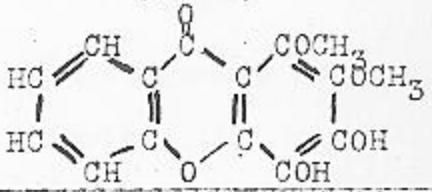
Hepta Hydroxy Substitution Products:

Octa Hydroxy Substitution Products:

Hydroxy Compound:



Compound:

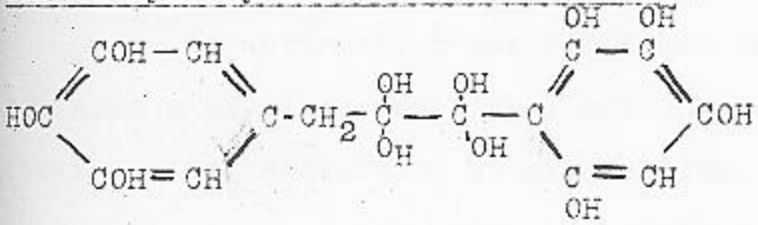


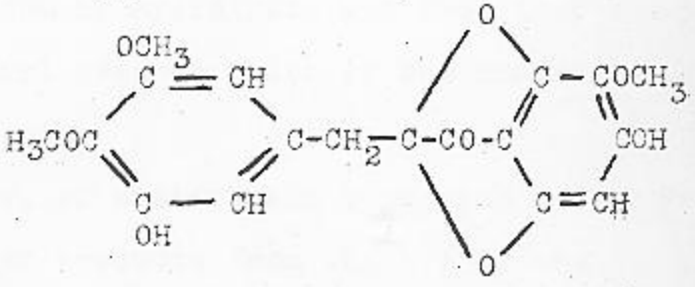
Datiscetin from Datiscin.

Nono Hydroxy Substitution Products:

Deca Hydroxy Substitution Products:

Undeca Hydroxy Substitution Products:





Irigenin from Iridin.

C_nH_{2n-16} Series.

Series C_nH_{2n-16} includes in all ten products of hydrolysis.

The first instances of colored compounds among the hydrolysis products are found in this series, the colors of the various compounds varying from bright yellow to deep red.

Four of the compounds, namely, Quercetin, Fisetin, Rhammetin , and Apigenin all possess a yellow color. These compounds also belong to the same class, i.e, they are directly referrable to the hydrocarbon, di phenyl propene, $C_{15}H_{14}$.

Structurally these compounds consist of three rings two homo cyclic(benzene rings) and one hetero cyclic ring (hexa cyclic) containing an oxygen atom. The compounds may be broken up at the oxygen atom by hydrolysis and then they assum the structure of a di phenyl propene which is the underlying hydrocarbon.

They are, however, of a different type with reference to the hydroxy substitution products from which they are derived.

Apigenin falls under the hepta hydroxy substitution products; Fisetin under the octa hydroxy; and Quercetin and Rhammetin under the nono hydroxy substitution products.

The remaining compounds all belong to a different class being tri cyclic and and the cycles are all homo cyclic (benzene rings) so that the skeleton assumes the form of the hydrocarbon, Anthracene.

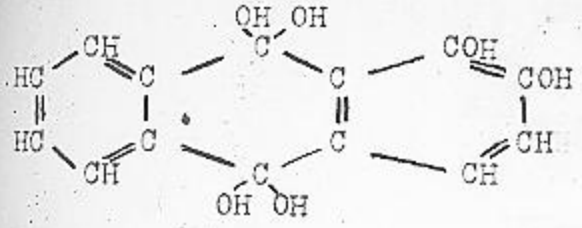
Anthracene, however, is not the underlying hydrocarbon, but di phenylo,o,di methylene or di hydro anthracene, $C_{14}H_{12}$.

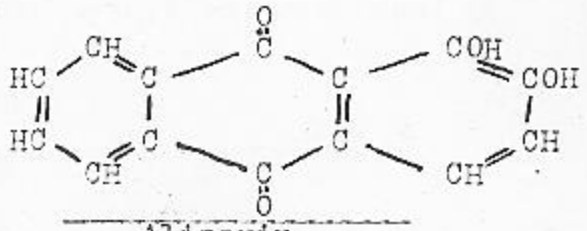
The six compounds which belong to this latter class namely , Emodin,Chrysophanic acid, Morindon and Alizarin , Purpurin and Rubiadin are all oxy anthrachinons; all possessing the same nucleus with the two ketone groups in the same positic n.

The compounds are also colored, varying from yellow to deep red.

The above are also of a different with reference to the hydroxy substitution products to which they may be referred. One compound that of Alizarin comes under the hexa hydroxy substitution products; Chrysophanic acid, Purpurin and Rubiadin all fall in the hepta hydroxy classonly differing in the position of the hydroxy groups; Morindon and Emodin are derived from the octa hydroxy substitution products and are probably identical compounds both being tri oxy methyl anthrachinon.

Mono Hydroxy Substitution Products:			
Di Hydroxy	"	"	
Tri Hydroxy	"	"	
Tetra Hydroxy	"	"	None.
Penta Hydroxy	"	"	
Hexa Hydroxy	"	"	

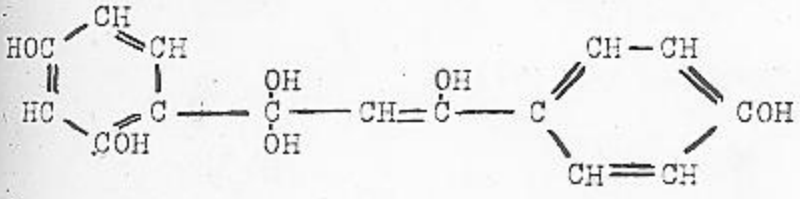


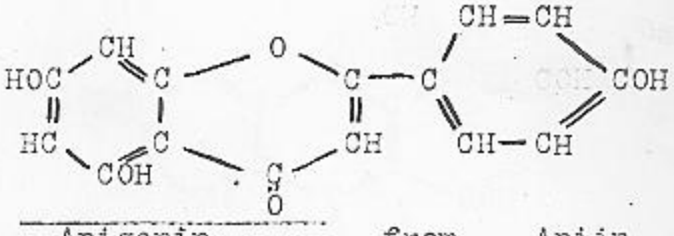


Alizarin
(Di oxy anthrachinone,2)

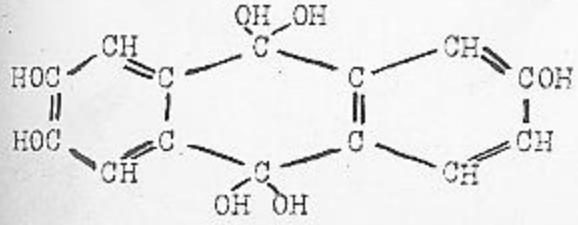
from Ruberythrinic acid.

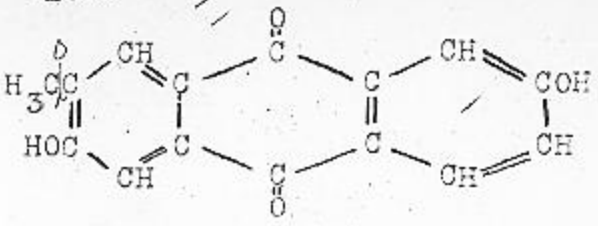
Hepta Hydroxy Substitution Products:





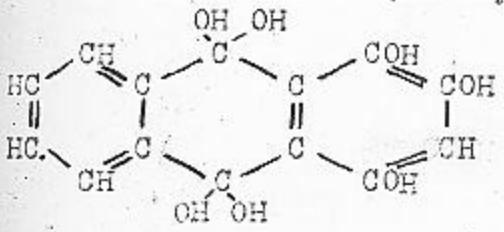
Apigenin from Apiin.

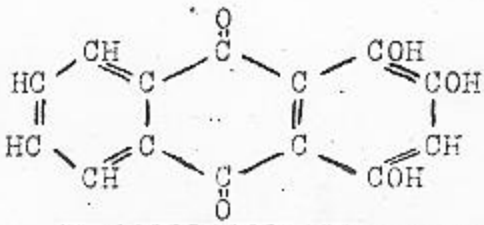




Chrysophanic acid from Chrysophan.

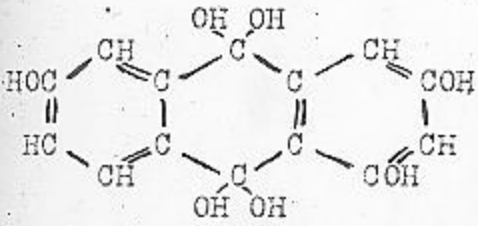
(Di oxy methyl anthrachinon)

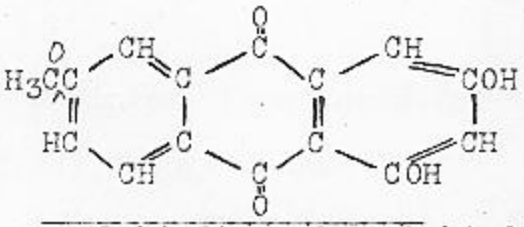




Purpurin from Purpurin Glucoside.

(Tri oxy anthrachinon 1,2,4)

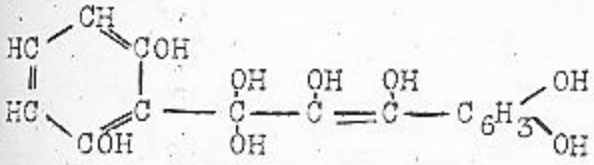


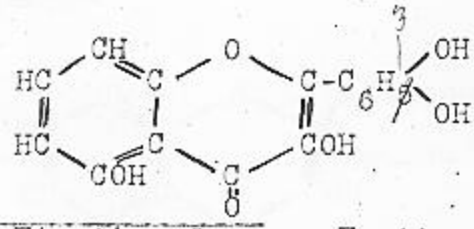


Rubiadin from Rubiadin Glucoside.

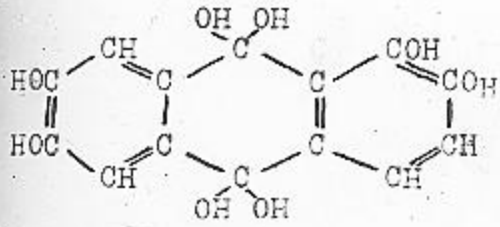
(Di oxy 2,4 methyl anthrachinon)

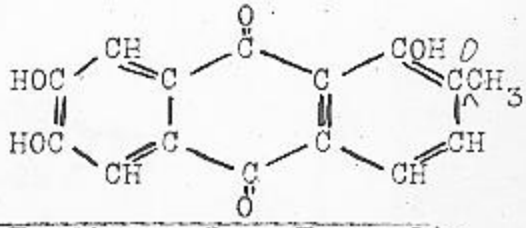
Octa Hydroxy Substitution Products:





Fisetin from Fustin.



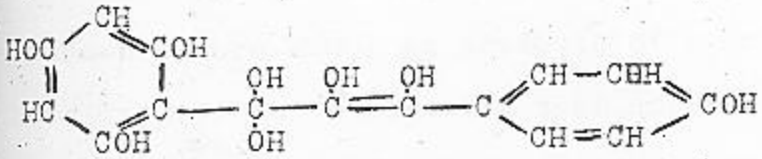


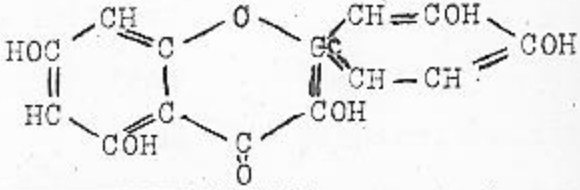
Emodin from Frangulin
Polygonin
Aloe glucoside.
(Tri oxy methyl anthrachinon)

Morindon from Morindin.

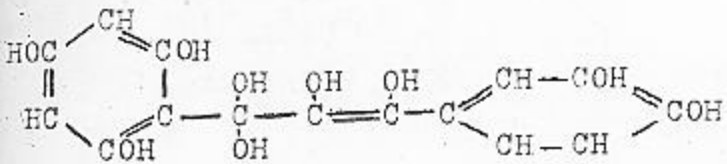
(Tri oxy methyl anthrachinon)

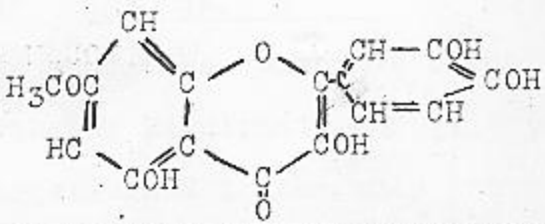
Mono Hydroxy Substitution Products:





Quercetin from Quercitrin.
Osyritin.
Rutin.
Robinin.
Myrticolorin.





Rhamnetin from Xanthorhamnin.

Series Unknown.

Several acids of either an unknown formula or of an unknown nature occur as products of hydrloysis and it is therefore impossible to classify them according to the degree of saturation or to refer them to their hydroxy substitution products. The compounds are as follows:

Villosinic acid	from	Villosin.
Cathartogenic acid	from	Cathartinic acid.
Lokanic acid ($C_{36}H_{36}O_{21}$)	from	Lokain.
Aescinic acid ($C_{24}H_{40}O_{12}$)	from	Argyrascin. Aphrodascin.
Chinovic acid ($C_{32}H_{48}O_6$)	from	Chinovin.
An Acid	from	Teucrin.

Inorganic Acids and other Compounds.

Among the hydrolysis occur two compounds of an inorganic nature, namely, Potassium Bisulphate, $KHSO_4$, from Sinigrin ; this is purely inorganic and is the only instance among the very large number of glucosides where an inorganic saly is formed.

The other compound ,Hydrocyanic acid, HCN, may be considered either organic or inorganic. Hydrocyanic acid occurs on the hydrolysis of three glucosides, namely, Linamarin Amygdalin and Lotusin.

CLASSIFICATION OF THE SUGARS.

Since all glucosides yield a "Sugar" together with some other compound on hydrolysis and since the other compounds have benn classified and discussed in a previous chapter, a classification of the sugars naturally suggests itself.

The general classification of the sugars is into mono,di, tri, and tetra saccharides.

The mono saccharides are further classified into dioses, trioses, tetroses , pentoses, hexoses, heptoses, octoses and nonoses. Each of these are subclassified into aldoses ketoses and their methyl derivatives.

The dioses may be considered as tri hydroxy substitution products of hydrocarbons; the trioses as tetra hydroxy the tetroses as penta hydroxy; the pentoses as hexa hydroxy; the hexoses as hepta hydroxy; the heptoses as octo hydroxy; the octoses as nono hydroxy; and the nonoses as deca hydroxy substitution products of the corresponding normal hydrocarbon with one less carbon atom than there are (OH) groups.

When two hydroxy groups are connected with the same carbon atom the compound is either aldehyde or ketone yielding according as to whether the hydroxy substitution has taken place in a methyl(CH_3) or a methylene (CH_2) group. If it has taken place in connection with a methyl group the elements of water step out and an aldehyde is the result and the compound is called an aldose.

If the substitution takes place in connection with a methylene group a ketone results and the compound is called a ketone. To illustrate the above a hexose may be taken as an example. A hexose is a hepta hydroxy substitution product of the normal hydrocarbon hexane. If a hydroxy group is introduced into each of the methyl and methylene groups a hexatomic alcohol is the result. If further substitution takes place it may be either in connection with an original methyl or a methylene group; if in the former an aldehyde yielding glycol group results which on dehydration yields an aldo hexose, e.g. Glucose . If substituted in a secondary alcohol group a ketone yielding glycol results which yields a keto hexose, e.g. Fructose.

Of the large number of theoretically possible di saccharides but few are of any import as far as the glucosides are concerned: Pharbitose and Pseudo Strophanthobiose are the only two representatives among the hydrolysis products of glucosides.*

Of the tri and tetra saccharides comparatively little is known, only a few compounds being identified. As far as the glucosides are concerned these also are of very little importance. Rhamninose obtained from Xanthorhamnin is the on only instance of a tri saccharide being found as a hydrolysis product of a glucoside.

* See Classification for several other Disaccharides.

MONO SACCHARIDES.

Tri Hydroxy Substitution Products: $(OH)_3$

Dioses - $C_2H_4O_2$.

Tetra Hydroxy Substitution Products: $(OH)_4$

Trioses - $C_3H_6O_3$.

Penta Hydroxy Substitution Products: $(OH)_5$

Tetroses - $C_4H_8O_4$.

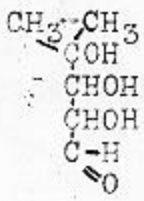
A - Aldo tetroses:

B - Keto tetroses:

C - Methyl tetroses:

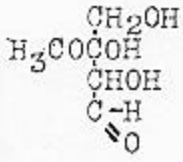
1) Digitoxose. $C_{10}H_{12}O_4$ from Digitoxin.

(Di methyl tetrose)



2) Apiose. $C_5H_{10}O_5$ from Apiin.

(β oxy methyl tetrose)



Hexa Hydroxy Substitution Products: $(OH)_6$

Pentoses - $C_5H_{10}O_5$.

A) Aldopentoses.

B) Keto pentoses.

C) Methyl pentoses:

1) Rhamnose. $C_6H_{14}O_6$.

H_2O

from Quercitrin.
Frangulin.
Datiscin.
Glycyphyllin.
Myricitrin.
Baptisin.
Fisetin.
Uabain.
Acocantherin.
Xanthorhamnin.
Strophantin.
*Hederin.
*Thuja Quercitrin.
*Käpern "
*Hesperidin.
*Naringin.
*Sophorin.
*Pseudo Baptisin.
*Solanin.
*Rutin.
*Robinin.
*Globulariacitrin.

2) Chinovose. $C_6H_{12}O_5$.

from Chinovin.

3) Rhodeose $C_6H_{12}O_5$.
(d Fucose)

from Convolvulin
or
Rhodeoretin.

* Glucosides marked with an asterisk also yield glucose in addition to rhamnose.

4) Methyl Pentoses of an Unknown Nature.

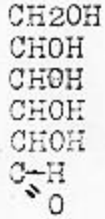
a)	Cyclamose	from	Cyclamin.
b)	Iso Rhodeose	"	Jalapin.
	$C_6H_{12}O_5$		Convolvulin.
			Saponin(many)
			Convallarin.
			Cyclamin.
			Convallamarin.
			Smilacin.
c)	Antiarose	"	Antiarin.
	$C_6H_{12}O_5$		
d)	Digitalose	"	Digitalin.
	$C_7H_{14}O_5$		

Hepta Hydroxy Substitution Products: $(OH)_7$

Hexoses - $C_6H_{12}O_6$.

A) Aldohexoses.

1) Glucose.



from

Abietin.
Absinthin.
Adonin.
Aesculin.
Agonaidin.
Aloe Glucoside.
Amygdalin.
Apiin.
Arbutin.
Asebotin.
Assamin.
Aurantiin.
Carminic acid.
Cascarin.
Chamaelirinin.
Colocynthin.
Coniferin.
Convolvulin.
Crocin.

Curangin.
Cuspidatin.
Danain.
Daphnin.
Digitalin.
Digitonin.
Fraxin.
Gaultherin.
Glycobernstein saure.
Glyco Drupose.
Glyco Lignose.
Glycotropaeolin.
Hedera Glucoside.
Hederin.
Heidelbeer Coloring Matter.
Helicin.
Helicoidin.
Helleborin.
Helleborein.
Hesperidin.
Hydrasculin.
Hydrochinon Gluc.
Hyocypicrin.
Indican.
Irid n.
Isohelicin.
Isohesperidin.
Isophloridzin.
Laurocerascin.
Lotusin.
Lupinid.
Macleyin.
Melanthin.
Melin.
Methyl Aesculin.
Methyl Arbutin.
Murrayin.
Myronic Acid.
Naringin.
Osyritin.
Osyritrin.
Periplocin.
Phillyrin.
Phloridzin.
Picein.
Picrocrocin.
Pinipicrin.
Plumierid.
Polychroit.

Polygonin.
Populin.
Potential Emodin.
Querascitrin.
Quercitrin.
Rebenfarbstoffe Gluc.
Rhodeoretin.
Rubiadin.
Salicin.
Salinigrin.
Saponin.
Sapotoxin.
Sarsaparilla Saponin.
Sinalbin.
Sinigrin.
Sophorin.
Strophanthin.
Syringin.
Tannic acid.
Tetrarin.
Thevetin.
Thevetosin.
Thujin.
Vaccinin.
Vicin.
Viola Gluc.
Viola Quercitrin.
Wistarin.

2) Galactose. from *Digitonin.
Hedera Glucoside.
$C_6H_{12}O_6$ Robinin.
Convallarin.
Convallamarin.
Myrticolorin.
Quercitrin.
*Vicin.
*Sapotoxin.
*Chamalerin.
*Quillajic acid.

3) Chitose. from Chitin.

$C_6H_{12}O_6$

B) Ketohexoses.

1) Fructose. from Inulin.
Pseudo Inulin.
CH_2OH Inulenin.(?)
CHOH Helianthenin.
CHOH Synanthrin. } Same
CHOH Lavulin. }
C=O Lavosin or Cerosin.
CH2OH Phlein.
Irisin.
Graminin.
Triticin.
Scillin or Sinistrin.

C) Hexoses of an Unknown Nature.

1) Blutoglobulin Sugar from Blutoglobulin.

2) Chondro Glucose " Chondrin.

3) Convallamarin Sugar " Convallamarin.

4) Hederose " Herderin.

5) Indiglucin " Indican.

6) Lokaose " Lokaein.

7) Pakoein Sugar " Pakoein .

8) Quillaja Sugar " *Quillajic acid.

9). Saporubrose — from Saporubrin.

10) Scammonose — " Scammonin. Ipomoein.

11) Skimminose — " Skimmin.

12) Solanose — " Solanin.

Octa Hydroxy Substitution Products. $(OH)_8$

Heptoses - $C_7H_{14}O_7$.

Nono Hydroxy Substitution Products. $(OH)_9$

Octoses - $C_8H_{16}O_8$.

Deca Hydroxy Substitutio n Products. $(OH)_{10}$

Nonoses - $C_9H_{18}O_9$.

DISACCHARIDES.

A) Derivatives of Tetroses.

1) Glyco Apiose- $C_{11}H_{20}O_{10}$ - from Apiin.

B) Derivatives of Pentoses.

1) Glyco Cyclamose - $C_{11}H_{20}O_{10}$ - " Cyclamerit n

2) Manno Rhamnose - $C_{12}H_{22}O_{11}$ - (Strophantho Biose)

a) Methyl Strophantho Biose -" Strophantin Pseudo "

$C_{12}H_{21}O_{10}.CH_3$

C) Derivatives of Hexoses.

C) Derivatives of Hexoses.

1) Maltose	fronm	Amygdalin. Lotusin. Gratiolin.

D) Disaccharides of Unknown Nature.

1) Pharbitose $C_{12}H_{22}O_{11}$	from	Pharbitis Glucoside.
2) Pseudo Strophantho biose		Strophanthin.

TRISACCHARIDES.

A) Derivatives of Pentoses.

1) Rhamninose $C_{18}H_{32}O_{14}$	from	Xantho Rhamnin.

TETRA SACCHARIDES.

None.

GLUCOSIDES.	NATURAL ORDER.	REFERENCES.
Abietin Coniferin Laricin	Pinaceae	Jahresb.f. Forster,1861,I,p.263 Jour. f.pr. Chem. 97,p.283. Ber. 1883,p.44; 1885,p.3335. V. p.96. J. p.54.
Absinthin	Compositae	Arch. der Pharm. 230,1892,p.94. Bull. de la Soc. Chim. paris (3) 19,1898, p. 537. V.p.467.
Acocantherin	Apocynaceae	Chem. Centrbl. 1902, 1217.
Achillein	Compositae	Ann. d. Chem. u. Pharm. 58,p. 21 155,p.145. W. Jahrb. f. Pharm. 34,p.300. V. p.470. J. p. 9.
Achornin	Leguminosae	V.p. 239.
Acorin	Araceae	Zeitschr. Chem. 1867,p. 730.
Adonin	Ranunculaceae	See Adinidin.
Adonidin	Ranunculaceae	Arch. Exp. Path. 15,p. 235. Caz. Chim. Ital. 14,p. 493. Pharm. Jour. III p. 145. Ber. 18(1885) p.566; 24(1891) p 2579. Arch. der Pharm. 1896, p. 456. V. p. 177.
Andirin	Leguminosae	Jahresb. 113, XX, 1885.
Aescinic acid	Hyppocastanaceae	Jour. pr. Pract. Chem. 87,p.1. V. p. 285. J. p. 10.
Aesculin	Polygonaceae	

Aesculin	Rosaceae Hyppocastanaceae Euphorbiaceae Thymellaceae Loganaceae Rubiaceae	Jour. f. Pract. Chem. 87,p. 1; 101, P. 415. Wiener Akad. Ber. 13,p. 169; 16,p. 1; 20,p. 351; 23,p. 1; 24,p. 32; 48,p. 236; 55,p.819; 57,p. 693. Ann. der Chem. u. Pharm. 87,p. 186; 88,p. 356; 15,p. 266; 90,p. 63; 161,p. 71; 14,p. 189,205; 107,p. 243; 139,p. 99; 278,p. 349. Ber. 1870, p. 366; 4(1871) p.550; 12 (1879) p. 993; 1871,p. 472; 1880, p. 1950; 15 (1882) p. 2072 14 (1881) p. 475; 10 (1877) p. 2218; 9(1876) p. 1182; 13(1880) p. 1590; 16(1883) p. 2106; 17 (1884) p. 2098; 32 (1899) p. 287 23(1890) p. 3347. Arch. der Pharm. 38,p. 130; 228 (1890) p. 440. Pharm. Jour. Trans. 9,p. 418. V. p. 295. J. p. 10.
Agoniadin	Apocynaceae	Arch. der Pharm. 192 (1870) p. 334. V. p. 378. J. p. 20.
Aloe Glucoside	Lilaceae	V. p. 111, 113.
Amygdalin	Rosaceae Asclepiadaceae	Ann. d. Chem. u. Phys. (2) 44, p. 352. Jour . d Pharm. 22,p. 118. Ann. der Chem. u. Pharm. 22,p.1; 24,p.45; 41,p.153; 66,p.239; 176 p. 89; 137,p. 233; 134,p.337; 65 p.337; 79,p.79; 81,p.241; 83,p. 175; 16,p.225; 31,p.263; 8,p.202 27,p.224; 31,p.211; 119,p.92; 243,p.321; Pharm. Centrbl. 1839,p. 493. Giessler Repert Pharm. (2) 19 p. 289; 17,p. 156; 16,p.327; 15 p.1; 29,p.82; 31,p.241; 25,p. 360. Comp. Rend. 19,p.1174; 69,p. 1237. Chem. Centrbl. 1865,p. 142. Jahresb. Pharm. 1872,p. 378.

Amygdalin	Rosaceae Asclepidiaceae	Ber. 1883,p. 2683; 1884,Refer. p. 171; 12(1879) p.296; 1308 1700; 9(1876)p. 198; 27(1894) p. 2989; 28,p. 1504; 32,1899,p.2699 Erst Verslag v/r orderz. naar de Plantenst. von Neder. Indie, p. 102, Batavia,1890. Pharm. Zeit. f. Russl. 1885,p. 353. V. p. 232. J.p. 21.
Angusturin	Rutaceae	Arch. Pharm. 229,p.591.
Antiarin	Moraceae	Ann. der Chem. u. Phys..(2) 26, p. 357; 28,p.305. Jour. Pract. Chem. 103,p.253. Arch. Pharm. 1896,p. 446. V.p. 161. J. p. 25.
Aphrodascin	Hyppocastanaceae	Jour. Pract. Chem. 87,p.1; 101 p.415; Ann. Chem. Phys. 58,p.101. V.p. 295. J.p.26.
Apiin	Umbelliferae	Repert. d.Pharm. 6,p.6. Ann. Chem. Phys. (3) 9,p.250; Ann. Chem. Pharm. 48,p.349; 74, p.262. Dissert. Wurzburg,1867. Ber. 9(1876) p.1121. Jour. Chem. Soc. 71(1897) p. 805; 72(1898) p.666. V. p.333. J. p. 27.
Apocynein	Apocynaceae	Arch. Exper. Path. 16 ,p.61. V.p.361. J.p.28.
Araliin	Araliaceae	Pharm. Jour. Trans. (3)11,p. 413 1882,p. 305. Ber. 1881,p.1112; 1882,p.2746. V.p.331. J.p.28.
Arbutin	Ericaceae	Ann. Pharm. Chem. 82,p.241; 84, p.3 56; 129,p.203; 278,p.356; 107,p.228; 116,p.292; 177,p.334 Amer. Jour. Pharm. 46,p.319. Traite de Chimie IV p. 265.

Arbutin Hydrochinon Glucoside	Ericaceae	Ber. 14,1841. V.p.342. J.p.29.
Achornin	Leguminosae	V.p.239.
Arganin Sapotin	Sapotaceae	Jour. Pharm. et Chem. V.p.351.
Argyrascin	Hyppocastanaceae	Jour. Pr. Chem. 87p.1;101,p.415. V.p.295. J.p.32.
Asclepiadin	Asclepiadaceae	Amer. Jour. Pharm.1861,p.335; 1869,p.113. V.p.382.
Asebotin	Ericaceae	Phytochem. Notizen uber einige Japanische Pflanzen, abhandlung des Tokio Daigaku Nr. 10,1883. Rec. des Trav. Chem. d. Phys. Bas. 2,p.201. V.p.337.
Assamin	Theaceae	Inaug. Dissert. Utrecht,1891. Nederl. Tydschr. v. Pharm. Chem Toxic. 1891,p.250. V.p.316.
Atractylin	Compositae	(See Atractylic acid)
Atractylic acid (Carlininic ac.)		J. Pract. Chem. 107,p.181. Jour. Pharm. (4) 10,p.325. Compt. Rend. 67,p.964; 76,p.438 V.p.471. J.p.33.
Aucubin	Cornaceae	Compt. Rend. 134,p.1441.
Aurantiamarin	Rutaceae	Compt. Rend. 102,p.1518. V.p.267. J.p.33.
Aurantiin (Naringin) Ischesperidin)	Rutaceae	(See Naringin)
Avernin	Rhamnaceae	Jahresb. Pharmacog. 1866,p.120. Ann. 165,p.229. V.p.310. J.p 33.

Baptin	Leguminosae	V.p.241.
Baptisin	Leguminosae	Chem. Zeit. Oct. 1885. Arch. Pharm. 235,1897,p.303. V.p.243.
Barosmin (Diosmin)	Rutaceae	Gazz. Chim. Ital. 1888,p.18. Repert. Pharm. 3[illegible],p.63. Pharm. Zeitschr. Russl. 1896,p. 353. V.p.263.
Boldoglucoside	Monimiaceae	Compt. Rend. 1884,98,p.1052. V.p.182. J.p.33.
Bryonin	Curcurbitaceae	Neues Jahresb. Pharm. 9,p.65,217 16,p.8. Jour. Pharm. Chem. 1893,p.300. Inaug. Dissert Erlangen,1894. V.p.463. J.p.34.
Caincetin	Rubiaceae	(See Caincin)
Caincin (Caincaic acid)	"	Ann. Chem. Phys. (2) 44,p.296. Pogg. Ann. 21,p.38. Jour. pr. Chem. 51,p.415; 85,p. 284; 102,p.16. V.p.436. J.p.34.
Calycanthin	Calycanthaceae	Zeit. f. Chem. 1868,p.571. V.p.181. J.p.35.
Camellin	Theaceae	Arch. Pharm. (3) 13,p.334. V.p.317. J.p.35.
Carissin (Strophanthin)	Apocynaceae	(See Strophanthin)
Carminic acid	Hymoptera	Ann. Chem. Phys. 8,p.250; (3) 54,p.52[illegible];51,p.194. Ann. 6,p.27; 52,p.375; 55,p.102 J.p.36-40. Ann. 64,p.1; 141,p.329; 163,p. 97; Bull. Soc. Chem. 2,p.414.

Carposid	Caricaceae	Arch . Pharm. 1897. V.p.318.
Cáscarin	Rhamnaceae	Compt. Rend. 115,p.474. V.p.299.
Catalpin	Bignonaceae	Neuere Arzneidrogen p. 91. V.p.428.
Cathartinic ac.	Leguminosae	Zeit. f. Chem. 1866,p.411. Ber. 18(1885) p.283; 1898,p.189 Pharm. Zeit. Russl.1898p.744. Arch. Pharm. (2) ii9,p.42; 190, p.69. Jahresb. Pharmacog. 1866,p.148. V.p.240. J.p.42.
Cedrin	Simarubiaceae	Compt. Rend. 32,p.510. V.p.271. J.p.157.
Cephalanthin	Rubiaceae	Pharm. Zeit. 34,p.384. Arbeit des Pharmak. Inst. d. Univ Dorpat VIII (1892) p.23. V.p.439.
Cerberin	Apocynaceae	Ber der Kais. Akad. d. Wiss. Wein. 16, Jan. 1864. V.p.378. J.p.42.
Cereinic acid	Cactaceae	Eerste Verslag von Onderzoek naar de Pflanzen stoffen vem Nederlandsch Indie Batavia,1890 p.70. Arch. Pharm. 1892,p.10. Tweede Verschlag u.s.w. 1898, p.131.
Chamaelirnin	Melianthaceae	Arbeit des Pharmak. Inst. der Univ. Dorpat, Herausgekommen von Kobert VI 1891,p.16. Amer Jour. Pharm. 50,p.250. V.p.118. J.p.42.
Cerosin	Graminae	(See Lavosin)

Cheiranthin	Cruciferaae	Arch. Exper. Path. u. Pharm. 41 p.302. Jour. Pharm. d Als. Loth. 1896 Nr.7. V.p.211.
Cinchona Tannic acid	Rubiaceae	Ann. Chem. Phys. (2)15,p.337. Jour. Pract. Chem. 56,p.76. V.p.434.
Chicorium Glucoside	Compositae	Arch. Pharm. (3)8,p.327. V.p.476. J.p.52.
Chinovin (Chinova Bitter)	Rubiaceae Rutaceae	Jour. Pharm. (2)7,p.112; (3)37 ,p.255. Ann. Chem. Pharm. 40,p.323; 17, p.164; 45,p.277; 79,p.145; 111, p. 162; 145,p.5. Repert. d. Pharm. 40,p.116; 51,p 193; 75,p.293; 81,p.42,51; 332; 91,p. 314; (3)4,p.206. Zeit. f. Chem. 1867,p.537. Jour. f. Pract. Chem. 102,p.16. Rec. d. Trav. Chim. des Pays bas 2(1883) p.160. Pharm. Jour. Trans.(3) 4,p.181. Ber. 16(1883)p.926; 17(1884)p. 861. V.p.429,489.
Chionanthin	Oleaceae	Pharm. Zeit. Russl. 1893,p.579. Arb. d. Pharm. Inst. Dorpat, Herausg. v. Kobert XIV 1896,p. 113. V.p.358.
Chiratin	Gentianaceae	Arch. Pharm. (2) 139,p.213. Jahresb. Pharm. 1870,p.91. V.p.360. J.p.48.
Chitin	?	Berz. Jahresb. 4,p.247; 24,p. 699; p.700. Compt. Rend. 47,p.1034,227. Arch. f. Path. Anat. 19,p.189. Ann. 98,p.105;115; 54,p.298; 111 p.21. Muller's Arch. Physiol. 1848,p. 461. Arch.f. Naturgesch. 18,p.22.

Chitin	?	Zeits. Phys. Chem. 5,p.384. 4,p. 139; 2,p.213. Ber. 1876,p.1200. Arch. f. Anat. Phys. 1874,p.362 J.p.51.
Chrysophan	Polygonaceae Cruciferеae	Ann. Chem. u. Pharm. 53,p.260; 107(1858)p.324; 284,p.193; 212,p 36; 9(1834) p.304. Arch. f. Pharm. (2)9,p.245; 17 (1839)p.42. Buchner's Repertorium 38,p.337 Jahresb. f. Pract. Pharm.4,p.72 129; Ber. 8(1875),p.1104; 8(1898),p. 183. J. Chem. Pharm. f. Elass-Lothri-ngen 1897,p.183. V.p.165. J.p.52.
Colocynthin	Curcurbitaceae	N. Jahresb. Pharm. 10(1818) ,p. 22; 9,p.16,725; 10,(1818) Repertoir. Pharm. 35,p.368. J.Chim. u.Phys.24,p.3. Pharm. Jour. Trans. 10,p.329. Schweiz Wochenschrift Pharm. 1958,p.216. Arch. Pharm. (3)21,p.201. Inaug. Dissert. Erlangen. V.p.464. J.p.53.
Condurangin	Asclepidiaceae	Arch. Pharm. (3) 23(1885) ,p.229 Arb. des Pharm. Inst. Dorpat, 1890,p.81. Compt. Rend. 100,p.277. V.p.382. J.p.54.
Coniferin (Abietin)	Compositae Pinaceae Chenipodiaceae	(See Abietin)
Convallamarin	Liliaceae	N.Jahresb. f. Pharm. 5,1;10,p. 145. V.p.115. J.p.59.

Convallarin	Liliaceae	(See Convallamarin)
Convincin	Leguminosae	Jour. f.PractChem.24(1881) ,p. 218; (2) 59,p.487. Ber. 29(1896) ,p.894,2106. Chem. Centrbl. 1899,II,p.125.
Convolvulin (Jalapin) (Rhodeoretin)	Convolvulaceae	Jour. Pharm. et Chem. T.III N. Jour. Phar,XXV,p.193. Buchner's Repert. I,9,p.83; I,37,p.203. N.Jahr. Pharm. 32,p.1. Ann. Chem.u.PharM. 51,p.81; 83, p.121; 92,p.125; 95,p.161. Comp. Rend. 35,p.379. Arch. Pharm. 2,64,p.160. Rec. des Trav. Chim. des Pays Bas, 13,p.187. Pharm. Zeit. Russl. 1892,p.726. Chem.Zeit. Repert. 1900,p.71. Inaug. Dissert. Frieburg, 1896. V.p.391. J.p.60.
Coriamyrtin	Coriariaceae	Comp. Rend. 51,p.798; 63,p.476, 480. Chem. Soc. Jour. T. 1901,p.121. V.p.276. J.p.62.
Coronillin	Leguminosae	Zeitschr.Allg. Osterr. Apoth. Ver. Bd. L. 1896,Nr.18,p.20. Ber. Uber die Pharmac. Litter. a. Bander,1899,III,8,169. V.p.253.
Crocin (Polycroit)	Iridaceae Solanaceae Schrophulariaceae Rubiaceae	Jour. Pract.Chem. 56,p.68; 74,p. 1;84,p.10; 101,p.65. Comp. Rend. 50,p.1181. Ber. 17(1814) ,p.2228; 21(1888) p.989. V.p.139. J.p.62.
Curangin	Scrophulariaceae	Mededellingen nit S Lands. Plantentium XVIII.

Curangin	Scrophulariaceae	Nederl. Tydsch. v. Pharm. Ch u. Tox. 11(1899) p.303. V.p. 411.
Cuscutin	Convolvulaceae	Pharm. Zeit. f. Russl. 1895,p. 650. V.p.402.
Cuspidatin	(See Polygonin)	
Cyclamin (Primulin)	Primulaceae	Jour. d. Chem. Med. VI 1830,p. 417. Comp. Rend. XLIV p.723; XLVII, 295,328; LXXXVII p.287. Jour. Pharm. XXXI p.427; XXXIV p.353; N. Rep. Pharm. VI p.326; VIII,p. 56,388. Chem. Centrbl. 1878,p.660. Ann. Chem. Bd. 185,p.214. Arb. des Pharmac. Inst. des Dor 1888,p.100. Repert. d. Pharm. 37,p.36. V.p.348. J.p.64.
Cyclopin	Leguminosae	Pharm Jour And Trans. 11,p.549. V.p.247.
Dambonite	Ebenaceae	Zeitsch. Chem. 1868,p.66. Comp. Rend. 67,p.820.
Danain	Rubiaceae	Comp. Rend. 101 (1885)955,57. V.p.435.
Daphnin	Thymeliaceae	Schweigg. Jour. 35,p.1. Ann. Chem. 84,p. 174. Ann. Chem. u. Pharm. 115,p.1. Jour. Pr. Chem. 90,p.442. Wiener Akad. Ber. 48,p.236. Ber. 1879,p.109; 1884,p.929; 1081 2098; 32(1894) p.287. V.p.322. J.p.67.

Datiscin	Distaceae	Ann. d. Chem. u. Phys. (2) 3,p.2 277; 98,p.166; 277,p.261;278,p. 346. V.p.320. J.p.69.
Dichroin	Saxifragaceae	Neuen Arznei drogen p.117. V.p.212.
Digitalin	Scroph ulariaceae	Jour. Pharm. (3)7,p. p.57; (4) 9,p.255; 16,p.430; 20,p.61. N. Repert. Pharm. 9,p.2. Pharm. Centrbl. 1846,p.140; 1861,p.109; Jahresb. Pharm. 14,p.20; 21,p.9 24,p.86; N.Jahr. Pharm. 8,p.322; 9,p. 302; 10,p.319. Arch. f. Exp. Path. 3,p.16. Arch. Pharm. 230(1892) p.250; 234((1896) p.233,481;235(1897) p.425 Ber. 31(1898) p.2454; 32(1899) p.2196; 2201; 5(1895) p.275; 7(1897)p. 125; 317,470. V.p.413-420. J.p.70.
Digitonin	Scrophulariaceae	(See Digitalin)
Digitophyllin	"	"
Digitaline	"	"
Digitoxin	"	"
Diosmin (Barosmin)	?	V.p.263.
Dulcamarin	Solanaceae	Arch. Pharm. (3) 7,p.289. V.p.407. J.p.77.
Durrhin (Durrhinic ac.)	Gramineae	Chem. News 85,p.301.

Echujin	Apocynaceae	Jahr. 25,1890,p.489.
Elaterinid	Curcurbitaceae	Bull. d. la Soc. Chim. d. Paris 5,1897,p.85. V.p.462.
Embelin	Myrsinaceae	Jahrb. Pharm. 23,1887,p.79.
Ericolin	Ericaceae	Wien. Akad. Ber. 91,p.307; 11,p. 371; 9,p.302; p.298,p.920. Ber. 1883,p.1502. V.p.337. J.p.77.
Erythrocentaurin	Gentianaceae	Arch. Pharm. 1892,p.48. V.p.362.
Erysimin	Cruciferaeae	Chem. Centrbl. 1900,p.1228.
Euparin	Compositae	Arch. Pharm. (2) 99,p.lu.285. V.p.468.
Eupatorin	Compositae	Pharm. Jour. Trans. (3)11,p.192. Amer. Jour. Pharm. 60,p.77. Chem. Centrbl. 1888,p.580. V.p.468. J.p.77.
Eurybin	Compositae	Ber. 1893,p.12. V.p.472.
Evonymin	Celastraceae	Pharm. Centrbl. 1885,26,p.220. Arch. f. Exper. Path. (16) p. 183. V.p.287. J.p.77.
Fabiana-Glyco-tannoid	Solanaceae	Bull. de la Soc. vaudoise de s Scienc. Nat. 30,Nr.115,p.140. Arch. Pharm. 237(1899)p.1. V.p.408.

Fragiarin	Rosaceae	Jahresb. Über die Fort. Chem. 1878,p.981. V.p.231.
Frangulic acid	Rhamnaceae	Pharm. Zeitsch. f. Russl.Heft.3. Jour. Pharm. els Loth. 1897,Nr.8 V.p.307.
Frangulin	Rhamnaceae	Ann. Chem. Pharm. 165,p.229; 76,p.356; 87,p.218; 104,p.77; 117,p.349; C.Rend. 47,p.153. Jahresb. f. Pharmacog. 1877,p. 161. Ber. 9(1876)p.1775. Ber. d. ph. Ges. 1898,p.176. Arch. Pharm. 1888,p.569. Chem. News,61,p.22; 64,p.305. V.p.304. J.p.78.
Fraxin	Hypocastanaceae Oleaceae	Ann. Pharm.Chem. 34,p.354. Pogg. Ann. 97,p.637; 100,p.607; 107,p.327; 107,p.331. Jour. Chem. Soc. 12,p.126. Wien. Akad. Ber. 40,p.37; 48,p. 436. Rep. d.Chim. purel,p.473. Gazz. Chim. Ital. 21IIp.452 . Be r.26(1893)p.596. V.p.352. J.p.79.
Fustin. (Fisetin Glucoside)	Anacardiaceae	Ber. 19(1886)p.1734. Monats. f. Chem. 12(1891)p.177; 14(1893)p.39; 15(1894)p.693; 18(1897)p.700. Jour. Chem. Soc. 1897,p.1194. V.p.277.
Gastrolobin	Leguminosae	Chem. Zeit. 1880,p.189. V.p.246. J.p.80.

Gaultherin	Lauraceae Betulaceae Rosaceae Polygalaceae Pirolaceae Ericaceae Erythroxylaceae	Amer. Jour. Pharm. XV 1844,p. 248. Arch. Pharm. 232(1894)p.437. Jour. Pharm. e. Chem. 1896,Nr.2 Centrbl. f. Bakter. Paros u. Infekt.II Abt. 5(1899)p.425. V.p.340.
Gein	Rosaceae	Pharm.Jour. 1905,p.772.
Gentiopicrin	Gentianaceae	Arch. Pharm. (2)1101,p.27. V.p.363.
Gillein	Rosaceae	Am. Jour. Pharm. 1892,p.513. V.p.213. J.p.80.
Gillenin	Rosaceae	" " "
Globularin (Globularescin) (Globularia Tannic acid)	Globulariaceae	V.Jahr. Pharm. 13,p.281. Ann. Chim. u.Phys. V.26,p.72. V.p.428. J.p.81.
Globularia citrin	Globulariaceae	Arch. Pharm. 241,289.
Glycobernstein saure (Glucoamber acid)	Saxifragaceae	Ber. 19(1886(p.595. Ann. Chem. u.Phys . (3)61p.282. V.p.212. J.p.81.
Glycyphyllin	Liliaceae	Chem. New s 1886,p.54,258. V.p.125.
Glycodrupose	Rosaceae	Ann. 138,p.1. V.p.230. J.p.82.
Glycolignose	Pinaceae	Ann. Sup. V.p.233. Ber. 8,1875,p.476. V.p.106. J.p.82.
Glyconasturtium		Ber. 32,p.2335.
Glycyrrhizin	Leguminosae Sapotaceae	Ann. 197,p.105; 72,p.143; 59,p. 224; 118,p.236. J.p.82.
Glycrrhizic ac	Leguminosae Sapotaceae	Pogg..Ann. 10,p.243.

Glycerrhizic ac	Leguminosae Sapotaceae	Jour. Pr. Chem. 28,p.1. Wien. Akad. Ber. 30,p.731. Dissert. Erlangen. 1877. Jahresb. Pharm. 1875,p.301. Gazz. Chim. Ital. 8,p.454. Ber. 1876,p.1158. Polytechn. J. 209,p.228. Pharm. J. Trans. (3)1,p.749. Viertelj. Pharm. 10,p.259. Jour. d. Pharm. (2)27,p.25. Comp. Rend. 100,p.151. Berz. Jahresb. III Aufl. 6,p.446 Jour. Chim. Med. 21,p.517. Jahresb. Pharm. 14,p.22; 21,p.1; 24,p.4.
Glykotropaeolin	Tropaeolaceae	Arch. Pharm. 237,1899,p.111. Centrbl. f.Bakt.Par.u.Infekt.II Abt.5,1899,p.428. V.p.258.
Gossypetin	Malvaceae	Jour. Chem. Soc.Aug.1899,p.825. V.p.314.
Gratiolin	Scrophulariaceae	Jour.Chim.Med.21,p.517. V.p.426.
Graminin Gratiosolin	Graminae "	C.Rend. 132,423. Ber.21,396. Jahresb.Pharm.10,p.65; 14,p.22; 21,p.1;24,p.4. Gmelin's Handbuch,7,p.1373. J.p.85-86.
Gymnemin Acid	Asclepiadaceae	Chem. News,59,p.159. V.p.386.
Hedera Gluc.	Araliaceae	Pharm.Jour.Trans.Ser.IIIVol.8,p.205. V.p.331. J.p.86.
Hederin (Epheu Gluc)	Araliaceae	Arch.Pharm.IIIR.Bd.6,p.299;1868, p.962. Bull.de la Soc.Chem.TXXXIVp.23.
Heidelbeer Coloring Matter (Whortleberry)	Ericaceae	Arb.D.Kaiserl.Ges.Amt.9,p.478. Forschungsber?uber Lebensmittel u.s.w.1895,p.350. V.p.344.

Helianthemum Glucoside	Cistaceae	Amer. Jour.Pharm.60,p.390. Arch.Pharm.Ref.1888,p.1046. V.p.318.
Helianthenin	Compositae	Comp.Rend. 117,50.
Helianthic Ac.	Compositae	Arch.Pharm.(2)99,p.1,285. V.p.468.
Helicin	Salicaceae	(SeeSalicin)
Helicoidin	Salicaceae	" "
Helleborein	Ranunculaceae	Ann.Chem.Pharm.135,p.55. V.p.178. J.p.87.
Helleborin	Ranunculaceae	Arch.Pharm.235(1897)p.414. Pharm.Jour.Trans. 12,p.174. V.p.180. J.p.88.
Helixin	Araliaceae	Jour. Pharm.Chem. 1891,11,p.20.
Hemmotannic Ac.	Lythraceae	Gehe & Co. Handelsber. Sept. 1896,p.8. V.p.326.
Herniarin (Herniaria Saponin)	Caryophyllaceae	Pharm.Zeit.f.Russl.1894,p.804. Arb.des Pharmak.Inst.Dorpat,XIV 1896,p.111. V.p.168.
Hesperidin	Rutaceae	Comp.Rend.102(1886)p.518. Jour.Pharm.14,p.377. Arch.Pharm.27,p.120;233,p.104. Ber.9(1876)p.26;;p.685,690; 14(1881)p.946; 9(1876)p.250; 20 (1887)p.1186; Bot. Zeit. 1874,p.481. Jour.Chem.Soc.73(1898)p.103. V.p.268 J.p.87.
Homovitexin	Verbenaceae	Jour.Chem.Soc. 1898,p.1019. V.p.405.
Hydrangin	Saxifragaceae	Am.Jour.Pharm.1887,p.123; 19 (1889)Nr.3. V.p.212.
Hydrasculin	Hypocastanaceae	(See Aesculin)

Hydrochinon Glucoside	Ericaceae	(See Arbutin)
Hyoscyamin	Solanaceae	Arch.Pharm. 191,p.215. V.p.407. J.p.91.
Indican (Plant Indican)	Polygonaceae Leguminosae Cruciferae Apocynaceae	Jour.f.Pract.Chem.66,p.321; 73, p.268; 74,p.99,174; p.75, 376. Ber. 12(1879)p.2311; p.1098; 29, 1896,p.2282; 28(1895)p.1632; 11 (1878)p.1228; 12(1879)p.456; 1315; Landw. Versuchsst. 45,p 195. Ann.d.Chem.Pharm. 140,p.29; 44, p.290; 195,p.305. Jour.f.Pract.Chem. 24,p.11. Ber. 13(1880)p.2254; 15(1882) p.50,775; 16(1883)p.2188; 2(1869 p. 680; 3(1870)p.514; 12(1879) p.350; 7(1874)p.1595; 8(1875) p.727; 9(1876)p.299. Jahresb.Chem. 1863,p.557. V.p.199. J.p.93.
Inulin	Compositae	Com.Rend. 116,514. J.Ph.V 28-57.
Inula Gluc.	Compositae	Jahresb. Pharmacog. 1869,p.19. J.p.95.
Ipomoein	Convolvulaceae	Pharm.Zeitsch.f.Russ. 1893,p.1. V.p.398.
Iridin	Iridaceae	Monats.f.Chem.20(1899)p.926. Ber.26(1893)p.2010. Chem.Centrbl.1900,I,p.417. V.p.126.
Irisin	Liliaceae	Ann.234,364.Chem.Zeit. 13,216.
Isohelicin	Salicaceae	(See Helicin)
Ischesperidin (Aurantiin) (Naringin)	Rutaceae	(See Hesperidin)

Isophloridzin (Phloridzin)	Leguminosae	(See Phloridzin)
Jalapin (Scammonin) (Rhodeoretin)	Convolvulaceae	Ann.Chem.u.Pharm.92,p.125; 95,p 161; 116,p.289; 51,p.101; 104,p 63; 109,p.209. Comp. Rend. 35,p.379. Inaug.Dissert.Erlang. Breslau 1883. Zeitsch.des Osterr.Apoth.Ver. 1892,p.391. Pharm.Zeitsch f.Russ.1892,p.674 625. Jour.Pract.Chem. (2)57,p.448. Ref.Chem.Centrbl.1898,II,p.486. Arch. Pharm.1894,p.241; 482; 315 V.p.396.
Kaffee Gerbsaure (Coffee Tannic acid)	Rubiaceae	Ann.d.Chem.Pharm.76,p.338; 142,p 220; Tracte d Chim.Organ.Bd.III,1854 p.886. Arch.Pharm.1893,p.613; 1897,p. 134. Jour. Pharm. 1897,p.59. V.p. 444.
Kakaonin	?	Chem.Centrbl.92,b.78;98,b.218.
Karakin	Corynocarpaceae	Ber. 1873,p.627. V.p.286. J.p.95.
Kastanea Quercitrin (Chesnut Quercitrin)	Hypocastanaceae	Wein. Akad. Ber. Bd. 33(1858) p.565. Inaug.Dissert.Jurjew,1893. V.p.296.
Kellin	Umbellifeaeae	Ber. 12(1879)p.2266.
Kola Quercitrin	Fagaceae	V.p.156.
Kolanin	?	Chem.Centrbl.92,p.602; 98,b. 218. Am.Chem.Jour.19,p.63.

Kolanin	?	Chem.Zeit. 21,R.180.
Laurocerasin	Rosaceae	(See Amygdalin)
Lavulin	Compositae	Comp.Rend.42-803. Ann.158,181.
Leptandrin	Scrophulariaceae	Neuer Arzneidrogen p.355.
Lavosin	Graminae	Chem.Zeit. 21,R 78. C.Rend.87,629.
Leucoglycodrin	Proteaceae	Jahresber. 1895,p.1. V.p.163.
Limettin	Rutaceae	Chem.Zeit. 1890,p.377. Dragendorff,Heilpflanzen 349. V.p.483.
Linamarin	Linaceae	Bull.de l'Acad.Roy.de Belgique 3 Serie XXI Nr.5(1891)p.521. Inaug.Dissert.1890. V.p.260.
Loganin	Loganaceae	Pharm.Jour.Trans. 14,1883,p.1025 V.p.359. J.p.96.
Lokain (Lokanic ac.)	Rhmnaceae	Ber. 5,p.388. Comp.Rend.74,p.994; 18(1885) p.3417. Weimar,1861. Notice die vert de chem,Paris 1858. V.p.311. J.p.96.
Loliin	Graminae	Arch.Pharm. V.p.109.
Lotusin	Leguminosae	Green,Fermentsand Fermentation
Lupinin (Lupinid)	Leguminosae	Ber. 11(1878)p.2200. Ann.Chem.u.Pharm.278,p.352. V.p.248. J.p.99.
Lycopodien Bitter	Lycopodiaceae	Ann.100,p.300. J.p.100.

Macleyin	Sapotaceae	Pharm.Zeit.23,Dec.1896. V.p.317.
Magnolin	Magnoliaceae	Am.Jour.Pharm. 1891,p.438. V.p.181.
Matezit	Ebenaceae	Bull.Soc.Chem. 21,p.219.
Megarrhin	Curcurbitaceae	Am.Jour.Pharm. 55,p.195. V.p.466. J.p.100.
Megarrhizin	Curcurbitaceae	Am.Jour.Pharm. 48,p.451.
Melanthin	Ranunculaceae	Arb.des Pharm. Inst.Dorpat, Heraus.v.Kobert,XIV (1896) Jahresb.Pharmac.1879,p.36. V.p.176. J.p.100.
Melin (Sophorin)		(SeeSophorin)
Menyanthin	Gentianaceae	Arch.Pharm. 1892,p.42; (2)108 p.263; (2)124,p.37. Dissert.Halle 1875. V.p.360. J.p.100.
Methyl Aesculin	Solonaceae	(See Scopolin)
Methyl Arbutin	Ericaceae	Ann.Chem.u.Pharm. 206,p.159; Ber.15,p.1845; 14,p.2097; C.Rend. 89 ,p.335. V.p.343.
Monesin	Sapotaceae	Neuen Arzneidrogen V.p.350.
Monninin	Polygalaceae	Heilpflanzen,Dragendorff p.349. V.p.483.
Morindin	Rubiaceae	Ann.Chem.u.pharm. 71,p.216; Jour.f.Pract.Chem. 97,p.234. Wien.Akad.Ber. 7,p.896. Jour. Chem.Soc. 1887,p.52; 1894 p.851. Chem.News,p.48,57. Ber.8(1898) p.186. V.p.483.

Munjistin	Rubiaceae	Ber.10,p 172,175,790; 11,p.431; Ann.Chem.u.Pharm. 130,p.329. V.p.455.
Murrayin	Rutaceae	Zeitsch.f.Chem. 1869,p.310. V.p.264. J.p.102.
Musennin	Leguminosae	Jour.Pharm.u.Chem. 1889,p.67. V.p.239.
Myricitrin	Myrtaceae	Proc.Chem.Soc. 18-11.
Myronic acid (Sinigrin)	Cruciferеae	(See Sinigrin)
Myrticolorin	Myrtaceae	Jour.Chem.Soc. 73(1898),p.697. V.p.630.
Naringin (Aurantiin) (Isohesperidin)	Rutaceae	Jahresb.f.Pharm. 1866,p.134. Ber.9(1876)p.690; 18(1885)p.1316 20(1887)p.297,1186. Arch.Pharm. (3)14,p.139. Zeitsch.des Ver. f.Rubenz-Ind. 15,p.562. V.p.265. J.p.105.
Nerianthin	Apocynaceae	(See Neriin)
Neriin	Apocynaceae	Arch.f.Exp.Path.16,p.151. V.p.372.
Neriodorein	Apocynaceae	Pharm.Jour.Trans. 3,11,p.873. V.p.370.
Neriodorin	Apocynaceae	" " " "
Oleandrin	Apocynaceae	(See Neriin)
Ononin	Leguminosae	Repert.Pharm. (2)26,p.21,28,618. J.f.Pract.Chem. 65,p.419. Inaug.Dissert.Dorpat 1891. V.p.250. J.p.107.
Onospin	Leguminosae	(See Ononin)
Orthosiphonin	Labiatae	Neure Arzneidr. p.306. V.p.406.
Osyritin	Santalaceae	Am.Jour. Pharm. 1897,Nr.12,p.622

Osyritrin	Santalaceae	Jour. ChemSoc. 1897,p.1132. V.p.478.
Ouabain	Apocynaceae	Comp.Remd. 107(1 888),p.1162; 126(1898)1,p.346; 1208,1280, 1654,1874. V.p.374.
Oxycyclopin	Leguminosae	(See Cyclopin)
Paridin	Liliaceae	N.Jahresb.Pharm.9,p.25. V.p.117. J.p.109.
Parillin (Smilacin)	Liliaceae	Arch.Pharm.Bd. 210(1877)p.535; (3)6,p.331. Schweigg.Jour.44,p.147. Ann.5,p.204; 14,p.76; 11,p.313; 13,p.84; 15,p.74; 17,p.166; 110, p.174. Arb.desPharmac. Inst.Dorpat. XIV 1896,p.14. Neues Jahresb. Pharm. 12,p.155. V.p.118. J.p.109.
Paristyphnin	Liliaceae	Jahresb.f.Pharm. 5,p.284; 13,p. 175,355;6,p.10. V.p.116. J.p.109.
Periplocin	Asclepiadiaceae	Arch.Pharm. 235(1897)p.163. V.p.387.
Pharbitis Glucoside	Convolvulaceae	(See Turpethin)
Phaseolus Gluc.	?	Chem.Zeit.27,p.686.
Phillyrin	Oleaceae	Ann.Pharm.u.Chem. 24,p.242; 92,P 109; 118,p.124. Rec.d.Prav.Chim.des Pays bas 5 (1886)p.127. V.p.354.
Phlein	Graminae	J.p.111. Ber.20,3311.
Phloridzin	Roseceae	Amn. 15,p.75-258; p.178; 30,p.1 192; 227,p.271; 229,p.371; 156, p.1; 172,p.366; 30,p.217; 74,p. 184.

Phloridzin	Rosaceae	Ann. 176,p.116; 119,p.103. Ber. 1881,p.303; 27(1894)p.409-1627; 28(1895)p.1393; 27(1894)p 2686. Repert.Pharm. 66,p.225. Zeitschr.f.Chem. 1868,p.711; 1867,p.267. Jour.f.Pract.Chem. 98,p.205; 16,p.374; 17,p.306; 17,p.298; 67 p.104; 72,p.395. Comp§Rend. 18,p.299. Jour.Chem.Soc.71,p.186. V.p.225. J.p.112.
Picain	Pinaceae	Comp.Rend. 119,p.80. V.p.107.
Picrorhizin	Scrophulariaceae	Neuer Arzneidr. p.355. V.p.411.
Picrocrocin	Iridaceae	(See Crocin) Ber. 1884,p.2228. V.p.140. J.p.116.
Pinipikrin	Pinaceae	Jour. Pract.Chem. 60,p.321. 64,p.16. Diss. Dorp. 1883. Jahresb.uber die fortschr. der Chem. 1883,p.1402. V.p.107. J.p.117.
Pittosporin	Rosaceae	(See Gillein)
Plumierid	Apocynaceae	Ber. uber das Jahr 1895. Mededeelingen nit s Lands Plantentium xIII p.11. Rec.D.Trav. Chim.d.P.Bel de la Belgique 18(1899)p. 334. V.p.376.
Polychroit (Crocin)	Iridaceae	(See Crocin)
Podophyllin(?)	Berberidaceae	Ber.1879,p.683. Arch.Exp.Path. 13,p.29. J.p.117.

Polygalic Acid	Polygalaceae	Arb.des Pharm. Inst. Dorpat Herausg. v. Kobert, I (1888) p.57. V. p.272.
Polygonin (Cuspidatin)	Polygonaceae	Jour. Chem. Soc. 1895, p.1084. V. p.165.
Populin	Salicaceae	Ann. d. Chem. u. Phys. (2)44, p.296. (3)44, p.366; (3)34, p.278. Ber. 12(1879) p.1648. Ann. d. Chem. u. Pharm. 154, p.1; 10[illegible], p.372; Comp. Rend. 34, p.606. Arch. Pharm. 46, p.104; 47, p.250. Vierteljahr f. Pharm. 6, p.47. V. p.141. J. p.117.
Potential Emodin (?)		Pharm. Jour. Trans. III Nr.952, p.242. V. p.241.
Primulin	Primulaceae	(See Cyclamin)
Prophetin	Curcurbitaceae	N. Jahresb. Pharm. 11, p.21, 178. V. p.461.
Pseudobaptisin	Leguminosae	Lippmann, Die Zuckerarten, p.166.
Pseudoinulin	Compositae	Comp. Rend. 116, 514.
Pseudofrangulin	Rhamnaceae	(See Frangulinic acid)
Purginic acid (?)	Convolvulaceae	(See Convolvulin)
Purpurin (Verantin)	Rubiaceae	Jahresb. 1874, p.486. Ann. d. Chem. u. Pharm. 75, p.2c; Ber. 8, p.152; 11, p.184; 10, p.608; 10, p.2172; 24, p.1614; 4, p.979; 10, p.551. Jour. Pract. Chem. (2) 18p.136. V. p.456.
Queraescitrin	Fagaceae	(See Quercitrin)

Quercitrin	Fagaceae Pinaceae Juglandaceae Moraceae Capparidaceae Resedaceae Leguminosae Anacardiaceae Celastraceae Hyppocastanaceae Vitaceae Sterculiaceae Theaceae Umbelliferaceae Ericaceae Oleaceae	Ann.d.Chem.u.Pharm. 156,p.1; 37, p.101; 115,p.54; 90,p.283; 96,p 123; 112,p.96; 127,p.362; 142,p 237; 123,p.145; Supl.Ip.257. Jour.Chem.Med. 6,p.158. Arch.Pharm. 2,p.25. Ber. 12(1879)p. 1178; 17(1884) p. 1680; 15(1882)p. 214; 4(1872) p. 1800. Zeitsch.f.Anal.Chem. 1875,p.233; 1873,p.127; Jour.f.Pract.Chem. 85,p.351; 106 p.1; 77,p.34; 98,p.379; 100,p. 247; 104,p.491; 91,p.238; 94,p. 65. Am.Jour.Pharm. 51,p.118; Jahresb.1883,p.1369; 1901,p.5 . Chem.Zeit. 1901,p.490. Dingl. Polyt. Jour. 162,p.143; 231,p.445,526. Zeitsch.f.Chem. 1862,p.41. Bull.Soc.Che m.Paris (2)33,p.582 II,47,p.668. Monatsheft fur Chem. 6,p.863884; 5,p.72. Jour.f.Pract.Chem. I,101,p.109. Pharm.Jour.Trms. III,p.672. Ber. 26(1893)p. 2302. V.p.153. J.p.118.
Quillajic acid	Rosaceae	Arch.f.Exp.Path. u Pharmakol. Bd. 23(1887)p. 233. Arb.des Pharm.Inst.Dorpat,Kobert VI,1891. V?p.221.
Rabelaisin	Rutaceae	Arch.d.Pharmacodyn. Vo l.II 1896,p.537. Ned.Tydschr. v.Genesk. 1896,II,p 132. V.p.483.
Randia Saponin	Rubiaceae	Arch.Pharm. 232(1894)p. 489. V.p.437.
Randia acid	"	

Rebenfarbstoff-glucoside (Grape Coloring matter Gluc)	Vitaceae	Ber.27(1894)p.487. V.p.313.
Rhamnazin	Rhamnaceae	Jour.Chem.Soc. 1895,1,p.496. Chem.News,71,p.240. V.p.303.
Rhamnin	Rhamnaceae	(See Xanthorhamnin)
Rhianthin	Scrophulariaceae	Arch.Pharm. (2)136,p.64; 142, p.199; Pharm.Jour.Trans. III Nr.953,p. 246. V.p.427. J.p.124.
Rhodendrin		Ch.Soc.Jour. 1901,p.734.
Rhodeoretin (Jalapin) (Convolvulin)	Convolvulaceae	(See Convolvulin)
Robinin	Leguminosae	Ann.d.Chem.u.Pharm. Suppl.I,p. 257. V.p.5 2. J.p.124.
Rosaginin	Apocynaceae	Arch.Pharm. 228(1890)p.352. V.p.371.
Ruberythrinic Acid	Rubiaceae	Ann.d.Chem.u.Pharm. 66,p.174; 71 p.336; 78,p.246; 80,p.321; 82,p 205; 75,p.1; 64,p.351; 86,p.117; Jour.Pract.Chem. 67,p.154; 46,p 1; 55,p.385. Phil.Mag. (3(33,p.282. Wein.Akad. Ber. 6,p.453. Ann.d.Chem.u.Physik. (3)35,p. 373. Ber.3(1870)p.292; 20,p.2247,2241 Jahresb.u.Fortschr. d.Chem. 186 p.930; 1864,p.814; 1867,p.955. Ann.Chem.u.Pharm.Suppl.7,p.296. V.p.449. J.p.25.

Rubiadin Gluc.	Rubiaceae.	Jour.Chem.Soc. 1893,p.999,1137; 1894,1,p.182. V.p.458.
Rutin	Rutaceae Polygonaceae	Pharm.Centrbl. 1842,p.903. Ann.d.Chem.u.Pharm. 82,p.197; 123,p.145; 96,p.123; 53,p.385. Ber. 15(1882)p. 214. Chem.News57(1888)p.60,70,303. Jour.Chem.Soc. 53,p.264. V.p.262. J.p.126.
Sabbatin	Gentianaceae	Neuen Arzneidr. V.p.360.
Salicin	Salicaceae Rosaceae	Ber.12(1879)p.2032; 14(1881)p. 302,317; 15(1882)p.1922; 6(1873) p.890; 8(1875)p.515; 18(1885)p. 1955; 10(1877)p.979; 12(1879)p. 1648; 27(1894)p.2985. Ann.d.Chem.u.Pharm. 154,p.1; 210 p.126; 218,p.185; 56,p.65; 97,p 254; 67,p.360; 88,p.284; 176,p. 89; 119,p.92; 101,p.372; 243,p. 321. Jour.f.Pract.Chem. 85,p.275; 17 p.306; 72,p.250; 56,p.1; 18,p. 365. Ann.d.Chem.u.Phys. (2)43,p.440: (2)44,p.220; 48,p.111; 44,p.296 418; (2)69,p.381; (3)14,p.257; (3)44,p.336; (3)34,p.278; (3)7,p.215. Zeitschr.f.Chem. 1864,p.577; 1869,p.126; 1865,p.516. Ber. 10,1900,p.31. Comp§Rend. 18,p.299; 19,p.602; 20,p.110; 1655; 34,p.606. Jahresb.d.Chem. 1866,p.676; 1854 p.628. Jahresb.Pharm. 1,p.157. Arch.Pharm.(2)14,p.304; 46,p. 104; 47,p.250. Zeitschr.f.Physiol.Chem. I,p. 244,357. Gazz.Chim. Ital. 8,p.60. V.p.143. J.p.128.

Salinigrin	Salicaceae	Jour.Chem.Soc. 1900,73,307 Pharm.Jour.1902. Chem.Centrbl.1903,b803.
Samaderin	Simarubaceae	Tydschrift voor Wetenschappelyke Pharmacie 1858. Nederl. Tydschr.von Pharm.Chem. u.Toxicol. 1890,p.48. V.p.272.
Saponin	Curcurbitaceae Rubiaceae Scrophulariaceae Solanaceae Rosaceae Araceae Liliaceae Amaryllideae Dioscoraceae Orchidaceae Salicaceae Urticaceae Polygonaceae Chenipodiaceae Phytolaccaceae Aizcaceae Caryophyllaceae Ranunculaceae Berberidaceae Menispermaceae Magnoliaceae Pittosporaceae Leguminosae Zygophyllaceae Rutaceae Xanthoxylaceae Simarubaceae Meliaceae Polygalaceae Celastraceae Hyppocastanaceae Sapindaceae Melianthaceae Rhamnaceae Theaceae Passifloraceae Lecythidaceae Araliaceae Myrsinaceae Primulaceae Verbenaceae	Wien.Akad.Ber. 11,p.335(1854); 45,p.7(1862); Liebig Ann.Chem.u.Pharm. Bd. 218(1883)p.231; Kobert's Arbeiten. Frieboes,Bietrage zur Kenntnis der Guajakpraparate,p.38-55. Arch.Pharm.Bd. 210,1877,p.532. Arb.des Pharmac.Inst.DorpatVI p 29,1891,p.45. Kobert,Saponin Substanzen. G.Dragendorff,Analyse von Pflanzenund Pflanzentheilen,1882,p 66. Ann.87,p.186; 88,p.356; 7,p.168; 4,p.383; 218,p.231; 90,p.211; 74 p.351; 37,p.352. Gehlen's Jour.81,p.548. Ann.Chem.u.Phys§ 52,p.294. Jour.d.Pharm. 14,p.247; 19,p.4; (2)22,p.460; 23,p.270; (3)19,p. 348; (3)10,p.339. Comp.Rend. 31,p.652. Chem.Centrbl. 1857,p.604. Arch.Pharm. (3)6,p.432; 481,503; (2)77,p.134; (2)119,p.42; 190,p 69. Jour.Prct.Chem. 85,p.275; 102,p 98. Gazz.Chim.Ital. 13,p.422. Zeitschr.Chem. 1861,p.153. Jahresb.21,p.35,(1886). Tweede Versl. u.s.w. p.80. Monatsheft.Chem. 5,p.94. Jahresb.Pharm.1866,p.148; 20 (1885)p.28; 21(1886)p.59. Arch.Exp.path. 11,p.22. V.p.213. J.p.139.

Saporubrin	Caryophyllaceae Rosaceae	Arb.des Pharmak.Inst.DorpatXIV 1896,p.1. Pharm.Zeit.f.Russl.1896,p.817. V.p.169,213.
Sapotin	Sapotaceae Caryophyllaceae	Am.Chem.Jour. 13,p.572. Tweede Versl. u.s.w. p.48. Ber. 25(1892)p.283; (5)18,p. 298. V.p.351,213.
Sapotoxin	Sapindaceae Rosaceae Caryophyllaceae	Arb.des Pharmak.Inst.Dorpat,I 1888,p.1. V.p.223.
Sarcolobid	Asclepidaceae	Tweede Versl. V.h. onderz. n.d. Plantenst.v.Nederl. Indie Batavia 1898,p.138. V.p.389.
Sarsaparilla Saponin (Smilasaponin)	Liliaceae	(See Smilasaponin)
Sarsasaponin	Liliaceae Rosaceae	V.p.123.
Scammonin	Convolvulaceae	(See Jalapin)
Scillain	Liliaceae	Arch.Exp.Path. 11,p.22. Inaug.Dissert.Erlangen 1894. Am.Jour.Pharm. 1894 ,p.245. V.p.114. J.p.142.
Scillin or Sinistrin	Liliaceae	A.CH.-III 18,60. A.Ch.V 2,291.
Scopolin	Hippocastanaceae Solanaceae	Phytochem.Notizen uber einige Japanische Pflanzen,Tokio, 1883,p.23,45. Arch.Pharm. 236(1888)p.185; 228 (1890)p.139; 228(1890)p.435. V.p.409. J.p.142.

Senegin	Rosaceae Polygalaceae	(See Saponin)
Sicopirin	Leguminosae	Jahresb.Pharm. 1876,p.217. Zeitschr.des Oest. Apoth.Ver. 1868,p.192. V.p.239.
Sinalbin	Crucifereae	Ann.Chem.u.Pharm. 199,p.163; 84,p.11. Ber. 17(1884)p. 230. Arch.Pharm. 235(1897)p.83,570.
Sinigrin	Crucifereae	Jour.d.Pharm.26,p.39. Ann.d.Chem.u.Pharm. 34,p.223; 119,p.376; 125,257; 199,p.163. Zeitschr.f.Pharm. III,p.430,577. V.p.183.
Skimmin (Aesculin) (Scopolin)	Rutaceae	Receul. d.Trav.Chim. des Pays bas 1884,p.204. V.p.264. J.p.145.
Smilacin (Parillin)	Liliaceae	(See Parillin)
Smilasaponin	Liliaceae Rosaceae	Schweigg. Jour. 44,p.147. Anm.5,p.204; 14,p.76; 11,p.313; 13,p.84; 15,p.34; 17,p.166; 110p p.174. Neues Jahresb.Pharm. 12,p.155. Arch.Pharm. (3)6,p.331; 210(188) p.535. Arb.des Pharmac.Inst.Dorpat,XIV 1896,p.14. V.p.121.

Sarsaparilla Glucosides.

Solanin	Solanaceae	Guareschi, Einfuhrung in das Studium der Alkaloiden uebers v. Prof. Kunze Krauze. Jour. Pharm. 6, p. 374; 7, p. 414; 18, p. 165. Jour. Med. Chem. (3) 8, p. 198. Ann. 7, p. 150; 26, p. 232. Monats. f. Chem. 10, p. 583. Ber. 36, p. 3204. V. p. 407. J. p. 145.
Solanein	Solanaceae	Chem. Centrbl. 1902, b, 804.
Sophorin	Leguminosae	Jour. f. Pract. Chem. 85, p. 35. V. p. 241. J. p. 151. Ber. 15 (1882) p. 214. Chem. News, 18, p. 2064. Vergl. unters. des Quercitrins Inaug. Dissert. Jurjew, 1893.
Synanthrin	Compositae	(See Lavulin)
Spirain	Ericaeaae Rosaceae	Centrbl. f. Bakter Paros u. Infect II Abt. 5 (1899) p. 825. V. p. 488.
Strophanthin	Apocynaceae	Comp. Rend. 107 (1888) p. 1162. Jour. Pharm. 19 (1889) p. 245; 26 ((1877) p. 1774 Ber 31 (1898) p. 514; 31 (1898) p. 534 Monats. f. Chem. 19 (1898) p. 385. Chem. Centrbl. 1898 II p. 1029. Pharm. Jour. Trans. 16, p. 109; 18, p. 6, 69; 20, p. 328. J our. Pharm. and Chem. 16, p. 23. V. p. 365.
Syringin	Oleaceae	Arch. Pharm. 13, p. 253; (2) 105, p. 9; 109, p. 18, 216; 113, p. 19; 17, p. 75. Ann. d. Chem. u. Pharm. 49, p. 320; 40, p. 319. V. p. 356. J. p. 151.

Tampicin	Convolvulaceae	Zeitschr.Chem. 1870,p.667. V.p.400.
Tanghinin	Apocynaceae	Jahresb. 1890,p.487.
Tannic acid	Santalaceae Loganaceae Puni caceae Combretaceae	Gehe & Co. Handels Ber. 1896,p.8 Pharm.Zeotschr.f.Russl. 1884,p. 513. Inaug.Dissert.Berlin,1898. V.p.367.
Taraxicin	Compositae	Amer.Jour.Pharm. 1895,Nr.9,p.465 V.p.466.
Telascin	Hyppocastanaceae	Jour.Prct.Chem. 87,p.1. V.p.295. J.p.153.
Tesu Glucoside	Leguminosae	Proc.Chem.Soc. 1896,p.11. Ber. 1896,p.658. V.p.258.
Tetrarin	Polygonaceae	Comp.Rend.136,p.385.
Teucrin	Labiatae	Gazz.Chim.Ital. 8,p.440. V.p.406. J.p.153.
Tiliacin	Tiliaceae	Sitz.Ber. des VIII Congr. Russischer Naturf. und Aerzte in St.Petersburg Chem.Z. 1890,p.216 V.p.314.
Thevetin	Apocynaceae	N.Tydschr. v.d. Pharmac.in Neder land 1884,p.138. Bull.de l'Acad.rogale de Medec. de Belg. 3II 1868,p.745. V.p.380. J.p.154.

Thevetosin	Apocynaceae	Pharm.Jour.Trans. 3,1877,p.854. V.p.380.
Triticin	Graminae	Chem.Centrbl. 80,808. Ann.Ph. III 2,500.
Thujin	Pinaceae	Wiener Akad. ber.29,p.10. Jour.Pract. Chem. 92,p.97. 74,p.8. V.p.105. J.p.154.
Thujigenin (?)	Pinaceae	" " "
Turpethin	Convolvulaceae	Jour.Pract.Chem. 92,p.97. Ann.d.Chem.u.Pharm. 139,p.41. Pharm.Zeitschr.f.Russl. 1892,31, p. 725. V.p.399. J.p.156.
Tutin	Coriariae	Ch.Soc.Jour. 1901,T.p.121.
Uabain	Apocynaceae	Comp.Rend. 126,346,1208. 127,181,1162.
Urechitin	Apocynaceae	Jour.Chem.Soc. 1878,1,p.252. V.p.381.
Urechitoxin	Apocynaceae	" "
Vaccinin (Arbutin)	Ericaceae	(See Arbutin)
Valdivin	Simarubaceae	Comp.Rend. 91,p.886. Comp.Rend. 32,p.510. V.p.271. J.p.157.
Verantin (Purpurin)	Rubiaceae	(See Purpurin)
Vernonin	Compositae	Arch?d.Physiol. 20(1888)p.121. V.p.467.
Vicin	Apocynaceae Leguminosae	(See Convicin)

Vincein	Leguminosae	Frieboes, Die Guaijac Preparate.
Villosin	Rosaceae	Am. Jour. Pharm. 1889. V.p.231.
Vincetoxin	Asclepidaceae	Comp. Rend. 100, p.277. Jour. Phar(2)11, p.305. V.p.390. J.p.157.
Viola Glucoside	Violaceae	Chem. Zeit. 22, R.247.
Viola Quercitrin	Violaceae	Pharm. Zeitschr. f. Russ. 1887, p. 329. Inaug. Dissert. Jurjew 1893. V.p.318. J.p.158.
Vitexin	Verbenaceae	Jour. Chem. Soc. 1898, p.1019. V.p.404.
Waldivin	Simarubaceae	Comp. Rend. 91, p.886.
Wistarin	Leguminosae	Pharm. Jour. Trans. 1886. Arch. f. Pharm. 1887, p.445. V.p.252.
Xanthorhamnin	Rhamnaceae	Ann. d. Chem. u. Pharm. 115, p.54; 196, p.299. V.p.299. J.p.158.
		Jour. Pract. Chem. 26, p.226; 29, p. 481; 105, p.97. Ann. Chem. u. Phys. (4)15, p.118. Repert. d. Phys. (3)4, p.47, 145. Comp. Rend. 63, p.840, 1081; 67, p. 343; 115, p.474; Ber. 12(1879) p.1595. Wiener. Akad. Ber. 92, p.1046. Monats. f. Chem. 9(1888)p.548; 10 (1889)p.561; 12(1891)p.171. Bull. Chim. Soc. Paris (3)21, 1899, p.1065, 1073. Chem. Centrbl. 1899II p.1100, 1900

Xanthostrumarin	Compositae	Pharm.Zeitschr.f.Russ. 20(1881) p. 661: V.p.467. J.p.162.
Xylostein	Caprifoliaceae	Verhandl. d. Schweiz. Apoth. Ver 1845. Enz. Viertelj. Pharm. 5,p 196. V.p.460. J.p.162.
Yucca Saponin	Liliaceae Rosaceae	Pharm.Zeitschr.f.Russ. 1894,p. 803. Arb.Pharmac.Inst .Dorpat,XIV 1896,p.109. V.p.115.

Abbreviations.

V. = Van Rijn - Die Glycoside.
J. = Jacobson - Die Glycoside.
B. = Berichte der deutschen Chem. Gesselschaft.

Chemical Properties.

Glucosides, as has been said have the nature of complex ethers or ethereal salts of sugars or carbohydrates.

The hydrolysis of the glucosides consists in the taking up of a molecule of water with the splitting up of the glucoside molecule with the formation of a glucose or a hexose and one or more simple or complicated compounds.

The sugar formed may not necessarily be glucose but may be some other sugar as rhamnose from frangulin , quercitrin, rutin etc. ; antiarose from antiarin; chinovose from chinovin; crocose from crocin and phlorose from phloridzin etc. Some glucosides form no hexose but peculiar sugar compounds as chinovit $C_6H_{12}O_4$, from chinovin and isodulcite $C_6H_{14}O_6$ from quercitrin.

The compounds formed besides the sugars are very much more complicated and consist of : alcohols, aldehydes, acids, phenols, katones and in some cases even hydrocarbons. As an example of an alcohol we have saligénin from the common glucoside salicin; the aldehyde, benzaldehyde, from amygdalin ; the acid, iriginic acid, from irigenin ; the diatomic phenol, hydrochinon, from arbutin; the diketone, alizarin, from rubery-thrinic acid and finally the terpene, $C_{10}H_{16}$, from picrocrocin.

The greatest number of glucosides contain as

elementary constituents C, H and O, a few also containing N (amygdalin and solanin) and some S as (myronic acid and sinalbin).

Glucosides suffer decomposition chemically by the action of either dilute acids or alkalies or vegetable ferments.

To the glucoside splitting ferments belong, emulsin myrosin, erythrozym, betulase and others. The hydrolyzing ferments accompany as a rule the glucosides in the plants. In bitter almonds is found the glucoside amygdalin accompanied by the ferment emulsin; in black mustard the glucoside sinigrin and the ferment myrosin; in Betula lenta the glucoside gaultherin and the ferment betulase; in the frangula barks the glucoside frangulin and the ferment rhamnase; in madder root the glucoside indican and the ferment erythrozym; in Lotus arabicus the glucoside lotusin is accompanied by the ferment lotase. Each particular ferment is required for the particular glucoside it accompanied, for instance emulsin fails to hydrolyze gaultherin and on the other hand betulase fails to convert amygdalin.

Chemical agents behave very differently towards glucosides. Some are broken up by boiling with water while others require the action of dilute acids and alkalies before they can be broken up into their components. Dilute hydrochloric and sulphuric acids are in general use but it will be noticed that the choice of acids is not always indifferent

as some split up with hydrochloric acid easier than with sulphuric acid. For instance saponin can be hydrolyzed with hydrochloric acid in one minute but with sulphuric acid it requires a week or more.

Conc. Citric and oxalic acids are also used as hydrolysis agents.

The electric current causes the hydrolysis of glucosides in some cases.

In general ferments give purer decomposition products than the acids. In using ferments, however, care should be taken not to heat higher than 70° or 80° at which temperatures they are destroyed.

As has already been stated the hydrolysis of glucosides takes place by the taking up of the elements of water. It can also be said that there are many cases where water is not taken up on hydrolysis and some cases where water is even split off.

Upon this uncertainty some of the previous formulas are wholly in error, as for example the formula of sinigrin is not as it formerly was thought to be . It is not $C_{10}H_{18}NS_2KO_{10}$ but $C_{10}H_{16}NS_2KO_9 + H_2O$. The assumption that the sinigrin molecule breaks up without taking up water is not correct.

The number of molecules of water which can step in by hydrolysis is very different, for example: salicin, one; populin, two; hesperidin, three; helleborin, four; jalapin, five;

senegin, seven; and scammonin, twelve.

The number of molecules of sugar separated can also vary, as high as four or five molecules of glucose are known to have been formed by hydrolysis of certain glucosides.

In a few instances there are also formed on the hydrolysis of glucosides a third or a fourth compound besides the sugar and the " other compound", as: Populin hydrolyzed gives benzoic acid saligenin and glucose; sinigrin yields allyl sulphocyanide, potassium bisulphate and glucose; amygdalin yields hydrocyanic acid, glucose and benzaldehyde.

The question as to how the sugars are bound to the glucosides has caused considerable comment. That the sort of binding may be very different proceeds out of the different ease with which the hydrolysis takes place in the different glucosides.

The sugars are generally present in the glucosides as glucose although they are probably also present in the form of poly saccharides. In either case they may be said to be bound to the other compound by condensation and then on hydrolysis this condensed compound is again broken up into its components. A very good example of this possibility is the case of the glucoside arbutin which on hydrolysis breaks up into hydrochinon and glucose. The condensation of two such compounds as hydrochinon and glucose may not at all be an impossibility and indeed the formula of arbutin is

generally conceded to be a molecule of glucose and a molecule of hydrochinon condensed to form one molecule by the simple elimmnation of the elements of water.

Some glucosides will combine with phenyl hydrazine or hydroxylamine while others will not. The cause of this difference is probably due to the presence or absence of aldehyde groups. In this case the condensation would take place in connection with one of the alcohol groups instead of with the aldehyde group.

In those cases in which the sugars are present as disaccharides there are two steps to the hydrolysis, namely, first with the formation of a secondary glucoside and a molecule of sugar and then this latter or secondary glucoside may be further hydrolyzed into sugar and some other compound.

There are cases known where the hydrolysis of the first sugar compound with the formation of a secondary glucoside took place so easily that the primary glucoside could nb not be found by the best qualitative methods only in traces.

A further proff of the assumption that the glucosides are combinations of the sugars and the other compounds is that we meet in the artificial glucosides combinations of sugars with alcohols, mercaptans, phenols, ketones, oxyacids etc.

Physical Properties and Isolation.

Glucosides are in general non volatile, amorphous substances although some are crystalline. They are soluble in alcohol and water with a neutral reaction but insoluble in ether. All are fairly stable.

Heated with conc. sulphuric acid and gallic acid a deep red color is produced(Pettenkofer's Reaction). Many have the power to reduce Fehling's solution and also ammoniacal silver solution.

In the isolation of glucosides an alcoholic or an aqueous extract of the drug is made and precipitated with the salt of a heavy metal as lead subacetate which precipitates the coloring matter and the gums. The solution is then filtered and the filtrate precipitated with hydrogen sulphide to throw down the excess of lead. This solution is filtered and the solution then evaporated and brought to crystallization.

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Approved Edward Kremers

Prof. of Pharm. & Chemistry