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Synoptic Description of Glycosides and Glycosidic Bonds

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Opinion Article

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DESCRIPTION

Glycosides play a variety of critical roles in living organisms. Many plants store chemicals as inactive glycosides. These can be activated by enzyme hydrolysis which causes the sugar part to be broken off, releasing the chemical. Many of these plant glycosides are used as medicines. Several Heliconius butterfly species can use these plant compounds as a form of chemical defence against predators. Poisons are frequently bound to sugar molecules in both animals and humans as part of their elimination from the body. The article on glycosidic bonds covers a lot of the chemistry of glycosides. The glycone and aglycone portions, for example, can be chemically separated by hydrolysis in the presence of acid and hydrolysed by alkali. There are also numerous enzymes capable of forming and breaking glycosidic bonds. The glycoside hydrolases are the most important cleavage enzymes and glycosyltransferases are the most important synthetic enzymes in nature. Glycosynthases, which are genetically altered enzymes that can form glycosidic bonds in high yield, have been developed.

Glycosidic bonds can be chemically synthesised in a variety of ways. Fischer glycosidation is the reaction of unprotected monosaccharides with alcohols (usually as solvent) in the presence of a strong acid catalyst to produce glycosides. The Koenigs-Knorr response Glycosides are classified according to the glycone, the type of glycosidic bond and the aglycone.

If a glycoside's glycone group is glucose, the molecule is a glucoside; if it is fructose, the molecule is a fructoside; if it is glucuronic acid, the molecule is a glucuronide; and so on. Toxic substances are frequently bonded to glucuronic acid in the body to increase their water solubility; the resulting glucuronides are then excreted. Compounds can also be classified based on the glycone class; for example, biosides are glycosides containing a disaccharide (biose) glycone. Glycosides are classified as glycosides or glycosides depending on whether the glycosidic bond is "below" or "above" the plane of the cyclic sugar molecule. Some enzymes, like amylase can only hydrolyze-linkages while others, like emulsin can only affect-linkages. Between glycone and aglycone four types of linkages exist:

Glycosides are further classified based on the chemical nature of the aglycone. This is the most useful classification for biochemistry and pharmacology. Salicin which is found in the genus Salix is an example of an alcoholic glycoside. Salicin is converted in the body into salicylic acid, which has analgesic, antipyretic and anti-inflammatory properties similar to aspirin. These glycosides contain an anthraquinone-derived aglycone group. They have a diuretic effect. Except for the Liliaceae family which is monocots, they are mostly found in dicot plants. They can be found in senna, rhubarb and Aloe species. Anthron and anthranol are anthraquinone derivatives.

The aglycone in this case is coumarin or a derivative of it. Apterin, for example has been shown to dilate coronary arteries while also blocking calcium channels. Dried leaves yield additional coumarin glycosides. The aglycone in this case contains a cyanohydrin group. Plants that produce cyanogenic glycosides store them in the vacuole but when attacked, they are released and activated by enzymes in the cytoplasm. The sugar portion of the molecule is removed allowing the cyanohydrin structure to collapse and release toxic hydrogen cyanide. Under normal conditions, storing them in inactive forms in the vacuole prevents them from causing damage to the plant. In addition to deterring herbivores, they control germination, bud formation, carbon and nitrogen transport and may act as antioxidants in some plants. Cyanogenic glycoside production is an evolutionarily conserved function.