communicate stereoinformation to the diastereotopic faces of the aglycone units.

If diastereopure products emerge, an added opportunity becomes available. Because of their acetal nature, glycosidic linkages undergo hydrolysis under mildly acidic conditions. There is therefore the prospect of obtaining the free aglycone in a stereopure state. Overall, the sugar unit would fulfil a chiral auxiliary role and an enantioselective synthesis of the aglycone would be achieved. Because of the abundance, low cost and stereochemical variety of sugars, the technology could provide practical routes to enantiopure compounds, materials that are of particular importance to the pharmaceutical industry.

Glycosides derived from D-glucose – the cheapest monosaccharide available – will be the focus of this lecture. Specifically, the ability of the 2,3,4,6-tetra-*O*-acetyl-β-D-glucopyranosyl unit to direct the facial reactivity of dienes in cycloaddition reactions (leading to the synthesis of anthracyclinones, monocarbadisaccharides, 5-arylpyranoses, disaccharides and piperazines) and of vinylogous esters/carbonates in hydrogenation, bromoalkoxylation and epoxidation reactions (leading to the synthesis of chirons bearing tertiary stereogenic centres with functional arms) will be addressed.

Stereoselective Synthesis of C-, S-, and N-glycosides of Therapeutic Potential from Levoglucosenone

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In continuing our research on the synthesis of (1-4)-inked C- and S- disaccharides from levoglucosenone, via Michael addition of nucleophiles, we expanded our study to other nucleophiles with strong reactivity. The advantage of the stereoselective, 1,4-addition is the exclusive formation of an *exo*-adduct *via* formation of the 1,4-C-linkage from the less hindered face of the molecule.

The shielding effect of the 1,6-anhydro bridge is sufficiently strong to direct any kind of nucleophilic attack exclusively from the *exo*-face of the molecule. The most direct way to prove the correct stereochemistry of the 1,4-adduct is to measure the coupling constants $J_{4,3ax}$ and $J_{4,3e}$, which are in the range 5.0–7.0 and 1.0–1.5 Hz respectively. Recently, we have demonstrated a facile procedure for the synthesis of (1-4)-S-thiodisaccharides. From the application of the procedure, we have achieved a facile systematic synthesis of a variety of other C-, S-, and N-disaccharides.

We now wish to present a new methodology of stereoselective synthesis of (1-2)-, S-, O-, linked disaccharides based on Michael addition carbohydrate thiols and other reactive nucleophiles to the new chiral synthon recently synthesized in our laboratory directly from levoglucosenone in three steps.

Stereoselective Synthesis of Optically Active, Highly Functionalized Carbocycles from Aldonolactones

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Highly functionalised cyclopentanes appear as structural elements in a number of biologically interesting compounds such as carbocyclic nucleosides, prostaglandines and glycosidase inhibitors. Our group has recently developed a short and efficient method for the stereo-selectively preparation of bicyclic cyclopentane derivatives from unsaturated bromodeoxy aldonolactones, which because of their bicyclic structure are versatile chiral synthons.

The bicyclic lactone 1(R),5(S)-7(R),8(R)-Dihydroxy-2-oxabicyclo[3.3.0]oct-3-one (**1**) can easily be prepared from commercially available D-*glycero*-D-*gulo*-heptone-1,4-lactone in five steps. Conversion of the diol **1** to the bromohydrin 1(R),5(R)-7(S)-Bromo-8(S)-hydroxy-2-oxabicyclo[3.3.0]oct-3-one (**2**) was regio- and stereospecifically performed in high yield using HBr/HOAc. Using **2** as the key synthon, amino hydroxy substituted bicyclic lactones could be obtained, either by reaction of **2** with ammonia or azide ions, or by conversion of **2** to the epoxide 1(R),5(S)-7(R),8(R)-Epoxy-2-oxabicyclo[3.3.0]oct-3-one (**3**). The latter in turn yielded similar products by regioselective opening with ammonia or with acetonitrile in the presence of BF_3 OEt_2 in a Ritter-type reaction. Furthermore the epoxide **3** could regioselectively be opened to a trans diol. Subsequent reduction of the lacton ring gave the substituted cyclopentanes 5-Deoxycarba-β-L-*xylo*-hexofuranose, 1-Amino-1,5-dideoxycarba-β-L-*xylo*-hexofuranose, tosylate, and 1-Amino-1,5-dideoxycarba-α-L-*xylo*-hexofuranose, tosylate. The compounds can be viewed as sugar mimics, and amino hydroxy cyclopentanes has been found to be glycosidase inhibitors.

Studies on the Structure of Glycoproteins

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Glycoproteins consist of a protein chain to which one or more carbohydrate chains are covalently attached. The carbohydrates are usually connected through N- or O-linkages, but also other types occur like C-glycosyl. In nature glycoproteins have a wide variety of biological functions. These functions may be dependent on the protein part, the carbohydrate part or on both. The most difficult aspect of the role of such compounds is the understanding of the structure-function relationship. This is in particular true for the carbohydrate moieties. The same glycan structure may be found on different glycoproteins, but involved in different types of function. The same glycoprotein can exhibit glycosylation patterns that change with the developmental stage of cell or organism. Our studies on Tamm-Horsfall glycoprotein have shown that an enormous amount of glycan structures occurs, even when the protein is obtained from a single donor. Comparison of the glycans derived from various donors suggests that a donor specificity exists.

The α-subunit of human chorionic gonadotropin contains two N-linked carbohydrate chains occurring at Asn-52 and -78, respectively. The glycan at Asn-52 is essential for hormonal activity. We investigated the structure of the free α-subunit in solution by using NMR spectroscopy. The two N-glycans behave differently as judged from the interaction with the protein backbone. Glycosylation beyond the Asn-linked GlcNAc-residue has no effect on the conformation of the free α-subunit. However, it could be shown that the protein moiety severely restricts the mobility of the inner three residues of the glycan at Asn-78. For the mobility of the two branches in the diantennary structure interesting observations were made.