Catalytic glycosylations in the synthesis of human milk oligosaccharides

Summary

The PhD project will focus on synthesis of human milk oligosaccharides (HMOs). The key steps in the synthesis of HMOs are glycosylations i.e. couplings of glycosyl donors with a specific leaving groups and acceptors with multiple hydroxyl groups. The main goal of the project is design efficient glycosylation methods and implement them in the synthesis of HMOs.

Research field:	Chemistry and biotechnology
Supervisor:	Prof. Dr. Tõnis Kanger
Availability:	This position is available.
Offered by:	School of Science Department of Chemistry and Biotechnology
Application deadline:	Applications are accepted between June 01, 2023 00:00 and June 30, 2023 23:59 (Europe/Zurich)

Description

Human milk oligosaccharides (HMO) are almost unique constituents of breast milk and are not found in appreciable amounts in cow milk. Due to several positive aspects of HMO for the development, health, and wellbeing of infants, the synthesis of HMOs is of importance.

The goal of this PhD project is to examine catalytic glycosylations. Catalyst design and synthesis is an essential part of the project. Considering variety of donors of HMOs and their conformational flexibility the catalyst core must be easily modified and easily adopt a defined three-dimensional structure to stabilize the transition states or intermediates. In recent years, attractive non-covalent interactions have been proposed more frequently as stereocontrolling elements in asymmetric catalysis. Catalysts with greater flexibility are required to maximize the strength of attractive forces. The synthesis of the catalyst core based on oligopeptides will be studied. The use of organocatalysts, including halogen-bond catalysts enabling simultaneous activation of the glycosyl donor and acceptor is one aim of the study. Specifically, the project should examine the influence of the catalyst structure on the selectivity and efficiency of the glycosylation.

The PhD student will gain extensive experience in chemical synthesis and analysis of oligosaccharides.

Responsibilities and (foreseen) tasks

- Design and synthesis of new catalysts for the glycosylation
- Apply new catalysts in the synthesis of HMOs
- To develop orthogonal or chemoselective strategies for the synthesis of HMOs.

Applicants should fulfil the following requirements:

- a master’s degree in chemistry or in a relevant scientific discipline
- experience in organic synthesis
- knowledge in analytical (NMR, MS) and chromatographic methods (HPLC, GC) for characterizing synthesized compounds
- a clear interest in the topic of the position

The following experience is beneficial:

- experience in chemistry of oligosaccharides is desirable but non-essential
- excellent command of English

- strong and demonstrable writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team

We offer:

- 4-year PhD position in the second large university in Estonia
- The chance to do high-level research in well-equipped labs in internationally recognized research group
- Opportunities for conference visits, research stays and networking with other universities and research centers in the fields of organic synthesis.

About the department

This PhD position will be hosted by Department of Chemistry and Biotechnology (DCB). The holder will also have opportunity to work together with colleagues across from and together with all the related departments in Estonia and abroad. DCB unites research groups in chemistry, cell and molecular biology and food technology. It offers training programmes at the BSc, MSc, and PhD levels in Chemistry, Biotechnology and Food Science. The department is developing applied chemical and life sciences technologies through the deeper understanding of the chemical nature of matter and that of biological processes at the molecular, metabolite, pathway, systems (incl. genome) and network levels. There is a particular emphasis on synthetic chemistry, catalysis, molecular technology, cell and chemical biology, sustainable chemistry, materials chemistry, plant biology, and food technology (https://taltech.ee/en/department-chemistry-biotechnology

Additional information

For further information, please contact Prof Tõnis Kanger tonis.kanger@taltech.ee or visit group web-page (https://taltech.ee/en/department-chemistry-biotechnology/catalysis).

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