

Structural engineering of novel protein food additives

Summary

The aim of the project is to establish a protein engineering pipeline for the development of novel food additives. Proteins with sweetener and colorant properties will be employed to develop and showcase the methodologies. These include computational protein design, heterologous protein production in bacteria/yeast, protein purification, biochemical and structural characterisation. This is a collaborative project with CRO TFTAK, where production scaling and application testing takes place. The project is co-funded by the European Union and Ministry of Education and Research via project TEM-TA24 (2024-2028).

Research field:	Chemistry and biotechnology
Supervisors:	Priit Eek Kaia Kukk
Availability:	This position is available.
Offered by:	School of Science Department of Chemistry and Biotechnology
Application deadline:	Applications are accepted between October 01, 2024 00:00 and October 25, 2024 23:59 (Europe/Zurich)

Description

In traditional food systems, additives derived from petrochemicals and animal products are widely used. While these compounds may possess desired techno-functional properties, they come with environmental, ethical, health, and sustainability issues. The larger goal of the project TEM-TA24 is to develop alternative protein-based food additives, such as colorants and sweeteners, that meet the needs of the food industry while addressing the concerns. Rational design, structural biology, and AI methods are utilized for protein development. In collaboration with TFTAK, a precision fermentation platform is developed to produce proteins in microorganisms. Protein samples are tested in model foods. Successful prototypes are commercialized through partnerships with the local food industry and startup accelerators. The gathered experimental data is used to model relationships between protein structure and techno-functional properties, facilitating the design of novel food proteins in the future.

The goal of this PhD project is to establish the protein engineering pipeline necessary to reach the goals of TEM-TA24. The thesis should showcase protein design methodologies employing both rational design and state-of-the-art machine-learning algorithms to improve the usability of various proteins as food additives. Properties such as thermal stability, pH stability, solubility etc. need to be optimized to allow the use of test proteins in food applications. Experimental work will include iterative production of engineered proteins and characterization of their structure and properties of interest.

Responsibilities and (foreseen) tasks

- rational and machine-learning based protein engineering
- experimental protein expression, purification and characterisation
- method development for protein engineering and characterisation
- supervision of BSc and MSc students
- publication of scientific results in journals and at conferences

Applicants should fulfil the following requirements:

- a master's degree in biochemistry, biotechnology or a similar relevant field
- solid knowledge in biochemistry, protein structure and bioinformatics
- a clear interest in protein design
- 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
- capacity and willingness to provide assistance in organizational tasks relevant to the project

The following experience is beneficial:

- basic molecular biology methods (cloning, gel electrophoresis etc.)
- heterologous protein expression in *E. coli* and *K. phaffii*
- protein purification using ÄKTA FPLC system
- protein crystallography
- programming in Python

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position with gross salary starting from 2300 euros
- a very collaborative and friendly work environment at TalTech Department of Chemistry and Biotechnology
- the chance to do high-level research in a field with rapidly growing commercialisation potential
- private sector internship with our partner – TFTA
- opportunities for conference visits, research stays and networking with globally leading universities and research centres

About the department

The department of Chemistry and Biotechnology is a multidisciplinary research centre at TalTech, Tallinn, Estonia, where the expertise in chemistry, molecular biology and food technology combine to open up completely new perspectives in the fields of medicine, industry, agriculture and environment. <https://taltech.ee/en/department-chemistry-biotechnology>

For further information, please contact Dr. Priit Eek (priit.eek@taltech.ee).



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