MUNI
PHARM

Proposal for Dissertation Topic in the Doctoral Program of Pharmacy at the Faculty of Pharmacy, Masaryk University

Study Mode: Full-time
Program Name: Pharmacy
Department*): Department of Chemical Drugs
Head of Department: Assoc. Prof. Ing. Pavel Bobáľ, CSc.
Number of Scholarship Positions: 1

Dissertation Topic

Design and Synthesis of Novel Fluorophores for Biomolecule Detection

Annotation

Fluorescent labeling of biomolecules is a widely used biochemical technique for their detection. The aim of this dissertation is to design, synthesize, and evaluate a new class of stable fluorophores for labeling biomolecules—particularly those that are difficult to detect or exhibit insufficient detection sensitivity. The fluorophores will primarily be applied to the detection of oligosaccharides and glycans. Glycans attached to protein molecules play a crucial role in living systems and are responsible for numerous biological and physiological processes (e.g., regulatory and recognition functions, cell communication, gene expression). Glycosylation is also a key critical quality attribute (CQA) of monoclonal antibody–based biotherapeutics; alterations in glycosylation can affect the efficacy and safety of such drugs.

Preliminary Objectives

1. Develop methodologies for the synthesis of stable fluorophore scaffolds characterized by high molar absorption coefficients and fluorescence quantum yields, including structure design, synthetic routes, and physicochemical characterization.
2. Modify the most promising scaffolds to introduce functional groups enabling covalent attachment to different biomolecular classes.
3. Assess the applicability of synthesized fluorophores for biomolecule detection using standard analytical methods (HPLC and CE coupled with MS and fluorescence detection), in collaboration with the Institute of Analytical Chemistry, Czech Academy of Sciences.

*) Specify the department where the student will primarily conduct the dissertation research.

4. Further structural optimization to improve analytical performance parameters.

Project Links and Funding

- Funding source: Initially from the OP TAK project; preparation of a joint LA GAČR project with Slovenia.
- Industrial collaboration: PhD topic is primarily focused on fundamental research.
- Associated grant: OP TAK CZ.01.01.01/08/23_036/0005327.
- Information on the availability of a position or project funding: OP TAK until March 31, 2026; salary 48,000 CZK/month (0.5 FTE = 24,000 CZK/month); additional funding possible from the Department of Chemical Drugs.

Student Requirements

- Publications: Experience with scientific writing and conference participation is preferred. Before graduation, the student must publish at least two papers in impact factor journals (including at least one as first author).
- Mandatory internship abroad: University of Ljubljana, University of Debrecen.
- Teaching involvement at the faculty: Possible participation in undergraduate teaching (Organic or Pharmaceutical Chemistry).
- Knowledge of English (specify the required proficiency): Required both spoken and written; ability to navigate professional literature in English is essential.

Supervisor's Information

Name: Assoc. Prof. Ing. Pavel Bobáľ, CSc.

- Summary of publications: (Web of Science): 51 total; h-index: 16.
- Recent publications (last 5 years): 12.
- Employment at the faculty: 1.0 FTE.
- Success in grant competitions (ongoing research projects): Co-investigator in OP TAK CZ.01.01.01/08/23_036/0005327, GA22-00236S (GA ČR) – co-investigator, OP PIK CZ.01.1.02/0.0/0.0/21_374/0026925 – co-investigator, Operational Program: Research, development and education – Smart akcelerator - module Assistance: JMK 114022/2021 –

principal investigator; involved in 35 internal projects (IGA MU, IGA VFU, Specific University Research, …)

- International cooperation (including potential student internships): University of Ljubljana, University of Debrecen, TU Vienna, IEE BRC SAS Bratislava, …
- Current PhD students: 3.
- Graduated PhD students: 2 (completed in 2017 and 2025; currently Assistant Professors at the Faculty of Pharmacy, MU).