

Summer Research Internship Project Proposal

Project Topic	Design and synthesis of new fluorophores for the detection of biomolecules		
Name	Pavel Bobál	Field	Chemistry
Department	Department of Chemical Drugs	Keywords	Organic synthesis, fluorescence, bioanalytical chemistry

Description of the Project (overview, expected outcomes, reason for research, proposed outcomes for student(s))

Fluorescent labeling of biomolecules is currently a very widespread biomolecular method of their detection. The project will aim to prepare and evaluate a new group of stable fluorophores for labeling biomolecules, especially those that are difficult to detect, or the sensitivity of their detection is not satisfactory. First, the prepared fluorophores will be applied to the detection of oligosaccharides and glycans. Glycans attached to protein molecules play a dominant role in living systems and are responsible for many biological and physiological processes (regulatory and recognition functions, cellular communications, gene expression, etc.). Altered glycosylation may affect the efficacy or safety of drugs.

Preliminary aims

(1) Development of methodology for the preparation of basic skeletons of a novel group of stable fluorophores characterized by high absorption coefficients and high fluorescence quantum yields (this also includes the design of suitable structures, design of their synthesis, synthesis itself, physicochemical characterization of prepared compounds, etc.). (2) Modification of the most suitable basic skeletons to find appropriate functional groups for their attachment to individual types of biomolecules. (3) Evaluation of their suitability for the detection of biomolecules using standard analytical methods (HPLC and CE with MS and fluorescence detection). (4) Further modification of structures to achieve the best possible parameters in the analytical determination of biomolecules.

The main outputs of the project are scientific publications but there is a chance that new fluorescent labels might be of commercial interest and will be tested in cooperation with the firms. We expect the participation of student(s) on a scientific paper. Students will gain experience from experimental organic synthesis, bioanalytical chemistry, various instrumental analytical methods and photochemistry.

Student Requirements (prerequisites, experience, acceptable fields of study, etc.)

- Student should have completed the subject organic chemistry including laboratory exercises,
- Student should have basic practical experiences in organic synthesis,
- Knowledge of working with instrumental analytical methods (NMR, HPLC, etc.) is beneficial,
- Practical experience with solving small research projects is beneficial,
- Active approach, initiative, and willingness to further professional growth,
- Acceptable fields of study: organic chemistry.

Proposed responsibilities of the student(s)

- Collaboration on the selection of prospective candidates for stable fluorophores,
- Cooperation in synthesis proposal,
- Carrying out organic synthesis experiments,
- Spectral characterizations of prepared compounds (NMR, MS, IR, ...),
- Determination of their general photophysical and chemical properties like absorption (λ_{max}), emission (λ_{max}), Stokes shift, molar absorption coefficient, quantum yield, stability, solubility,

Additional important information (max. number of students, additional staff/faculty involved, etc.)

- We can accept 2 students on this project,
- The student(s) will collaborate with regular PhD student in my group,
- Some experiments will be performed outside the faculty (various instrumental techniques).