Univerzita sv. Cyrila a Metoda v Trnave
Fakulta prírodných vied
Námestie Jozefa Herdu 2
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**ENTRANCE EXAMINATIONS FOR DOCTORAL STUDIES IN ACADEMIC YEAR 2022/2023**

The Faculty of Natural Sciences, University of Cyril and Methodius in Trnava, has launched the Entrance Examinations for the doctoral degree programme in

**Applied Analytical and Bioanalytical Chemistry**

in the full-time and part-time forms of study. The graduates of Slovak or foreign higher education institutions may apply for admission to study providing that they have completed their master's or engineering studies.

**APPLICATION FOR DOCTORAL STUDIES**

The applicants should submit a filled-in application form with annexes at the Student Affairs Office at the Faculty of Natural Sciences of UCM no later than **15 June 2022.**

**The applicants will register for the announced thesis topics.**

**Annexes to attach to the application form:**

- A verified copy of the higher education diploma in the same or related field of study and programme;
- The state leaving examination certificate;
- A short curriculum vitae with the list of published and unpublished works;
- A medical certificate;
- A certificate of the accomplished practice (not obligatory);
- A dissertation thesis proposal.

**Entrance examinations**

The entrance examination has the character of a selection procedure in the form of a dialogue. The applicant presents his or her motives and study skills, the dissertation thesis proposal, and the foreign language knowledge. The admission commission will also take into consideration the applicant's participation in the student research conferences and the results of previous master's or engineering studies. The applicant applying for the part-time study will submit a certificate of employment in the specific field.

**Contact address:** Faculty of Natural Sciences of UCM in Trnava, Nám. J. Herdu 2, 917 01 Trnava, Slovak Republic Tel. No.: 033/55 65 321,033/55 65 316

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doc. Ing. Jozef Sokol, PhD.

Dean of the the Faculty of Natural Sciences
UCM in Trnava

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# Proposal of topic of dissertations for Applied analytical and bioanalytical chemistry study program in academic year 2022/2023

**Topic: Preparation of special magnetoactive compounds and analysis of their properties**
**Supervisor:** prof. RNDr. Ján Titiš, Ph.D.

**Workplace:** Department of Chemistry, Faculty of Natural Sciences, University of Ss. Cyril and Methodius in Trnava

**Annotation:** The thesis will focus on the research of magnetoactive coordination compounds, such as single-molecule magnets. These represent a class of highly sophisticated magnetic materials with the potential for technological transfer to the field of microelectronics. In this sense, new complexes containing transition metals or lanthanides will be prepared, which will be subsequently characterized by methods of elemental, spectral and magnetochemical analysis. The central object of the research will be magnetic anisotropy and slow magnetic relaxation, which will be systematically investigated on the basis of structural, susceptibility (DC, AC) and magnetization data analysis. Experimental data will be supported by calculations base on contemporary methods of quantum chemistry (DFT, MCSCF, MRPT, MRCI). The student gets acquainted with the methodology of synthesis of coordination compounds, analytical techniques used for the characterization of the compounds (H/ N/C/S, AAS, IR, UV-Vis, EPR, XPD, XCD, SQUID and others) and the theoretical basis of molecular magnetism.

**Topic: Use of electroanalytical methods in pharmaceutical analysis**
**Supervisor:** doc. Ing. Andrea Purdešová, Ph.D.

**Workplace:** Department of Chemistry, Faculty of Natural Sciences, University of Ss. Cyril and Methodius in Trnava

**Annotation:** The aim of the research will be devoted to development, validation and application of novel electroanalytical methods for determination of selected analytes in clinical and pharmaceutical samples. Electroanalytical methods may under certain conditions, provide a cheaper alternative to routinely used analytical methods and procedures.

**Topic: Use of chromatographic methods in combination with mass spectrometry in pharmaceutical and clinical analysis**

**Supervisor:** doc. Ing. Andrea Purdešová, Ph.D.

**Workplace:** Department of Chemistry, Faculty of Natural Sciences, University of Ss. Cyril and Methodius in Trnava

**Annotation:** The aim of the research will be devoted to development, validation and application of analytical methods based on chromatographic separation and mass spectrometric detection. Pharmaceutical and clinical samples will be the object of analysis.

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Matrix effects, which are the significant problem for chromatographic analysis of complex real samples, will be solved.

**Topic: Preparation and application of radioactively labelled biomolecules and complexes utilized in imaging methods**
**Supervisor:** doc. RNDr. Miroslav Horník, Ph.D.

**Workplace:** Department of Chemistry, Faculty of Natural Sciences, University of Ss. Cyril and Methodius in Trnava

**Annotation:** The dissertation thesis is aimed to prepare new radioindicators – biomolecules and organic complexes radiolabelled using mainly positron emitters (e.g. $^{58}$Co, $^{64}$Cu, $^{65}$Zn, $^{68}$Ga or $^{89}$Zr), which would be utilized in imaging methods, such as positron emission tomography (PET), or in the imaging and analysis of the movement of substances in living organisms, respectively In the experimental part of the work, the vitamin-type biomolecules or substances showing complex-forming properties labelled with radioisotopes of metals will be prepared in the first step. The pre-cultivation of selected plant species will be carried out under hydroponic laboratory conditions and experiments realization involving the PET analysis or another imaging method (e.g. autoradiography or use of detectors based on TIMEPIX, MEDIPIX chips) will be designed. The experiments and analyzes performed in this way will be aimed to evaluate the application of prepared substances labelled with radioactive emitters as radioindicators in the visualization and quantification of their distribution in selected plant species as studied biological objects. Validation of the results obtained, whether from the point of view of the PET analysis, autoradiography or in terms of confirmation of the occurrence of prepared radioindicator in the given plant tissue by direct gamma-spectrometry, will be also carried out. A separate part of the work will be devoted to the bioaccumulation of metals – positron emitters in living cells (e.g. algae cells or stem cells) and the use of biotracers prepared in this way in diagnostic techniques. The realization of the dissertation project will take place in cooperation with the company BIONT, Inc. as a producer of positron emitters and with the Institute of Medical Physics, Biophysics, Informatics and Telemedicine of the Faculty of Medicine, UK in Bratislava (signed memoranda and cooperation agreements between UCM in Trnava and the mentioned institutions).

In Trnava 08.03.2022

approved by:

prof. Ing. Ernest Beinrohr, DrSc.
Chair of Specialized Board of Doctoral Degree
in Analytical Chemistry

doc. Ing. Jozef Sokol, CSc. mim. profesor
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