BIOCHEMISTRY

Study of topoisomerase activity of new 3,6,9 trisubstituted acridine derivatives.
supervisor: prof. RNDr. Mária Kožurková, CSc. (maria.kozurkova@upjs.sk)
study form: full time
Annotation: In the thesis, we will study the effect of novel 3,6,9-trisubstituted acridine derivatives on topoisomerase I/II activity. We will also deal with the influence of these compounds on interaction with nucleic acids. The spectroscopic characteristics, hydrophobicity, stability in water solution, and reactivity of the newly synthesized compounds will be studied. The mode of interaction, calculation of binding constants, and neighbour exclusion parameters we will determine. The potential of antitumor effect on these compounds will test against both human and mice leukaemia cell lines and HeLa cells. The effect of substances on cells will be studied using flow cytometry analysis, and determine the mode of cellular death. The localization of derivatives in cells will also be analysed using confocal microscopy.

The study of interaction of new acridine derivatives with selected proteins.
supervisor: prof. RNDr. Mária Kožurková, CSc. (maria.kozurkova@upjs.sk)
study form: full time
Annotation: In the thesis, we will deal with an interaction of novel small derivatives – acridine derivatives which can influence the structure of selected proteins. The spectroscopic characteristics, stability in water solution and reactivity of the newly synthesized compounds will be studied.
We will determine the mode of interaction and calculate binding constants. The effects of these compounds on serum albumin (bovine and human) and histone proteins will be examined. The potential antitumor effects of these compounds will be tested against both human and mice leukaemia cell lines and HeLa cells. The effect of substances on cells will be studied using flow cytometry analysis and the mode of cellular death will be determined. The localization of derivatives in cells will also be analysed using confocal microscopy.

Purification and characterization of selected haloalkane dehalogenase mutants.
supervisor: doc. RNDr. Erik Sedlák, DrSc. (erik.sedlak@upjs.sk)
consultant: Mgr. Mária Tomková, PhD.
study form: full time
Annotation: Haloalkane dehalogenases are microbial enzymes - hydrolases, which are able to cleave carbon-halogen bonds in halogenated compounds and convert them into less toxic alternatives – alcohols. Since most of the halogenated compounds used in practice also represent prominent environmental pollutants, the capability of dehalogenases to partially degrade these compounds has a significant value for environmental protection. The aim of the dissertation is to provide a detailed analysis and characterization of biophysical and biochemical properties of individual haloalkane dehalodenases mutants obtained by directed evolution with an emphasis on the study of enzyme kinetics.

Study of DNA/BSA interaction with newly synthesized low-molecular ligands.
supervisor: RNDr. Danica Sabolová, PhD. (danica.sabolova@upjs.sk)
study form: full time
Annotation: Uv-Vis and fluorescence spectrophotometric methods were used to determination of ctDNA/ BSA binding with newly synthesized low-molecular ligands. The Stern-Volmer and binding constants were calculated. CD spectra were measured to establish the mode of binding (intrecalation /or groove binding) of investigated compounds. The nuclease activity test and topoisomerase I/II inhibitory assay were performed using electrophoretic methods.

The influence of ligands binding recognizing non-canonical structural motifs of nucleic acids.
supervisor: doc. RNDR. Viktor Viglaský, PhD. (viktor.viglasky@upjs.sk)
study form: full time
Annotation: The occurrence and location of non-canonic structural motifs in nucleic acids, e.g. DNA hairpins, triplexes and G-quadruplexes, are non-random. These motifs, and not mutation in structural genes, are crucial control elements influencing various biological processes including a gene expression of regulating proteins. There are responsible for example for the loss of cell proliferation control, induction of neoplasms formation, inefficiency in DNA repair and recombination, unexpected cell differentiation and senescence. The main task will be to determine condition of non-canonic motifs formation and their stabilization by specific ligands and their influence to cell viability.

Development of tageted contrasting DNA- aptamer-nanoconjugates for dignostics.
supervisor: doc. RNDR. Viktor Viglaský, PhD. (viktor.viglasky@upjs.sk)
study form: full time
Annotation: Nanoparticles are commonly used for bioimaging and drug delivery in cancer diagnostics and treatment. Their use can be substantially improved when they are modified with DNA aptamers, artificial nucleic acid ligands, recognizing various molecular targets with high selectivity and sensitivity. Binding of the aptamer to its target “anchors” the aptamer nanoparticle conjugate at its site of action. The goal of investigation will be focused on development of targeted nanoparticle-aptamer bioconjugates. The main goal of research will be to find universal procedure for low cost production of conjugated receptor molecules which could be used for diagnostics of wide scale of molecular targets.