BIOCHEMISTRY

Excited states of biomolecules supramolecular complexes
supervisor: prof. Ing. Marián Antalík, DrSc.
study form: full time
Annotation: Electronic excited states molecules can have very different nature than the electronic ground state. The excited states have a marked charge transfer character. Transient spectroscopy encompasses a powerful set of techniques for probing and characterizing the electronic and structural properties of short-lived excited states (transient states) of photochemically and photophysically relevant biomolecules. These states are accessed upon absorption of photons and essentially represent higher energy forms of the molecule, differing from the lowest energy ground state in the distribution of electrons and structural geometry. Goal of PhD. research theme will be characterization of excited properties of biological molecules as well as dyes in complexes with biomacromolecules.

The biological role of non-canonic DNA structural motifs
supervisor: doc. RNDr. Viktor Víglaský, PhD.
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 potential impact to cell viability.

DNA aptameric biosensors
supervisor: doc. RNDr. Viktor Víglaský, PhD.
study form: full time
Annotation: DNA aptamers are highly selective against various molecular targets. Their affinity reaches the comparative level as those typical for antibodies. G-quadruplexes are one of secondary structural motifs which can adopt DNA aptamers. Aptamers are highly attractive in biomedicine due to highly selective receptoric moiety suitable for biosensors, diagnostics and developing of nanoconjugates as drug-targeted delivery systems. The characterization of some DNA aptamers in details will be the goal of thesis and the second aim will to prepare specific biosensoric nanconjugates.

Biological funcion of new 3,6 disubstituted derivatives of acridines.
supervisor: doc. RNDr. Mária Kožurková, PhD.
consultant: RNDr. Ladislav Janovec, PhD.
study form: full time
Annotation: In the thesis, we will deal with an interaction of novel derivatives of 3,6 disubstituted derivatives of acridines. The spectroscopic characteristics, hydrophibicity, stability in water solution and reactivity of the newly synthesized compounds will be studied. We will determine the mode of interaction; calculate binding constants and neighbor exclusion parameters. Inhibition effects of these compounds on topoisomerase I and II will be examined. The potential antitumor effects of these compounds will be tested against both human and mice leukemia cell lines and HeLa cell. 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 analyzed using confocal microscopy.

The study of interaction of new coumarin derivatives with selected proteins.
supervisor: doc. RNDr. Mária Kožurková, PhD.
consultant: RNDr. Slávka Hamuľaková, PhD.
study form: full time
Annotation: In the thesis, we will deal with an interaction of novel small derivatives – coumarine 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 and histone proteins will be examined. The potential antitumor effects of these compounds will be tested against both human and mice leukemia cell lines and HeLa cell. 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 analyzed using confocal microscopy.