***HunProtExc\_Tematic webpage***

***Title of project: Protein-gold nano-complexes for bioanalytics·***

***Co-operating partners:***

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***Brief description of the supported project***

The synthesis and complex study of protein – gold nano-complexes (PGC) came to the hot spot of nano-research because of their many favourable properties. The latest studies demonstrate that fluorescence and super paramagnetic PGCs can be produced by using appropriate proteins. These complexes provide new possibilities in the field of bioanalysis, for example fluorescence, and in the same time, light resistance PGCs seem to be suitable for detection of special target proteins. New medical diagnosis and therapeutic methods can be introduced by using super paramagnetic PGCs. In order to develop these types of novel applications, the precise knowledge of the mechanism of PGCs formation and that of their biocompatibility is of crucial importance but they are still not clearly understood. The effect of gold clusters on the structure and function of proteins is indispensable but it is also largely unexplored.

In the present project we intend to monitor the formation of different PGCs and study the effect of the central gold-clusters on the structural behaviours of the protein part. Moreover, we plan to apply vesicle-like cell-membrane model-systems whereby the observation of the interactions between PGCs and their biological lipid-milieu comes possible.

In the first period of the project, we will study the reaction between bovine serum albumin (BSA) and tetrachloroauric acid (HAuCl4·3H2O) in the function of temperature, pH, reaction time, and the concentration of further additives and then the fluorescence behaviour of the BSA@Au complex will be explored. The formation of the BSA@Au complex is accompanied by the change in BSA conformation. The formation of the central gold nanocluster, known as Au25 in the literature, and the whole BSA@Au complex will be studied by means of the time-resolved small angle X-ray scattering technique. Beside this nanostructural studies, we will use infrared and fluorescence spectroscopy to obtain fine structural information on the atomic scale for the explanation of the fluorescence features. In the second part of the project, we intend to utilize the results obtained on the BSA@Au nanocomplex in order to elaborate further PGCs embedding other target proteins and to produce novel type of materials in the field of medical-biological applications.



**Figure**: Red-emitting BSA@Au nano-complexes embedded in multilamellar vesicles. The periodicity of the loaded vesicles depends on the temperature (small angle-ray scattering curves are shown: pure, hydrated vesicles (blue), Ca2+ containing hydrated vesicles (red), BSA@Au nanocomplex containing vesicles (black). Temperature dependent change in the shape of BSA@Au is demonstrated in the upper part. (Söptei et. al., Journal of Physical Chemistry B, 118 (2014) 3887-3892.)

**List of our most important relevant publications**:

1. B. Söptei, J. Mihály, J. Visy, A. Wacha and **A. Bóta**: Intercalation of Bovine Serum AlbuminCoated Gold Clusters between Phospholipid Bilayers: Temperature-Dependent Behavior of Lipid-AuQC@BSA Assamblies with Red Emission and Superlattice Structure, Journal of Physical Chemistry B, 118 (2014) 3887-3892.

2. A. Wacha, Z. Varga and **A. Bóta**: CREDO: A New General-Purpose Laboratory Instrument for Small-Angle X-ray Scattering, Journal of Applied Crystallography, 47 (2014) 1749-1754.

3. B. Söptei, J. Mihály, I. C. Szigyártó, A. Wacha, C. Németh, I. Bertóti, Z. May, P. Baranyai, I. E. Sajó, **A. Bóta**: The supramolecular chemistry of gold and l-cysteine: Formation of photoluminescent, orange-emitting assemblies with multilayer structure, Colloids and Surfaces A., 470 (2015) 8-14.

4. K. Bali, Gy. Sáfrán, B. Pécz and **R. Mészáros**: Preparation of Gold Nanocomposites with Tunable Charge and Hydrophobicity via the Application of Polymer/Surfactant Complexation, ACS Omega, 2 (2017) 8709-8716.

5. O. Y. Milyaeva, R. A. Campbell, S-Y Lin, G. Loglio, R. Miller, M. M. Tihonov, **I. Varga**, A. V. Volkova, B. A. Noskov: Synergetic effect of sodium polystyrene sulfonate and guanidine hydrochloride on the surface properties of lysozyme solutions, RSC Advances, 5 (2015) 7413-7422.