ZAJEDNIČKI SEMINAR

Hrvatskog biofizičkog društva i Instituta Ruđer Bošković

Institut Ruđer Bošković, Bijenička cesta 54, predavaonica Ivana Supeka

utorak, 25. rujan 2018, u 15:00 sati

Coupling imaging and spectroscopy of biological systems on the micro/nanoscale

Assist. Prof. Zoran Arsov

Jozef Stefan Institute, Department of Condensed Matter Physics, Laboratory of Biophysics, Ljubljana, Slovenia

zoran.arsov@ijs.si

http://lbf.ijs.si/

Spectroscopic techniques offer a possibility to follow and characterize processes in biological systems at molecular level but do not give spatial information. In this respect, it is particularly advantageous to couple molecular spectroscopies and micro/nanoscopic imaging because this allows a fast and informative localized inspection of sample properties.

First, application of infrared spectroscopy based approaches to study supported stacks of lipid bilayers will be presented. Due to its low light penetration depth on the order of hundreds nm, attenuated total reflection Fourier transform infrared (ATR-FTIR) spectroscopy is specifically suited to study fully hydrated stacks. Spectroscopic information can be upgraded with spatial information by using scanning near-field infrared microscopy (SNIM) that combines the advantages of IR spectroscopy with high resolution of atomic force microscopy (AFM). Other vibrational spectroscopy AFM-based platforms will be briefly mentioned, such as AFM-IR and tip-enhanced Raman spectroscopy (TERS).

Next, the use of fluorescence microspectroscopy (FMS) or spectral imaging with fluorescent probes that report about molecular vicinity through Förster resonance energy transfer (FRET) or aggregation will be described. In one application this approach was used to follow a receptor-mediated cell internalization. In a recent paper it was exploited to follow lipid wrapping of nanoparticles incubated with model lipid vesicles. Moreover, other advanced micro/nanoscopy and spectroscopy techniques were used to show that these nanoparticles are also able to wrap themselves with lung epithelial cell membranes, leading to their disruption. Assuming that such action could cause damage to the otherwise impenetrable air-blood barrier, these findings could have physiologically relevant implications.

In the end I will shortly elaborate on possibilities offered by a newly acquired super-resolution microscopy system in our laboratory that combines stimulated emission depletion (STED) microscopy, spectrally resolved fluorescence lifetime imaging (FLIM), and two-photon excitation (2PE) microscopy.