The Hebrew University Center
for Nanoscience & Nanotechnology

Nano Seminar

Conformation-electrochemical sensing relationships

Prof. Shlomo Yitzchaik

Institute of Chemistry and the Center for Nanoscience and Nanotechnology,

the Hebrew University of Jerusalem, Jerusalem-9190401 Israel

Abstract:

In this contribution we'll exemplified the usefulness of label free electrochemical biosensors that utilizes proteins and peptides conformational changes for improved biosensing. Molecular recognition events accompanied with conformational alternation are prone to undergo collective structural change when assembled in monolayers. This phenomenon is demonstrated for ions, small molecules and proteins biosensing. A case study for neurodegenerative disease will be described in depth.

Zinc and copper are essential metal-ions for numerous biological processes. Their levels are tightly maintained in all body organs. Impairment of serum Zn^{2+} to Cu^{2+} ratio was found to correlate with many disease states, including immunological and inflammatory disorders, autism, Alzheimer's disease, skin diseases and cancer. Oxytocin is a neuropeptide and its activity is modulated by zinc- and copper-ion binding. We developed an oxytocin based sensor by immobilizing the neuropeptide onto glassy carbon electrode. We describe its application for the simultaneous impedimetric determination of Zn^{2+} and Cu^{2+}. Oxytocin monolayer assembly on silicon wafer was characterized by ellipsometry, XPS and AFM. The oxytocin sensor showed a linear correlation between the charge transfer resistance and the concentration of Zn^{2+} and Cu^{2+} over a wide range of concentration from 1 pM to 100 nM. The developed biosensor was ultrasensitive to Zn^{2+}/Cu^{2+} ions at physiologic pH and not to other biologically relevant ions. The detection limit for Zn^{2+} is 100 fM while for Cu^{2+} is 500 fM. Selective masking of Zn^{2+} and Cu^{2+} was used to simultaneously detect the metal ion concentrations and allowed for the determination of zinc to copper ions ratio by the oxytocin sensor. We showed that the oxytocin sensor can discriminate between healthy control and multiple-sclerosis sera samples by determining Zn/Cu ratio. Thus, we project that the oxytocin sensor will find numerous applications in bio-medical research and pave the way to other types of "neuro-mimetic" sensors.

Gathering & Refreshments at 10:50

Please contact Alexandra Bannych at 6584919 if you are interested in meeting the lecturer.

Tuesday, Apr 25th 2017, 11:00 at the Seminar Hall

Los Angeles Building, entrance floor.