UCLA College | Physical Sciences Chemistry & Biochemistry

ORGANIZATION FOR CULTURAL DIVERSITY IN SCIENCES SEMINAR

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4:00 PM
via Zoom

"Electrochemical biosensors for viruses and bacteria: new approaches and challenges"

DNA nanotechnology deals with the manufacturing of pre-designed nanostructures made of DNA. For example, DNA nanostructures have been proposed for the delivery of anti-cancer drugs, which promises to advance anti-cancer therapy. DNA origami approach was proposed for genotyping single nucleotide polymorphisms in DNA using atomic force microscopy. We have been taking advantages of nanostructures for nucleic acid analysis to improve selectivity and sensitivity of hybridization sensors for the diagnosis of human diseases, most specifically virus and bacteria. Electrochemical analysis of nucleic acids brings the benefit of portability and compatibility with modern electronic devices and, therefore, is promising for molecular diagnostics. Traditional electrochemical probes are stem-loop folded oligonucleotides attached to a gold electrode and conjugated with Red/Ox markers (methylene blue-MeB). Binding a complementary nucleic acid target changes the conformation of the probe to the elongated probe-target duplex, which separates the MeB label from the electrode's surface, thus reducing the electrochemical signal.

We modified this ON/OFF signaling system to create a biosensor with OFF/ON signaling mode by using the immobilize DNA crossover structure introduced by DNA nanotechnology. Upon association of the target with two adaptor strands (m-strand and f-strand) and a universal DNA hairpin strand, the Red/Ox marker came in proximity with the electrode's surface to turn ON the electrochemical signal. In addition to the ON signal, the electrochemical sensor demonstrated advantages of 1) high selectivity at ambient temperatures, which cannot be achieved by hairpin probes, 2) ability to detect point mutations in highly structured nucleic acids; 3) possibility to analyze different nucleic acid sequences using the same electrode-attached oligonucleotide. In this talk our preliminary results of the application of this technology in the detection of SARS-CoV-2 will be presented.

Please contact marla@chem.ucla.edu for additional information.