Biomedical Discussion Group

"Nanostructured based Lab-on-chips for optical and electrical detection"

Thursday April 14, 2016
2:30 –3:30 pm, DC 1304

Dr. Sara Mahshid

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Abstract:
Nanostructured materials and nanofabricated lab-on-chip devices can play pivotal roles in biomedical research applications including genetic diagnosis and sensitive pathogen detection. Identifying genetic disorders or disease states on-chip requires dynamic manipulation and efficient trapping of a small number of molecules of the target nucleic acid. Current technologies are limited either by sensor resolution or by trapping a low concentration of molecules at the detection sites. Inspired by the state of the art nanofabrication and nano-synthesis methods, my research is focused on designing and fabricating lab-on-chip devices and nanostructured electrodes to overcome these limitations.

In order to enhance the detection sites for biomolecules in low concentration analytes (e.g. Dopamine) we developed metallic/metal oxide nanostructures with an extended surface area for electro-chemical and biochemical reactions. We have adopted a similar approach to develop nanostructured surfaces to efficiently immobilize DNA and proteins, as part of assays to indirectly detect a wide range of biomolecules. We use electrochemical techniques to fabricate the modified nanotubular and nanowire structures that have successfully been used for sensitive detection of dopamine, glucose, uric acid and ascorbic acid.

To further improve trapping efficiency for long nucleic acid molecules, we have developed a sample-delivery system based on reversible, tunable nanofluidic confinement of biomolecules based on the dielectrophoretic force, applied using Silicon Nitride and Indium Tin Oxide nano-patterned electrodes. The resulting device can concentrate and manipulate molecules at high throughput; and can be used to create open-access and simple designs that can be easily interfaced with microfluidic devices for buffer exchange and sample processing; and integrated with optical detectors or on-chip nanostructured electrodes to detect single biomolecules (such DNA fragments up to 100,000 base pairs in length). The ease of fabrication and uncomplicated instrumentation makes this technology a unique point of care instrument for optical and electrical detection of biomolecules.

Biosketch:
Dr. Mahshid's research interests are in nanomaterials (nanotubes/nanowires) based electrochemical biosensing and nano/microfluidics lab-on-chips medical devices. A recent work in which she played an important role was published in PNAS 111, 13295-13300, 2014 and lab-chips 15, 3013-3020, 2015.

If you are interested in meeting with Dr. Mahshid, please email CBB. See cbb.uwaterloo.ca/events for more information.

Event is FREE – please RSVP via EventBrite
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