TECHNISCHE UNIVERSITÄT DRESDEN

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cfaed Seminar Series

DATE: April 11, 2017
TIME: 09:30 am – 10:30 am
LOC: Seminar room HEM 219 (second floor)
Walther-Hempel-Building, Mommsenstr. 4, 01069 Dresden

GUEST SPEAKER:
Prof. Hossam Haick
The Department of Chemical Engineering and Russell Berrie Nanotechnology Institute,
Technion – Israel Institute of Technology, Haifa 3200003, Israel

TITLE: "Novel Alliance between Advanced Materials and Volatile Biomarkers for Non-Invasive Medical Evaluation"

ABSTRACT:
Medical evaluation for early detection of a disease is required to reveal groups of individuals from the general population in whom the likelihood of the disease is increased and who could benefit from further medical evaluation. The ideal medical evaluation is high-accuracy, low-cost, non-invasive, easily repeatable, effortlessly operated by a lay-person and has minimal impact on the person's daily activities. In our research, we tackle these requirements by the development of novel solid-state and self-healable flexible[1] devices/sensors that are based on advanced functional materials as well as electronic sensory nanoarrays for profiling **volatile biomarkers** that are emitted from cells in the affected area and that can be detected either via the exhaled breath or from the skin, **without going invasively into the human body**. Our results show that an interaction between the volatile biomarkers emitted from breath / skin sample(s) and the smart nanoarray can be recorded, stored and pre-processed by tailor-made lab-on-chip, and then the relevant electrical signals can transferred wirelessly to an external server. Statistical pattern recognition methods are then applied on the received data and a clinical report including the screening results is sent back to the designated receiver (e.g., specialist, family doctor) in case of positive result is revealed. The developed nanoarrays have been put into **practical evaluation in more than 20 hospitals worldwide**. The results of this clinical evaluation have evidenced the ability of the combined diagnostic technology to detect and **discriminate between various types of cancers, chronic and acute kidney disease, hepatic disease, pulmonary arterial hypertension and more**, with accuracies that range between 84-98%. For many disease states, the technology developed was able **to discriminate even between sub-categories of a specific disease** as well as between volatile organic compounds that are associated with **genetic mutations** of important disease states (P53, K-RAS, EGFR, and ALK), aspects that aid in providing personalized diagnosis and help tailor personalized treatment. The development and the use of these systems to identify high-risk groups for specific diseases and genetic mutations and to monitor the therapy provided to people affected by that disease will be presented and discussed.

[1] Self-healing to flexible devices means compensation (or self-repairing) for the mechanical / electrical / chemical properties upon incidental scratches and/or mechanical cuts.

BIOGRAPHY:

Hossam Haick, an expert in the field of nanotechnology and non-invasive disease diagnosis, is a full professor and the F.M.W. Academic Chair in the Department of Chemical Engineering and the Russell Berrie Nanotechnology Institute at the Technion – Israel Institute of Technology. Prof. Haick received his B.Sc. and Ph.D. (direct track) in Chemical Engineering from the Ben-Gurion University (1998) and the Technion (2002) respectively. After a two-year period at the Weizmann Institute of Science (2002-2004), he moved to the California Institute of Technology – Caltech (2004-2006) for postdoctoral research, and then to the Technion as an assistant professor in 2006.

At the Technion, Prof. Haick has made a significant mark through his development of artificially intelligent nanoarray technology to detect diseases non-invasively. This work has earned him prestigious grants: the Marie Curie Excellence Grant, the ERC and the Bill & Melinda Gates Foundation Award. Among the many consortia Prof. Haick has coordinated are the FP-7 consortium (LCAOS; 2011-2015), a EuroNanoMed II consortium (VOLGACORE; 2014-2017), and the Horizon2020 ICT consortium (SNIFFPHONE; 2015-2019).

Prof. Haick has published more than 170 publications in top-level journals in the field of nanotechnology and advanced/applied materials/chemistry, and more than five book chapters. Additionally, Prof. Haick holds more than 28 patents for his inventions.

Prof. Haick's research interests include nano-array devices for screening, diagnosis and monitoring of disease, nanomaterial-based chemical (flexible) sensors, electronic skin, breath analysis, volatile biomarkers, and molecule-based electronic devices.