Stony Brook University

Biomedical Informatics Grand Rounds

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The Use of Surface Enhanced Raman Spectroscopy in the Detection and Delineation of Breast Cancer Cells

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Health Science Center L3-LH6

Abstract:
The need to detect circulating tumor cells and to optimize healthy margin delineation upon tumor resection has highlighted the urgency for developing imaging modalities with micron and sub-micron scale resolution. In order to address this need, we propose to use Raman spectroscopy, since it is a non-destructive and sensitive technique for exploring the structure and chemical composition of biological materials. In order to make the technique better suited for such biological applications, a variation of the original method, the surface enhanced Raman scattering (SERS) technique, is particularly attractive. This work deals with the development of a Raman imaging platform by measuring the SERS spectra of healthy, benign, and cancer cells at given spatial intervals over the whole area of the tissue of interest, keeping a precise correlation between the location of the measurement and the resulting spectrum. The selective imaging of the tumor is based on the selection of relevant and unique Raman bands and their intensities as a function of sampling location. In this work we investigated the surface-enhancing Raman capabilities of various morphological permutations of star-like Au nanoparticles. that were achieved by changing the synthesis temperature. These variations yielded a novel particle geometry that has quasi-fractal branches. The Raman signal enhancement of these nanoparticles has been shown to be closely correlated to their extent of branching and particle size. To probe the feasibility of this novel method, we probed the effect of the various morphologies of synthesized Au nanoparticles on SERS intensity using two types of breast cancer cells, the breast epithelial adenocarcinoma cell lines SK-BR-3 and MDA-MB-231, as well as the MCF10A human normal epithelial cell line. The results that we will present here concerning the different degrees of Raman enhancement and selectivity observed with the SK-BR-3, MDA-MB-231 and MCF10A cells cell lines, indicate that SERS could contribute a reliable form of personalized medicine into the imaging fields, thus providing a highly sensitive new tool to identify diseased tissue in patients, which could aid in the control of their disease, and as a result, increase their rates of remission and reduce their rate of recurrence.

Bio:
Dr. Tannenbaum is originally from Israel where she received a B.Sc. in chemistry and physics from the Hebrew University, an M.Sc. in physical chemistry from the Weizmann Institute of Science. and a D.Sc in chemical engineering from the Swiss Federal Institute of Technology in Zürich. She served on the faculties of several universities, including the University of Minnesota, the Technion-Israel Institute of Technology, and the Georgia Institute of Technology. Currently, Dr. Tannenbaum is a full professor in the Department of Materials Science and Chemical Engineering and a member of the Stony Brook Cancer Center at Stony Brook University in New York. To date she has published over 200 peer-reviewed articles, reviews and refereed conference proceedings. She is the recipient of numerous awards such as the best paper award in the 1st International Conference on Applied Physics (2003), the Sigma Xi best thesis advisor award (2004), the MRS Fall 2006 Meeting outstanding paper award (2007), 1st prize in the SAIC best paper competition (2007, 2010 and 2012) and best paper award in the 6th Symposium of Frontiers in Polymers (2019). She is a member of the Advisory Board of several professional journals and a member of the American Chemical Society, Materials Research Society, the American Physical Society, the Israel Polymer and Plastic Society and the Israel Chemical Society. Dr. Tannenbaum's areas of interest are soft condensed matter and complex fluids, biomedical applications of Raman spectroscopy, nanocomposites from renewable resources, biomaterials for bone implants and tissue engineering, bio-adhesion, nanofluids, bio-nanostructures and nanoplatforms for cancer diagnostic and targeted drug delivery.

****CME Credit Available****

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