The Iby and Aladar Fleischman
Faculty of Engineering
Department of Materials Science and Engineering

אוניברסיטת תל-אביב
TEL AVIV UNIVERSITY

הפקולטה להנדסה
ע"ש איבי ואלדר פליישמן
המחלקה למדע והנדסה של חומרים

You are cordially invited to attend this seminar to be held on

Collagen-based nano-biocomposite materials and their potential applications as tissue scaffolds

Special Seminar

Wednesday, December 31th, 16:00
Room 101, Engineering Class (Kitot) Building

Prof. Rina Tannenbaum

Stony Brook University

In this study, we developed a novel synthesis to create a complex collagen-based biopolymer that promises to possess the necessary material properties for a bone graft substitute. The synthesis was carried out in several steps. In the first step, a ring-opening polymerization reaction, initiated by hydroxyapatite nanoparticles (nHAP), was used to polymerize D,L-lactide and glycolide monomers to form poly(lactide-co-glycolide) (PLGA) co-polymer. In the second step, the polymerization product was reacted with succinic anhydride followed by with N-hydroxysuccinimide (NHS) in the presence of dicyclohexylcarbodiimide (DCC) as the cross-linking agent in order to activate the co-polymer for collagen attachment. Finally, in the third step, the activated co-polymer was attached to calf skin collagen type I, and the resulting hybrid co-polymer with attached collagen, nHAP-PLGA-col, was isolated. The synthesis was monitored by ^{1}H NMR, FTIR and Raman spectroscopies and the products after each step were characterized by thermal analysis (TGA and DSC). Calculations of the relative amounts of the various components coupled with initial dynamic mechanical analysis testing of the resulting biopolymer, afforded a preliminary assessment of the structure of the complex biomaterial formed by this novel polymerization process. The tensile properties for 2-D scaffolds of PLGA and nHAP-PLGA changed over time, however, the properties for nHAP-PLGA-col remained stable, which indicates that nHAP-PLGA-col scaffolds should have better shelf life. Moreover, the ultimate tensile strength for nHAP-PLGA-col was very close to the range of human cancellous bone. hMSCs were viable on 2-D scaffolds of nHAP-PLGA-col and differentiated into osteocyte and deposited mineral which allowed the nHAP-PLGA-col scaffolds with the cells to have higher tensile strength and moduli. The results obtained from this study inspire the use of nHAP-PLGA-col as a suitable candidate for potential use as bone graft substitute.

Biosketch

Prof. Tannenbaum is originally from Jerusalem, Israel. She received her B.Sc. in chemistry and physics from the Hebrew University, her M.Sc. in physical chemistry from the Weizmann Institute of Science and her D.Sc. in chemical engineering from the Swiss Federal Institute of Technology in Zürich. Dr. Tannenbaum is currently a professor in the Program of Chemical and Molecular Engineering in the Department of Materials Science and Engineering and a member of the Stony Brook Cancer Center at Stony Brook University in New York. To date she has published over 150 peer-reviewed articles, reviews and conference proceedings. She is the recipient of numerous awards such as the best paper award of 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) and best paper award in the SAIC paper competition (2007, 2010 and 2012). She is a member of the advisory board of several professional journals and a member of the American Chemical Society, Materials Research Society and the American Physical Society. Dr. Tannenbaum's areas of interest are soft condensed matter and complex fluids, bio-based functional materials, nanocomposites from renewable resources, biomaterials for bone implants and tissue engineering, bioadhesion, nanofluids, bio-nanostructures and hierarchical nanoplatforms for targeted drug delivery.