TEXAS TECH UNIVERSITY
Department of Mechanical Engineering

Nanofluidic Systems for Drug Delivery and Cell Transplantation

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Abstract

Controlled delivery devices have gained significant interest for their ability to mimic body glands in responding to biological signals. In this context, biocompatible materials can be engineered at the nanoscale to present functional interactions with molecules and fluids. This is the case for silicon nanofabricated nanotechnologies and surface modified polymers, which have enormous potential in implantable medical systems. This lecture focuses on silicon MEMS technologies and biodegradable polymers as applied to implantable drug delivery systems for the tunable and sustained release of therapeutics as well as for the transplantation of pancreatic islets and insulin-producing islet like aggregates of differentiated mesenchymal stem cells.

Bio

Dr. Grattoni obtained his Bachelor and Master Degree in Mechanical Engineering at the Politecnico of Torino, Turin, Italy focusing his studies on osmotic pressure of no-ideal solutions through nanoporous membranes. Dr. Grattoni obtained his Ph.D. degree in Biomedical Engineering at Politecnico of Torino while working in Dr. Mauro Ferrari's team at the University of Texas Health Science Center at Houston. In this new context, he engaged in the study of transport phenomena in silicon nanofluidic devices for drug delivery. Since then, he has directed the nanochannel Delivery System (nDS) project focused on the development, and validation of nanochannel membranes for long-term administration of therapeutics from implantable capsules. His research is dedicated to experimental and phenomenological analysis, in vitro and in vivo, of concentration-driven transport in nanoconfinement developing experimental tools and mathematical models of the nanofluidic system. Additionally, he performed analysis of electrokinetic transport in nanochannels for the purpose of modulating the release of therapeutics from reservoirs. Finally, Dr. Grattoni's team is developing novel microencapsulation for cell transplantation. He also collaborates with the company NanoMedical Systems (NMS) Inc., Austin, TX, toward the translation of the nDS technology to the clinic. Currently, he is serving as Co-Chair and Assistant Professor of the Department of Nanomedicine at the Houston Methodist Research Institute. His team has received support from NASA, NIH, CASIS, DoD, Vivian Smith Foundation, Nancy Owens Memorial Foundation, as well as NanoMedical Systems, Inc.

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