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The next generation of controlled drug delivery devices based on Micro-Electro-Mechanical-Systems (MEMS) and novel integration of biomaterials

Noel M. Elman
Massachusetts Institute of Technology, USA

Advances in Micro-Electro-Mechanical-Systems (MEMS) and nanotechnology have enabled the creation of biomedical microdevices intended for treatment of various chronic and acute illnesses. The ability to miniaturize and create very precisely defined micrometer and nanometer features allows implementation of novel biomedical microdevices, which can be wearable, or implanted using minimally invasive procedures. These novel microdevices can be pre-programmed, or telemetrically activated to provide tailored pharmacokinetic profiles for controlled therapeutic drug delivery. Several medical applications will be presented in the context of translational research, including implantable devices proposed for treatment of hemorrhagic shock, acute cardiac conditions, and cancer therapy. A description of device designs, pre-clinical experimental results and potential clinical applications will also be presented. The microdevice designs and use of biocompatible materials constitute powerful biomedical platforms for use in a variety of medical applications. Several novel concepts will also be discussed including the use of biodegradable materials for implementation of fully absorbable devices, as well as the integration with sensors for closed-loop operation. The multidisciplinary development of such innovative biomedical platforms exemplifies the translational path from idea conceptualization to prototyping, pre-clinical research, and entrepreneurial realization. The successful implementation of such biomedical microdevices provides a systematic approach for creation of disruptive technologies to find solutions for large and complex medical needs. The next generation of biomedical microdevices will therefore implement revolutionary technologies to ultimately achieve broader social impact.

Biography

Noel Elman leads a translational research group at the Institute for Soldier Nanotechnologies at MIT in therapeutics and diagnostics. His research group is uniquely focused on rapid clinical translation that start from idea conceptualization, simulations (CFD, FEA), rapid prototyping (SLA and Nano/Micro-Fabrication), and in-vitro and in-vivo testing. He received his bachelor's and master's degrees in Electrical Engineering from Cornell University and his PhD from the Department of Electrical Engineering at Tel-Aviv University in 2006, and later pursued postdoctoral work at MIT. He has published over 30 articles, patents and a CRC book in biomaterials. He's founded several startup companies.

nelman@mit.edu