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Bioelectronics for therapeutics based on the integration of Micro-Electro-Mechanical-Systems (MEMS) and biomaterials

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Abstract

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 novel micro and nano-technologies to ultimately achieve broader social impact.

Biography

Dr. Noel Elman is currently a research scientist and principal investigator at the Institute for Soldier Nanotechnologies at the Massachusetts Institute of Technology (MIT). His research translational research group is focused on development of biomedical devices for therapeutics and diagnostics, as well as investigation of novel biotechnological platforms. Noel is also the founder of high-tech startups in the field of microdevices, and is authored of over 30 scientific papers, chapters and books

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