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Active tunable release of therapeutics through the nanochannel Delivery System (nDS)

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Nanofluidic devices have been investigated for over a decade as promising platforms for the controlled release of therapeutics. The nanochannel drug delivery system (nDS), a nanofluidic membrane manufactured with high accuracy, silicon microfabrication techniques, is capable of sustained, zero-order release of drugs at clinically relevant dosages over periods ranging from weeks to months. This is made possible through fabricating dense arrays of parallel nanochannels with a precision of ±0.1 nm and a density of >400,000/mm2. In order to improve this implantable bionanotechnology, the next generation of nDS implants possess key advancements for achieving active control of therapeutic release. Platinum electrodes were integrated on the membrane surfaces, permitting a low voltage (< 2 V) potential at the inlet and outlet of the membrane's fluidic channels. This enabled overt control of electrokinetic transport, allowing modulation and even complete binary gating of ionic flow. This breakthrough exhibited active external control of nanochannel transport and tunable administration of overall drug dosage, which, in turn, motivates future medicine possibilities of personalized and telemedicine treatment protocols. The capability of this nanotechnology platform to temporally control the diffusive release of molecules offers potential solutions in management of several chronic diseases such as cancer, heart disease, circadian dysfunction, hypertension, pain, and stress, as well as directly enabling modern treatment regimens such as chronotherapy.

Biography

Thomas Geninatti has completed his bachelor's and master's degrees in biomedical engineering in 2012, at the age of 25 years, from Politecnico di Torino, Turin, Italy. In 2013, he got accepted in the joint PhD program between the College of Materials Science and Engineering of the University of the Chinese Academy of Science, Beijing, China and the Houston Methodist Research Institute, Houston, TX, USA. His research is focus on active implantable devices for remote control of drugs' delivery.

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