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Remotely programmed transdermal delivery device for counseling enhanced addiction treatment

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Addiction treatment is one of the most difficult health care challenges due to the mixture of complex changing neurochemical pathways and psychological behavior. Generally the most effective treatments require psychological monitoring/counseling and adaption of therapeutic techniques. For large population addiction, such as nicotine, it is cost and time prohibitive to have face to face meetings. A promising system is where a dosing regiment (within a doctors' prescription limit) can be remotely programmed to account for daily environmental factors, patient input, and counselor feedback from phone interviews or internet-based surveys. Needed for this system is an ultra-low power, compact, and programmable delivery device not currently available with electroporation or mechanical pumps.

Carbon nanotubes (CNTs) are electrically conductive and support dramatic internal flow rates. These properties are nearly ideal for introducing efficient electro-phoretic and electro-osmotic flow to be used as the basis of a programmed transdermal delivery device. These CNT membranes are 100 fold more energy efficient than conventional nanoporous materials allowing watch battery operation for 1 week. An in-vitro cell, composed of a reference electrode, reservoir solution, CNT membrane electrode, gel contact and human skin sample were assembled in a Franz cell. Therapeutically useful fluxes for Nicotine treatment were controllably switched between, with 0.56 and 2.0 micromole/cm2-hr at 0mV and -600mV respectively. Prototype device studies on hairless guinea pigs showed active switching with further refinement of time dependent dosing using microdialysis membrane assays *in vitro*. Wireless Bluetooth programmed control with basic survey input was also demonstrated allowing for the combination of psychological and physiological approaches in addiction treatments. Support was provided by NIH NIDA (R01DA018822).

Biography

Bruce Hinds has a formal and research-based background in chemistry and electronic device processing. Bachelor studies were in Chemistry at Harvey Mudd College in California (1991), Ph.D. (1996) Northwestern University. Post-doctoral research at NC State and a NSF-JSPS fellowship at Tokyo Institute of Technology. In 2001 he joined the faculty of the University of Kentucky and was promoted to Full Professor in 2011. He has authored 60 papers, has recently received a Presidential Early Career Award (PECASE) award sponsored by NIH and is the William Bryan Professor of Materials Engineering.

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