A Transistor-less, Wireless Neural Implant

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Abstract

Wireless neural stimulators are being developed to address problems associated with tethered implants, including scar tissue growth and lead breakage. However, designing wireless stimulators on the sub-millimeter scale (<1mm3) is challenging because as device size shrinks, it becomes difficult to deliver sufficient wireless power to operate the device. Here, we present a novel design for a sub-millimeter, inductively powered neural stimulator consisting of a coil to receive power, a capacitor to tune the resonant frequency of the receiver, and a diode to rectify wireless signal to produce a DC current to excite neurons. By not including transistors in the design, we have reduced the required voltage levels that are needed to operate the device from 1 - 2V to approximately 0.25 – 0.5V. This reduced voltage requirement allows us to achieve smaller device size than previously reported stimulators. The device is designed to operate across a large range of distances, including in deep brain tissue (>5cm depth). Furthermore, each stimulator can be individually addressed by tuning the resonant frequency of the device, allowing multiple sites of stimulation.