Biotechnology: Using wireless power to light up tiny neural stimulators

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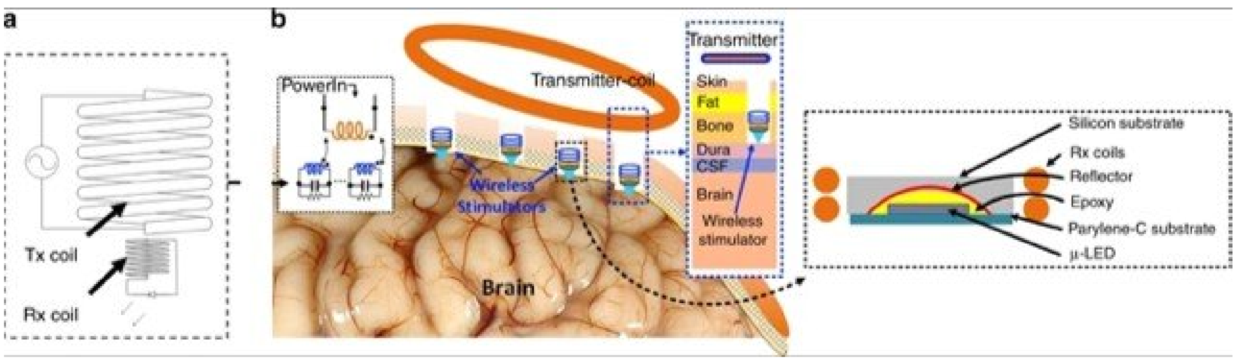

Conceptual diagram of the inductively coupled neuro stimulator system. (a) An overview of the inductive link system. (b) Conceptual diagram of the wirelessly-powered opto neuro-stimulator and its placement over the cortex of the animal brain. Credit: Microsystems & Nanoengineering, doi: 10.1038/s41378-019-0061-6

Implantable optical devices that target neurons can be improved using miniature coils smaller than a grain of rice using optogenetic technology. Scientists can propagate pulses of light using the method to turn protein expression on or off in genetically modified neurons. Neuroscientists have used bulky cables and batteries to control and collect data from such experimental setups so far. In a recent study, Wasif Khan and a team of researchers in the interdisciplinary departments of Electrical and Computer Engineering and Physiology in the U.S. developed a completely wireless prototype to replace the bulky hardware.

For this, the team coupled a microscale light-emitting diode (LED) with two millimeter-scale coils to create an inductive charging system, which delivered instantaneous power at biologically safe frequencies in an experimental rodent (rat) model. The wireless setup stimulated neurons in the visual cortex, while maintaining the temperature increase below 1^0C as a critical safety threshold for biomedical implants. The results are now published on *Microsystems and Nanoengineering*.

Khan et al. introduced a single channel neurostimulator containing a reflector-coupled, microscale light-emitting diode (μLED) with an integrated millimeter sized wireless receiver (R_X) coil. The experimental setup allowed for free-floating, battery-free, untethered optogenetics neuromodulation. They used a two-coil inductive link in the system to deliver instantaneous power at a low operating frequency (

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