Brain Interface: Electrophysiology and Optimal Neuromodulation at Cellular Resolution

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The evolution of Michigan neural probe technologies will be reviewed toward scaling up the number of recording sites and adding selective neural modulation capability to enable optogenetic control of neurons at cellular resolution. Multiple neuro-size micro-LEDs (~10 μm) were monolithically integrated on a probe shank to achieve high spatial temporal modulation of neural circuits. Initial prototype optoelectrodes (MiniSTAR) demonstrated independent control of distinct neuron cells ~50 μm apart in the CA1 pyramidal layer of freely-moving mice at 60 nW light power. The number of optical stimulation sites has scaled up to integrate 128 micro-LEDs along with 256 recording sites (HectoSTAR). Recently, 3D origami architecture has been introduced to deploy the optoelectrodes on non-planar surfaces and enable multi-modalities by incorporating the additional sensors to monitor neurotransmitters and temperature of the local brain region and their effects on electrophysiology.

References

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