

Specified Neuronal Differentiation and Neuronal Learning

- iGEM (International Genetically Engineered Machines) competition is held annually by MIT and our team has entered to compete in this years competition.
- We decided to work with neurons in hopes of creating a synthetic neuronal network.
- We settled on a two-part project which deals both with neuronal logic and patterning and also with induced learning of synthetic neuronal networks.
- We achieve synthetic neurons by transfecting a lentivirus with a synthetically created plasmid and then infecting neuronal precursor cells. To ensure success we use antibiotic and flourescent markers.

100 μm

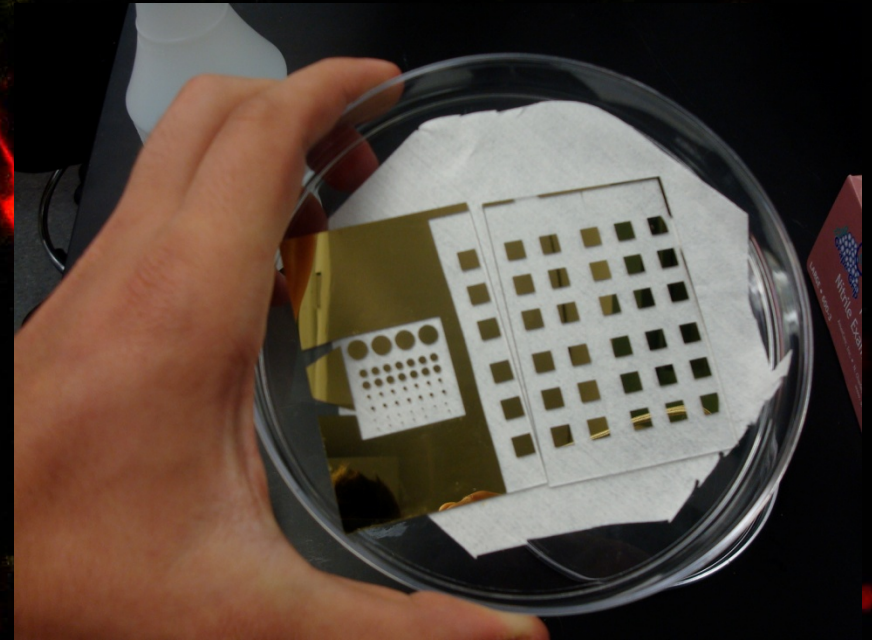
The Two Parts

- Neuronal RS Latch: We are creating a neuronal bi-stable switch out of pacemaker cells and inhibitory neurons. The inputs will inhibit the pacemaker's constant activation.
- Neuronal Learning Network: Long-Term Potentiation is the basis of memory and is maintained necessarily and sufficiently by the Protein Kinase PKM-zeta. If we facilitate the transcription of PKM-zeta for 'correct' responses and inhibit its maintenance during 'incorrect' responses we should be able to 'teach' the circuit what we want it to do

100 μm

Cell Patterning

- Optical Tweezers: We are using a 1 mW YAG laser to create an optical tweezer setup which can hold cells in place using the power of the laser.
- Surface Patterning: Our other option is using dendrimers patterned on a gold surface using a photomask. The cells will only adhere to the dendrimers thus creating a path for the cells and axons to follow without the need of constant laser pressure on the cells.



100 μm