# A Biomimetic 2D Transistor for Audiomorphic Computing ID# 2019-4934



#### **TECHNOLOGY READINESS LEVEL** 1-3

#### Seeking

Licensing | Research

#### Keywords

- Beyond Boltzmann Devices
- Neuromorphic Devices
- Neuromorphic Computing
- Biomimetic
- 2D materials / transistors

### Researchers

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Barn Owl auditory cortex

## **Technology Summary**

This technology is a biomimetic audiomorphic device that captures the neurobiological architecture and computational map inside the auditory cortex of the barn owl, which is known for its exceptional hunting ability in complete darkness using auditory cues. The device consists of multiple split-gates with nanogaps on a semiconducting MoS2 channel connected to the source/drain contacts for imitating the spatial map of coincidence detector neurons and tunable RC circuits for imitating the interaural time delay neurons following the Jeffress model of sound localization. Furthermore, global back-gating capability is used to demonstrate neuroplasticity to capture behavioral and/or adaptation related changes in the barn owl. This technology implementation can supercede that of the barn owl by several orders of magnitude.

AN: Auditory Nerve Fiber

## **Application & Market Utility**

Neuromorphic computational devices are able to offer a low cost, low energy alternative to supercomputing by mimicking components of a biological nervous system. By taking inspiration from nature, such technology can enable high-performing functionality at a fraction of the cost (energy, component size/number, computational steps/complexity, etc.) of traditional methods. This type of efficiency will become ever more important as vast numbers of sensors are deployed to any number of devices, including IoT, autonomous vehicles, micro-devices, and defense applications.

## Next Steps

This technology is patent pending. The research team seeks collaboration for future development and licensing opportunities.



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### Delay Neurons NM AN Coincidence Neurons Spatial Computational Map Auditory Cortex of Barn Owl NM: Nucleus Magnocellularis NL: Nucleus Laminaris