ENGINEERING HONORS PROGRAM
UNIVERSITY OF MICHIGAN

LuCelegans

A 3-dimensional interactive installation of a nematode's nervous system

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Overview

We are building the **first interactive, physical, 3–dimensional prototype of *C. elegans* nematode nervous system**. The 1mm long nematodes are one of the most broadly used model systems in experimental biology. The 7-feet long installation includes artistic representations of key neurons (sensory, inter– and motor neurons) and neuronal circuits. The viewer will use proxies to stimulate targeted circuits which will light up, illustrating neuronal pathways along the worm's body. Four teams have worked on the model, and improvements are constantly being made to most accurately depict *C. elegans* nervous system. The completed model will be displayed in various museums and galleries, and our goal is to engage the public to learn about nervous systems, neurobiology, and biological research at large.

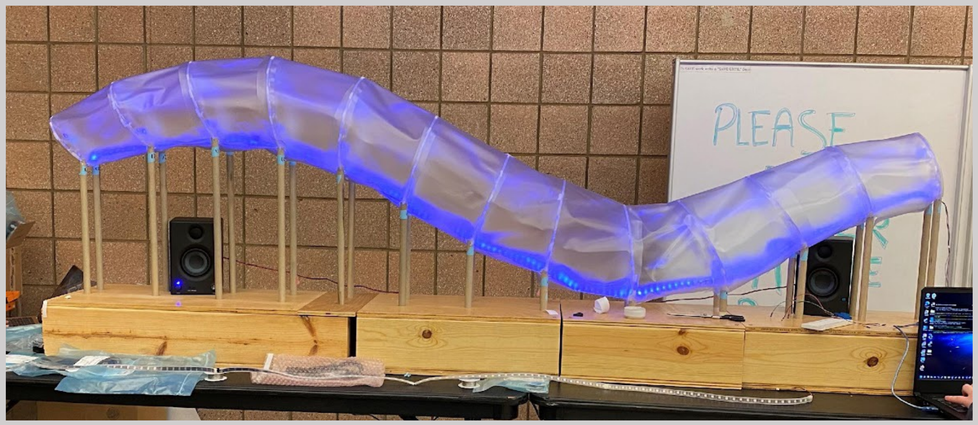


Figure 1. The physical model shows a single motor neuron lit up in blue.

Building and Fabrication

13 rings made of laser cut acrylic sheets represent the electron micrographs of *C. elegans* body's cross sections and serve as scaffold for the EL wires that spread across the model body (Fig. 2). PVC pipes are used to support the model, and 3D-printed joints hold the rings in place. The joints (Fig. 3) are specially designed to hold the rings at an angle that represents the natural curvature of the organism's body.



Figure 2. Acrylic rings wrapped in vinyl sheets, representing the worm's skin



Figure 4. Access door in the model's base



Figure 3. 3D printed joint with PLA attached to PVC pipe

The wooden base of the model has holes for the PVC pipes, as well as access doors for the electronics stored within the base (Fig. 4).

Sensors and Circuits



Figure 5. Connection of EL wire to main wire, before soldering

The neuronal circuits will be represented by EL wires which are soldered onto main wires running through the base of the model (Fig. 5). The unique structure of the PVD mechanosensory neurons is specifically created and mounted on a template made of laser-cut clear acrylic (Fig. 6). The communication between sensors and circuits is facilitated by Arduinos, and the final iteration will feature a total of 52 circuits.

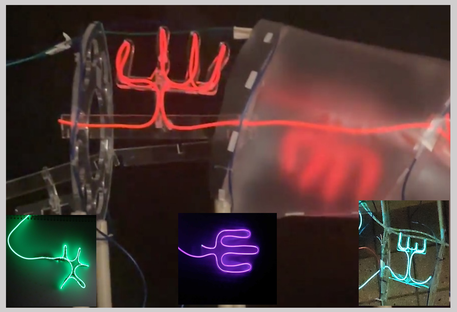


Figure 6. Iterations of PVD neuron design

Educational Content

The project's overarching goal is to educate the public about the use of model systems in biological research, with a focus on *C. elegans*. Therefore, we've created educational content to share with the community, e.g., animation videos, and an audio guide. Efforts include a comprehensive video highlighting the progress made in our project. Moreover, at the 2023 Midwest Worm Conference, held at Wayne State University, former team member, Sara, and I presented a detailed poster showcasing the work completed on the model. My contributions to the team also include meeting and event scheduling, leading and engaging discussions, and helping make decisions about the direction of the project.

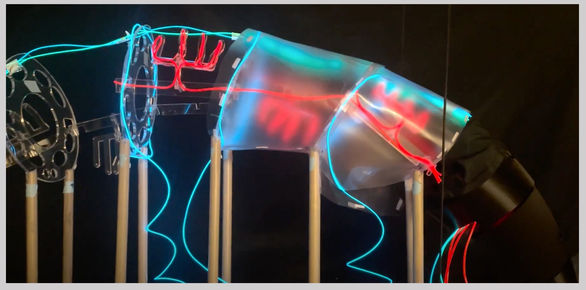


Figure 7. Motor and sensory neuron lit together



Figure 8. Current state of model

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