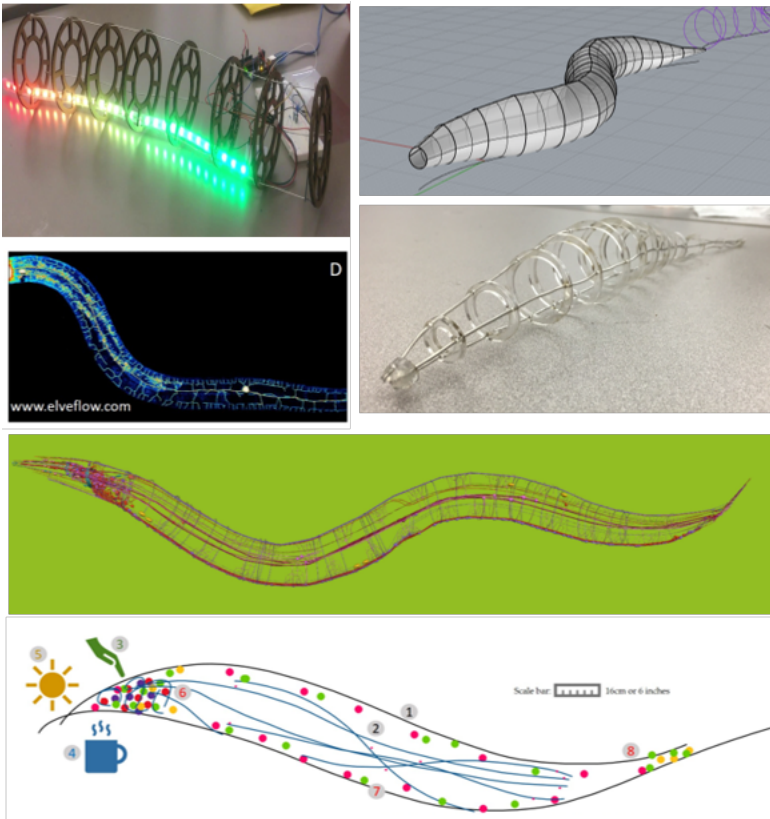


LUCELEGANS: THE INTERACTIVE WORM NERVOUS SYSTEM



The project is called LuCelegans (Luce: light in latin; Light-up *C. elegans*), or the Interactive Worm Project. It is about building the first interactive, physical, 3-dimensional prototype of *C. elegans* nervous system. *Caenorhabditis elegans* (*C. elegans*) is a tiny transparent roundworm, a very broadly used model organism in experimental biology, especially biology of aging, developmental biology, and neurobiology. Moreover, it is the only living organism with a fully mapped nervous system. Although it has only 302 neurons (and >5,000 synapses), this small invertebrate is capable of foraging, mating, decision-making, and learning. The idea is to build a physical medium scale prototype, which will include realistic representations of key neurons (sensory, inter- and motor neurons) and neuronal circuits. The viewer will be able to use proxies to stimulate targeted circuits, which will light up, illustrating neuronal pathways along the worm's body. The

first iteration is planned to include a selected number of neurons and neuronal connections, showcasing key circuits which underly major sensations (chemosensation, mechanosensation, thermosensation) in young adult hermaphrodites.

We envision future iterations to include:

- i. a more complete set of neurons and circuits
- ii. learning circuits
- iii. the effect of aging
- iv. the male nervous system
- v. behavioral output (evoked locomotion) of neuronal activation
- vi. simultaneous stimulation of >1 circuits, etc.

In addition to applying neuroscience knowledge into building LuCelegans, we aspire to explore:

- i. interactions with art and design which relate to science-based installations of organismal models
- ii. educational applications (middle-school, high-school, undergraduate students)
- iii. artistic representations interplay with scientific fidelity in neurobiology-inspired installations
- iv. audience interactions with a scientific specimen
- v. research priorities meeting artistic installations restrictions

The UARTS Faculty Engineering/Arts Student Team (FEAST) will be engaged in achieving the following goals:

- polish the first working prototype, the LuCelegans 1.0

- enrich the sensory modalities included in the model and enhance the ways a viewer can interact with it (LuCelegans 1.1 and 1.2)
- find a home for LuCelegans (e.g. museum, exhibit site in UoM)
- make LuCelegans available and accessible to the broader public
- set the stage for adding the effect of learning (work on LuCelegans 2.0)

We envision our prototype worm to ultimately grow into:

- an adventurous LuCelegans, that will travel to many places and visit many cities
- a friendly LuCelegans, that will invite researchers, students of all ages, and the broader public, to learn more about neuroscience and how the nervous system works
- an arty LuCelegans, that will be aesthetically beautiful and artistically intriguing
- a scientific LuCelegans, that will instigate discussions about the capabilities of nervous systems
- an evolving LuCelegans, that will continuously integrate new traits
- a playful LuCelegans, that will welcome people to play with it and learn from it
- a multifaceted LuCelegans, accompanied by special animations for the viewer to explore
- a responsive LuCelegans, that would actually move because of neuronal stimulation instigated by the viewer

MEETING TIME AND LOCATION

The team will meet at a North Campus location (GGB, Duderstadt, Design Lab or elsewhere) every Thursday 5-7pm or 6-8pm. Day and time will be finalized after discussions with team.

STUDENTS SOUGHT

ELECTRONIC HARDWARE SYSTEMS (2)

- Student skills: coding, use of Arduino, building electronic circuits, working with sensors
- Likely majors: CE, CS, ME, EE

FABRICATION & PROTOTYPING (2)

- Student skills: CAD design, 3D printing, laser cutter; fabrication experience and working with materials like vinyl, acrylic, plastic, wire, copper tape, conductive sheets, LED strips, EL wires
- Likely majors: ARTDES, ARCH

3D VISUALIZATION AND ANIMATION (2)

- Student skills: working with Blender, making animations, interest in building simplified miniature version of LuCelegans or artistically varying and diverse pocket versions of LuCelegans
- Likely majors: ARTDES, ARCH, PAT, SI, ROB

STEM ENGAGEMENT (2)

- Student skills: neuroscience principles, basic neurobiology of invertebrates, preferably (but not necessary) some familiarity with *C. elegans*, interest in outreach activities and educational applications of scientific installations, ability to seek exhibition venues and visibility for our model, interest to explore how we can engage the broader high school student community around Ann Arbor
- Likely majors: BIOLOGY, COGSCI, EARTH, EDUC, ENVIRON, BCN, NEUROSCI

FACULTY PROJECT LEAD



Eleni Gourgou received her BS in Biology from National & Kapodistrian University of Athens (NKUA), Greece, in 2003 and earned her PhD in Animal Cell Physiology also from NKUA in 2010. She joined University of Michigan in 2011 as a postdoctoral fellow, working with microfluidic biochips and bio-MEMS. Later, she shifted her focus on the dynamics of biological systems and in 2015 she began working on memory and learning in invertebrate animals. She is currently a Research Faculty, in the rank of Assistant Research Scientist, splitting her time between Mechanical Engineering Dept and the Institute of Gerontology, Medical School. Her research interests lie at the interface of neurobiology, dynamics of biological systems, and behavioral neurogenetics on one side, and emerging technologies (e.g. 3D printing), mathematical

biology, and imaging techniques on the other. To answer exciting neurobiology and aging-related questions, she uses the nematode *C. elegans* as a model system. She is the recipient of a NIH-NIA K01 Career Development Award.