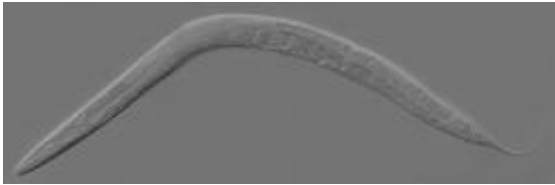# Building a digital life form: OpenWorm, Open Source

May 7 2013, by Nancy Owano

Caenorhabditis elegans. Image: Wikipedia.

(Phys.org) —The worm *Caenorhabditis elegans* is one of the most widely studied creatures. Scientists consider the worm a model organism for exploring animal development including neural development. The reasons are basic; it has one of the most simple nervous systems, and is convenient for genetic analysis. Never mind that, in turn, there is already an enormous amount of biological data about the C. elegans; scientists are still seeking more answers about the worm. Now there is a novel information path, The OpenWorm Project. They are working up an artificial life form, computationally created, a digital life form as no other.

"OpenWorm is an open source project dedicated to creating a virtual *C. elegans* nematode in a computer," says the project web page.

This is a collaborative undertaking that includes software developers and neuroscience researchers. Their work marks the first comprehensive

computer model of the [Caenorhabditis elegans](#) nematode worm. This will be a detailed simulation modeling each of the worm's cells.

Their data draws from completed [scientific experiments](#) conducted over the past ten years. They are incorporating the available data into software models. They hope that modeling the creature with enough detail will trigger complex behaviors, such as feeding, finding mates and avoiding predators, spontaneously. In other words, their virtual worm would, as they anticipate, behave like a real-world worm.

With all the C. elegans simplicity, however, their work is not so easy. Reporting on their progress so far, the OpenWorm project site notes that "the challenge of simulating even a tiny worm is immense. It requires a lot of parallel activities."

The OpenWorm project is traveling over five hills to get where they need to go: NeuroML connections; the Geppetto simulation engine; the OpenWorm browser; a [fluid mechanics](#) simulator; and optimization engine.

Talking about the NeuroML Connectome, they converted all 302 neurons into multicompatmental neuronal models described in NeuroML format. "We are currently building descriptions of the synaptic junctions and the ion channels for each cell."

Talking about the fluid mechanics simulator, they said they implemented an algorithm, Smoothed Particle Hydrodynamics (SPH), to simulate the body of the worm and its environment using GPUs. This algorithm was worked out in C++ (with OpenGL visualization), then ported to Java as a bundle for Geppetto, the simulation engine.

As for Geppetto, this simulation platform is designed to run the different models together. Geppetto features a built-in WebGL visualizer, for

visualization of simulated models right in the browser.

Code, data and models produced as part of the OpenWorm project is open-source under the MIT [license](.).

The Open Worm project thus far has produced an early demo that shows five muscle segments of the worm's body moving in water. "People will need to wait some months, though, before being able to download the virtual creature, according to one of the development team members. He estimated it would take another three to five months before simulations are debugged and integrated "to the point where the average curious developer could build and run the project and see the muscular shell of a worm swimming around," he told *New World Notes*.

What's the point of all this effort to create a digital worm? "If we cannot build a computer model of a worm, the most studied organism in all of biology, we don't stand a chance to understand something as complex as the human brain," according to the project site." We must crawl before we can walk!"

The project members hope this is the first step toward creation of more biologically accurate virtual creatures.

  More information: [nwn.blogs.com/nwn/2013/05/open … artificial-life.html](.)

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