NEUROSCIENCE

Peeking below the belt in *C. elegans*

A map of the male worm's posterior nervous system offers some surprises.

Mating in *Caenorhabditis elegans* is a slithering dance between male and hermaphrodite during which physical contact triggers copulation. The hermaphrodite either accepts the male's advances or slips away to its own self-fertilizing party.

A team of researchers has now completed the wiring diagram of the posterior nervous system in the male worm, revealing the neural circuitry governing its mating behavior. The researchers annotated electron micrographs using their software tool Elegance (https://github.com/Emmonslab/elegance/). As the scientists analyzed the micrographs, their mouse clicks were translated into map coordinates.

"We're back in the connectomics business," says Scott Emmons, who led the new effort at Albert Einstein College of Medicine to reconstruct a synapse-level map of the nervous system from 5,000 existing images from the Cambridge, UK, lab of Sydney Brenner.

In 1986, Brenner and his colleagues published the hermaphrodite's complete neuronal wiring diagram. Since then, researchers have tried tracing the male's branching neurons but have abandoned the complex task, says Emmons. Joining forces with others, he has now translated the electron micrographs into a "highly revealing" connectome.

Of the 170 neurons in the animal's posterior nervous system, 144 belong to the mating circuit. Applying graph theory, the scientists integrated quantitative cell biology information into the wiring diagram. Using a mathematical model, the team worked out the neural network's connectivity. They included the number of synapses and the physical size of each synapse as a proxy for the functional strength of each neural connection.

Neurons are not equally connected across this connectome. The scientists found that interaction strengths vary more than 100-fold. In previous work, researchers focused on counting synapses, "but they didn't judge synapse size," he says. "If you just know what is connected to what, but you don't know how strongly, you can't really do a sensible quantitative analysis." The group combined individual synapse size and the number of connections to infer interaction strength for each set of connected neurons.

The team's next project is about gender. After completing the male's connectome, they will compare it to the hermaphrodite's wiring. The male has the same set of head neurons as the hermaphrodite, says Emmons. "But we don't know the extent to which those neurons are wired the same or differently."

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RESEARCH PAPERS
Jarrell, T.A. *et al.* The connectome of a decision-making neural network. *Science* **337**, 437–444 (2012).