**Introduction**

The complete description of the morphology and synaptic connectivity of all 302 neurons in the nematode, Caenorhabditis elegans, enabled us to predict the full comprehensive understanding of the neuronal basis of an animal's entire behavioral repertoire. The advent of new electronic imaging and functional mapping techniques for C. elegans neurons has made this project more realistic than before. Further progress would be accelerated, however, by prior knowledge of the morphological characteristics underlying the behavior of C. elegans, together with knowledge of how these characteristics could be implemented with C. elegans-like neuronal elements. Here, we used a computer algorithm to search for patterns of synaptic connectivity sufficient to compute the sensory transformation underlying chemosensory behavior. Common patterns of connectivity between the model and biological network suggest novel new functions for previously identified connections in the C. elegans nervous system.

**Assumptions**

1. Primary chemosensory neurons in C. elegans report attractant concentration at a single point in space.
2. Chemoafferent neurons converge on a network of locomotory command neurons to regulate turning probability.
3. The sensorimotor transformation in C. elegans is computed mainly at the network level, not at the cellular level.

**Network**

Neurons were modeled by the equation:

$$ E_{i}(t) = -A_{i}(t) + c_{i}(t), \quad \text{with} \quad c_{i}(t) = \sum_{j} w_{ij} E_{j}(t) + b_{i} $$

where $A_{i}(t)$ is the activity level of neuron i; the function $c_{i}(t)$ is the static function; $w_{ij}$ is the weight; and $b_{i}$ is bias. The time constant $\tau$ determines how rapidly the activity levels adjust to weak drive signals for constant $E$.

**Optimization**

The sensorimotor network model was optimized to compute an idealized version of the known sensorimotor transformation (Fig. 2) by tuning probability. To construct the idealized sensorimotor transformation, we required the conditions, defined by $c_{i}(t)$ of the tuning probability, (a) to be between the conditions defined by $c_{i}(t)$ of the tuning probability, (b) to be between the conditions defined by $c_{i}(t)$ of the tuning probability, and (c) to be between the conditions defined by $c_{i}(t)$ of the tuning probability. The network was tuned by adjusting the parameters synaptic strengths, time constants, and thresholds in the network. The network was defined by three parameters: synaptic strengths, time constants, and thresholds.

**Results**

Figure 4 illustrates the network's chemosensory transformation in the real nematode. Successful chemotaxis was defined as if a worm is able to reach a target stimulus within 3 cm of the stimulus. Average turning angles are defined as 1 cm of the curve.

**Conclusion**

• Common patterns of connectivity between the model and biological networks suggest new functions for previously identified connections in the C. elegans nervous system.

• It should be possible to test these functions through physiological recordings and neuronal ablations.