

What is *C. elegans*?  
What are its navigational  
strategies?

David Biron

*C. elegans* –  
a self-replicating digestive system...

Adult (1110-1150  $\mu\text{m}$ )

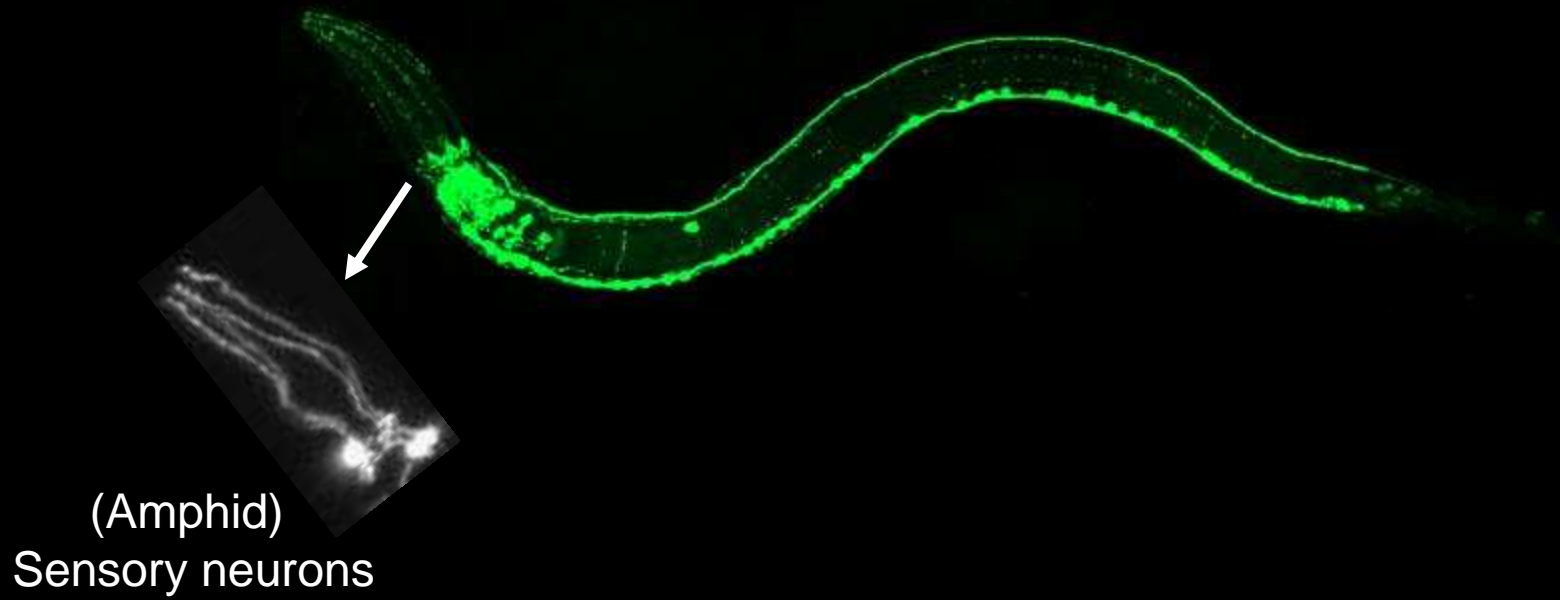


(Adapted from [www.wormatlas.org](http://www.wormatlas.org))

... that became a model system.

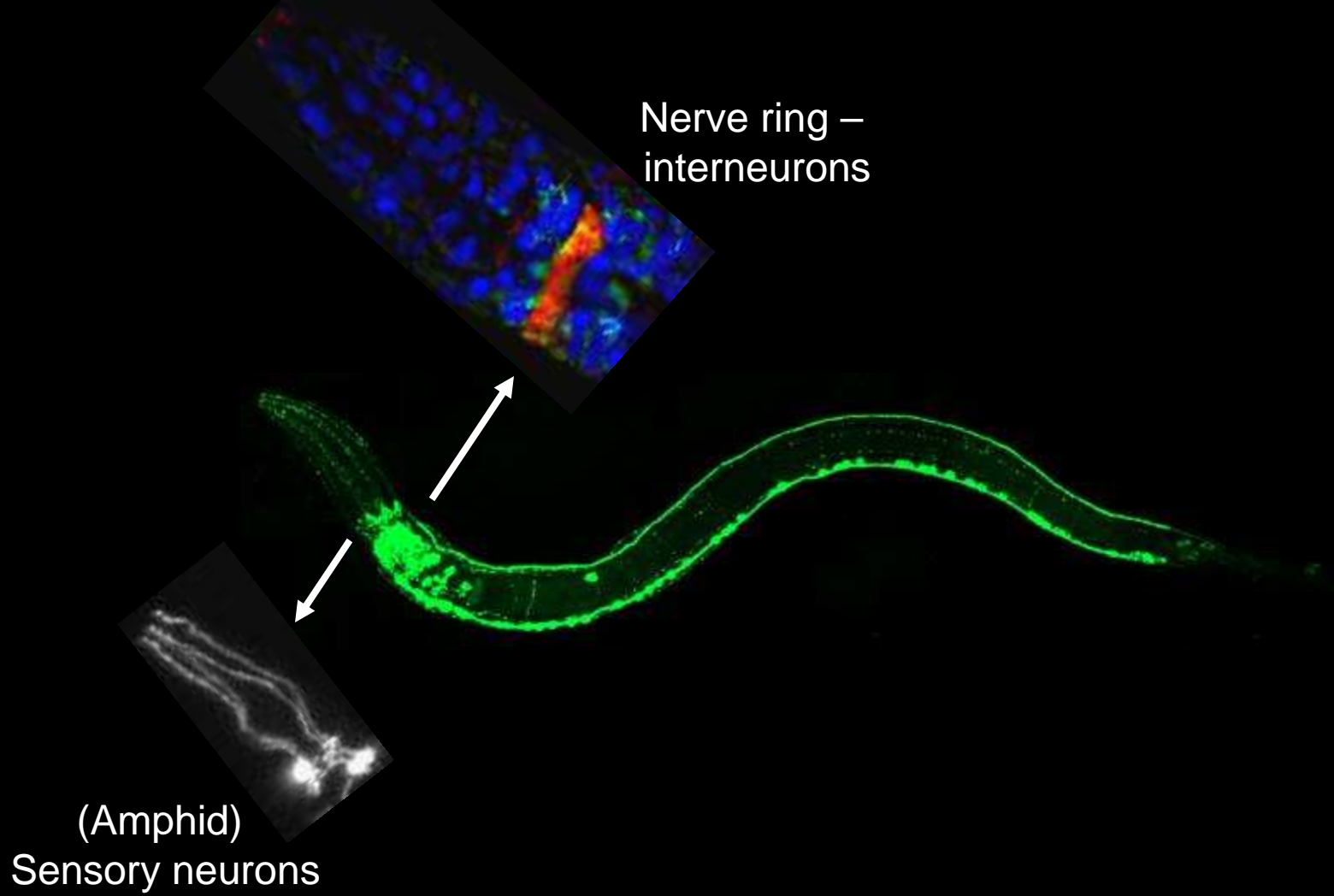
- genome completely sequenced / many genetic tools
- Only 302 neurons, the connectivity (the “wiring diagram”) of which has been mapped anatomically
- Exhibits experience dependent behavior and rudimentary navigational skills

*C. elegans* neurons

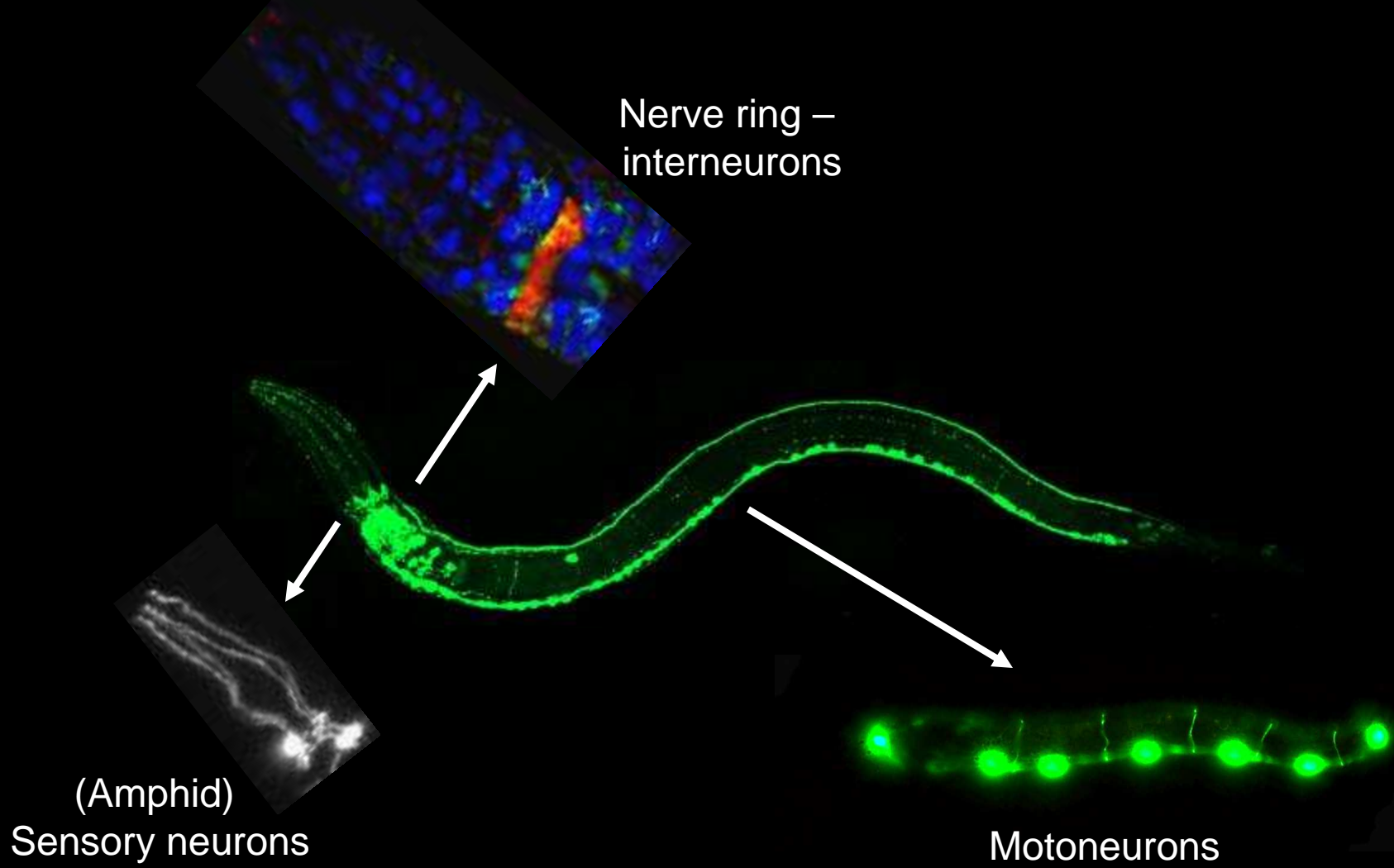


(Amphid)  
Sensory neurons

# *C. elegans* neurons



# *C. elegans* neurons



# Scales at which computations are performed

## Computing cell – E. coli

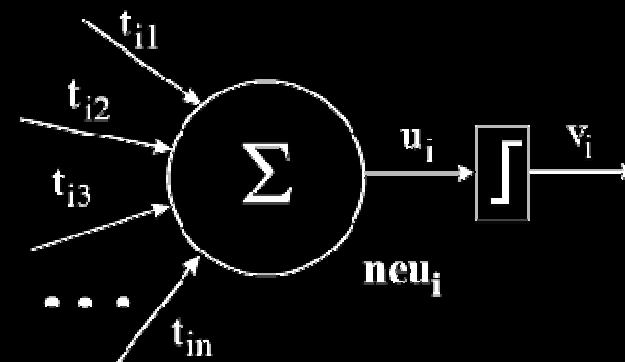


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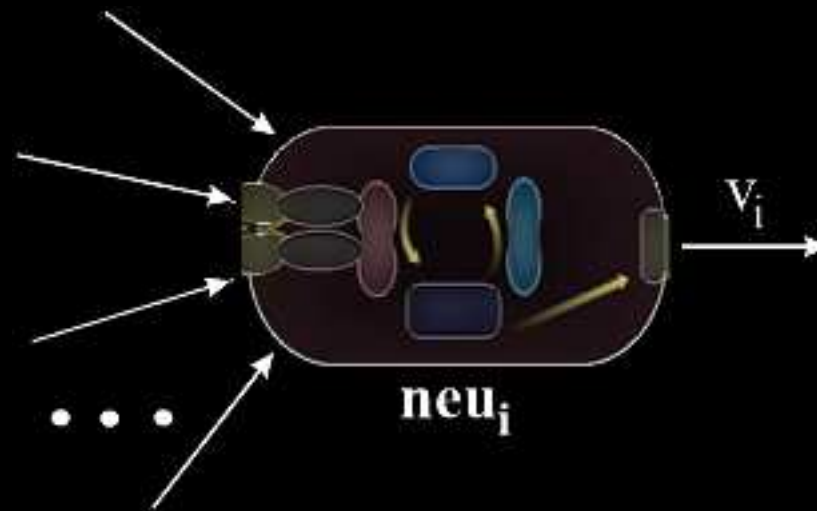


## Computing neurons – Neural network



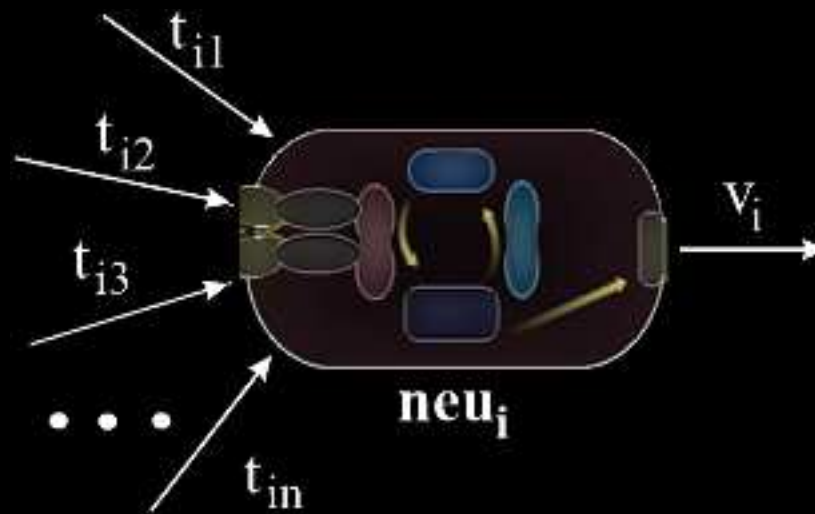


Where are computations performed in small neural circuits?



“Telegraphic” propagation of intra-neuron computation results along *fixed* connections?

Where are computations performed in small neural circuits?

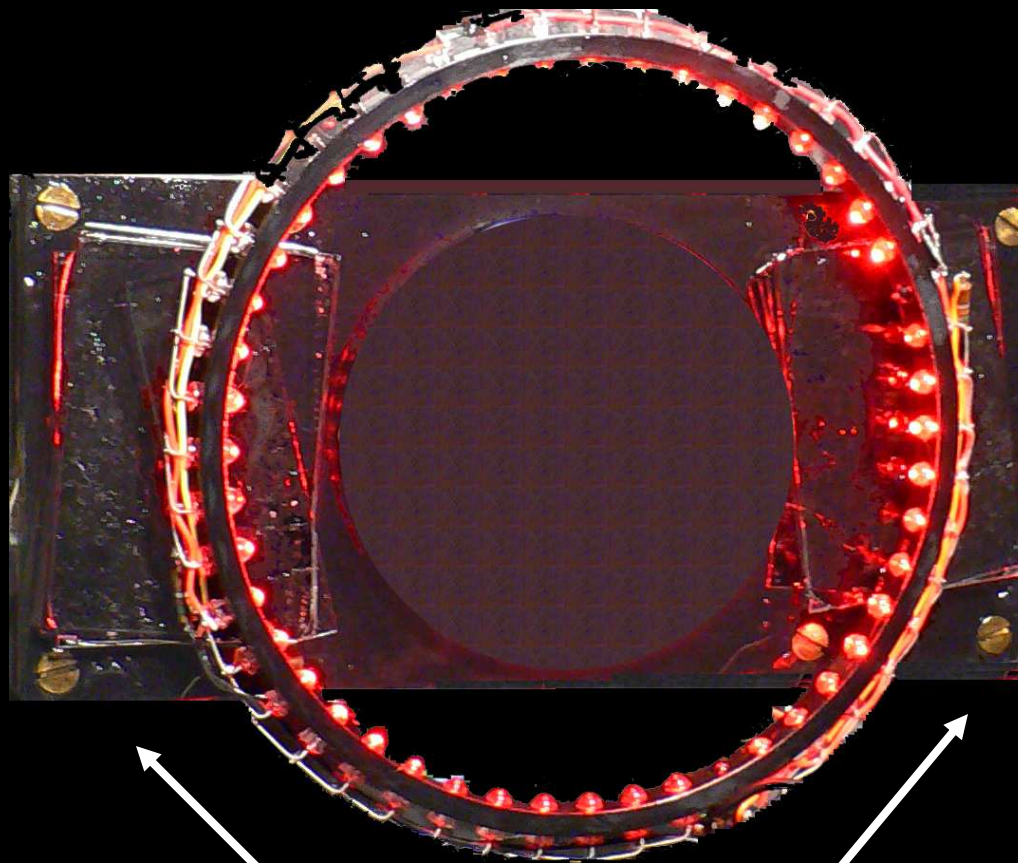


Propagation of intra-neuron computation results combined with *variable* connections?

## Different levels of description of behavior (thermotaxis)

- Mathematical modeling of motion (1000  $\mu\text{m}$ )
- Information processing in neural circuits (10  $\mu\text{m}$ )
- Underlying molecular machinery – protein interactions (<0.01  $\mu\text{m}$ )

Providing the worms with choices –  
the spatial temperature gradient



Heating/Cooling Peltier