

What is *C. elegans*?

What are its navigational strategies?

David Biron

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

Adult (1110-1150 μm)

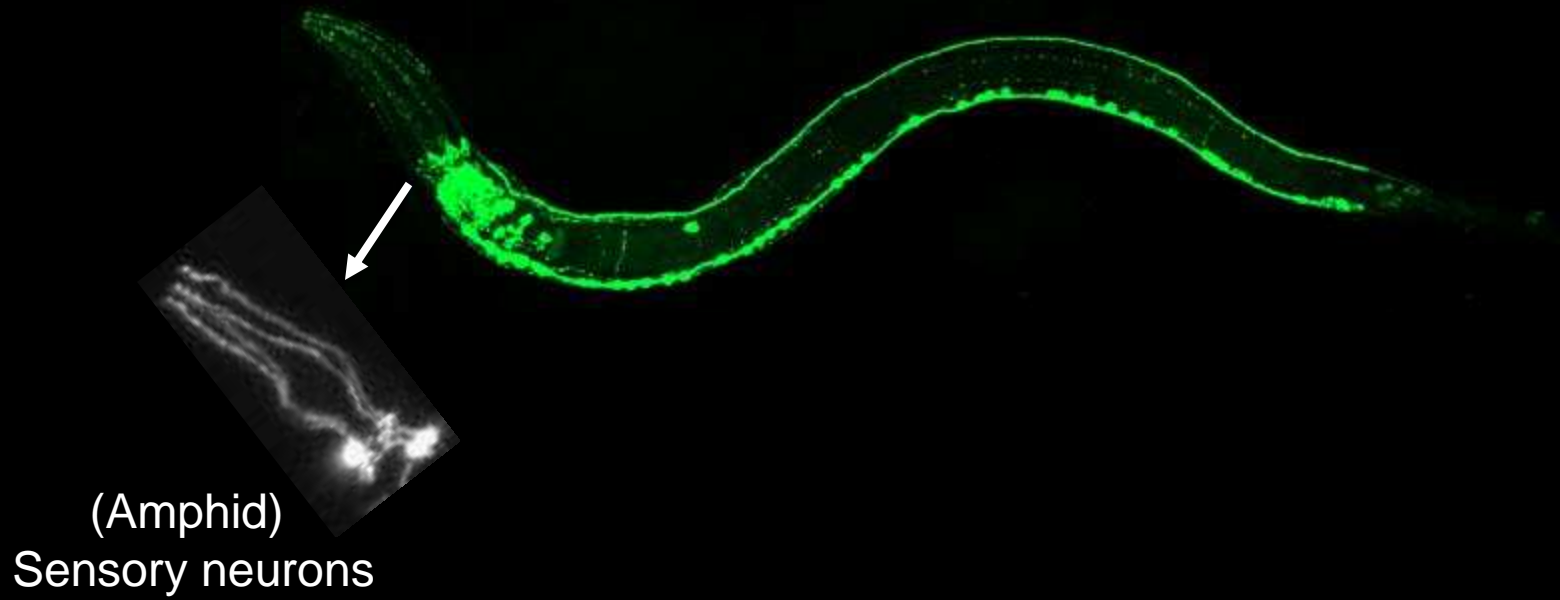


(Adapted from www.wormatlas.org)

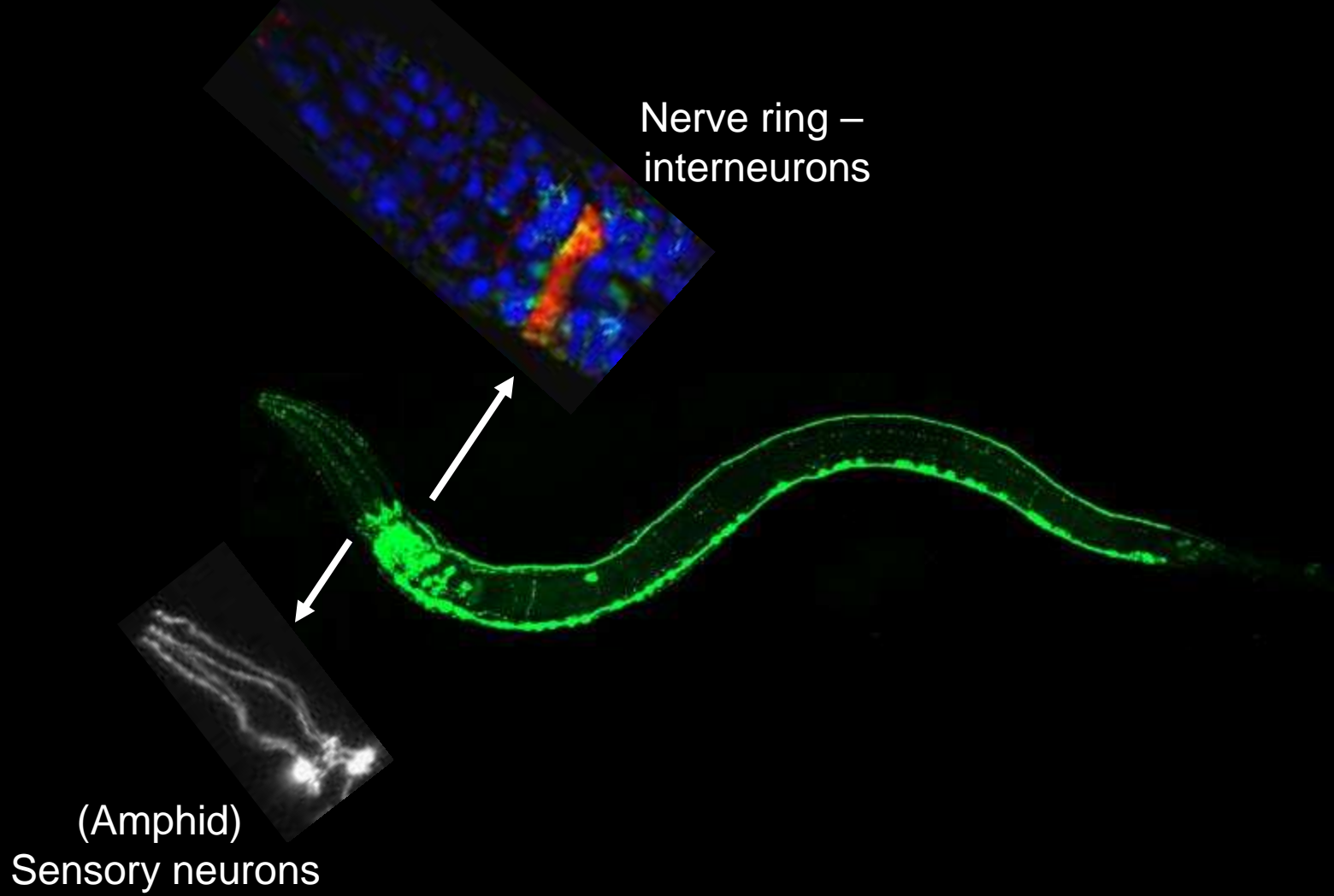
... that became a model system.

- 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

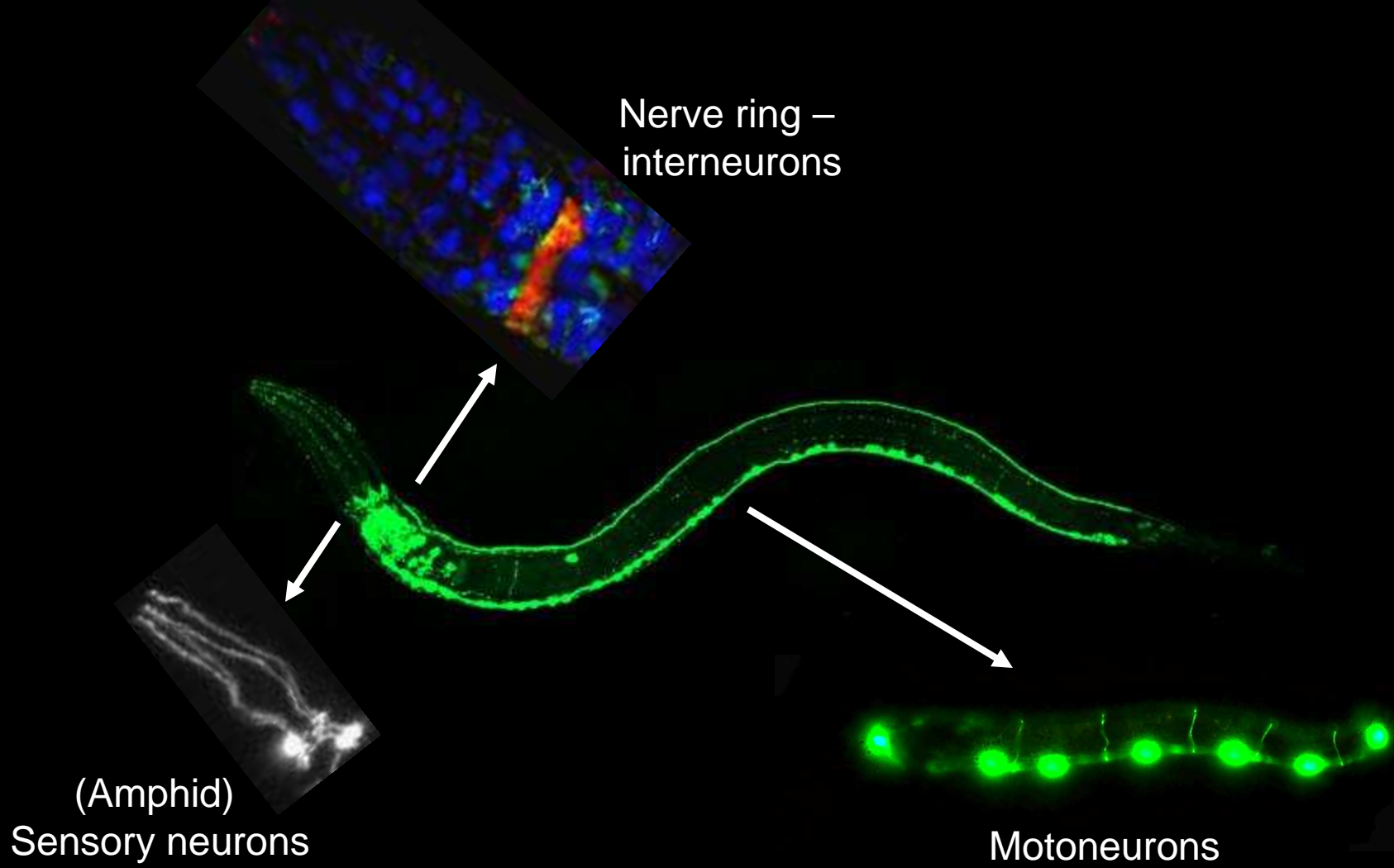
C. elegans neurons



C. elegans neurons



C. elegans neurons



Scales at which computations are performed

Computing cell – E. coli

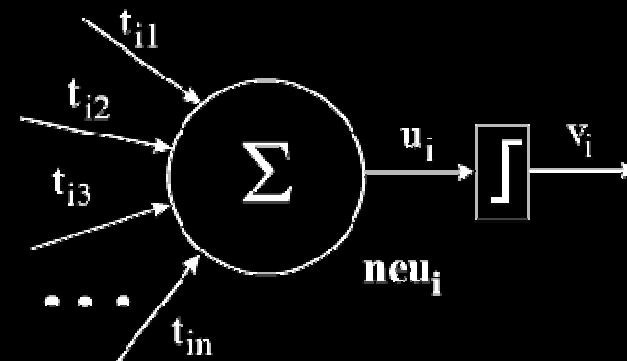


Scales at which computations are performed

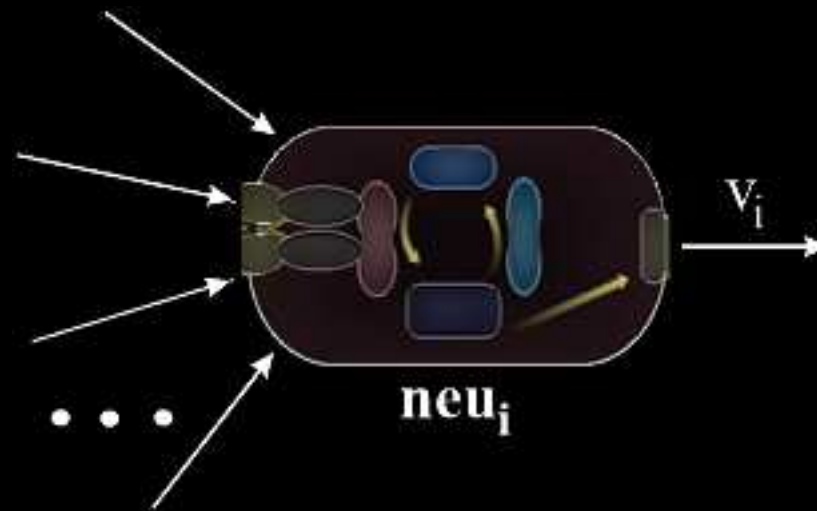
Computing cell – E. coli



Computing neurons – Neural network

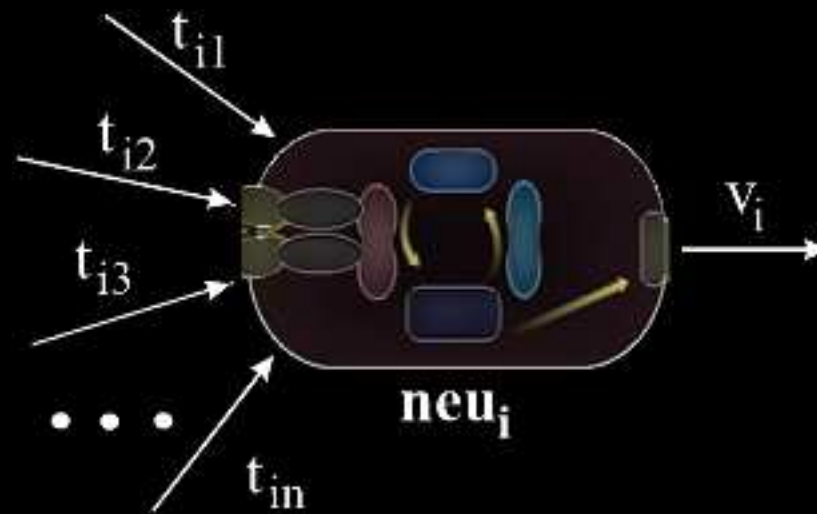


Where are computations performed in small neural circuits?



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

Where are computations are performed in small neural circuits?

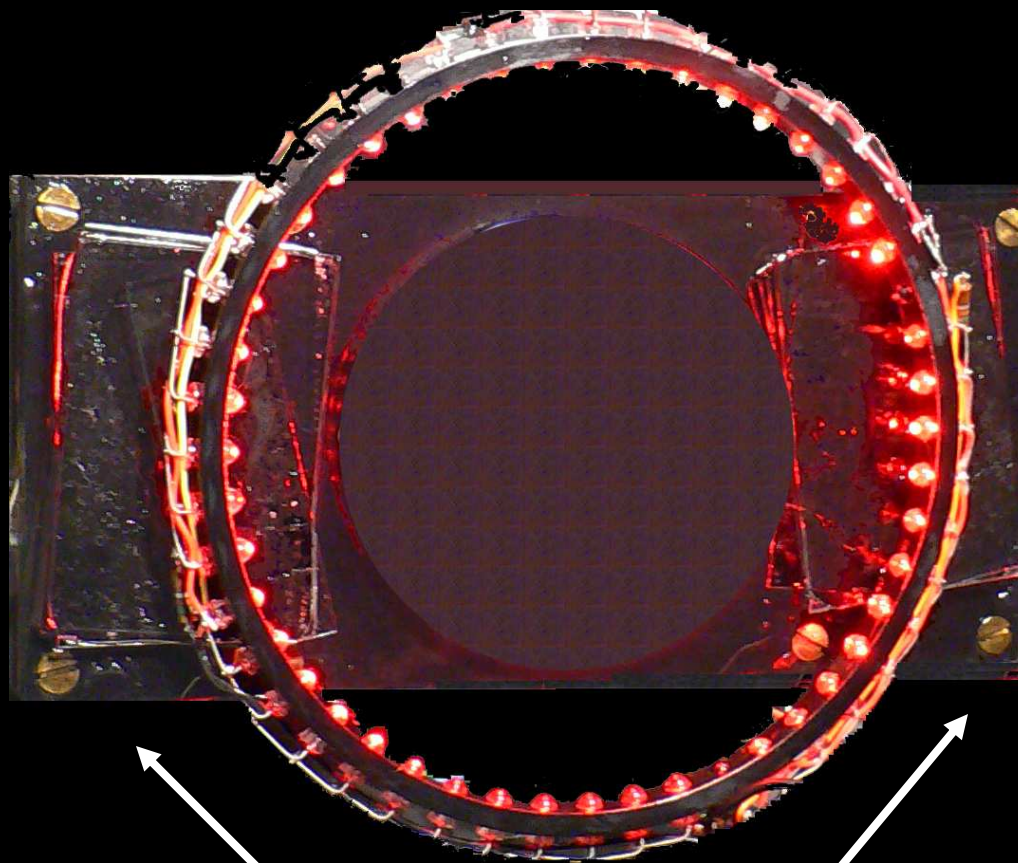


Propagation of intra-neuron computation results combined with *variable* connections?

Different levels of description of behavior (thermotaxis)

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

Providing the worms with choices –
the spatial temperature gradient



Heating/Cooling Peltier