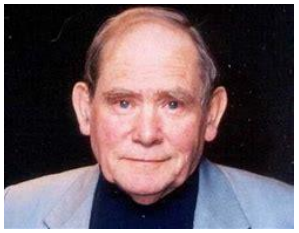
What is *C. elegans*?

Caenorhabditis elegans, or *C. elegans*, is a small roundworm (nematode) usually found in the soil in temperate climates all around the world. It feeds on microorganisms like bacteria and can be most easily isolated from rotten fruit. ~ 1mm length.



C. elegans moving on an agar plate



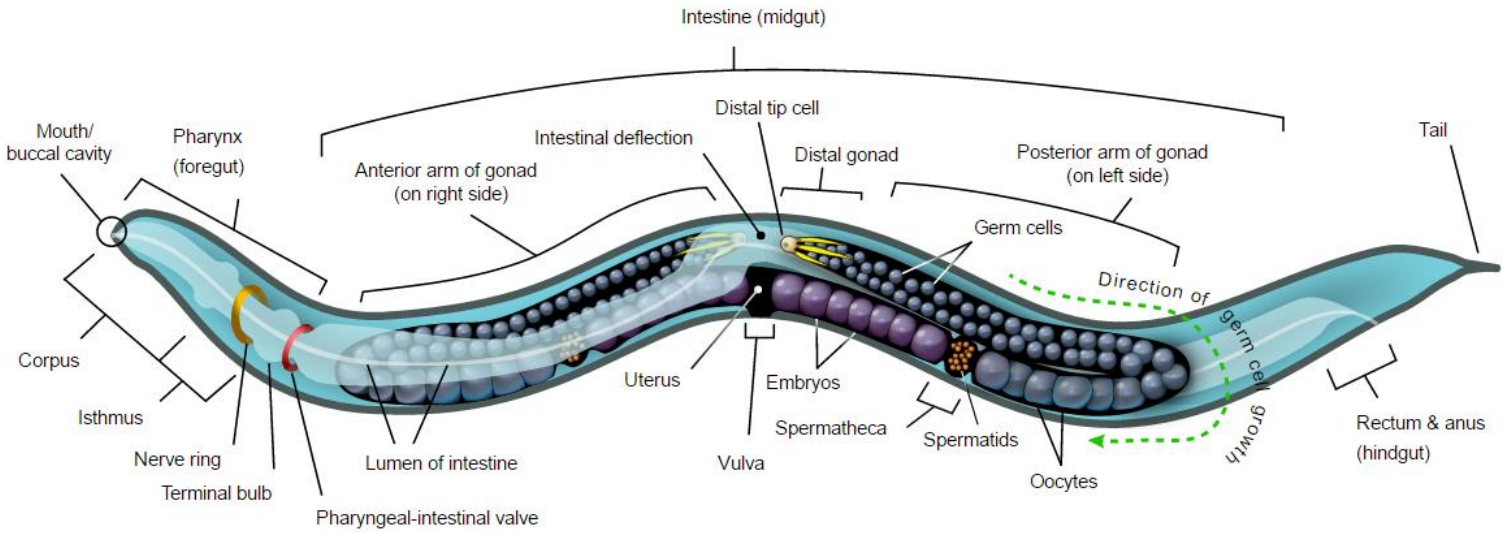
In the 1960s Sydney Brenner at the MRC laboratory in Cambridge, England, decided to use this particular species as a new model organism to study embryonic development. Specifically he was looking for a multi cellular organism that was small, had a simple anatomy with only few cells, was easily cultivated and would reproduce quickly - hallmark features of many nematodes and *C. elegans* in particular. Since then *C. elegans* has become one of the most intensively studied animals and the number of researchers working with *C. elegans* today (2007) exceeds the number of cells this tiny animal has in an adult hermaphrodite.

~1 mm in length, that lives in temperate soil environments

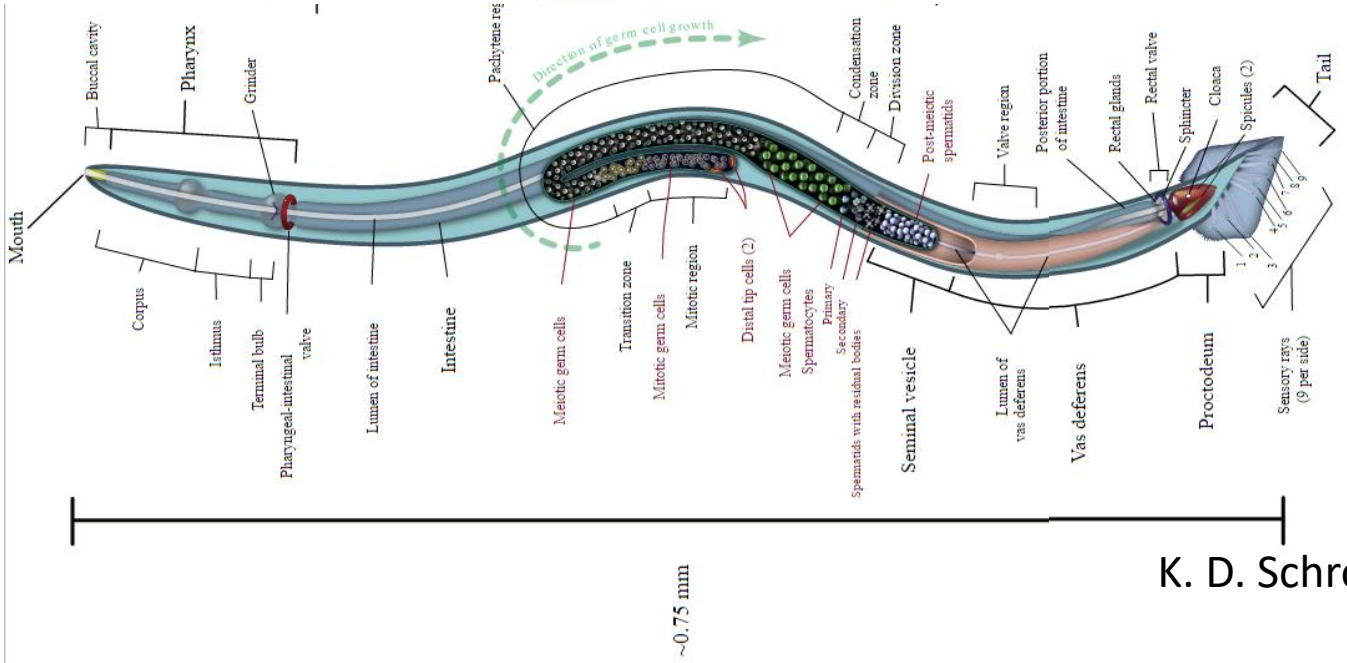
Anatomy

C. elegans has a simple anatomy with a small number of tissues and internal organs. The head contains the brain and the prominent feeding organ - the pharynx. The main body is filled with the intestine and - in the case of an adult hermaphrodite - the gonad consisting of the uterus and spermathika. Embryos start to develop inside the mother and are laid through the vulva around gastrulation stage.

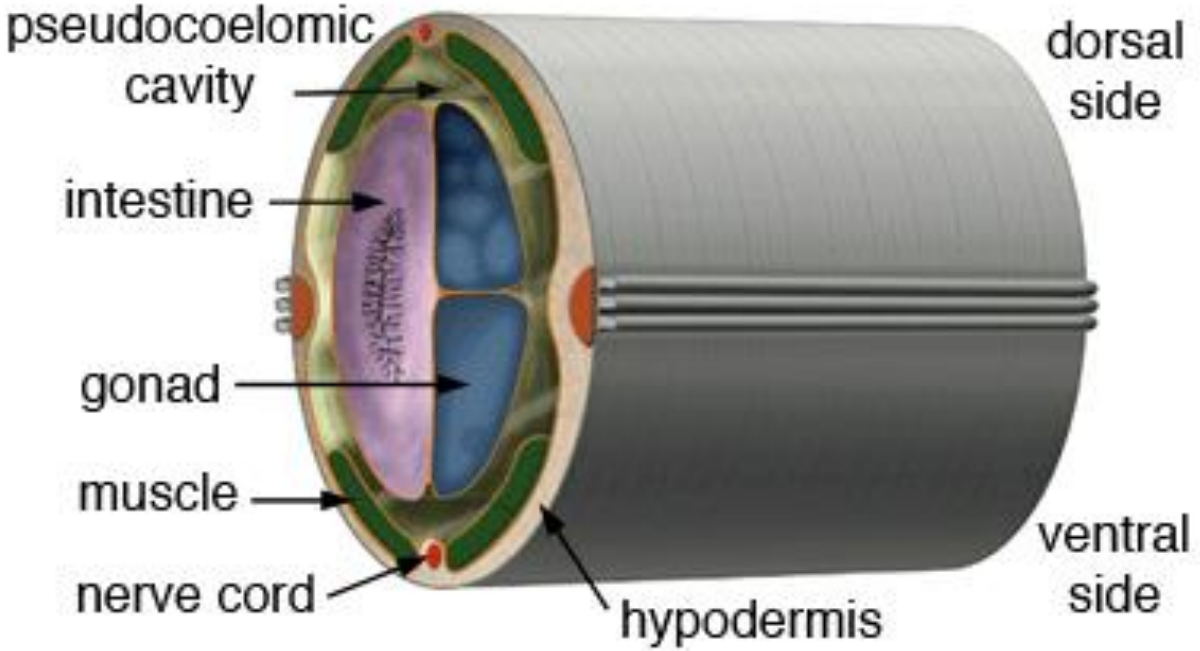
C.elegans was the first animal whose genome was completely sequenced (published 1998)



~1 mm



K. D. Schroeder

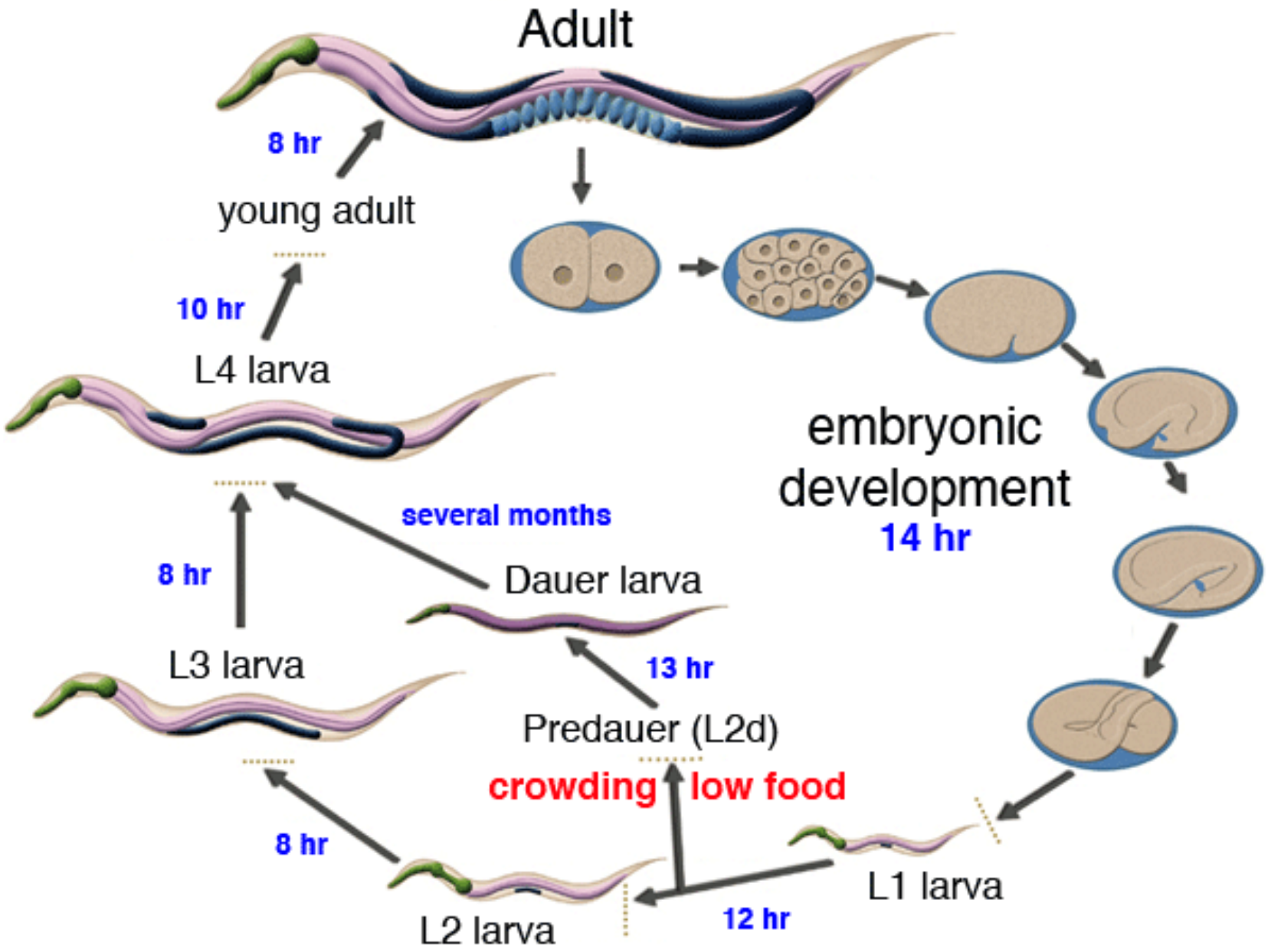


C. elegans anatomy - cross section through the main body (artwork by Altun and Hall, © Wormatlas)

Life cycle

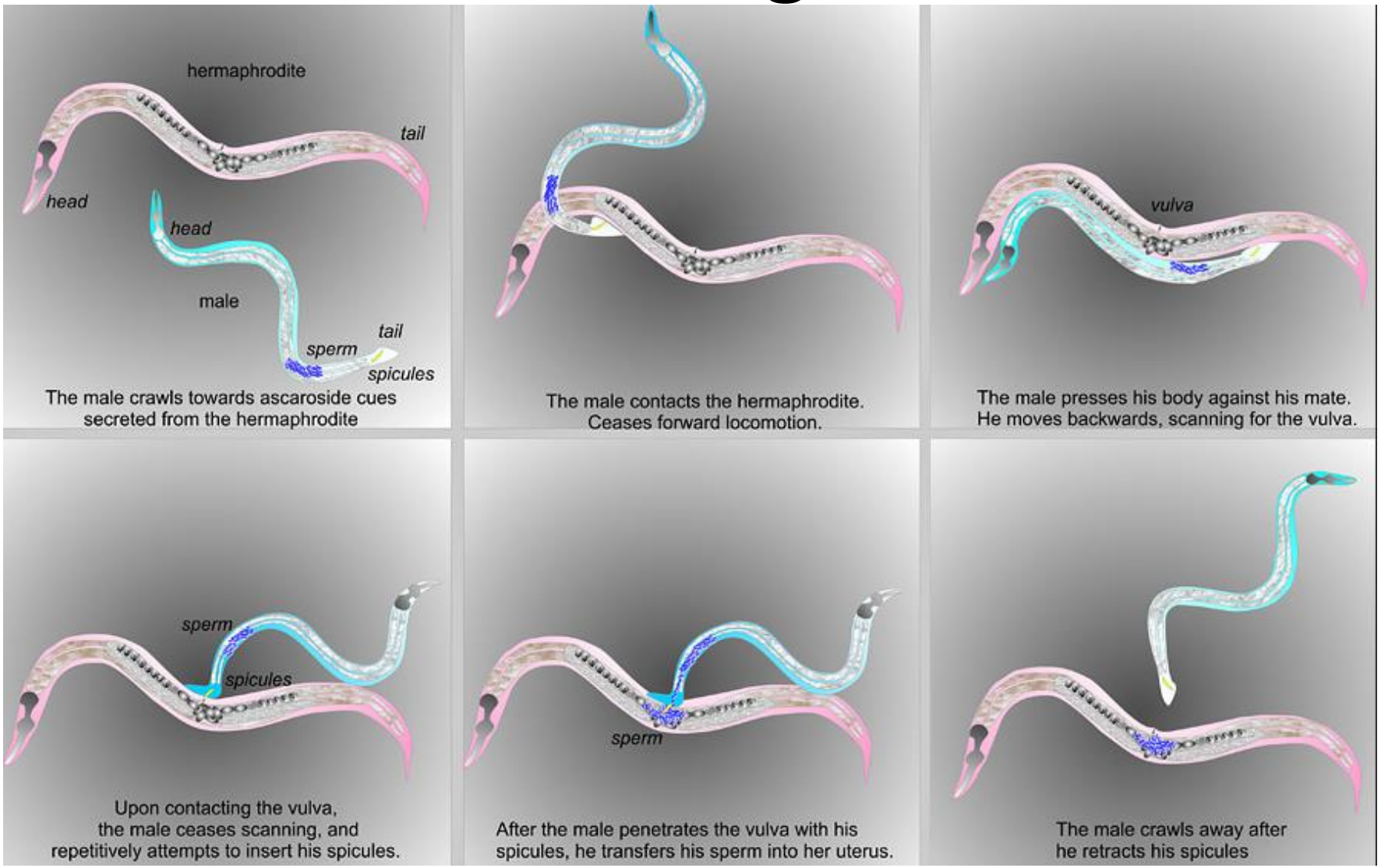
- *C. elegans* embryos develop rapidly and hatch after 14 hours. The first larval stage is completed after another 12 hours and the animals proceed through four molt cycles before becoming adults. Under crowded conditions or in the absence of food larvae can choose an alternative developmental pathway leading to the dauer larva, which does not feed but can survive adverse conditions for several months. When life gets better normal development is resumed, the animals exit the dauer larval stage and develop into the normal fourth larval stage before becoming adult. Adult animals are hermaphrodites and produce both sperm and eggs.

- Over the course of 3-4 days ~300 eggs are laid. The overall life span of *C. elegans* is 2-3 weeks. The short generation cycle facilitates genetic experiments and is a major advantage for researchers working with this organism.

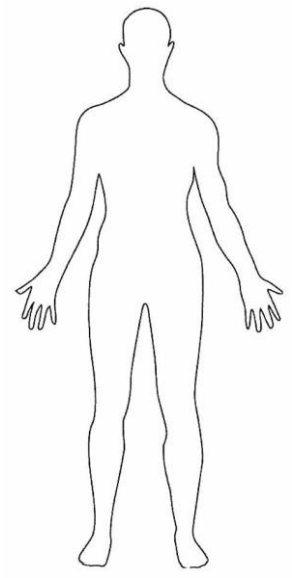


: *C. elegans* life cycle at 22˚C (artwork by Altun and Hall, © Wormatla

Mating


hermaphrodite
tail
head
head
male
tail
sperm
spicules
The male crawls towards ascaroside cues secreted from the hermaphrodite
The male contacts the hermaphrodite. Ceases forward locomotion.
vulva
The male presses his body against his mate. He moves backwards, scanning for the vulva.
sperm
spicules
Upon contacting the vulva, the male ceases scanning, and repetitively attempts to insert his spicules.
sperm
After the male penetrates the vulva with his spicules, he transfers his sperm into her uterus.
The male crawls away after he retracts his spicules

Genome size



Homo sapiens



C. elegans

Human genes : 29,000 *C. elegans* ~19,000.

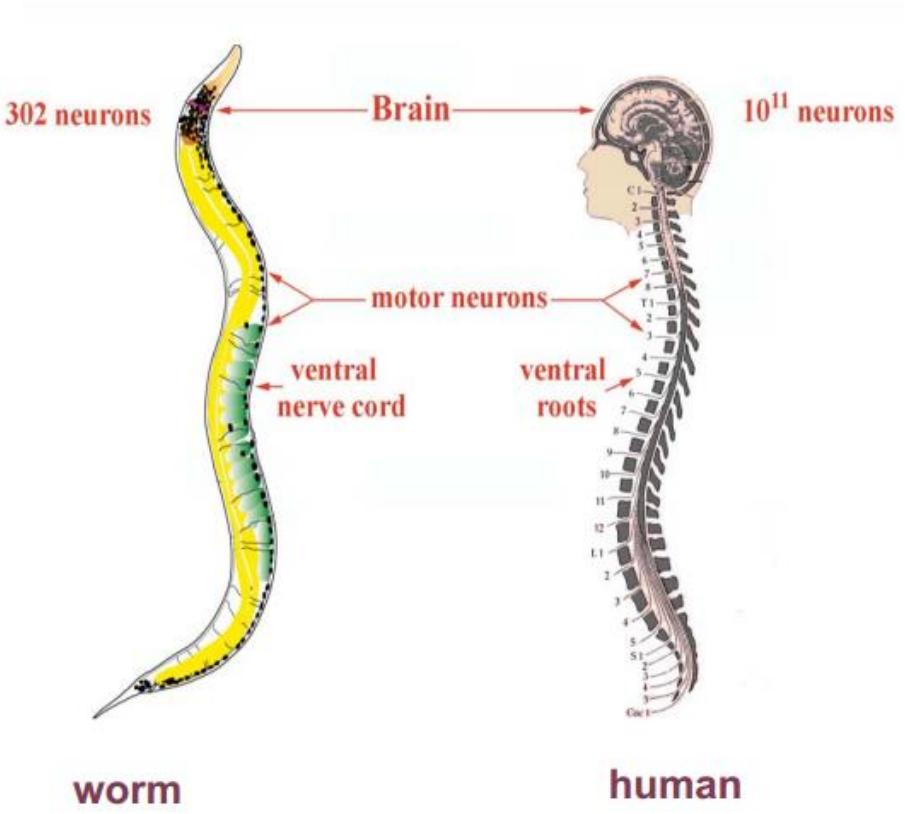
Human genome : 3000 Mbp (3gbp). *C. elegans* 100 Mbp

Nervous system

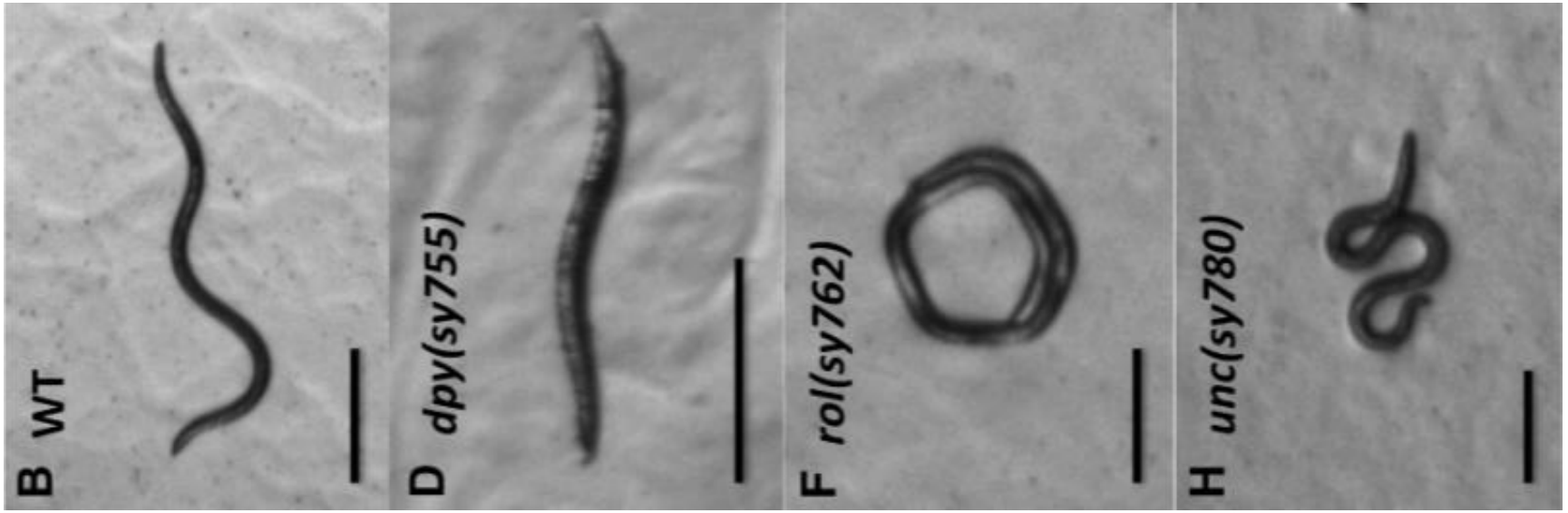
Neuronal specification:
Homeodomain protein code

Axonal guidance:
UNC-6, UNC-5, UNC-40 etc.

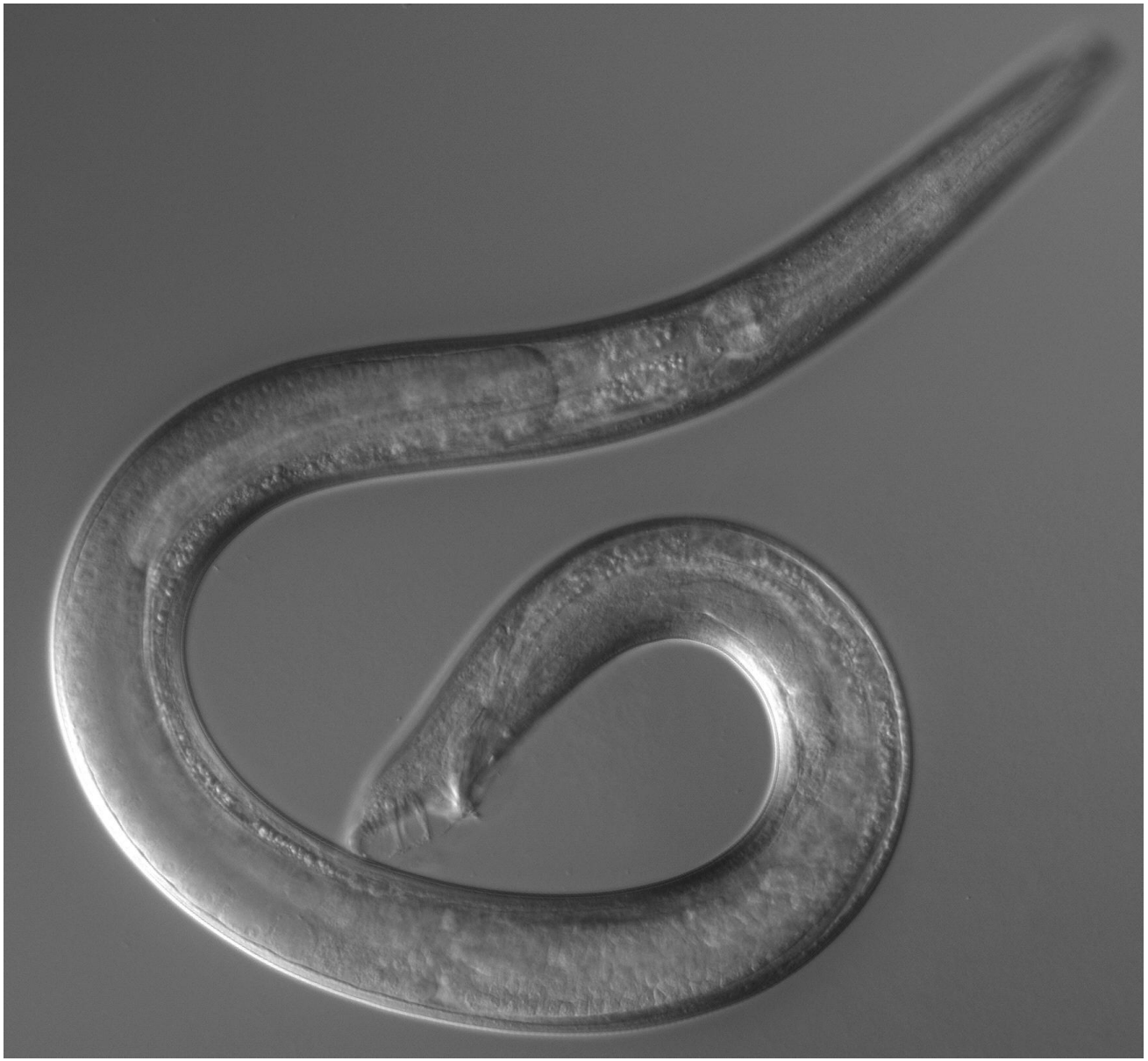
Neurotransmitters:
acetylcholine, GABA etc.



Movement

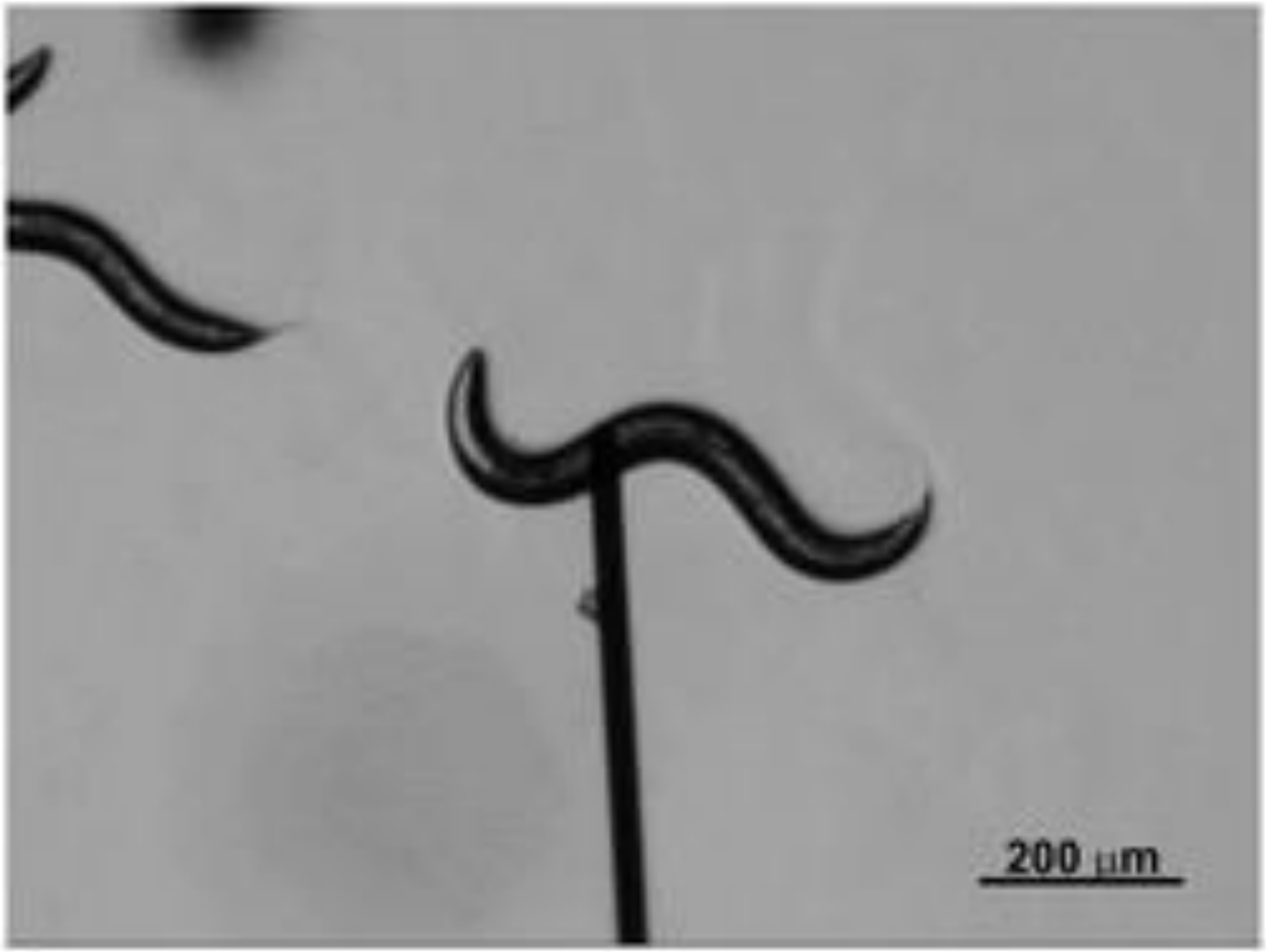











200 µm