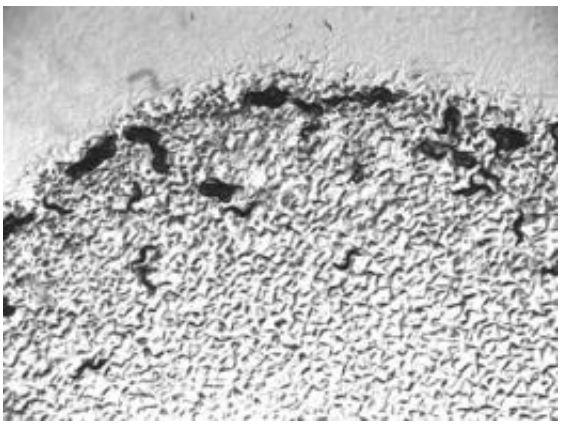
Worm seeks worm: Researchers find chemical cues driving aggregation in nematodes

January 12 2012, by Katie Neith



Chemical cues are used to promote aggregation among roundworms (in black) on a petri dish. [Credit: Caltech/Jagan Srinivasan]

(PhysOrg.com) -- Scientists have long seen evidence of social behavior among many species of animals, both on the earth and in the sea. Dolphins frolic together, lions live in packs, and hornets construct nests that can house a large number of the insects. And, right under our feet, it appears that nematodes—also known as roundworms—are having their own little gatherings in the soil. Until recently, it was unknown how the worms communicate to one another when it's time to come together. Now, however, researchers from the California Institute of Technology (Caltech) and the Boyce Thompson Institute at Cornell University have

identified, for the first time, the chemical signals that promote aggregation.

"We now have an expanded view of a very fundamental type of communication, which is recognizing other members of the same species and getting together with them," says Jagan Srinivasan, a senior research fellow in biology at Caltech and lead author of the study detailing this process, which was published in the January issue of *PLoS Biology*.

The researchers looked at the lab-friendly Caenorhabditis elegans worm—a relatively safe version of the phylum, whose parasitic cousins include hookworms, whipworms, and trichinas, which cause trichinosis—to gather data.

According to Paul Sternberg, Thomas Hunt Morgan Professor of Biology at Caltech and a corresponding author on the paper, nearly 25 percent of the world's human population is infected with some type of parasitic nematode; animals and plants can fall prey to the nasty worms, too. Since nematode parasites live inside a host and attack it internally, knowing how the worms communicate via chemicals could be very important to the fields of biomedicine and agriculture.

"One of the ways to eradicate them would be to have some sort of a chemical that can attract them in order to kill them more efficiently," explains Srinivasan.

Sternberg and Srinivasan are not new to the idea of chemical signaling among C. elegans. In 2008, their research showed how the worms secrete chemicals as a sexual attractant. This time, they worked to find chemical cues that control the social behavior of aggregation. What they found is a complex "language," in which the worms combine different chemicals into compounds, building a molecular library of signals that regulate behavior. They did this by testing a previously identified family of

chemicals in mutant worms—made to not produce the chemicals on their own—to measure the behavioral effects of the different chemical combinations.

"We're starting to get a hold on the chemical 'alphabet' that makes up these words, which have different meanings in different social contexts," says Srinivasan. "It's a modular code that tells us that within the physiology of the organism, there is a lot going on in terms of how the environment is interpreted and read out for social communication."

For example, one class of chemicals the researchers found encourages worm-to-worm company, while a different class of compounds being expressed at the same time keeps other worms away. This suggests that the worms release different amounts of each compound based on what each worm is trying to communicate. If the worm is starting a new colony, it probably just wants a certain number of worms around to find and share food—too many and the colony may not thrive. However, if there is a big piece of fruit, the worm may call on a large group to help access the food source.

"The amazing thing here is that for one chemical, if it's modified even just a little bit, the meaning is changed," says Sternberg, who is also an investigator with the Howard Hughes Medical Institute. "That's what makes it more like a language. If I say a Chinese word, and my intonation is wrong, the word has a different meaning."

Next, the team will explore whether or not the same chemical compounds are made by other nematodes. They will also work to figure out how the worms' nervous system senses and sorts the different compounds.

"Understanding the worm's language is just a first step," says Srinivasan. "We hope that by learning more about how social recognition occurs in

the worm nervous system, we can eventually provide insights into how the human brain encodes social information, too."

More information: "A Modular Library of Small Molecule Signals Regulates Social Behaviors in Caenorhabditis elegans," *PLoS Biology*.

Provided by California Institute of Technology