In the sex lives of male worms in the lab, one gene makes a big difference

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The worm C. elegans

For tiny nematode worms of the species *Caenorhabditis elegans*—one of the workhorses of modern biology—males are rare and all but irrelevant in nature. That's because the vast majority of *C. elegans* individuals are self-fertilizing hermaphrodites. In the laboratory environment, males of the species do turn up with some regularity, and now researchers reporting in the Cell Press journal *Current Biology* on October 8 have made an intriguing discovery: natural variation in a single gene produces males with excretory pores that attract the sexual attentions of other males.

"We found that variation in a single gene makes male worms attractive to other male worms, at least under very controlled and defined conditions in the lab," says Matthew Rockman of New York University. "Although this attraction is probably never manifest in nature, given how rare males are, it points to the way that sexual attraction in these worms

is mediated by molecular biology and shaped by simple genetic differences among individuals."

Scientists have known for a while that some *C. elegans* males are attracted to other males. Rockman and his colleagues were intrigued based on a general interest in understanding how and why individuals differ from one another when it comes to sexual behaviors, as well as other traits. They went in search of the genes responsible for male-male mating in the worms.

They've now traced much of the variation in this behavior to a single gene known as plep-1. Males carrying two copies of a plep-1 mutation attract other males for reasons that remain mysterious. As it turns out, this doesn't work out so well for the worms. When males mate with the excretory pore of another male, they leave an injurious plug behind. Males with plugged excretory pores have trouble during mating, and they don't live as long as, either.

When the researchers asked where this gene is active, they made another remarkable find. "Of the 1,000 cells in a *C. elegans* male, the gene turns out to be active in one: the excretory cell," Rockman says.

The researchers say that the persistence of this gene, despite its detrimental effects on the individuals who carry it, may be explained by relaxed selection on male function in the species. In other words, males are rare and relatively unimportant anyway. In the scheme of things, the plight of plep-1 mutants makes little difference to the larger population. The prevalence of self-fertilization also makes natural selection very inefficient in this species.

This isn't the first study to show that worms' behaviors can be "surprisingly modular," explains Luke Noble, the paper's lead author. "In some cases, the activity of single genes is required to specify single

neurons, which are in turn required for components of behaviors such as locomotion and environmental sensing, at least under very restricted conditions in the lab."

Still, most of their behaviors, including mating, are more complex, involving multiple genes and genetic networks. As a result, the new findings come as something of a surprise.

The researchers say they'd like to figure out how this one mutation in one gene makes males attractive to other males. They'd also like to explore male-male excretory pore plugging in the closely related species *C. briggsae* and the function of the gene plep-1 in worms and other species.

"These genes have been conserved across a huge swath of evolutionary history, and their functions are unknown," Rockman says.

More information: *Current Biology*, Noble et al.: "Natural Variation in plep-1 Causes Male-Male Copulatory Behavior in C. elegans" dx.doi.org/10.1016/j.cub.2015.09.019

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