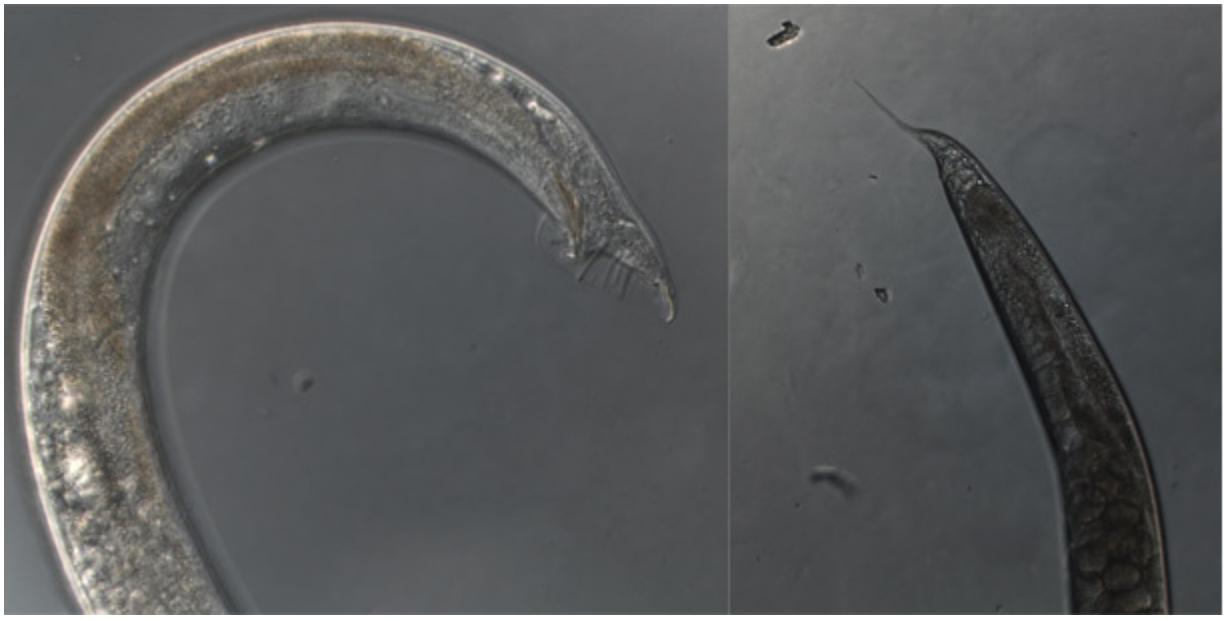
Evolution Keeps Sex Determination Flexible

September 9, 2011



Researchers studied adaptations in sexual determination of 50 generations of female/hermaphrodite nematodes (right) and male nematodes (left), and their findings show the worms evolved rapidly to compensate for the effects of harmful mutations. Photos by Chris Chandler.

There are many old wives' tales about what determines a baby's sex, yet it is the tight controls at the gene level which determine an organism's sex in most species. Researchers at Michigan State University have found that even when genetic and genomic mechanisms are disrupted, organisms quickly evolve ways to compensate.

In research published this week in the journal *Evolution*, scientists from the BEACON Center for the Study of Evolution in Action headquartered at Michigan State University along with colleagues from other universities used an experimental evolution approach to study adaptations in sexual determination of nematodes, more commonly known as worms.

"Our findings show the nematodes evolved quickly to diminish any negative effects caused by mutations in the sex-determining mechanisms," said Christopher Chandler, a post-doctoral researcher who led the study.

Chandler and a team of researchers studied 50 generations of nematodes, after introducing mutations in the genes that normally help worms develop into males or females. These mutations' effects also depend on the environmental temperatures, so the team tested whether worms adapted to the mutations at just one temperature, or across a range of temperatures.

"Unless we grew them in pretty warm environments, it didn't seem to matter much – the worms evolved to do better across a range of temperatures," said Chandler.

"At the genetic level, the worms by-passed the problem rather than fixing it directly," said Ian Dworkin, assistant professor of zoology. "There was little or no change in the genes involved, and instead they made the changes elsewhere. As they evolved, they swiftly compensated to create a balance with respect to their sex."

The findings have big implications for how sex determination evolves. Sex determination is important for reproduction in all

organisms and it is tightly controlled at the gene level.

“Our findings show the mechanisms themselves are flexible and adaptable from an evolutionary viewpoint,” said Chandler. “If something goes wrong with the control mechanisms, a work-around can quickly be found to restore the balance.”

The National Science Foundation funded the study. Dworkin and Chandler are members of the BEACON Center for the Study of Evolution in Action, an NSF-funded Science and Technology Center headquartered at Michigan State. The research team also included Genna Chadderdon and Fredric Janzen from Iowa State University, and Patrick Phillips from the University of Oregon.

More: EXPERIMENTAL EVOLUTION OF THE CAENORHABDITIS ELEGANS SEX DETERMINATION PATHWAY

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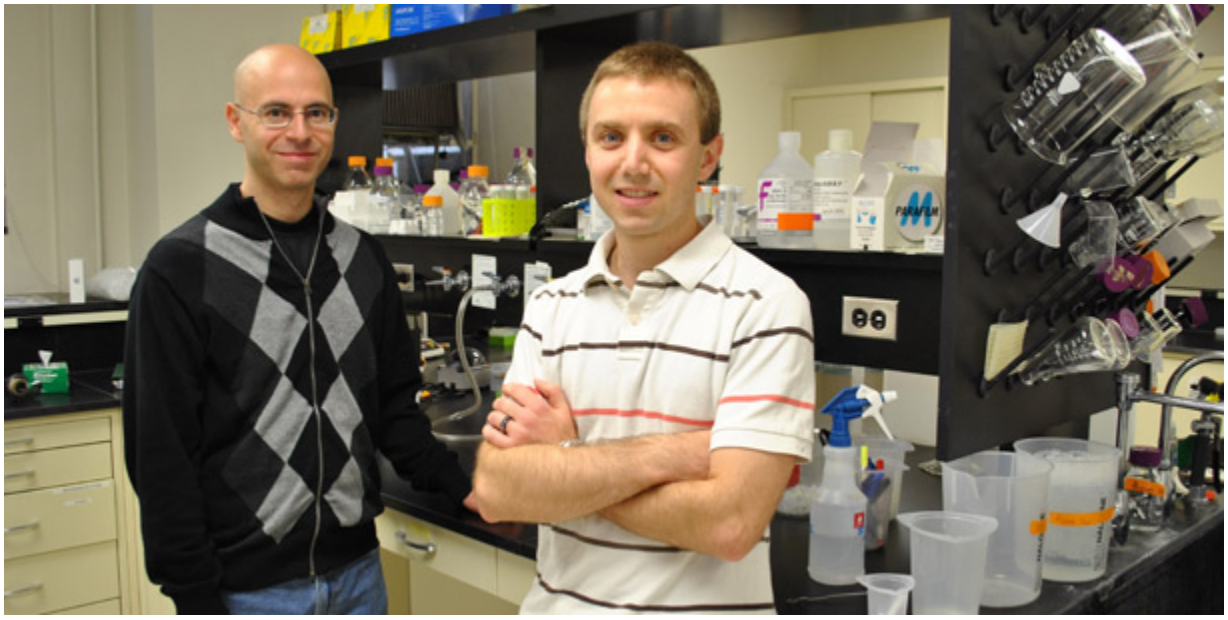
News release written by Michael Steger, MSU College of Natural Science



Assistant Professor Ian Dworkin (left) and Post-Doctoral Researcher Chris Chandler (right) in the Dworkin Lab in MSU's historic Giltner Hall. Photo by Michael Steger.

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