Evolution keeps sex determination flexible

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There are many old wives' tales about what determines a baby's sex, yet it is the tight controls at the gene level that 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 Evolution, scientists from MSU's BEACON Center for the Study of Evolution in Action led a team of researchers using 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 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," Chandler said.

At the genetic level, worms bypassed the problem rather than fixing it, said Ian Dworkin, assistant professor of zoology.

"There was little or no change in the genes involved, and instead they made the changes elsewhere," he said. "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," Chandler said. "If something goes wrong with the control mechanisms, a work-around can quickly be found to restore the balance."

Provided by Michigan State University