The nature of nurture is all about your mother, study says

March 31 2015

A mother squirrel carries her young pup. Credit: Ryan W. taylor

When it comes to survival of the fittest, it's all about your mother - at least in the squirrel world.

New research from the University of Guelph shows that adaptive success in squirrels is often hidden in the genes of their mother.

"Some squirrels are genetically better at being mothers than others," said Andrew McAdam, a professor in U of G's Department of Integrative Biology and co-author of the study published today in *Proceedings of the Royal Society B*.

The research team analyzed 24 years' worth of data from a population of North American red squirrels in Canada's Yukon and measured maternal genetic effects in squirrel offspring.

"We provide evidence that genetic differences in the nurturing ability of red squirrels affect the fitness of their offspring," said McAdam. He worked on the study with Eryn McFarlane, a former Guelph graduate student and lead author of the paper who is now at Uppsala University in Sweden.

Biologists have debated "nature vs. nurture" for decades, McAdam said. "Are we born a blank slate or is our destiny in life written out for us in terms of our genetics?"

It's widely recognized that mothers make important contributions to attributes of their developing offspring.

"But our study is the first to measure how important these genes in the mothers are to the evolutionary success of their offspring."

Researchers tracked squirrels throughout their lifetime by marking each animal and using radio collars to find their nests. "It was a collaboration with researchers from three Canadian universities," McAdam said, crediting his PhD adviser, University of Alberta professor Stan Boutin, with establishing the project.

At first, the researchers found no evidence for the heritability of fitness. "This is not uncommon, but it's depressing for someone interested in

studying adaptation," McAdam said.

"But Eryn noticed that there seemed to be a difference in fitness among squirrels that depended on who their mother was, and decided to look and see whether those differences among mothers were due to genetics."

Female squirrel with her older pup. Credit: Ryan W. Taylor

They discovered a hidden source of adaptive potential that has not been measured before, McAdam said. "It wasn't in the genes of the offspring—it was hidden in the genes of their mothers."

These maternal genetic effects on offspring fitness can drive evolution even when offspring genes have no direct effect on fitness, he said.

"It represents a previously undocumented source of adaptive potential in wild populations."

Although they don't know all attributes that make for a "better mother," the researchers found that genetically gifted mothers often give birth earlier in the breeding season and their pups are more successful in establishing territories. "This is just one attribute. We also know that there are still more yet to be discovered."

"What is clear is that the benefits of good mothering early in life are compounded across a whole lifetime."

More information: The Nature of Nurture in a Wild Mammal's Fitness, rspb.royalsocietypublishing.or … .1098/rspb.2014.2422

Provided by University of Guelph

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