# Bees fight to a stalemate in the battle of the sexes

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Just like humans, whether or not some genes are switched on in bumblebees is a result of a battle of the sexes between genes inherited from their mother and genes inherited from their father.

Published online today in the Royal Society journal, *Proceedings of the Royal Society B,* a new study from the University of Leicester provides new evidence for the kinship theory of evolution of genomic imprinting in bumblebees.

Each bumblebee worker inherits two copies of every gene – one from their mother and one from their father. For a small number of genes, they only ever use one copy, and which copy is used depends on whether

it came from their mother or their father. This is known as genomic imprinting and occurs through a process called methylation which has been found to be important in whether or not a worker bumblebee reproduces.

Lead researcher, Dr Eamonn Mallon from the University of Leicester's Department of Biology, said: "Genomic imprinting is absolutely fascinating. Paternal and maternal genes are constantly at war with each other and are selected to behave in different ways. Our study has shown that genes involved in whether a bumblebee worker can reproduce are involved in methylation; the molecular mechanism for imprinting.

"Worker bees can reproduce, but don't because the Queen is physically preventing them. When the Queen is removed from the colony, we found bees became more aggressive as they attempted to dominate reproduction.

"The kinship theory states that genomic imprinting – a rather strange phenomenon – evolved as a result of an eons long battle of the sexes between the genes which come from a mother and the genes that come from a father. The theory predicts that genes involved in queenless worker bees' reproduction should be imprinted."

In the first step to testing the theory, the researchers have shown that methylation – a molecular switch that prevents a gene from being turned on, and the main mechanism for genomic imprinting – is important in worker reproduction. By interfering in the methylation process, the researchers were successful in changing normal worker bees into reproducing bees.

Dr Mallon added: "Next, we will look directly for genomic imprinting in this behaviour and evidence of this would dramatically alter our understanding of how bees developed their social lives.

"The study is important because lots of human diseases, including cancer, occur when genomic imprinting goes wrong, and so it is vital for us to understand this evolutionary battle to enable us to better understand how cancers and other such diseases occur."

**More information:** Harindra E. Amarasinghe, Crisenthiya I. Clayton, and Eamonn B. Mallon. "Methylation and worker reproduction in the bumble-bee (Bombus terrestris)." *Proc. R. Soc. B* April 7, 2014 281 1780 20132502; DOI: 10.1098/rspb.2013.2502 1471-2954

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