

## Royal jelly triggers queen genes

[Anna Salleh](http://www.abc.net.au/profiles/content/s2193248.htm?site=science) (<http://www.abc.net.au/profiles/content/s2193248.htm?site=science> )  
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Royal jelly determines which bee larvae turn into queens by boosting the activity of particular genes, say Australian researchers. They say the findings could provide clues on how the environment interacts with genes to produce obesity, longevity, sterility and brain disorders in humans.

Molecular biologist Dr Ryszard Maleszka and colleagues from the [Australian National University](http://www.anu.edu.au/) (<http://www.anu.edu.au/> ) in Canberra report their findings today in the journal *Science* (<http://www.sciencemag.org> ) .

"The larvae that develop into workers and queens are genetically identical," says Maleszka.

Yet he says those fattened up on royal jelly become fertile queen bees and are much larger and longer-lived than the rest that turn into sterile workers.

The researchers wanted to test the idea that royal jelly controls queen and worker development via epigenetics.

Epigenetics involves chemical modification of the genome to change gene expression, and provides a way for the environment to affect an organism's genetics.

Some scientists think epigenetic factors explain why psychiatric diseases such as schizophrenia don't always appear in both identical twins.

### Experiment

Maleszka says the sequencing of the honey bee genome in 2006 revealed genes that mediate epigenetic effects in mammals.

One of these genes codes for the enzyme DNA methyltransferase (Dnmt3) that in mammals suppresses the expression of particular genes by attaching a methyl group to them.

The researchers tested what happened when they silenced the Dnmt3 gene in hundreds of larvae.

When the Dnmt3 gene was silenced, most of the larvae turned into queens. When the Dnmt3 gene was active, most of the larvae turned into workers.

"It was a beautiful switch," says Maleszka. "The results were so spectacular."

### Royal jelly feast

They then compared the pattern of gene expression in larvae fed royal jelly in the hive with that in larvae whose Dnmt gene was silenced.

"The same genes were being activated by royal jelly as when the DNA methylation was silenced," he says.

Maleszka says the findings provide strong evidence that silencing the epigenetics mimicks the effect of royal jelly.

"This is the clearest demonstration that DNA methylation is involved in determining a very specific characteristic," says Maleszka.

Maleszka says he doesn't know how royal jelly silences the Dnmt3 gene but speculates the insulin signalling



In a colony of 60,000 bees, only the queen (marked in blue) can produce offspring. Now scientists say they know what sends larvae on the path to queendom (*Source: Ryszard Maleszka*)

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pathway is involved.

### **Future research**

He says the next step is to study whether Dnmt3 is involved in controlling bee brains and the social behaviour of workers and queens.

Maleszka says such research will give clues to scientists who are looking for epigenetic factors in human obesity, infertility, longevity and brain disorders.

A spin-off from the new work is that the team has developed a way of producing queen bees in a test tube, without using royal jelly.

Maleszka says this is of great interest to US beekeepers who want to get "clean" queen bees to help re-establish colonies devastated by Colony Collapse Disorder.

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