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A Minute with May Berenbaum

Entomology professor and department head May Berenbaum wrote an [Op-Ed article published in the New York Times](#) in March about the collapse of honey bee populations across North America. Berenbaum presides over the department that is home to several faculty members who led the sequencing of the honey bee genome, completed in 2006, putting Illinois researchers and their partners at other institutions in a unique position to tease out the genetic dynamics of this mysterious decline. Berenbaum was interviewed by [News Bureau Life Sciences Editor Diana Yates](#).

How bad is the current decline in honey bee populations?



Honey bees have been through the wringer since the early 1980s, when a species of parasitic mite was accidentally introduced into North America. As of 2005, we had about a third fewer honey-producing colonies than we did before the introduction of the mite. Between 2005 and 2006 there was another marked decline, and now it looks like the numbers are dropping precipitously. What makes the situation particularly critical is the fact that the demand for pollination services – not honey, per se, but the services – is exploding.

How does a colony respond to a drop in the number of its workers?

An essential focus of (entomology professor) Gene Robinson's work for years has been to understand how individual workers in colonies know what work needs to be done. You can experimentally create a shortage of foragers – the individuals that go out in the field and collect nectar and then watch what happens. Foragers typically go through a progression of tasks within the colony before they become foragers. If you remove all the foragers, the remaining workers speed up development to fill the missing slots. But with colony collapse disorder there are just too many missing slots to fill.

Have you ever seen anything like this before?

No, this is without precedent on this scale. Bees have died before, in vast numbers generally they leave bodies behind. Now, there are no bodies. That's what's so puzzling. People have suggested that colony collapse disorder could be the result of the combined effects of parasites, pesticide exposure and fungal disease. But where are the bodies? Very strange, very sad.

Why is the scientific community at such a loss to explain why honey bees are disappearing?

We really in many ways are appallingly ignorant of the complex social life of the honey bee and of pollinators in general. I was on the National Research Council Committee charged with evaluating the status of pollinators in North America. And it is staggering how little I know about some of the most familiar insects in North America. We just haven't bothered to take them for granted.

How could the honey bee genome be helpful to understanding what's going on?

Well, this is a phenomenal tool. For the first time we can query all 11,000 (plus or minus 1,000 or so) genes that are in the genome with a technique called microarray analysis. We can compare gene expression – which genes are turned on and which genes are turned off – in healthy and afflicted bees. If, for example, afflicted bees differ in the pattern

expression of genes associated with immune response, that suggests that they've been exposed to a pathogen. If the genes that are associated with detoxifying certain substances such as pesticides are differentially expressed, that implicates the presence of some foreign toxic substance. If genes associated with foraging behavior are affected, that suggests there may be a problem with navigation or orientation.

It's unfortunate that there's a crisis. But it's really fortunate that it's this year and not last year, because this year we have the honey bee genome and the whole genome map.

Is there anything else you want to say about this phenomenon?

There is an effort to include language in the new Farm Bill on pollinator conservation. Pollinator conservation means identifying and supporting land management practices that encourage pollinator populations. So, instead of planting wild grasses, farmers are encouraged to plant wild flowers that can provide nectar and pollen. Plant floral resources for wild pollinators – not just bees, but also butterflies and bats.

One of the findings of the National Research Council Committee report is that habitat degradation and habitat loss are clearly contributors to pollinator decline. So we need to figure out incentives for people to provide resources to maintain pollinator survival.

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