

[Home](#) > [News](#) > [Daily News Archive](#) > [2007](#) > [November](#) > 15 November (Kaplan)



Queen Bees Control Sex of Young After All

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Royalty has its privileges, even in the insect world. Queen honey bees can choose the sex of their offspring, a new study shows. Like a sharp stinger, that finding pokes a hole in the notion that queens are merely mindless egg layers and that worker bees have the final say on whether the queen lays eggs that give rise to males or females.

Decider in chief.

A young queen (*center*) surrounded by larger drones and smaller workers.

Credit: Zachary Huang/Michigan State University

Every young queen goes on a mating flight and then stores the sperm she collects from multiple matings for the rest of her life, using it up bit by bit as she lays eggs. Males, called drones, emerge from unfertilized eggs, and females emerge from fertilized ones and

become the workers. So if the queen adds sperm to an egg, it will produce a female; if she withholds sperm, the egg will produce a male. That would appear to give the queen control over the sex of her offspring. However, the dogma among entomologists is that workers control the type of eggs the queen lays. The workers build the cavities, known as cells, in which the queen will lay her eggs. A queen will lay an unfertilized egg in a particular cell only if the cell is big enough to accommodate a male larva, which is bigger than a female one. So by controlling how many cells they build of each size, the workers can limit how many male offspring the queen produces.

Despite these constraints, the queen can still tip the gender balance of the hive, report Katie Wharton and a team of entomologists at Michigan State University in East Lansing. To prove it, they confined queens inside their hives in specially built cages. Each cage was placed so that the queen could not reach the large cells where she could lay drone eggs but only the small cells where she could lay worker eggs. After 4 days, the cage was removed and the queen allowed to roam free in the hive, which had ample empty cells of both sizes. The queen then sought out the larger cells and, on average, laid nearly three times as many drone eggs as usual, apparently making up for the skewed hive gender ratio that resulted from her incarceration, the researchers report in the November/December issue of *Behavioural Ecology*. "The workers and the queen clearly share control of honey bee demographics," Wharton says. "It was like discovering a checks-and-balances government inside the hive."

The queen's ability to make "her own decisions" adds a new layer of complexity to life in the hive and raises questions about what stimuli the queen is responding to, says Lars Chittka, an entomologist at Queen Mary University in London. "Is she remembering how many eggs she has laid, can she sense how much sperm she has used, or is there some sort of chemosensory cue telling her how many drone larvae are in the cells?" Chittka says. "Following this new research, it's anybody's guess."

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