

YA CAN'T TELL THE PLAYERS WITHOUT A SCORECARD To find out if bumblebees are multi-taskers, Kathryn Gardner '01 kept track of individual workers by gluing numbers on their backs and videotaping their activity.

research

Bumblebee housewarming: It's not my job, man

Bumblebees, it appears, aren't always that busy

Should you have the luxury of lounging in a meadow some sunny afternoon, you might notice that honeybees skip right over clover and alfalfa flowers (apparently they are the Brussels sprouts and broccoli of honeybeedom). Later you might observe that their larger cousins, the black-yellow-and-orange bumblebees *Bombus huntii* are rather partial to these very blossoms.

Of course, animal-behavior researchers already knew this. And they knew that the warmblooded *Bombus huntii*, native to the Pacific Northwest, are successful in cooler climes because they can heat their bodies while flying from flower to flower on a chilly day. That makes them valuable pollinators for cool-weather food crops such as blueberries, cranberries, and greenhouse-grown vegetables.

But researchers didn't know exactly how bumblebees survived temperature extremes *inside* their nests. To find out, Kathryn Gardner '01 conducted a summer research project under the guidance of Robin Foster, associate professor of psychology at UPS, and Sean O'Donnell, associate professor of psychology at the University of Washington.

Running hot and cold

"We knew that these bumblebees incubated, or heated, the nest, and that they fanned, or cooled, the nest to temperatures ideal for the brood's development," Gardner explains. "But we did not know whether every bee participates or whether they follow a strict division of labor. This was the first time that behavioral mechanisms of temperature control for these bees was investigated."

Foster and Gardner began their summer project in March 1999. The *Bombus huntii* queens had to be fresh from hibernation, so they crossed the Cascades to harvest queens in Eastern Washington, which offers a more predictable period of hibernation emergence than the varying climates of Western Washington.

Back in the laboratory, they set the queens up in ersatz nests resembling large glass-covered soup bowls. Foster made the nests from porous concrete she mixes and pours into molds designed by Christopher Plowright at the University of Toronto. Through glass-topped plywood feeder boxes, they regularly fed the bees with fresh honeybee pollen bought from local beekeepers.

Bee I.D.

To keep track of each bee, Gardner (then a UPS sophomore, now a Cornell entomology Ph.D.) glued tiny 1.5-mm tags to the thorax of worker bees. Anyone who's put rain gear on toddlers or sweaters on shorthaired dogs might wonder how. The tempting solution: Put them in a stupor.

Surf city

“I placed the bees in the fridge, and soon they were asleep,” Gardner says. “Next, I took one out, laid it on the counter, spread its legs with forceps, put a tiny drop of Krazy Glue on the back of its thorax, and affixed a colored and numbered tag. Within a minute or two, I could see its wings vibrate, which helps it warm up. Then I put it right back in the nest.” She emphasizes that the glue is safe, with no residual odor. Bees are extremely sensitive to smell, and any bees returning to the nest with lingering *eau de glue* would be attacked.

Watching summer reruns

Gardner simultaneously videotaped and observed the activity of as many as 60 bees. Under four temperature conditions—cold, moderate, warm, and hot, a range of about 50 to 101 degrees Fahrenheit—she observed the incubation (warming) and wing fanning (cooling) performed by individual workers. Later, she reviewed the videos in slow motion in order to make sense of the frenetic activity.

“I had to slow it way down. That’s a lot of bees to keep track of,” she adds with a chuckle.

Gardner was not surprised when, under lower temperature conditions, incubating worker bees vibrated wing muscles to move body heat to their abdomen, which they held close to a comb containing the brood. But when she removed some of the active incubating workers, she learned that the colony’s remaining incubating workers responded not by sending an SOS to bees doing other jobs but by increasing their own rate of incubation. She also found that bees involved in warming the nest did not switch to fanning when the temperature became too warm, and vice versa.

Nice work if you can get it

Which begs the question, what do these bees do when the nest temperature does not require their attention? Flying in the face of their clichéd busyness, they are idle.

“The take-home message from the study is that certain bees specialize in a given function in the nest. That’s what they do and pretty much all they do,” Gardner says.

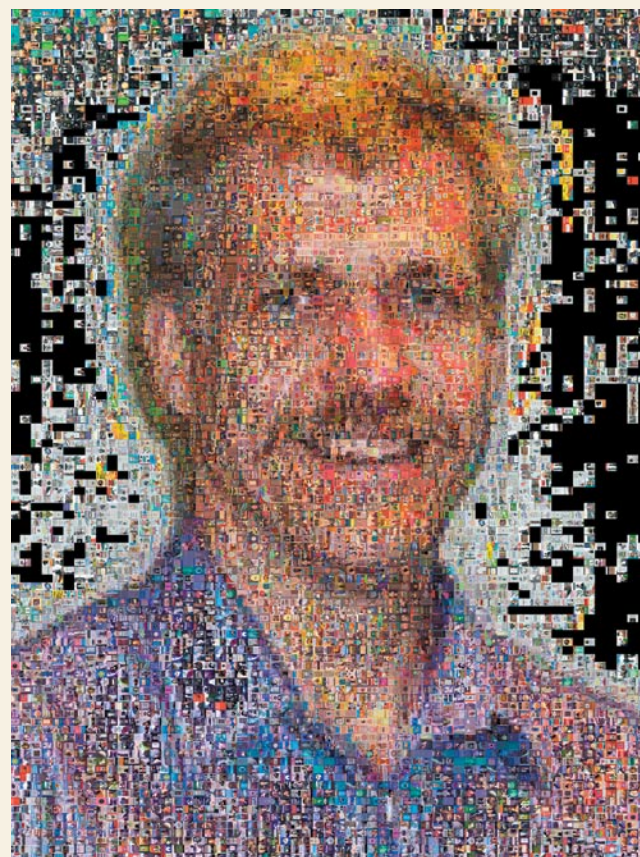
It appears that *Bombus huntii* can choose any role in the nest, and the research team could find no genetic basis for their specialization.

“But we’re not ruling anything out,” Professor Foster adds. “We are still working on many studies to better understand the division of labor in bumblebees.”

Gardner continues her own work with honeybees and bumblebees, something that has earned her the moniker “The Bee Lady” in Ithaca, N.Y., where she lives.

And the bees? Their lives wind down in September, when a new queen mates and burrows into the earth, ensuring the birth of a new generation and another curious mix of specialization, hard work, and idleness next summer. — **Lynda McDaniel**

Kathryn Gardner’s research was funded by the National Science Foundation, the Murdock Charitable Trust, and Phi Sigma, a biological sciences honor society. It was published in the journal Behavioral Ecology and Sociobiology but only recently was made available to the public.



Steve Champion '86

You are what you read

Steve Champion '86 applied that notion literally when he used the covers of 1,960 of his favorite books to make a photo mosaic of his own visage. All were titles he has either read, owns, or both. The black areas in the mosaic represent room for future reads, he says. Steve, who is system trainer and staff webmaster for the Pierce County Library System, writes a blog called “Mostly NF” (NF = nonfiction) for the Pierce County libraries site:

www.piercecountylibrary.org/blogs.aspx?blog_id=5

At the top of his list of good reads recently: *Anderson Island* by Elizabeth Galentine, *Dress Your Family in Corduroy and Denim*, by David Sedaris, and *1776* by David McCullough.

Among other UPS people who have book-related Web sites that we’ve had fun visiting lately are these “What I’ve Been Reading” pages by:

Professor of International Political Economy Mike Veseth '72
www2.ups.edu/faculty/veseth/reading.htm

Assistant Professor of English Priti Joshi
www2.ups.edu/faculty/pjoshi/Books.htm