



# Mr. Personality!

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*Shy or fearless?*



*Adventurous or careful?*

**Turns out, bugs have  
personalities too.**



**T**he cockroach bait failed again, and you're beginning to wonder if that stinking cucaracha is plotting against you. What's with this stubborn pest and his refined taste buds? Oh, he must be the rebel of his species, the guy that strays from the crowd and gets into trouble. He's gotta be different — doesn't want to eat from the same buffet. This must explain the control problem, right?

Actually, that theory could be right on. We bet you never thought about the personality of the insects you confront on a daily basis, but research tells us that individual insects within a species can have different likes and dislikes, attitudes and tendencies. And when a trait, such as acting explorative, is observed in various circumstances, that behavior then can be called personality.

"We've underestimated them again," says May Berenbaum, head of the department of entomology at the University of Illinois at Urbana-Champaign. She's talking about how insects are complex little guys and gals, and even in the same species, they're not all alike. "Personality is behavior, and we don't appreciate the sophistication of most insect behavior," she says.

In fact, there really are different strokes for different insect-folks. A gregarious German cockroach that saunters across the kitchen floor in broad daylight is a real go-getter — not like the rest of his buddies, hiding out in the dark.

Some daredevil field crickets have a no-fear attitude toward predators. Others are timid, preferring to keep a low profile.

Aphids aren't all the same either. Some, when faced against predators, will drop off of a branch; others stick around. It's the old fight or flight — or, in the aphids' case, a decision to stay or go.

And a new study in *Science* revealed that novelty-seeking honeybees are more likely to scout for nest sites and food. Researchers wanted to find out if there is a molecular reason for certain individual honeybees' thrill-seeking behavior. Is there something going on in the brains of these bees? Turns out, there is.

The brains of novelty-seeking bees exhibit distinct molecular activity, according to the study, led by Gene Robinson, a

University of Illinois entomology professor and Institute for Genomic Biology director. Some honeybees are more wired to seek out adventure. "What was most surprising was that some of the same molecular pathways implicated in novelty-seeking behavior in humans also seemed to be involved in scouting behavior in bees," Robinson says.

So, it turns out, insects have personalities, too.

**SOMETHING IN COMMON.** Observing variations in behavior within insect species is nothing new. What's different



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today is that “personality” has become a more widely accepted term in entomology circles. (Purists still identify what we recognize as “personality” as behavior syndromes.)

For one, pinning personalities to individual insects isn't all that easy because, to the human eye, insects of a species all look the same. It's not like the bold cricket flashes a toothy grin and sports black leather wings. "Insects are not expressive facially, so [personality] can be hard to tell," Berenbaum says matter-of-factly.

Insect behavior must be strictly observed and tested. "There is a gold standard for personality research, and that is if you show the same tendency in different contexts, then that can be called a personality trait," Robinson told *Science*.

"People are trying to understand what is the basis of novelty-seeking behavior in humans and in animals," Robinson continues. "And a lot of the thinking has to do with the relationship between how the brain's reward system is engaged in response to some experience."

In the honeybee study, Robinson and his colleagues studied two novelty-seeking behaviors in honeybees: scouting for nest sites and scouting for food. They found that the nest scouts were 3.4 times more likely to become food scouts. So, their willingness to go the extra mile to seek a nest transcended their desire to scout for food. This, then, became an identifiable personality trait.

Robinson and team took this a step further and wanted to find out *why* these bees were so motivated. So, they used whole-genome microarray analysis, which helps researchers understand what's going on in the brain. They found thousands of distinct differences in gene activity in the brains of scouting and non-scouting bees. "What was most surprising was that some of the same molecular pathways implicated in novelty-seeking behavior in humans also seem to be involved in scouting behavior in bees," Robinson told PCT.

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**“You can train tarantulas so they exhibit a different personality, the same way you’d deal with dogs.” – Tom Turpin, entomology professor, Purdue University, on the influence of environment**

So perhaps we have more in common with bugs than we thought. “There are likely some very ancient ‘modules’ that can be used and reused during behavioral evolution to give rise to similar kinds of traits in very different species,” Robinson says.

**PERSONALITY TEST.** We’re learning that personality is shaped by genes, gender, life experiences and environmental conditions. “But, we need to make a distinction whether a variation in behavior is due to genetic underpinnings or due to a learned behavior, or whether it’s a true personality difference between individuals,” says Coby Schal, an entomologist at North Carolina State University.

Schal tells of a study conducted in France where a researcher wanted to find out if solitary confinement would change cockroach behavior like it does in humans. So, a German cockroach was isolated for a period of time and then exposed to a variety of situations. “Whereas the socially reared cockroaches tended to be very explorative — they wanted to go out into novel environments and forage more — the solitary cockroaches avoided exploring. They were reserved, very shy. There

was much less foraging activity.”

The experience altered the cockroaches’ personalities.

Along that same vein, Tom Turpin, entomology professor at Purdue University, shares how a tarantula’s environment shaped its behavior. A tarantula the university “inherited” a few years ago was previously cared for by a woman who was quite afraid of the spider. “She would open the cage and throw crickets in there [for food],” he says. “The tarantula got used to being thrown at and tended to be very defensive when the cage lid was opened.”

Now, food is not tossed into the cage and the tarantula’s caretakers are comfortable with her. “She has developed a totally different personality in the time that we have had her,” Turpin says, relating that the tarantula is gentle enough for children to handle her. “You can train [tarantulas] so they exhibit a different personality the same way you’d deal with dogs.”

But, understand that traits that vary by species are not the same as personality traits. “You cannot look at personality across species,” Schal emphasizes. “And that’s where it gets confusing.”

“You cannot say the personality of a dog is more friendly than the personality of a cat,” he continues. “That’s totally meaningless because we’re comparing two differ-

ent species and completely different genes underlying their behavior.”

Similarly, different species of crickets display varying behavior — and that’s not personality, that’s species differentiation. For example, Schal says, some crickets are aggressive and others are passive. The crickets could only be defined as bold or timid if individuals within the same species were being compared.

This individual behavior is exactly what researchers are observing. In a study published by the Proceedings of the Royal Society B, lead author Eniko Gyuris explains that insects do display traits such as being bold, explorative, active and aggressive.

But “bold” for an insect means something different than what a human might consider bold. “Boldness — whether [insects] are shyer or braver — could be defined, for example, as to how quickly they start after an alarm, or how soon they come out of their refuge,” Gyuris told *Discovery News*. “Explorativeness could be measured in another context, mainly in which they have the opportunity to discover a new environment with novel objects.”

**BAIT OR A TRAIT?** So, how does this personality business affect the way you approach insect control? Considering the fact that there are personality differences

## Species Lineup

Personality is defined as a variation in behavior within a species — for example, the one German cockroach that acts differently than its brothers and sisters. You can’t compare the German cockroach with an African honeybee. But anyway, we thought it would be fun to line up some usual suspects to show just how interesting our insect kingdom is.

Here’s a cast of characters you confront on a daily basis...

### German Cockroach

These fast runners hide out during the day and invade at night. They can really trash a place, damaging wallpaper, fabrics, books...this is public enemy No. 1 to kitchens everywhere.

### Bed Bug

These hitchhikers always find a cozy place to crash. The little vampires feed at night, and take up residence in even the finest accommodations (yes, even the beds at five-star hotels).

### Subterranean Termite

They love the light, and the workers favor “deconstruction” jobs, like destroying wood.

### Argentine Ant

This persistent invader has a sweet tooth (cookies and a Coke, please!) and enjoys outdoor living in moist locations. It has an appetite for foraging, all day and night, and likes to play follow the leader — you’ll find them in a trail.

### Fruit Fly

These foodies hang out in restaurant kitchens and bars and invite all of their fruit fly friends to join the feast.



in insects could reduce the likelihood that an individual will encounter pesticides, Berenbaum says.

“If cockroaches have different personality traits, I would guess that would influence their likelihood of encountering pesticides in the environment, and that could explain in some cases why control measures don’t work,” she says.

What we need to keep in mind, Schal says, is that insects of a species are *not* all the same. They behave differently sometimes, and that’s because personality comes into play. “It’s absolutely critical for the PCO to understand how insects respond behaviorally to whatever treatment is being put out, and it’s most obvious with baits. If the bait isn’t palatable, then the control effort will fail.”

Schal says that research in his laboratory is revealing how behavioral changes linked to genetic mutations in cockroaches are responsible for why some individual roaches are turned off by the taste of bait. He compares the concept to humans consuming caffeine, a bitter compound that we “learn” to like. “If you give caffeine to a baby, without exception, they will reject it because it stimulates bitter cells in our mouths, but we learn to accept it,” he says. “Imagine a genetic mutation where caffeine tasted like sugar.”



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Individual cockroaches with the genetic mutation aren’t interested in the bait like their buddies. They’re hard-wired to say, “Thanks, but no thanks.” And this sometimes means a fail for the PCO.

As we learn more about how individual insects behave, the information can be di-

rected into control practices. “It’s critical to understand behavioral variation in any given species of insects,” Schal says. **PCT**

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