



PAW ASKS GREGORY JOHNSEN GS:

Can we minimize civilian deaths in fighting terrorism?

Gregory D. Johnsen GS, a Ph.D. candidate in Near Eastern studies at Princeton, is a former Fulbright fellow in Yemen. He is the author of *The Last Refuge: Yemen, al-Qaeda, and America's War in Arabia* and writes the blog *Waq al-Waq*. He spoke with PAW intern Allie Weiss '13 about the CIA and the fight against terrorism in Yemen.

What role should the CIA take in the fight against terrorism?

The U.S. has great technological tools — these drones that can do great things.

What I'm worried about is that the CIA is moving away from [collecting human intelligence], and ... we'll be hamstrung by our lack of human intelligence on the ground. That, I think, is directly responsible for the number of civilian casualties that we see in a place like Yemen.

What has been the effect of civilian casualties in Yemen?

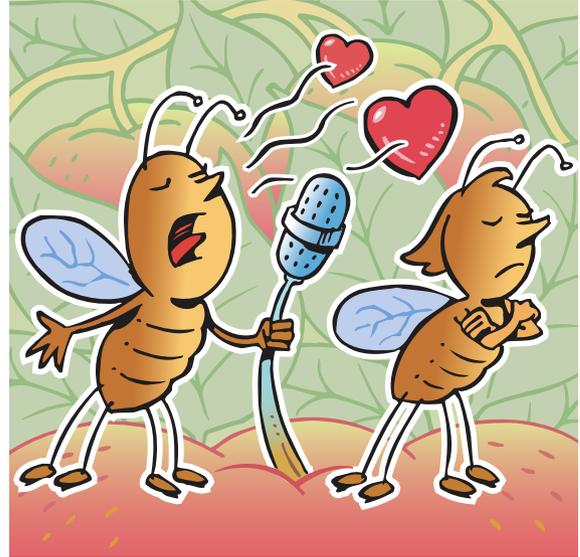
The U.S. has been carrying out strikes in Yemen since December 2009. They've certainly killed a number of people within al-Qaeda, but they've also killed a number of civilians. These civilian casualties are, I think, the main reason we've seen al-Qaeda in the Arabian Peninsula go from a group that had 200 to 300 individuals in December 2009 to a group that is now, according to the best estimates by the U.S. government, at least 1,000 fighters and most likely more. ■

BREAKING GROUND

New buzz about auditory perception

OVERHEARING SONGS OF COURTSHIP What does a male fruit fly sing to a female fly to capture her attention? A laboratory at Princeton has recorded thousands of the unique courtship songs male fruit flies sing to attract their mates — the first extensive analysis of its kind.

Now we know that each time the male fruit fly, or *Drosophila*, sings to a female, the components of his song are slightly different. The lab has built devices to overhear these private courtship sounds, which we humans couldn't hear even if the courting pair had landed right in our ear. But if the female fruit fly doesn't like the song of her courtier, she may not mate with him.



THE LAB The laboratory of Mala Murthy, an assistant professor in the molecular biology department and the neuroscience institute, is studying how these courtship songs are processed by the brain to produce mating behavior. The ultimate goal is to understand how neurons in the human brain process information from the outside world.

THE RESEARCH Rather than studying songbirds or crickets, which are more commonly used for studies of acoustic communication, Murthy has pioneered the study of how fruit flies communicate. Like many scientists working to understand a complex process, you need to start small. Unlike the human brain, which has billions of neurons, *Drosophila* has 100,000. Murthy's lab is the first to record from the part of the fruit fly's brain that registers and processes sound. The lab set up a system to record the activity of individual neurons, labeled with a fluorescent dye in the exposed fly brain, while keeping the fly alive. The fly hears a recorded courtship song during the procedure so that the neurons that respond to the sound cue can be studied.

 LISTEN: The courtship song of a fruit fly @ paw.princeton.edu

OF FLIES AND HUMANS The large range of courtship song sounds “gives us the opportunity to ask not only how the different sounds are generated, but also how the brain deals with this kind of variability,” Murthy said. The large range of *Drosophila* sounds is similar to differences in the rhythm of our own voices. “This is the same kind of challenge the human brain faces,” she said — to take in a sound, extract the relevant information, create meaning, and then respond with a thought, action, or speech. “We don't actually yet know, in any system, how this happens.”

Leslie B. Vosshall, who also studies complex behaviors in the fruit fly at Rockefeller University, said Murthy's lab is conducting “highly original” research. “The combination of genetics and electrophysiology positions her exceptionally well to make major contributions here,” Vosshall said. ■ *By Anna Azvolinsky '09*

JEFF TAYLOR

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