BIOLOGY GRAD STUDENT STUDIES HOW ANIMALS NAVIGATE

Global Positioning Squirrels

When autumn comes to Kananaskis country, a wilderness southwest of Calgary, Alberta, the Columbian ground squirrels living near the R.B. Miller Field Station have already begun their winter hibernation. If they dream, it's likely of peanut butter and a horse feed containing oats, barley and dried corn. The treats were training inducements used by Anna Vlasak, Gr'06, a biology grad student who spent 20 months over a period of five years studying how these rodents navigate. Fieldwork is generally descriptive, but Vlasak's methodology is experimental. "You mix field and lab components," she says, "and I think you get very interesting results" — plus a new approach to animal studies.

In 2001, when Vlasak was at the field station helping another scientist, she noticed a ground squirrel dig out from under four feet of spring snow, travel 60 feet on top, then disappear below again. When she checked where its trail through the snow had ended, she found a tunnel leading directly to a burrow entrance. How could the squirrel have pinpointed it so accurately? she wondered.

Apparently, life depends on it. According to Vlasak, a ground squirrel (*Spermophilus columbianus*) must remember many burrows under extreme time pressure. "A predator comes, and if the squirrels cannot find their burrow within a few seconds — a fraction of a second actually — they will be dead."

Vlasak, who was born in a mountainous region of Kazakhstan and came to the United States for undergraduate study at Cal Tech, devised navigation experiments that used set-ups common in laboratory work. Her subjects, however, were non-captive animals, which she repeatedly trapped and trained with food rewards and released. The setting for her studies was the squirrels' own subalpine meadow or one adjacent where the animals already knew the landscape.

The research showed that Columbian ground squirrels find foraging patches primarily through global landmarks like the distant outline of forests or mountains. To locate escape burrows, older squirrels use global cues while pre-breeders depend on local ones, like nearby rocks, logs and bushes. Prior to her experiments, scientists hadn't noted what she calls "the overwhelming importance of global markers," because navigation studies of other animals had been done in the lab.

Vlasak also tackled a currently popular question in animal cognition: Do animals — ground squirrels in this case — have some form of mental map of their environment? She wondered if they could reach a food reward through a combined above-ground and underground route she set up. Since the animal cannot see both places simultaneously, a successful trip might involve a mental representation of the unseen part. The results were mixed. In some tests, the number of immediately successful squirrels was beyond chance; in other tests, all initially failed. "It's a complicated task," she explains, "and while everybody eventually solves the problem, only some individuals are good at it."

Not all scientists have Vlasak's ability to work in so primitive an environment (no phone, Internet, or even running water until the creek melts). But she loves the outdoors, especially mountains, which she often explores alone.

Vlasak welcomes the challenge of fieldwork. "It's a constant battle between you and the environment," she says, "and you and the animals, who outsmart you all the time" and even try to become experimental subjects. "When they see you setting up traps somewhere else, they will actually travel there. Some even learn to roll the traps over and get in from underneath."

She must be using some awesome kind of peanut butter. ■

—MARTHA LEDGER

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