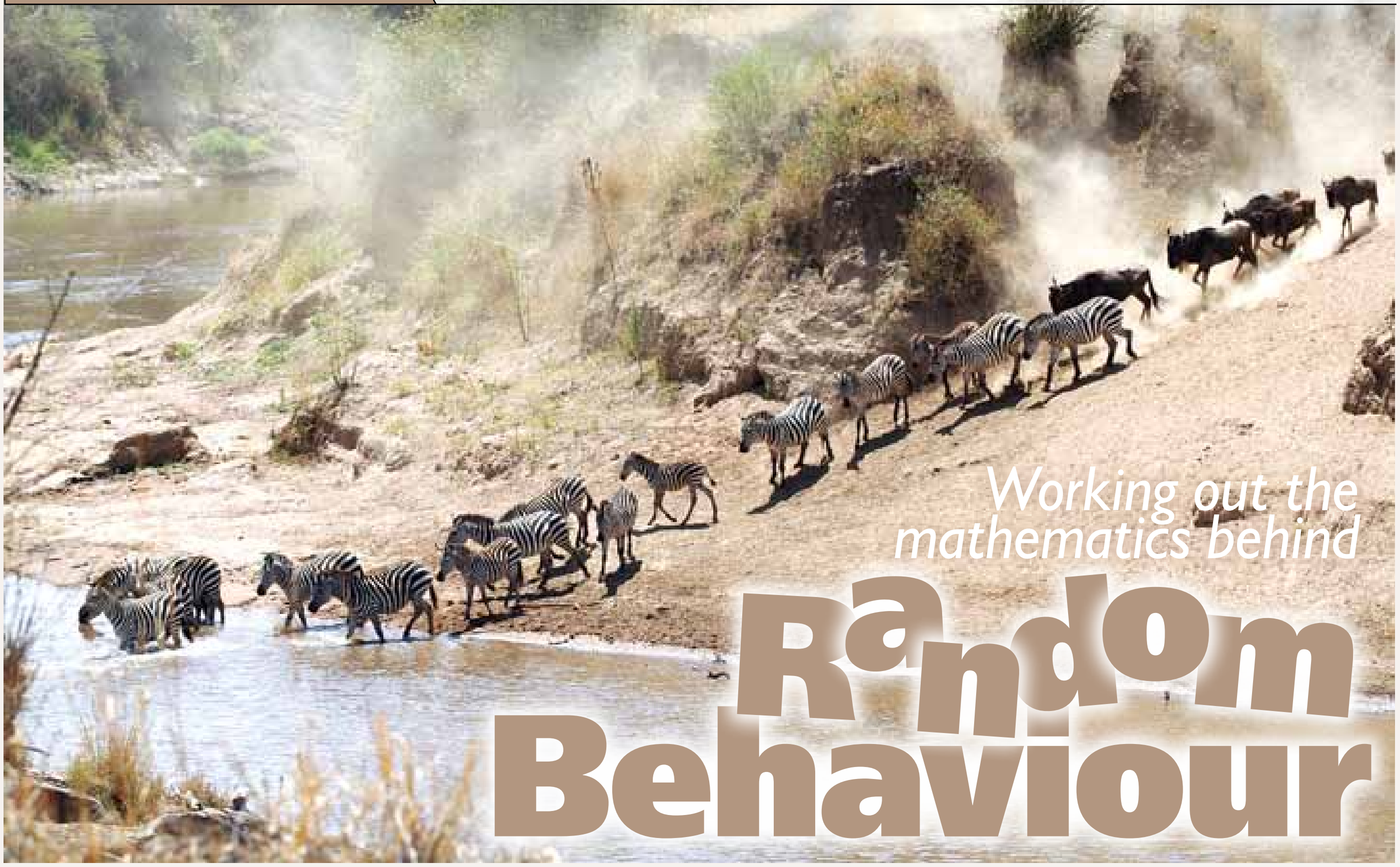
Raluca Eftmie – PhD 2008



Working out the mathematics behind Random Behaviour

Raluca Eftmie has never been to the Serengeti, but she has discovered things about the animals there that biologists in the field had never known.

Her special insights also extend beyond the African plains to answer questions about fish, birds and insects—even bacteria colonies—that have stumped experts who've spent their lives studying these organisms.

What's more, the Romanian native was able to make these breakthroughs while she was a PhD student at the University of Alberta.

The secret to her success, she believes, is that she has taken a new approach to answering old questions.

In her work related to animals, Eftmie used applied mathematical modeling to figure out how "self-organizing" groups of animals within species—especially those thought to be "leaderless"—move and behave.

Scientist have long believed certain animals exhibit seemingly random patterns when they move in packs, such as zigging, zagging and reversing course, and that these creatures were acting under the principle of attraction and repulsion; that is, their movements were dictated by a desire to remain a specific distance from each other—not too far and not too close.

However, Eftmie's modeling has shown the animals' movements are also related to subtle forms of communication within the group. As such, the sudden shifting of, say, a herd of gazelles or a school of fish, is partially random but is also in part due to communication mechanisms between individuals in the group, as they avoid predators and find food, for example.

Eftmie's work earned her the 2008 Best Dissertation Award in the Canadian Applied and Industrial Mathematics Society Competition. She was humbled by the honour, but she hopes the work she's doing will become more commonplace in the future.

"Traditionally researchers have worked in their fields and discovered all they are able to discover, I think, but the new research involves interactions between different fields, and mathematics can act as a link for this. You can use mathematics to make sense of large amounts of data and answer questions that you couldn't before," she says.

These days, Eftmie is a post-doctoral fellow at McMaster University, where she is analyzing interactions between cancer and immune cells. The ultimate goal is to create a cancer vaccine to prevent and even cure the disease.

"I love applied mathematics because it gives me an opportunity to make a contribution," she says. "I think all of us want our lives to matter in some small way, and if I can add even just a tiny bit to the whole store of human knowledge, then, when I'm 80, I think I'll be satisfied that I didn't live in vain."