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Biophysicist in Profile

LEAH EDELSTEIN-KESHET

You might say that *Leah Edelstein-Keshet* is carrying on the ‘family business,’ combining her parent’s professions for a best-of-both-worlds career. Her father, a “pure” mathematician, convinced her to study math, while her mother, a biologist, clearly had an influence as well—“I got to see life under the microscope at an early age,” said Edelstein-Keshet. After starting in mathematical biology, she has since evolved into cell biology and biophysics.

Born in Israel, Edelstein-Keshet arrived in Canada with parents in tow when she was 12 years old. She completed both her bachelor and master of science degrees at Dalhousie University in Halifax, Nova Scotia. She majored in pure mathematics as an undergraduate but transitioned to biomathematics for her master of science, a new program at the university during the mid-1970s.

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— Leah Edelstein-Keshet

She continued her studies at the Weizmann Institute of Science in Rehovot, Israel, where she studied applied mathematics and worked on the growth patterns in filamentous fungi. During her PhD work, Edelstein-Keshet used modeling to describe the colony shapes of the fungi and did experiments growing the fungi in the lab at the Faculty of Agriculture at Hebrew University, conveniently located across the street from the Weizmann Institute.

After completing her PhD, Edelstein-Keshet was a visiting assistant professor at Brown University and Duke University before returning to a permanent position in Canada. “It was a challenge to find a permanent job in the 1980s,” she said. “Mathematical biology, which was my main area of research at that time, was still not recognized as a useful area.”

Despite her struggles, she eventually found a position in Applied Mathematics at the University of British Columbia (UBC), in Vancouver, Canada, where she has been ever since. *Alex Mogilner* was one of her graduate students in the early 1990s at UBC (though she freely confesses to having learned more from him). They spent much of that decade collaborating on the alignment of elongated objects with an emphasis on biological applications. “The papers we published in our early research led both of us to thinking about cytoskeleton—dynamic polymer scaffold inside the cells—and the realization that there are really interesting quantitative questions in that area,” said Mogilner. In 2002, Edelstein-Keshet and Mogilner published a paper in the *Biophysical Journal* that became the first mathematical model of self-

organization of actin network at the motile cell's leading edge. "I'm very proud of that paper," Mogilner said. "It was mathematically elegant, showing that the qualitative dendritic nucleation model introduced in cell biology by *Tom Pollard* and others made sense, and it made some predictions that seriously influenced a number of people in the cell motility field."

Today, Edelstein-Keshet is a full professor at UBC and her work is now much more biological than earlier in her career. "My work gradually evolved, starting with trying to understand actin structures," she said. Now, Edelstein-Keshet works on the link between the internal signaling (e.g., of Rho GTPases) in eukaryotic cells and the shape and motility of those cells. "The biological challenge is how to decipher what are the signaling networks and their key elements; the computational challenge is how to simulate deforming a cell where the internal chemistry affects the protrusion/retraction of the cell edge," she explains. She still relies on her mathematical background to solve biological problems, and enjoys the fact that biophysics includes novel applications of mathematical and physics ideas.

She also serves the Biophysical Society as a member of the *Biophysical Journal* Editorial Board. "I like the *Biophysical Journal*," she said. "It is one of the few journals with the aim of helping authors to improve their papers, rather than just rejecting most of them." Being part of the Society, and part of the Editorial Board, has made Edelstein-Keshet much more cognizant of what constitutes good and relevant biophysical research.

Adriana Dawes, a former student of Edelstein-Keshet's, regards her editing and publishing expertise as one of the most helpful things she learned from her. "Of the two core things I learned from Leah, the first is constructing and interpreting mathematical models in the context of biology, and the second is how to write

and edit a manuscript," said Dawes. "In fact," she continues, "I use Leah as my benchmark for whether a manuscript is ready to submit—if I'm not comfortable with the idea of Leah reading it, it needs more work."

Working with Edelstein-Keshet when she was a graduate student, and now as a fellow faculty member at UBC, Dawes admires Edelstein-Keshet, saying, "Leah is incredibly generous with her time and ideas." Adding, "She is very insightful and I rely tremendously on her advice—It's not always what I want to hear, but she is always right!"

Edelstein-Keshet's insight and mentoring abilities have extended to many students over the years. "The part I enjoy most about my work is collaborating with young scientists and writing up our research for publication," Edelstein-Keshet said. Her advice to Mogilner in his final year of graduate school and facing a difficult job market may bolster some young scientists today. "I was fretting and venting about bad global prospects, saying that I'll probably end up hauling crates of oranges in an Israeli port," Mogilner recounted. "When Leah told me, 'Ah! Prospects-schmospects! Trends-schmends! You need this one job, what do you care about the global trends?'" Her advice to focus on his own work and job search paid off, and things worked out "just beautifully" for Mogilner, as Edelstein-Keshet had predicted. Today, he is a professor at the University of California, Davis, and, at the time of publication, has never spent a day hauling oranges in an Israeli port.

In addition to her research, writing, and teaching, Edelstein-Keshet enjoys reading, exercising and spending time with her family. An avid gardener, she built an indoor platform for her seedlings that could be rolled into different positions in the living room and kitchen to maximize light exposure during cloudy Vancouver springs.



Leah Edelstein-Keshet's group at UBC as of 2013: (right to left) (Back row) Hildur Knutsdottir, Mark Zajac, Meghan Dutot (Front row) May Anne Mata, Laura Liao. Edelstein-Keshet is on the left.