

## DEAN'S MESSAGE



Science has always been a flagship to integrating teaching and research, and an excellent example of this is Science Honours Fest, where some of our best and brightest undergraduate students show off graduate level research and compete for awards. This year's first-place winner, Karlee Bamford from the Department of Chemistry, took

home the \$2,000 Boehm Family Award for Excellence in Science. Congratulations Karlee!

Two long-time members of the faculty will hand in their keys this spring. Reinhardt Illner from the Mathematics and Statistics department and Terry Pearson of Biochemistry and Microbiology will officially retire this year. Please read more about their UVic careers on page 3.

Lastly I had the honour of being ratified to continue to serve as Dean of the Faculty of Science for a second term. I hope to see you on campus at some events this year, or just for a visit to say hello. Your continued and sustained support is critical to the life of the faculty and success of our students.

Rob Lipson



Fritz Boehm, Karlee Bamford and President Jamie Cassels

## Honours Fest 2015

Honours Fest keeps getting better every year. In February, 49 undergraduate honours students from across Science departments showed off their research with poster presentations, which were judged by a committee of faculty members.

President Jamie Cassels opened the awards ceremony with an impassioned speech on the importance of scientific exploration and student research. VP Academic David Castle reiterated those comments and talked about what student research means to the university. Dean of Science, Rob Lipson then handed out awards to nine students; one honourable mention from each department, and cash prizes for the top 3 research posters. Second and third place, respectively, went to Evan Kiefl from Physics and Astronomy and Janessa Li from Biochemistry and Microbiology. First place, and winner of the \$2,000 Boehm Family Award for Excellence in Science, went to Karlee Bamford, a chemistry student. Fritz Boehm, the donor for the award, was in attendance for the first time and had an opportunity to talk with Karlee and President Jamie Cassels. Fritz is huge supporter of the Faculty of Science, and we were delighted he could be with us for the event. Special thanks go to Dean's Assistant Tracy Sobotkiewicz, who was instrumental in coordinating such a fantastic event.



Eric Foxall

Photo: UVic Photo Services

# UVic student completes solution of Mandelbrot's problem

By Julie Sloan and Rod Edwards

Benoit Mandelbrot is arguably one of the most well-known mathematicians of modern times for his discovery of what we now call the Mandelbrot set, and for "fractals," whose beautiful images have become the hallmark of the modern mathematical fields of dynamics and chaos. Mandelbrot also did seminal work in the analysis on the problem of 'scaling' in language and other fields. In 1955, he published a partial solution to this problem, but it remained incomplete until very recently.

Ten years ago, Rod Edwards, now Chair of the Department of Mathematics and Statistics, along with two colleagues from McGill—Ted Perkins and Leon Glass, started working on Mandelbrot's incompletely solved problem as a side project.

Enter Eric Foxall, a graduate student in mathematics at UVic. Rod discussed the problem with Eric and asked if he could help. Eric more than helped. He produced the key piece of analysis that allowed the team to complete the solution. Not only that, Eric took it a step further and solved a more general problem than Rod and his colleagues had been aiming for. The technical result was published in the *Electronic Journal of Linear Algebra*, but the team has also shown, in a recent paper in *Nature Communications* (14 Oct. 2014), its wide applications in many fields ranging from protein folding to musical sequences. Rod explains:

"If one ranks the words in English in order of how frequently they occur, their frequency of occurrence is inversely proportional to their rank—the 'scaling' is  $1/\text{rank}$ . So the tenth most common word occurs about twice as often as the 20th most common word. Mandelbrot showed that a similar inverse scaling (with the inverse of some power of the rank) applies

even if a sequence of words is correlated – the word preceding 'tolls' is more often 'bell' than most other words, for example. He also realized that this same scaling phenomenon occurs for other sequences of items, where the probabilities of one thing following another can be specified – for example, the sequence of configurations a protein molecule can adopt as it undergoes folding."

And Rod continues to explain where Eric comes in:

"Such sequences can be thought of as random walks on a network of items linked by their 'transition probabilities.' But not all such sequences have this inverse power ('power law') scaling. What has never been clear, until now, is exactly what determines whether the scaling will be power law or not, and exactly what other types of scaling can occur. Eric was able to determine (and prove!) exactly how the type of scaling depends on the structure of the network."

As Rod puts it, "it is a rare student (or even experienced mathematician) that can do this. We were struggling with the problem. Eric worked it out, tightened it up and made it beautiful."

Eric, who did his undergraduate degree in Engineering Physics at UBC, worked on the problem while writing his PhD thesis on Stochastic Growth Models. So what comes next for a humble young mathematician who has just made such a significant contribution to his field? Eric will head to Arizona State University in the fall to do post-doctoral research on interacting particle systems, with a long-term goal of research and teaching in the halls of academia.