Mathematics Newsletter

2010

Message from the Head, Rachel Kuske

As we look back at the first decade of the new millenium, a few words come to mind: energy, growth, and transformation. It may not be evident from standing outside and looking at the exterior of our department buildings, but just step inside and it is clear there have been some big changes over the last 10 years.

First consider a few numbers:

- Over 40 new faculty members since 2000, with 14 of these coming in the last four years.
- Included in our faculty are eight Canada Research Chairs, nine joint appointments with Science, Applied Science, and Economics, and three Instructors.
- 35 postdoctoral research fellows (PDFs), up from around 10-15 in the late 90's.
- Over 100 graduate students, doubling since the late 90's with additional growth expected this year.
- Nearly 16,000 undergrads in our courses each year, with courses for students across the University.
- An effective office and IT staff of 12, who keep everything running smoothly.

Aside from these numbers, this newsletter gives you some snapshots of major department initiatives and also introduces you to two of our illustrious alumni, David Cheriton and Robert Langlands. We hope that the summaries of faculty awards, facts about our undergraduates, updates on our graduate program, and highlights of some of our many outreach activities will stimulate your interest in UBC Mathematics activities.

One critical component in our expansion has been partnerships. Our institute partnerships include The Pacific Institute for the Mathematical Sciences (PIMS), The Banff International Research Station (BIRS), and the Institute for Applied Mathematics (IAM), all major influences in our research and training programs. UBC Mathematics faculty have been leaders in both founding and directing these institutes, and these productive relationships have benefited all involved. In undergraduate programs we have pursued new cooperative efforts with Applied Science (Engineering), Education, and the Carl Wieman Science Education Initiative (CWSEI). Together with these partners, we continue to build on local, national, and international networks to support our strategic initiatives.

Another key element to our success, appropriate for a Mathematics department, has been "integration". Our research, education, international, and outreach programs are integrated in ways that make them stronger and more effective. Our graduate and postdoctoral programs, major pillars in our research programs, contribute significantly to our teaching program. At the same time we have expanded the training and professional development programs for our students and PDFs to support both our undergrad teaching and their future careers. Together with our institute partners we have expanded our international networks, supporting our

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Editors: George Bluman, Patrick Brosnan, Ailana Fraser, Lee Yupitun

Newsletter design: Ruby Mawira

research, visitor and recruitment programs. Our interdisciplinary programs hinge on close ties between our institutional partnerships, our outside connections supported through both joint appointments and regular Mathematics faculty, and our training of graduate students and PDFs. Participation in our outreach programs comes from faculty, students, staff, and alumni, and involves cooperation with our partners, the Faculty of Science, and other UBC faculties. These programs are closely connected with our undergraduate training, providing critical links with our community through school workshops, after school tutorials, contests, and teacher training and professional development.

Those of you who are familiar with the Math buildings may wonder how we managed to find space to accommodate this expansion in personnel and programs. Indeed, this has been a challenge, with some renovations providing some intermediate solutions. The most recent renovation was in 2007-08, when the Math Library collection was moved to the UBC Main collection in the Irving K Barber Learning Centre. While its loss was mourned, the space formerly known as the UBC Math Library has been renovated as the new "Heart and Soul of the Math Department". This renovated space is now a vibrant Math Graduate Centre with grad student offices and informal meeting space for the department, a seminar room, the mailroom, and movable walls to accommodate large department gatherings. Even with these renovations the Mathematics Department still occupies all or part of five different buildings. We are working on opportunities (including the seeking of funding!) for a new UBC Math Building that would physically unite the department.

As we pursue our continued expansion opportunities and work on our space challenges, we look forward to keeping in touch with you, through this newsletter, our website, and upcoming UBC Math Events. Whether or not you've seen us lately, please come by for a visit, either in person or online: *http://www.math.ubc.ca*. ■

Photo: Roland Bauerschmidt

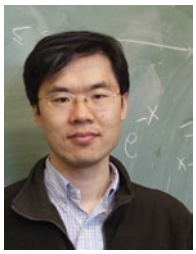
Some of our great office staff!

New Faculty

2009-2010 was a year of growth for UBC Mathematics which welcomed four new faculty members: Eldad Haber, Bud Homsy, Young-Heon Kim and Fok-Shuen Leung.

Eldad Haber graduated from UBC in the IAM program and Geophysics in 1998. He worked with Uri Ascher as a PDF from 1998 to 2000. He then joined Schlumberger for a year before becoming an Assistant Professor at Emory University. He became an Associate Professor in 2007 and joined UBC as an NSERC Industrial Research Chair in 2009 and as a Professor, jointly in Mathematics and Earth and Ocean Sciences. His research focuses on computational mathematics with applications to geophysical and medical imaging.

George "Bud" Homsy came to UBC in 2010 as a Professor, jointly in Mathematics and Mechanical Engineering, and as Deputy Director of the Pacific Institute of Mathematical Sciences. Before coming to UBC, he was a Professor in the Chemical Engineering Department at UC Santa Barbara and previous to that Professor and Chair of Chemical Engineering at Stanford University. Homsy, who was elected to the National Academy of Engineering (USA) in 2006, is one of the world's leading researchers in fluid mechanics.



Young-Heon Kim obtained his PhD in 2005 from Northwestern University, under the guidance of Ezra Getzler. His thesis was on the spectral geometry of Riemann surfaces. He then moved to Toronto as a postdoc, and there he started working in optimal transportation theory. Before arriving at UBC, where he was appointed as an Assistant Professor, he spent a year at the Institute for Advanced Study. Kim, who is originally from Korea, is the father of two young daughters.

Fok-Shuen Leung is a graduate (in Math and Music) of Queen's University in Kingston. He did his doctoral work with Roger Heath-Brown at Oxford, and taught at Waterloo for two years before coming to UBC as an Instructor who is also associated with the Science One program.

Interview with Alumnus David Cheriton

Photo: Martin Dee

Dr. David Cheriton is a Professor of Computer Science at Stanford University and one of the 800 richest men in the world. Dr. Cheriton came to UBC in 1971 as a transfer student from the University of Alberta, and completed an undergraduate degree in Honours Mathematics in 1973. He finished both his Masters (1974) and PhD (1978) in Computer Science at the University of Waterloo. He returned to UBC as an Assistant Professor for three years, and then moved to Stanford in 1982.*

In 1996 Dr. Cheriton and Andy Bechtolsheim founded Granite Systems which was sold to Cisco Systems in the following year for over $200 million. In 1998, Dr. Cheriton was approached by Larry Page and Sergey Brin, two Computer Science graduate students at Stanford University, who sought his assistance for their newly developed search engine. Google Inc. was then formed, and Dr. Cheriton's initial investment of $200 thousand is now worth over $1.1 billion.

Not only has Dr. Cheriton seen tremendous financial success, he has also made significant contributions in his research, and in 2003 was award the SIGCOMM Lifetime Achievement Award by the ACM. This award was initiated in 1989 as "a means of honouring computer communication professionals for outstanding lifetime technical achievement in the fields of data and computer communications."

Dr. David Cheriton was interviewed by telephone on Friday January 15th 2010 by Eric Naslund, one of our outstanding 2nd year Mathematics undergraduate students.

**Forbes 2009 List*

Eric: How did you first come to UBC?
David Cheriton: Well, I first came to UBC as an undergraduate in 1971. I was a transfer student from the University of Alberta as my parents were living in Edmonton.

Eric: How did you become interested in Mathematics?
David Cheriton: I think I have always enjoyed Mathematics. In public school, I found it amazing how things worked and fit together, and I always found the problems interesting. I didn't like to memorize a lot of random things like they end up doing in other fields, and in Mathematics if you were smart enough you could just rediscover what the rules were or how to solve some problem rather than having to remember it.

Eric: What memories do you have of UBC, good or bad?
David Cheriton: Well, let's see. I have good memories of riding out to UBC on my bicycle from my aunt and uncle's place in West Point Grey. The ride up the hill from where they were located was always a good piece of exercise in the morning. I would often ride back on Marine Drive, right along the ocean.

I have fond memories of being in classes in the Math building. It's still the same old Math building as I saw when I was there recently. The high ceiling, old fashioned wood trim and so on. I really enjoy those types of buildings.

I was involved in Theatre when I was at UBC, and I have great memories of being involved in a Freddy Wood production. I met a very attractive young lady who was my girlfriend for the time I was at UBC. She was also in Theatre.

Of course there were the cinnamon buns in the Old Auditorium. I always went there in the morning for hot cinnamon buns. It's great to see that place renovated, but I am not sure where you would get cinnamon buns from now, if any place.

Eric: I heard that you originally wanted to go into Music?
David Cheriton: I have always had this great interest in Music. At the University of Alberta I applied for Music as well as Mathematics, and they rejected me in Music and accepted me in Mathematics. That was sort of the end of my aspirations to get a university education in Music. Although I took more Music lessons, vocal lessons from Donald Brown, who was a Music instructor at UBC, I ended up doing it as a hobby.

Eric: How would things have been different if you had gone into Music instead?
David Cheriton: I doubt that I would be in the same financial situation. But money has never been the top priority for me. I think I would have been less happy because one of the things I discovered as a student was the unfortunate experience to run into people in Music who were better than me without trying. I met very, very talented people and came to the realization that no matter how hard I tried I would not have been in the same league as they were. That's why I think I wouldn't have been as happy there in the long term. Also, in Theatre I encountered people at UBC that really lived and breathed Theatre in a way that I didn't, and I realized that I didn't quite have the involvement or the commitment needed to continue on in that. So I think it turned out for the best.

Eric: Did you have a favourite course or topic in Mathematics?
David Cheriton: Yes well, let's see. I really enjoyed Topology (currently offered as Math 426/427), and I liked Measure Theory (Math 421). The other elements I discovered somewhat later on in my career at UBC. I think the last courses I was taking, were on proof theory, mathematical logic and the theory of computation, which I found fascinating.

Eric: What influenced your decision to go into Computer Science?
David Cheriton: There was actually a very significant event at UBC. I was taking three courses in my fourth year. One was about the Theory of Computation, another was on Mathematical Logic (currently the seldom offered Math 415), and the third one was on Set Theory (the old Math 414). All three courses came at undecidability and the theory of computation from three different angles at the same time. There was Gödel's incompleteness proof, the halting problem, and Post-systems, and I recognized that these were all the same thing. To me it was such a dazzling idea of undecidability that permeated these formal systems that I felt I needed to study this further. That made me very enthused about getting the computational context which seemed like an exciting one. Being able to know there was something computers simply could not do, I'd call it mind-boggling or mind-blowing, and it was really that experience that made me go into Computer Science.


David Cheriton
Photo: Martin Dee

Eric: How did you first get into the entrepreneurial aspect of Computer Science?
David Cheriton: When I came to Stanford there were a number of people involved in outside consulting activities, and a few that were looking at starting companies. One was Jim Clark, a pretty well known internet entrepreneur, the man behind Netscape, and a colleague of mine at Stanford. He was starting his first company called Silicon Graphics. There was also Andy Becholsteim who was at Stanford at the time and was founding Sun Microsystems. I saw other people doing this which gave me connections in the area, and acted as a role model to follow as well. That got me interested, and then over the years I was involved in a number of these companies. I tried to start a company myself which was at first unsuccessful. I got involved by knowing the people and knowing how to do this, by seeing the obvious rewards, and by seeing the technology out there.

Eric: Can you tell us about founding Granite Systems?
David Cheriton: Granite Systems made gigabit ethernet switches. This was one of these unexpected events. I had known Andy Becholsteim when he founded Sun in the early 80s and in 1994 I was taking a sabbatical from Stanford and had it all planned out. Then Andy showed up. He displayed great frustration with networking technology known as ATM, with which I actually had similar frustrations. We started talking and we both decided it was an opportunity to start a networking company. Ethernet was taking over the world and it was an opportunity to go faster than the standard 100 megabits. But it was also an opportunity to build a much more integrated switch chip. Andy knew a lot about hardware. I don't know that I can claim I knew a lot about networking but I certainly knew more about networking than he did at the time, and so we decided to join forces and start the company.

Eric: What made you invest in Google?
David Cheriton: I originally knew Larry (Page) and Sergey (Brin) as PhD students at Stanford. They didn't work with me directly, but they came to me on a few occasions for some business advice. The first time they were looking for some advice about how to license their technology to other companies. I suggested some people that could help. But I also mentioned that there were not many people I was aware of that ever managed to be successful by passing their technology off to someone else. They came back after a year of trying to license their technology to different companies, including Yahoo and other search engine companies at the time. This was in 1998, and they came and said they wanted to form their own company as they hadn't been successful with the licensing. They were concerned about raising the money. But I told them that raising the money wasn't a problem. I was willing to put in money and I knew many other people that were too.

Eric: What was it about their technology that convinced you to invest with them?
David Cheriton: Even the Stanford prototype of Google was dramatically better than the other search engines at the time. I'd be crazy to cite this, but here is the truth: the first time, I typed in "Canadian Exchange Rate" and found this site that was run by the Bank of Canada that provided a great set of information. I was literally surprised by this being the result. In 1998, many people don't remember, a number of companies started as search engine companies like Yahoo and Excite and others had been compromised into being iterated in circles so the search was terrible. They were more or less online magazines and newspapers that were not really good for searches. The Web had been growing enormously and I personally was having great problems trying to find things and I knew other people were too. So when I saw how good Google

was on every search that I typed in, I knew there had to be value there. But what I didn't realize was two things; how much value there turned out to be and also I didn't really appreciate how hard it would be to take it further.

Eric: Could you elaborate on that?
David Cheriton: It takes a lot of computer cycles, and a lot of networking analysts and a lot of computer resources to do a high quality search. The demo I saw had a small number of users using it. To make it viable you had to have tens of millions of users, so you really have to do a very good job of figuring how to stay alive at that level. A silly analogy is to imagine someone provides you with a really nice cup of lemonade, and you want to turn this it into an enterprise. The problem is that the mechanism used to make the lemonade has to scale up cost effectively from hundreds to millions. Many people don't appreciate that Google is a technical marvel behind the scenes. To service a search is very simple, and the core algorithm, the page rank algorithm, is barely understandable. But the amount of careful engineering behind the scenes to actually deliver the result cost effectively is dazzling.

Eric: What do you feel is your greatest accomplishment?
David Cheriton: Well I don't know that I can identify a greatest accomplishment. Let me tell you a few things I feel proud of. I do feel like I gave Larry and Sergey some useful help and guidance in the early days. I don't deserve a lot of credit for Google overall. I am happy I had some small part, as some people have written, "It's hard now to imagine a world without Google." I certainly graduated a number of students who have gone on to have a useful impact on the world and I think that's another accomplishment. I will list a third area, that there's an amazing number of things that I have almost done wrong but didn't. I could probably come up with a long list of them, but I think I am convinced that one of the keys to success is just avoid doing really dumb things.

Eric: What is one of the most important things you have learned throughout your career and from your work?
David Cheriton: One of them is that there is a very useful perspective, the engineering perspective, on problem solving in life in general, which is all about trade-offs. You encounter choices and make trade-offs between the different options, and that type of trade-off thinking is certainly a big thing I have learned. Some people are after the perfect solution and sometimes there isn't one. Other people don't explore all the possibilities before they make a decision or choose a solution, which goes away once you think everything is all about trade-offs. What are the options and what are the trade-offs?

Eric: What can you tell us about your research and the Distributed Systems Group at Stanford?
David Cheriton: The Distributed Systems Group has migrated its interest over the years depending on my interest and the students' interests. It used to be more towards a broad system, application-independent view of how you build distributive systems. Then I spent several years looking at the internet as a distributive system and trying to identify some of the issues there. More recently, I have become interested in the question of how to build distributive applications. I think there's an opportunity to build very complex applications that are automating even more complicated systems. Air traffic control is one of my favourite examples to point at where it ends up being distributed for performance and because the problem is geographical. So that's the primary area of focus these days, distributive applications.

Eric: What did it mean for you to achieve the SIGCOMM lifetime achievement award from the ACM.
David Cheriton: I was very honoured by that. It's always really exciting to be recognized by your peers in the field. When other people in the field who are very knowledgeable about what you're doing and knowledgeable about the field think that you've made significant contributions, it's really exciting.

Eric: There is a quote of yours I liked, "These people who build houses with 13 bathrooms, there's something wrong with them." Could you elaborate on this?
David Cheriton: Well I think that there is a certain type of craziness, people have a latent stupidity and that latent stupidity is held in effect by lack of money. Suddenly someone is given a lot of money, by an investment or some good fortune, and there is a danger they unleash this latent stupidity. I don't think building the largest possible house is anything other than craziness. It seems more like monument building. I think it is unfortunate when you have people with extra money doing things that seem just beyond what's real. Having the biggest house in the whole city seems to prove a point that doesn't need to be proved. I like the view that when somebody is fortunate and acquires a lot of money they can live a little bit better as a result. I think that's fine. But I think they should also try and retain the view that they are part of a society and the society is part of what enabled them to attain that wealth. There are more productive uses of it than 13 bathrooms.

Eric: If you could give an undergraduate student one piece of advice what would it be?
David Cheriton: Try to take advantage of unexpected new opportunities and try to prepare yourself for unexpected opportunities that come along. That's pretty general, but to me it is a key element. I am also a big fan of Mathematics, and I'd advise people to take a small number of core Math courses as an undergraduate. You can take anything else you want, but just take a small number of core Math courses all the way through to the third or fourth year and that will set you up with the right disciplined thinking to do almost anything.

Eric: What does Mathematics mean in your life today?
David Cheriton: I regard Math as the basis for how I reason about things. While I don't think that I use terribly sophisticated Mathematics, many times just arithmetic, I think that the instinct I gained from being a Math student is invaluable. When somebody says something I immediately think, "Is that provably true or provably false?" and if not, perhaps is it just an opinion. The same is true when

something comes out of my mouth: I tend to ask, is this a theorem or is this a conjecture? I believe that style of thinking, part of using carefully made definitions, really distinguishes people who do that from the vast majority of the human race. ■

Eric Naslund

Photo: Robert Klinzmann

The Mathematics Annex building on a beautiful summer day.

Report from the Undergraduate Chair, Rajiv Gupta

As in the rest of the department, our undergraduate programs have seen growth and transformation in recent years.

Here are some statistics about our programs:

- 2009-2010 total enrolment is over 15,000, up 11% from the previous year, and largest total ever.
- Math is one of nine departments in the Faculty of Science, and does 20% of its teaching.
- Breakdown of teaching students in different faculties: Science 39%; Applied Science (Engineering) 32%, Arts 15%, Commerce 4%, and other faculties 10%.
- Breakdown by course type: First-year calculus courses 46%, Second-year calculus 13%, first courses in linear algebra and differential equations 18%. Remaining more advanced third and fourth year courses, many aimed at Math Majors/ Honours 23% .

We have the challenge to constantly provide both quality lower-level service teaching on a large scale and valuable courses for some of UBC's very best advanced undergraduates. We've given you a snapshot of our undergraduate activities here, and hope you can visit our undergraduate website for more details: *http://www.math.ubc.ca/Ugrad/index.shtml*.

Course development and MATH-CWSEI

Maintaining effective courses is a continual process, with particularly high activity in the past few years.

One major factor in these activities has been our engagement since 2008 in the Carl Wieman Science Education Initiative (CWSEI), a Faculty-of-Science-wide program being led by its Nobel-Laureate namesake. The goal of the program is to dramatically improve undergraduate education by performing scientific, evidence-based study of teaching and learning. A major expansion of the MATH-CWSEI activities has started this year thanks to a generous $2 million donation by Dr. David Cheriton to the Math and Computer Science branches of the CWSEI program. Dr. Cheriton, a UBC alumnus, is currently a professor at Stanford University and is widely credited with mentoring Google's founders.

Much of our recent energies have gone into two main directions: improving student performance in first year calculus, through problem solving workshops in Math 180 and 184, and in computational course activities and labs in second and third year linear algebra, differential equations, and multivariable calculus courses with connections to applications. Through the MATH-CWSEI funding the department employs "Science Teaching Learning Fellows" (STLFs) to study and improve the teaching in our department. These STLFs, together with TAs and postdocs, work with faculty to develop learning goals, revised course materials, and assessment materials for student performance.

The expansion of the MATH-CWSEI program will include development and tracking of proof skills through the curriculum, incorporation of online homework in many of our courses, development of modelling and project based courses, and contribution to the newly revamped General Science program through a new second-year Math modelling course. These efforts complement recent departmental development and revision of courses in math modelling (MATH 445), linear algebra (MATH 310 and 412), and first year calculus (MATH 110/101) .

Our Programs

The Mathematics Department offers Majors and Honours degrees to students in Science and Arts, with 252 Science and 86 Arts students specializing in Mathematics. In addition, there are 24 students pursuing a Math Minor in Science, Arts, and Applied Science. About 100 students graduate each year with a degree in Mathematics.

Our programs are diverse, with many variants, including Combined Honours (e.g. some common ones are Physics/Math and Economics/Math), Double Majors, Combined Major, and a Co-op option. These options support a variety of directions after graduation, ranging from grad school to a range of public and private sector jobs, and teaching careers. A new program, the Dual Degree Program in Mathematics and Education, was created in 2008. This program allows students to simultaneously

take courses in these two disciplines, instead of first completing a Mathematics degree and then enrolling in Education. We also actively participate in two special programs for first-year students: Science One and the Coordinated Science Program.

Our Excellent Students

Our students are some of the most talented at UBC:

- 12 times in the past 20 years, the Governor General's Silver Medal for the top graduating student in Science has gone to one of our students! That's an overrepresentation by a factor of 10.
- In the past decade, 6% of BSc students specialize in Mathematics but 70% of the top graduating BSc students were from one of our programs.
- In 2006, the top graduating undergraduates in both Science (Dustin Tseng, Honours Computer Science and Mathematics) and Arts (Pak Hung Au, Honours Economics and Mathematics) were in Mathematics!

Our students also do well in comparison with students across North America: in the past decade, in each year the UBC team has placed in the top 20 in the annual Putnam Mathematics Competition, involving around 400 universities and colleges across North America. Participants attend weekly training sessions led by Greg Martin, with the number of UBC contest participants doubling in the past decade to around 25. Our undergraduates also get together at the Undergraduate Mathematics Colloquium, newly revived under the guidance of our new faculty member, Fok-Shuen Leung.

A number of scholarships and prizes are awarded to Mathematics students each year. Students who have won these awards in the past year are listed alphabetically below. Two of these awards, the Collison and Palliser-Wilson scholarships, were established within the past four years. See the end of this report for descriptions of these awards.

- Farzin Barekat (4th year): Daniel Buchanan Scholarship in Mathematics, John Collison Memorial Scholarship in Mathematics, Lawrence Roberts Putnam Prize
- Mohammad Bavarian (3rd year): Reginald Palliser-Wilson Scholarship
- Jonathan Blackman (3rd year): Reginald Palliser-Wilson Scholarship
- Tristan Collins (graduated): G. C. Webber Memorial Prize
- Joel Fox (4th year): Lorraine Schwartz Prize in Statistics and Probability
- Dennis Huang (3rd year): W. H. MacInnes Scholarship in Physics and Mathematics
- David Kurokawa (4th year): Reginald Palliser-Wilson Scholarship
- David MacNeill (4th year): Ron Riddell and Roy Douglas Memorial Scholarship in Mathematics, John Collison Memorial Scholarship in Mathematics
- Joochun Park (2nd year): Ralph D. James Prize
- Oren Rippel (4th year): John Collison Memorial Scholarship in Mathematics
- Farbod Roosta-Khorasani (4th year): Ron Riddell and Roy Douglas Memorial Scholarship in Mathematics
- Robert Tseng (graduated): Dr R. D. James Medal in Mathematics
- Stanley Xiao (graduated): Lawrence Roberts Putnam Prize

In addition, in February 2009 Farzin Barekat and in February 2010 Oren Rippel were two of only a handful of UBC students to win Premier Undergraduate Scholarships and receive a designation of Wesbrook Scholar. These awards are granted not only on the basis of academic merit but also leadership and community involvement.

Photo: Lee Yupitun

Undergraduate students Philip Mar, Jonathan Blackman, and Jeremy Hoskins

Our undergraduate students as a whole also have a strong involvement in the local mathematical community. Just a few of their activities are:

- Our Math Club sells final exam packages, supporting undergraduates in lower-level courses.
- Our undergraduates (13 in 2010) voluntarily lead the Metro Vancouver Olympiad Circle, bringing roughly 40 talented students from Metro Vancouver for weekly faculty presentations and work on challenging Math problems
- Undergraduate tutors provide after school workshops in various BC elementary and secondary schools, and some are especially involved with aboriginal students.

Our Instructors and Staff

Teaching around 16,000 undergraduate students a year requires the hard work not only of the approximately 90 instructors who teach around 200 undergraduate course sections but also of our efficient staff. Our courses are taught by our faculty, postdoctoral fellows, visitors, and graduate students. The involvement of grad students and PDFs is a critical part of their professional development, and we provide a range of training activities for them. They assist in teaching large first-year courses and large second-year courses under the supervision of an experienced faculty member.

Several members of the Mathematics Department have recently won prizes for their teaching. Over the past decade, eight Math faculty have received the UBC Killam Teaching prize. The Mathematics Department has also awarded teaching prizes to outstanding postdoctoral fellows and graduate students (see *http://www.math.ubc.ca/Dept/History.shtml* for these awardees)

Managing the needs, queries, and paperwork from many hundreds of students and our instructors is no small matter. Our front office manager and course registration and scheduling expert, Mar Ness, and our undergraduate secretary, Verni Brown, are both invaluable, effective, and ever-patient in their support of students and instructors. ■

Rajiv Gupta

Photo: The Ha

Students and teacher George Lin from Pinetree Secondary, Coquitlam (1st place in BC section, Euclid Contest 2009). Holding the plaque is Robin Cheng (2009 Canadian Olympiad team). In the background are Michael Bennett, Acting Head of Mathematics, and Simon Peacock, Dean of Science.

Governor General's Silver Medalists in Science, 2000–2009

Year	*Name*	*Program*
2007	Tyler Dodds	Combined Honours Physics and Mathematics
2006	Dustin Tseng	Combined Honours Computer Science and Mathematics
2004	Max Metlitski	Combined Honours Physics and Mathematics
2003	Pascal Tomecek	Combined Honours Mathematics and Statistics
2002	Zheng Zhang	Combined Honours Computer Science and Mathematics
2001	Joseph Wong	Combined Honours Computer Science and Mathematics
2000	Scott MacLachlan	Combined Honours Computer Science and Mathematics

Performance of UBC Team and Students in Putnam Competition, 1999–2008

Year	*Team Rank*	*Students in Top 200 and Rank*
2008	19	Cedric Lin (13), Farzin Barekat (46), Stanley Xiao (115)
2007	15	Cedric Lin (45), Joel Fox (205)
2006	11	Cedric Lin (17.5)
2005	13	Nima Kamoosi (57), Dustin Tseng (90)
2004	13	Daniel Brox (42), Dustin Tseng (53), Balin Fleming (142)
2003	10	Daniel Brox (29), Eva Koo (106), Dustin Tseng (118)
2002	14	Daniel Brox (48), Wayne Grey (104), Miranda Holmes (210)
2001	15	Miranda Holmes (130), Max Metlitski (130), Daniel Brox (144)
2000	15	Wayne Grey (140), Jesse Goodman (156)
1999	10	Joel Erickson (13), Jesse Goodman (23), Scott MacLachlan (120)

Description of Current Mathematics Awards for Undergraduates

Daniel Buchanan Scholarship in Mathematics

As a memorial to Daniel Buchanan, Dean of the Faculty of Arts and Science (1928-1948), and Head of the Department of Mathematics (1920-1948), and in recognition of his teaching and research in Mathematics, Alumni and friends (through the UBC Alumni Fund), together with members of the Department of Mathematics, have endowed a scholarship of $750. It is offered to the student who gains the highest standing in the third year of an Honours Course in Mathematics and proceeds to the final year in that course.

Photo: Unknown student

Farzin Barekat leading an Olympiad Circle session.

John Collison Memorial Scholarship in Mathematics

Scholarships totalling $5,000 have been endowed in memory of John Collison by the Madison Group. The awards are offered to students who are either in the Honours Mathematics Option in any engineering discipline or in the combined Honours Program in Mathematics and Physics. Preference is given to students who participate in UBC varsity sports and/or have a serious interest in aeronautics. Eligible candidates must have completed Mathematics 301 (Applied Analysis) or equivalent. The awards are made on the recommendation of the Department of Mathematics.

Dr R. D. James Medal in Mathematics

A medal plus a cash prize of $150 recognizes the meritorious service and distinguished achievements of Dr. R. D. James as Head of the Department of Mathematics from 1948 to 1973. It is awarded to the student in the graduating class whose record and promise in Mathematics are considered by the Department of Mathematics to be the most outstanding.

Ralph D. James Prize

A prize of $315 has been endowed by friends and colleagues in memory of Professor R. D. James, Head of the Mathematics Department from 1948 to 1973. The award is made on the recommendation of the Head of the Department of Mathematics to the student with the highest mark in Mathematics 121.

W. H. MacInnes Scholarship in Physics and Mathematics

A scholarship of $1,500, the gift of Mr. W. H. MacInnes of Vancouver, is offered to the student obtaining highest standing in the second year and proceeding to the combined honours course in Physics and Mathematics.

Photo: Unknown student

Mohammad Bavarian leading an Olympiad Circle session.

Reginald Palliser-Wilson Scholarship

Scholarships totalling $3,400 have been endowed through a bequest by Joy Gertrude Palmer Helders for students majoring or honouring in Mathematics. The awards are made on the recommendation of the Department of Mathematics. (First awards available for the 2009/10 Winter Session)

Ron Riddell and Roy Douglas Memorial Scholarship in Mathematics

Two scholarships of $250 each have been endowed by friends, family and the Math Club in memory of Ron Riddell and Roy Douglas. One award of $250 is offered to an honours student entering fourth year. The other award of $250 is offered to a majors student entering fourth year. The awards are made on the recommendation of the Department of Mathematics.

Lawrence Roberts Putnam Prize

In memory of Dr. Lawrence Roberts, Associate Professor in the Department of Mathematics. A $250 prize is awarded to any student who places in the top 200 on the Putnam contest for the first time.

Lawrence Roberts Mathematics Entrance Scholarship

A $1,500 scholarship has been endowed through a bequest by Frances Roberts in honour of her son Lawrence Roberts. The award is offered to a student entering the Mathematics program from a B.C. secondary school outside the Lower Mainland or Greater Victoria. The award is made on the recommendation of the Department of Mathematics in consultation with the Major Entrance Scholarship Committee and is non-renewable.

Lorraine Schwartz Prize in Statistics and Probability

In memory of Dr. Lorraine Schwartz, Assistant Professor in the Department of Mathematics. 1960-65, a $300 prize has been endowed by her friends and colleagues. It is awarded for distinction in the fields of statistics and probability to an undergraduate or graduate on the recommendation of the Departments of Mathematics and Statistics.

G. C. Webber Memorial Prize

A $650 prize has been endowed as a memorial to G. C. Webber, through a generous donation from his wife, Mrs. Eva Webber. The award is made on the recommendation of the Department, to an outstanding student in Honours Mathematics.

Metro Vancouver Olympiad Circle

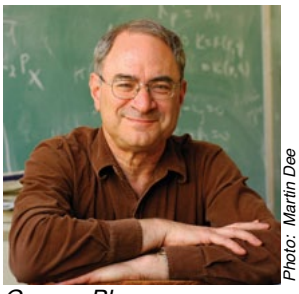


Photo: Martin Dee

George Bluman

This Circle was started in 2006. The initial objective was to create a network to enhance the performance of the top Metro Vancouver HS students in the various math competition opportunities that lead to consideration for selection to the Canadian International Mathematical Olympiad team in 2006 or in future years. The initial meeting was in late February. The Circle was primarily run by Andrew Adler. The initial focus was to prepare the students for the upcoming March contests: APMO (Asia Pacific Mathematics Olympiad) and CMO (Canadian Mathematics Olympiad). In 2006, we invited the top 10 Metro Vancouver students in the 2005 COMC (Canadian Open Mathematics Challenge). Nancy Nguyen was added later due to her winning the prize for the best Math project in the Canada-Wide Science Fair. The meetings were held for about six weeks each Monday from 5-7pm in the Math building. Consequences from this first Circle: Farzin Barekat was a member of the 2006 Canadian IMO team and had the highest score on the Canadian team and won a Silver Medal; Steven Karp was a member of the 2007 Canadian IMO team; Danny Shi was a member of the 2008 Canadian IMO team (he was in Grade 9 in 2006); Danny Shi was again a member of the 2009 Canadian IMO team and was the only Canadian to achieve a Gold Medal in 2009. All of the students came faithfully each week and had a wonderful time and built a very strong network!!

Photo: The Ha

Olympiad Circle 2010

A second (and more important) objective of the Circle is to make interested HS students aware of the wonderful world of mathematics and related sciences beyond contests!

No Circle was held during 2007. Late in 2007, five undergrads approached George Bluman to resurrect the Circle. Two of these undergrads (Farzin Barekat and Nancy Nguyen) had participated in the 2006 Circle and wanted to give something back to UBC for their wonderful experience. In December 2007, the top BC students in the 2007 COMC and 2007 Euclid Contest as well as a few students recommended by teachers were invited to participate in the 2008 Circle. The 2008 Circle began in early January and lasted until early April. It met on Mondays from 5-7pm in the Math building with about 25 HS students and was run by Farzin Barekat (2nd yr Hon Math/Phys), Nancy Nguyen (2nd yr Hon Math/Stat), Cedric Lin (2nd yr Hon CpSc/Phys), Oren Rippel (2nd yr Hon Math/Phys) and Mohammad Bavarian (1st yr) with the assistance of Andrew Adler. All of these students had been in Canada for less than three years and originated from four different countries (Iran, Israel, Taiwan and Viet Nam). Each week, the first hour involves a Math or Physics topic given by a UBC professor or student and the second hour (after pizza and refreshments provided by the UBC Math dept) is devoted to problem solving. During the week, the students network and work on problem solving. Almost all students return week after week (unlike the situation for Circles in other North American cities)—a tribute to our student volunteers led by Farzin Barekat. In the 2008 COMC, two of these students finished tied for first in Canada and the top five BC students had participated in the 2008 Circle.

In 2009, the Circle was run in the same fashion as the 2008 Circle with the involved UBC students including Farzin Barekat (3rd yr Hon Math/Phys), Cedric Lin (3rd yr Hon CpSc/Phys), Oren Rippel (3rd yr Hon Math/Phys), Mohammad Bavarian (2nd yr Hon Math/Phys), Joel Fox (3rd yr Hon Math/Phys), David MacNeill (3rd yr Hon Math/Phys), and Matthew Folz (Math grad student) with the assistance of Andrew Adler. In 2009 there were about 50 participating HS students—half based on contest performance, half based on recommendations from teachers. Because of the increased numbers, the sessions were moved to the LSK building at UBC. The Math department offered a token of support to the six math undergrads running the workshops for mathematical purposes: to attend the annual CMS undergrad research conference, buy books, etc.

In 2010, the Circle has continued. Involved UBC students include 13 undergraduates: Farzin Barekat (4th yr Sc), Mohammad Bavarian (3rd yr Sc), Aram Ebtekar (2nd yr ApSc), Simon Foreman (4th yr Sc), Joel Fox (4th yr Sc), Richard Lei (2nd yr Sc), Cedric Lin (4th yr Sc), David MacNeill (4th yr Sc), Eric Naslund (2nd yr Sc), Maya Perry (2nd yr Sc), Owen Ren (2nd yr Sc), Oren Rippel (4th yr Sc), and David Solymosi (2nd yr) as well as two graduate students: Matthew Folz (Math) and Daniel Brox (EECE), again with the assistance of Andrew Adler. In 2010, there are 41 participating high school students, almost all invited based on contest performance. The Circle has now become a very important way for our senior undergrads and graduate students to mentor our junior undergrads and has become an informal math club for many of our talented undergrads. ■

George Bluman

Interview with alumnus Robert Langlands

Professor Robert Langlands is probably the most prominent Canadian-born mathematician and one of the leading mathematicians of the 20th century. Born in 1936 in New Westminster, he obtained his Bachelor's and Master's degrees in Mathematics at UBC. He received his PhD degree at Yale University in 1960. Subsequently, he became a professor at the prestigious Institute for Advanced Study in 1972.

Langlands has done remarkable work and shown extraordinary insight in the fields of number theory, automorphic forms and representation theory. In 1967, he initiated and helped develop the Langlands program, a set of conjectures that connect number theory and the representation theory of certain groups. A special case of one of the conjectures in the Langlands program, proved by Langlands and Tunnell, was the starting point of Andrew Wiles' attack on Fermat's last theorem.

Robert Langlands has received many awards for his outstanding work including the 1996 Wolf Prize (with Andrew Wiles), and the 2007 Shaw Prize in Mathematical Sciences (with Richard Taylor). These are two of the most prestigious awards open to mathematicians.

In what follows, we have taken the liberty of abbreviating the responses of Professor Langlands to questions of one of our outstanding graduating Mathematics students, Farzin Barekat. The full interview is available on Robert Langlands' website at http://publications.ias.edu/rpl/series.php?series=58 and on the UBC Mathematics Department's website.

Farzin Barekat is very grateful to Professor Robert Langlands for accepting this interview and for his detailed and most interesting responses. The interview was conducted through e-mail responses.

Farzin: Please tell us how you chose to come to UBC as an undergraduate?
Robert Langlands: In grade 12, we had an excellent teacher, Crawford Vogler. He is one of the people to whom I owe most and for a very specific reason. Toward the end of the year, he took up an hour of class time to explain to me, in the presence of all the other students, that it would be a betrayal of God-given talents for me not to attend university. I had had no intention of doing that. None of my classmates did; at the time very, very few students, at the best one or two, did so in any year. I was flattered by his comments, my ambition was aroused, and I decided then and there to write the entrance examinations. I worked hard and was successful, even winning a small fellowship from UBC.

Farzin: Why did you study Math?
Robert Langlands: When I arrived at UBC, I took, as was common at the time and as was perfectly appropriate for anyone with my lack of academic experience, aptitude tests. The results were predictable. In those domains, mathematics and physics, where, at least in the context of such tests, only native talent matters, I did extremely well. In the others I also did well, but not so well. So the university counselor, whom one was encouraged to consult after the tests, suggested at first that I might want to become an accountant, even a chartered accountant. This lacked all glamour. So he then suggested mathematics or physics, cautioning me that this would require a master's degree or even a PhD. I decided on the spot that I would become a mathematician or physicist.

Although it may appear that I quickly abandoned the desire to become a physicist or even to acquire some understanding of physics, the desire persisted and I took a large number of courses that I enjoyed, both as an undergraduate and during my year as a graduate student at UBC. My experience suggests nevertheless that it is easier to learn mathematics on one's own than physics. It also suggests that my natural aptitude for mathematics was greater than my natural aptitude for physics. Physics appealed to me, especially mathematical explanations as in the treatise of Maxwell on electromagnetic theory or that of Raleigh on the theory of sound and I would read such books or those of more modern figures, such as Neils Bohr, with pleasure. I fear, however, that I was more attracted to the mathematical explanations than to the physical phenomena themselves.

The second-year physics course contained some thermodynamics which fascinated, puzzled and troubled me. For some reason or other that I no longer remember I had occasion to submit my theoretical reflections to the instructor, James Daniels, a low-temperature experimental physicist from England, probably better than competent, but he was somehow offended by my attempts to deduce the laws of thermodynamics from the perfect gas laws or conversely. I have no real recollection of what I wrote, but he, apparently having little respect for such philosophical elucubrations, chose to mock it in class. Certainly, this

was one factor in my decision at the end of the year not to continue with the double honours course, but to concentrate on mathematics.

Farzin: What memories (good or bad) do you have from your years at UBC?
Robert Langlands: At some point in the first or second year, because of my intention to choose honours in mathematics, I spoke with Prof. S. Jennings. He gave me a piece of advice for which I am grateful to this day. The year would have been 1954, thus not long after the war, when the atmosphere that reigned in mathematics before the war had not dissipated. He declared that to be a mathematician one had to learn French, German and Russian.

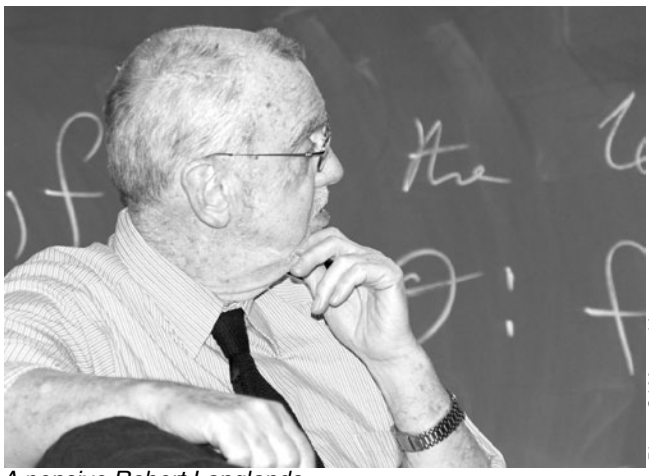


Photo: CJ Mozzochi

A pensive Robert Langlands

There was also a course on methods of applied mathematics, basically special functions, separation of variables, and second-order boundary value problems, all topics that appealed to me then and have appealed to me over the years, although I have had little time to cultivate them. The teacher was Thomas Hull, a melancholy but helpful fellow, who went on to develop computing at the University of Toronto.

As a graduate student I took some physics courses, one in electromagnetic theory, with an instructor of somewhat doubtful competence, another in group theory and quantum mechanics, given by Opechowski, a professor in the department, whose competence I could test myself. The course was basically a matter of the use of orthogonality relations for characters to decompose representations of finite groups. The final examination, a take-home exam, was to decompose the representation of the tetrahedral group in the space given by the coordinates of four particles moving independently at the vertices of a regular tetrahedron. His idea was that we should use the same orthogonal coordinates at each vertex and character formulas. It was not brilliant. It is clearly much better to take as the coordinate axes at each vertex the sides passing through that vertex. Then the representation can be decomposed by inspection. This I did. He was utterly confused by all the zeros and ones, but persuaded that it was I who was confused and who, in the hopelessness of my confusion, had introduced the regular representation into the problem. There was no convincing him otherwise. I expected to fail the course. This did not happen, but I did receive a very low grade. It was the final evidence of an incompatibility, if not between me and physics, certainly between me and the physics department at UBC.

Farzin: Why did you choose to go to Yale University as a PhD student?
Robert Langlands: I was eager to finish the Master's degree as soon as possible and to continue with what seemed to me genuine graduate work. I applied to three universities all American, why only American I do not know. It would not have occurred to me then to go abroad, thus to Europe or Great Britain, and no one suggested a Canadian university. That was probably just as well. I applied to three institutions: Harvard, Wisconsin and Yale. Yale because Robert Christian, an excellent and enthusiastic UBC teacher, had obtained his doctorate there and spoke to me often of the many functional analysts who were active there. Why Harvard, I cannot say. Perhaps because Benjamin Moyls was formally the supervisor of my Master's thesis and that is where he had taken his Ph.D. Wisconsin was probably simply in case I succeeded at neither of the other two. I was accepted by all three, but Wisconsin was without aid. I would have had to teach. I had discovered in my year as a candidate for a Master's degree at UBC that teaching interfered with learning mathematics. So I did not hesitate to decline Wisconsin. Yale offered a fellowship that would, with almost no help from my family, support both me and my wife, who would not be allowed to work in the USA. Besides I had some familiarity with the mathematics of the faculty at Yale. I was accepted at Harvard but with no support. So the choice was evident.

In retrospect, it was extremely fortunate for me that Harvard did not offer a fellowship. I would have gone there and missed in one way and another a great deal. At Yale I was on my own and allowed to follow my own inclinations. At Harvard, I would have had to deal with fields that were both popular and extremely difficult and with fellow students who were already initiated into them. That would have taken an incalculable toll.

Farzin: Which of your accomplishments are most meaningful to you?
Robert Langlands: The ideas formulated in the paper Problems in the theory of automorphic forms (*http://publications.ias.edu/rpl_works/L5/problems/problems-ps.pdf*) and earlier in a letter to Weil, a letter now available on the web (*http://publications.ias.edu/rpl_works/letters/weil/langlands-weil-ps.pdf*) and fairly widely read, have certainly been decisive for my career and, I suppose, my reputation.

Farzin: What do you think are the exciting fields in mathematics at this time?
Robert Langlands: I have seen in the course of 50 years as a mathematician many "exciting" fields come and go. So I have no answer to this question. My continuing interest in mathematics is, by and large, reserved, on the one hand, for mathematics to which I was introduced in the course of my career but about which my curiosity was

never fully satisfied and, on the other, for mathematics related to the topics with which I have been seriously concerned during my career: first of all, automorphic forms and representation theory with a little arithmetic and geometry; secondly, and to a considerably lesser degree, indeed in a very amateurish way, mathematical aspects of renormalisation, thus a little statistical mechanics, field theory, even fluid mechanics.

Farzin: What advice would you give to aspiring mathematics students?
Robert Langlands: None. In so far as I accomplished anything of value, I did it by following my own inclinations. I hope they do so too. ■


Farzin Barekat

Photo: Lee Yupitun
Two graduate student teams participated in the Storm the Wall event this year.

Report on Graduate Affairs

Mathematics Graduate Program

We currently have a vibrant graduate student community of 103 graduate students (43 MSc and 60 PhD students). Our students come from all over the world. There is an increasing trend of applications from China, India, Iran, Mexico and the United States. We offer Tuition Fee Awards to all our PhD students for the first four years of their doctoral program. As graduate students in the department, their contributions are invaluable in research and teaching duties.

New and Updated Graduate Courses

The graduate program offers at least 30 graduate courses per year including topics and seminar courses. This year the department created a number of new courses to accommodate the expansion of our graduate program. The following is a list of new and updated graduate courses that should soon be approved by Senate:

503 Discrete Mathematics
513 Mathematical Classical Mechanics
515 Partial Differential Equations of Fluid Mechanics
546 Continuous Time Stochastic Processes
548 Discrete Random Processes
555 Compressing Sensing
556 Industrial Mathematics
561 Mathematics of Infectious Diseases and Immunology
563 Physical Modelling of Cell-Scale Biology
564 Evolutionary Dynamics
566 Theory of Optimal Transportation
567 Nonlinear Wave Equations
592 Topics in Automorphic Forms
614 Topics in Mathematical Finance
615 Topics in Algebraic Geometry
616 Topics in Discrete Mathematics

TA Accreditation Program

Over the past year our new faculty member Fok-Shuen Leung and a team of graduate TAs have been working tirelessly to create a departmental TA Accreditation Program. Through a series of seminars, as well as workshops and other extracurricular activities, the TA Accreditation Program promotes and supports a teaching community in the department for graduate students. Topics have ranged from the use of clickers to engage students in the classroom to the effective ways of dealing with difficult matters through case studies. The seminar series is currently organized by Alia Hamieh, Vishaal Kapoor, David Kohler and David Steinberg. More information can be found at *http://www.math.ubc.ca/~fsl/TAAP.html*

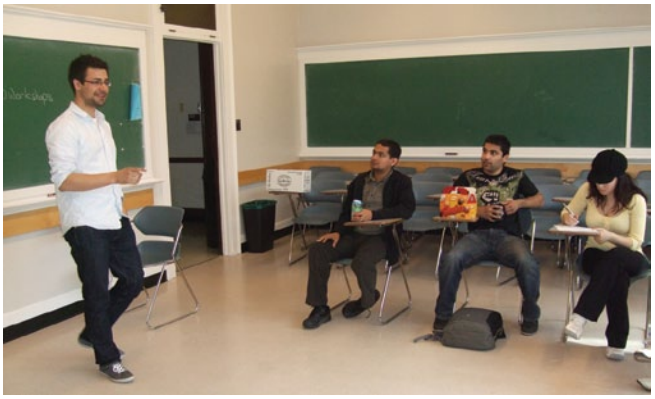


Photo: Lee Yupitun
David Kohler leading a TA seminar discussion

Graduate Fellowships

About 40% of our current students hold prestigious awards such as NSERC, Killam and Vanier Fellowships. Fellowship winners in 2009-10 include the following:

Vanier Fellowship: Cindy Blois

PIMS-IGTC Fellowships: Jun Allard, William Carlquist, Kelly Paton

NSERC Fellowships: Kael Dixon, Kyle Hambrook, Michael Lindstrom, Jennifer Morrison, Iain Moyles, Daniel Pareja, Kelly Paton

Four-Year Fellowships: Roland Bauerschmidt, Yu-Ting Chen, Craig

Cowan, Alex Duncan, Mostafa Fazly, Hardeep Gill, Jay Heumann, Xiaohu Ji, Vishaal Kapoor, Aurel Meyer, Andrew Morrison, Cihan Okay, Kai Rothauge, Ryan Schwartz, Dennis Timmers, Tereza Wei

Two-Year Fellowships: Alexander Jakobsen, Athena Nguyen, Ali Vakil

PIMS Summer School

Our graduate program has been very fortunate to participate in the summer schools organized by the Pacific Institute of Mathematical Sciences (PIMS). This year PIMS will host the Risk Sharing and Risk Management summer school at the UBC Point Grey campus. These summer schools are very well attended and include graduate students external to UBC. Lecturers will include Bruno Bouchard (Universite Paris-Dauphine), Ivar Ekeland (University of British Columbia), Mathieu Rosenbaum (Ecole Polytechnique) and Charles-Albert Lehalle (Chevreux Quantitative Research). In previous years, PIMS has hosted summer schools in Probability and Math Biology.

For further information, see *http://www.pims.math.ca/scientific-event/100607-mpussrmrs*

IAM

The Department of Mathematics currently has 40 graduate students who are members of the Institute of Applied Mathematics (IAM). Through their affiliation, they are required to complete the degree requirements set out by the IAM handbook in conjunction with the Faculty of Graduate Studies. More information on the IAM can be found at *http://www.iam.ubc.ca/*

Photo: Lee Yupitun

Graduate students attending a seminar.

Graduate Student Seminars

Every second Thursday, graduate students are invited to lecture on a topic of their choice. This gives them the opportunity to showcase their research and polish their presentation skills in an informal environment with peers. For a complete list of past and upcoming seminars, visit *http://www.math.ubc.ca/~GradComm/Grad_Seminar.html* ■

Lee Yupitun

Alumni News

Below is a list of where our 2009-10 graduates are working. For more alumni news, visit *http://www.math.ubc.ca/Grad/gradAlumni.shtml*

Graduate	*Thesis / Interest*	*Supervisor*	*Pgm*	*Life After UBC*
Jilkine, Alexandra (BSc, Manitoba) (MSc, UBC)	A Wave-pinning Mechanism for Eukaryotic Cell Polarization Based on Rho GTPase Dynamics	L. Keshet	PhD	Postdoc position at the University of Texas
Halasan, Florina (MSc & BSc, Iasi, Romania)	Absolutely Continuously Spectrum for the Anderson Model on Trees	R. Froese	PhD	Postdoc position at the University of Berlin
Merchant, Sandra (BSc, UNBC) (MSc, UBC)	Spatiotemporal Patterns in Mathematical Models for Predator Invasions	W. Nagata	PhD	Postdoc position at UBC
Code, Warren (BSc, UBC) (MSc, Saskatchewan)	Measure-driven Impulsive Systems: Stabilization, Optimal Control and Applications	P. Loewen	PhD	Postdoc position at UBC
Carrasco-Teja, Mariana (BSc, Mexico) (MSc, Washington)	Primary Cementing of a Highly Deviated Oil Well	I. Frigaard	PhD	Postdoc position at UBC
Molina-Escobar, Alberto (MSc and BAcc, Mexico)	Filtering and Parameter Estimation for Electricity Markets	M. Barlow	PhD	Unknown
Cantarero-Lopez, Jose Maria (Licenciado, Malaga, Spain)	Equivariant K-Theory, Groupoids and Proper Actions	A. Adem	PhD	Postdoc at CRM in Barcelona, Spain
Chen, Wan (Bsc, Wuhan, China)	Asymptotic Analysis of Dynamic Instabilities in the Gray-Scott Model	M. Ward	PhD	Postdoc position at Oxford University
de Oliveria, Gustavo Barbagallo (Mestre and Diplom, Sao Paulo, Brazil)	Asymptotics for Fermi Curves of Electric and Magnetic Periodic Fields	J. Feldman	PhD	Unknown

Guan, Meijiao (BSc, Central China) (MSc, Huazhong)	Asymptotics and Singularities in Landau-Lifshitz Equations	S. Gustafson / T. Tsai	PhD	Postdoc position at UBC
Kliem, Sandra Martina (Diplom, Berlin)	Stochastic ODEs and PDEs for interacting multi-type populations	E. Perkins	PhD	Postdoc position at Eindhoven Technical University in the Netherlands
Lukeman, Ryan James (BA, St. Francis Xavier) (MSc, Dalhousie)	Modeling collective motion in animal groups: from mathematical analysis to field data	L. Keshet	PhD	Assistant Professor at St. Xavier University
Ayaz, Ulas (BSc, Bogazici, Turkey)	Sigma-Delta Quantization and Sturmian Words	O. Yilmaz	MSc	PhD student at Bonn University
Folz, Matthew Bryan (BSc, SFU)	Gaussian upperbounds for heat kernels on Markov chains and on manifolds	M. Barlow	MSc	Continued to Ph.D. at UBC
Gunn, Keira Leanne (BSc, McMaster)	Collatz-Type problems with multiple divisors	G. Martin	MSc	Teaching at Douglas College
Prosk, Erin (BSc, McGill)	The Cofilin Activity Pathway in Metastasizing Mammary Tumor Cells	L. Keshet	MSc	Teaching in Montreal
Schwartz, Ryan Clifford (BSc, Witwatersrand, South Africa)	On Affine Cubes in Squares	J. Solymosi	MSc	Continued to Ph.D. at UBC

Department Dinner 2010

Photos: The Ha

Emeriti Peter Bullen, Ed Granirer, and Ray Chacon.

Patrick Brosnan, Kee Lam, and John MacDonald

Graduate students: Xin Geng, Thomas Wong, and Shane Cernele.

Rachel Kuske and post-doc Jessica Conway

Initiatives in Aboriginal Education

Over the last few years, the UBC (Vancouver) Mathematics Department has been increasing its support of a number of initiatives designed to enhance mathematics education for Aboriginal students in BC, and particularly in the Metro Vancouver area. Our activities are focussed on after school workshops and tutorials for students, professional development workshops for teachers, and pre-service training for teachers. We aim to enhance the math training for Aboriginal students on several critical fronts.

1. Improving access to the wide range of university programs that require Mathematics by providing opportunities for Aboriginal students to improve their math skills.
2. Supporting teachers in elementary and secondary schools to find more effective ways of teaching Mathematics.
3. Creating opportunities for UBC undergraduates to take Mathematics courses for prospective teachers that focus on the needs of Aboriginal students.
4. Providing opportunities for UBC undergraduates to work regularly with Aboriginal students in BC schools.

The larger picture is that there is a crisis in Aboriginal mathematics education in British Columbia. Aboriginal students make up over 10% of the school-age population in BC, with that percentage increasing steadily. Yet only 2% of BC Aboriginal students complete Principles of Math (POM) 12, the required level of mathematics in the high schools to enter most university programs, as compared to more than 25% over all completion of this course, and even then success in UBC programs is challenging for Aboriginal students. What is noteworthy is that this problem appears to be most serious in Vancouver area schools. For example, in Britannia Secondary, the high school with the largest percentage (over 30%) of Aboriginal students in the Vancouver area, no Aboriginal student completed POM 12 until 2009.

Student Mentorship Programs

For the last two years (2007-2009), the UBC Mathematics Department has sponsored undergraduate mentors to help Aboriginal students with their math at Britannia Secondary. In 2009/10, five UBC math undergraduates are volunteering on a weekly basis at Britannia to mentor PIMS sponsored Aboriginal students in Grades 9-12 as well as assist two Grade 8 teachers. Also in 2009/10, the UBC Mathematics Department, in partnership with the Vancouver School Board, UBC Bridge Through Sport, PIMS and the Musqueam Band, is sponsoring four undergraduate students as mentors of Aboriginal students at Point Grey Secondary on a weekly basis. This program has also expanded in 2009/10 to involve three sponsored undergraduates as mentors of Aboriginal students at Templeton Secondary as well as two sponsored undergraduates as mentors of Aboriginal students at MacDonald Elementary, a Britannia partner elementary school. Further support is being provided by our Department for after school workshops at Windemere.

We are eager to expand these mentoring opportunities to Britannia's other five partner elementary schools (Britannia, Grandview, Nelson, Strathcona, and Seymour Elementary Schools) as well as other elementary schools to further improve the math skills of students and support their future success. The after school mentoring activities complement the Math Summer Camps for Aboriginal students held at PIMS and Britannia Secondary. Together these summer camps and mentoring activities provide year round opportunities for students to strengthen their mathematical training through working with caring and masterful teachers/mentors.

School tutorial at Britannia Secondary with Alia Hamieh (graduate student and student mentor).

In-service Teacher Initiatives

Two UBC Mathematics faculty (Mark MacLean and Wayne Nagata) initiated a Teachers Circle on Aboriginal Mathematics Education to explore various mathematics topics encountered in teaching. The goal is to support the teachers as they learn to implement effective teaching strategies for Aboriginal students. Meeting several times during the past two years, this program is aimed at teachers from Britannia's partner elementary schools, and has

included one-on-one interactions with participating teachers in their respective schools.

A Summer Math Institute for in-service elementary school teachers of Aboriginal students was held at UBC in August 2008, and in December 2009 a professional development day helped teachers become familiar with the JUMP program, to complement workshops held throughout the year. The aim of these workshops was to help teachers build their classroom math skills and to teach diverse classes more effectively.

Photo: The Ha

Rahael Jalan and her NITEP students

Preparation of Future Teachers

Through the sponsorship of NITEP (Native Indian Teaching Program), the UBC Mathematics Department has offered special sections of MATH 335 (Introduction to Mathematics) in Summer 2006, Fall 2006 and Spring 2010, for Aboriginal students in the Faculty of Education NITEP program for prospective elementary teachers. This course fulfills the math requirement for their program. Graduates from this program are training to teach in Aboriginal schools throughout BC. These special sections have been ably taught by Rahael Jalan and have been greatly acclaimed by participating Aboriginal students.

Support of Mathematics Initiatives in Aboriginal Education

UBC Mathematics plays a part in a much larger effort of Aboriginal Math Education in Vancouver and BC, with some key contributors. In particular:

- The Pacific Institute for the Mathematics Sciences (PIMS), supports year-round activities for elementary and high schools.
- NITEP, at UBC, supports the expansion of pre-service training for teachers.
- The Vancouver Foundation provided generous seed funding for teacher professional development in 2007-09.
- Melania Alvarez, PIMS BC Education Coordinator, has led the expansion efforts of after school tutorials at schools in Vancouver. Students for these activities have been recruited by Melania and George Bluman (UBC Math Faculty).
- Britannia Secondary has supported a variety of programs over a number of years in coordination with Melania Alvarez, and with the work of Vicki Vidas, Math Head at Britannia, Beverly Seed, Principal of Britannia Secondary and Rahael Jalan, PIMS Aboriginal Education Coordinator.
- Mark MacLean (UBC Math Faculty) has led the expansion of professional development activities for teachers, with substantial contributions on UBC Math-sponsored activities from Melania Alvarez, and other contributions on this front from Rahael Jalan.

We are very grateful to many UBC student mentors for their valuable work at various schools. In particular, Julie Harris, Aleksandre Hrycaiko, Bowen Tang, Arman Tavakoli and Surina Wang are after school volunteers at Britannia Secondary this year; Jason Chu, Hee-Soo Chun, Julie Harris, Flora Hung, Jessica Johnson, Vaden Masrani, Sahar Moafi, Mary Shen, Lai Wah Robert Yeung, Andy Zhou are supported through work study in other after school tutorials. ■ *Rachel Kuske*

Emeritus lunch in December 2008.

Graduate students Steve Bennoun and Robert Klinzmann with Lee Yupitun, Graduate Secretary, at the Olympic Torch Relay at UBC.

2009-2010 Banner Year for Faculty Awards

UBC is considered to be one of the top two mathematics departments in Canada, and one of the principal indicators of this is the number of national and international honours won by our faculty members. However, 2009-2010 was an exceptional year even for this exceptional department. Perhaps taking our cue from the Olympic athletes, in the past year we really "owned the podium." (See the UBC mathematics awards page at *http://www.math.ubc.ca/Dept/Awards/* for updates.)

Omer Angel won the 2009-2010 Andre-Aisenstandt prize which recognizes outstanding research achievement by a young Canadian mathematician. He also won a 2010 Sloan Research Fellowship, a prestigious two-year fellowship awarded to young faculty members in the USA or Canada. Angel's research is in probability, one of the areas in mathematics where UBC's research group is pre-eminent. His work has applications to many other areas of mathematics, for example combinatorics, and to biology and physics.

Martin Barlow was awarded the 2009 CRM-Fields-PIMS prize. The citation notes that Barlow is "a leading figure in probability and the leading international expert in diffusion on fractals and other disordered media."

Daniel Coombs is the 2010 winner of the CAIMS/PIMS Early Career Award in Applied Mathematics which recognizes researchers less than ten years past their Ph. D. who have a record of exceptional research in any branch of applied mathematics. Coombs, who works in the field of computational immunology, addressing a wide range of problems in viral disease dynamics and HIV modeling, is cited for his creativity, productivity and ever-growing impact on mathematics applied to problems in biology.

Kai Behrend was awarded the CMS 2011 Jeffrey-Williams prize for established mathematicians who have made outstanding contributions to mathematical research. The citation notes that, "Behrend's work on Gromov-Witten theory, Donaldson-Thomas theory, and the virtual fundamental class has had a large and lasting impact on algebraic geometry. In particular, his 1996 Duke paper (with Manin) and his two 1997 Inventiones papers (one with Fantechi) are among the most heavily cited papers in the subject."

Patrick Brosnan was awarded the 2009 Coxeter-James prize by the Canadian Mathematical Society. The prize, which recognizes research contributions by young Canadian mathematicians, cites Brosnan's work on number theory, algebra and algebraic geometry.

David Brydges and **Zinovy Reichstein** have both accepted invitations to speak at the International Congress of Mathematicians (ICM) in 2010 in Hyderabad, India. This is an extremely prestigious honour as the ICM, which meets only once every four years, is a mathematical analogue of the Olympics. David Brydges, a Canada Research Chair professor at UBC, is a world leader in probability and mathematical physics. One of his research focusses is the mathematical theory of the renormalization group from quantum field theory. Reichstein, an algebraist, is a coinventor of the concept of essential dimension, a concept that has sparked an avalanche of research by people interested in algebraic groups and related topics.

Nassif Ghoussoub was awarded the 2010 CMS Borwein Career Award recognizing "exceptional, broad and continued contributions to Canadian mathematics." Ghoussoub has been a tireless promoter of the Mathematics Department at UBC and of Canadian mathematics in general. Among his many other accomplishments, he is one of the founders of the Pacific Institute of Mathematical Sciences (PIMS). He is also a founder and current director of the Banff International Research Stations (BIRS), one of the best places in the world for mathematicians to hold research-level conferences.

The current head of the UBC Mathematics Department, **Rachel Kuske,** was awarded the CMS 2011 Krieger-Nelson prize recognizing female mathematicians who have made outstanding research contributions. The citation states that Kuske "has made important contributions to the study of ordinary, stochastic, and partial differential equation models for a wide range of applications including neuroscience, mathematical biology, buckling under compression, mathematical finance, and hydraulic-fracture mechanics."

Gordon Slade, was awarded the 2010 CRM-Fields-Prize. According to the citation, Slade's research addresses "some of the most difficult problems in central areas of probability and statistical physics."

Brian Wetton is the 2010 recipient of the CAIMS/MITACS Industrial Mathematics Prize recognizing exceptional research, conducted primarily in Canada, in any branch of industrial mathematics. The citation notes Wetton's contributions in the area of fuel cells, an area where Wetton has used advanced mathematics to solve real world problems.

UBC Faculty Awards (past 10 years)

Adrian Pouliot Prize*	George Bluman 2001
Andre-Aisenstadt Prize	Omer Angel 2010, Jozsef Solymosi 2008, Alexander Holroyd 2007, Tai-Peng Tsai 2006, Vinayak Vatsal 2004, Jingyi Chen 2002
CRM-Fields-PIMS	Gordon Slade 2010, Martin Barlow 2009, Joel Feldman 2007, Ed Perkins 2003
Coxeter-James Prize	Patrick Brosnan 2009, Vinayak Vatsal 2007, Izabella Łaba 2004, Jingyi Chen 2003, Kai Behrend 2001
CMS Excellence in Teaching Award	Philip Loewen 2005
Jeffery-Williams Prize	Kai Behrend 2011, Martin Barlow 2008, Nassif Ghoussoub 2007, Joel Feldman 2004, Ed Perkins 2002, David Boyd 2001
Krieger-Nelson Prize	Rachel Kuske 2011, Izabella Laba 2008, Leah Keshet 2003
Sloan Research Fellowship	Omer Angel 2010, Jozsef Solymosi 2006, Vinayak Vatsal 2002
NSERC Steacie Fellowship	Michael Doebeli 2005
Fellow of the Royal Society (London)	Ed Perkins 2007, Martin Barlow 2005
Fellow of the Royal Society (Canada)	Ivar Ekeland 2008, David Brydges 2007
ICM Speakers	David Brydges, Zinovy Reichstein 2010 (Hyderabad), Vinayak Vatsal 2006 (Madrid)

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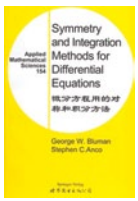
Recent Books by Faculty

Alejandro Adem, J. Leida, Y. Ruan, *Orbifolds and Stringy Topology*, Cambridge Tracts in Mathematics, Volume 171, Cambridge University Press, Cambridge, 2007

Alejandro Adem and R.J. Milgram, *Cohomology of Finite Groups*, Springer-Verlag Grundlehren 309 (1st edition 1994, second edition 2004)



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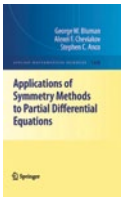

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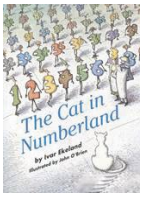

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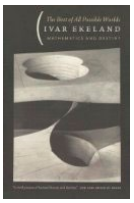

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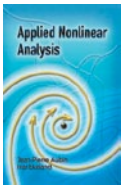

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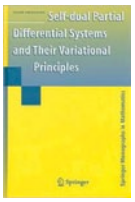

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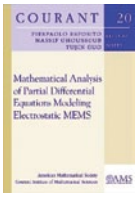

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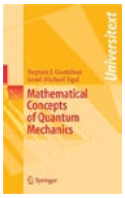

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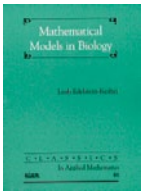

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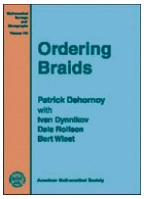

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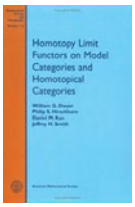

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