



Mathematics

Newsletter

2012

Message from the Head, Mike Bennett

Dear Friends, Colleagues and Alumni of UBC Mathematics,

I am greatly honoured to have the opportunity and challenges associated with being the Head of one of the strongest Mathematics departments in North America, a department I first joined as a graduate student more than 25 years ago. I would like to use this occasion to thank Leah Keshet for serving as Acting Head from October 2011 until January 2012 and, especially, Rachel Kuske for setting the bar impossibly high during her term as Head. A truly great university is, more than anything else, founded upon a core of truly great people. In this respect, our department is in fantastic shape, from our 14 office and IT staff members, through our 68 faculty, more than 40 postdoctoral fellows, research associates and visitors, and 122 graduate students. In the past year, for the first time in five years, the department underwent an external review, conducted by a distinguished group of mathematicians from the US and Canada. Preparation for this review was a tremendous challenge for the faculty and staff, but provided us an opportunity both for introspection and for looking ahead. The review committee was strongly impressed with what they found, an endorsement of the hard work and vision of our previous Heads and of the department as a whole.



Head and Assistant

As you will read in this newsletter, activity in the department continues unabated, with new faculty members hired to replace distinguished colleagues retired, prizes won for research, award-winning teaching delivered, and outreach initiated. In the midst of generally negative news from NSERC, this year was, rather improbably, one of our very best years for NSERC grants. We continue to strengthen our relationships with the Institute of Applied Mathematics (IAM), now part of the Faculty of Science, with the Pacific Institute for the Mathematical Sciences (PIMS), and with our other institute partners, Mitacs, Mprime and BIRS. The department's involvement in the Carl Wieman Science Education Initiative (CWSEI) continues, with great success and tangible benefits to our students. Outreach, to gifted high school students through our Math Circle, to First Nations students, in collaboration with our partners at PIMS and the First Nations Longhouse, and through the Canadian Open Mathematics Challenge, remains central to the department.

The coming years seem certain to be, as they say, "interesting times", primarily due to budget uncertainties. As a department, it is safe to say that we remain central to the mission of the University.

Indeed, we continue to teach an extraordinarily large number of undergraduates, more than 16000 last year, not to mention our large and successful graduate and postdoctoral programs.

Moreover, in the future, we will be heavily engaged in a variety of new international student initiatives on campus. Optimistically, we plan to use this considerable forward momentum to push for a new UBC Mathematics Building, to physically unite our scattered flock! This exciting prospect has advanced beyond the state of a "pipe-dream", with the completion of a new Mathematics & Institute of Applied Mathematics Masters Program.

In any case, wherever you are in the world, please keep in touch. Tell us what you're up to, come by and visit, turn up at a seminar or colloquium, or just check us out online at <http://www.math.ubc.ca>. ■

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New Faculty



Originally from Israel, **Asaf Nachmias** received his PhD from the University of California at Berkeley in 2008 under the supervision of Yuval Peres. He subsequently held postdoctoral positions at Microsoft Research (Redmond) and MIT, before moving to UBC as an Assistant Professor in 2011. Nachmias is

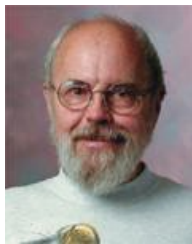
a probabilist who has made contributions in several areas of probability theory, especially to the theory of random walks, random graphs, and percolation.



Dong Li received his PhD from Princeton in 2006, and joins UBC following a postdoctoral position at the IAS in Princeton and an Assistant Professorship at the University of Iowa. He has authored more than 50 papers on subjects ranging broadly throughout applied math and analysis, including

Mathematical Physics, Mathematical Biology, Fluid Dynamics, and Nonlinear Dispersive Systems.

New Emeritus Professors



Dale Rolfsen received his BSc from Illinois Institute of Technology in 1963 and his MSc and PhD from the University of Wisconsin in 1965 and 1967. Following visiting appointments at the IAS in Princeton, ETH in Zurich and the Tata Institute in Bombay, he joined UBC in 1970. Dale is a topologist specializing in Knot Theory. In addition to numerous journal publications, he is known for his classic textbook *Knots and Links*, first published in 1976 by Publish or Perish Press and re-published in 2003 by AMS Chelsea. This book features many delightful figures, drawn by hand, of knots and links. Dale has served in various capacities for mathematics societies and institutes. He was UBC Math Department Head from 1989 through 1994, and earlier he blew the whistle on storage of radioactive materials in the Mathematics Annex.

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Brian Seymour received his BSc from the University of Manchester in 1965 and PhD from the University of Nottingham in 1969. His thesis focused on viscous flows in viscoelastic tubes, in the context of blood flow, combining both fluids and solids. This was the era of the first artificial hearts and his supervisor had a connection to DeBaKey in Houston. In 1970 he joined Joe Keller's group at NYU, as Assistant Pro-

fessor until 1973, when he moved to UBC. Brian served as Director of the UBC Institute of Applied Mathematics from 1986 to 1993. He has continued to work in areas connected to fluids or solids, mainly in engineering contexts, with applications to many areas including water resources and oceanography. Brian has numerous publications in applied mathematics and engineering journals, with 49 co-authors mainly from departments other than mathematics. Outside of mathematics he served on the executive of the BC Field Hockey Association and is currently chair of a non-profit society providing wireless internet services to Texada Island with funding from Network BC.

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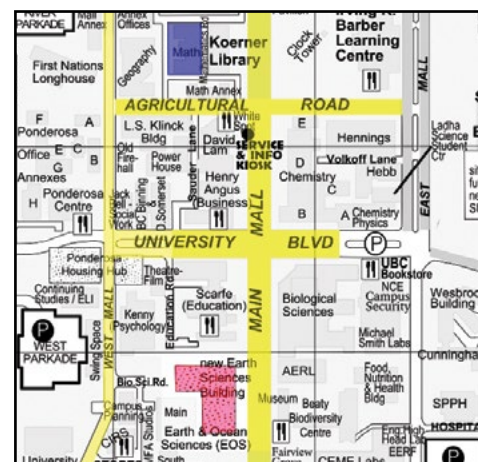
PIMS on the Move



PIMS-Mprime Summer School in Probability

In August 2012, the UBC headquarters for the Pacific Institute for the Mathematical Sciences (PIMS) moves to a new state-of-the-art, centrally located facility on the 4th floor of the brand new Earth Sciences Building at UBC. This is an impressive building located on the Main Mall, across from the Beaty Biodiversity Centre.

The new space includes a reception area, offices for administration, offices for up to 24 visitors and postdoctoral fellows and lab workspace for ten graduate students. It also has a dedicated videoconferencing room and a spacious lounge. Moreover there are classrooms in the building available for PIMS seminars and workshops. PIMS looks forward to welcoming all current and former members of the UBC Mathematics Department to its new site!



■ Math Building
■ PIMS

Interview with alumnus Dan McLeod



Dan McLeod is a founder, publisher, editor and sole owner of Vancouver's eclectic weekly newspaper The Georgia Straight. Dan earned an Honours BSc Math degree from UBC in 1965. He was also a grad student in the UBC Math department.

As an undergrad, Dan became involved in the poetry scene: writing and submitting poems to and, with several friends, eventually running the alternative newsletter Tish.

*In 1967 he and others founded The Georgia Straight. The paper had wild beginnings: "McLeod emerged as the prime leader behind the idealistic, naive, frequently irresponsible, consistently cheeky, often insightful, collectively-run initiative because he was most willing to take the brunt of police persecution and unmitigated legal harassment that ensued."**

The Georgia Straight is now an established part of the Vancouver cultural scene. Dan won The Bruce Hutchison Lifetime Achievement Award from the Jack Webster Foundation for outstanding work in journalism in 1998 and the lifetime-achievement award from the Western Magazine Awards Foundation in 2002. Today, Dan still publishes The Georgia Straight while also involving himself in philanthropic work and other projects in support of the arts.

Dan McLeod was interviewed in person on June 5, 2012 by Kristina Nelson, an outstanding 2nd year Honours Math /CpSc undergrad. The full interview is available on the Math Department's website.

**The Georgia Straight: What the Hell Happened? (Douglas & McIntyre 1997)*

Kristina: Apparently you went to Kitsilano High School? What was your experience with Mathematics there, and how did that effect your decision to take Mathematics at UBC?

Dan McLeod: Yes, from Grades 10 to 12. I don't remember that much about high school but I did like my Math teacher Mr. Ord. I took Chem 101 from Mr. Holton in Grade 12 and thought I might be a chemical engineer at first, because that was an up-and-coming thing at the time. And then when I entered UBC I thought maybe a nuclear engineer; maybe that would be better because it seemed more forward thinking.

So when I entered UBC I took Honours Math and Physics but I was also very interested in English. George Bowering was my first year English professor; he's now maybe the best known poet in Canada. So for that first couple of years I was taking math and physics but I was also getting involved in the poetry scene. George and Lionel Kearns, Fred Wah and Frank Davey were grad students at UBC who were editing a poetry magazine called TISH. I became involved in the magazine, writing poems, and when they graduated they turned the magazine over to me and a bunch of others to continue it. Then, after second year I had to make a decision, I had to drop something, and so I dropped the English at that point although I picked it up again in summer school.

There was this English 410, this creative writing poetry course that had a summer session which invited the top American poets at that time, like Charles Olson. Also Robert Creeley was teaching at UBC, and Warren

Tallman in the English Department was kind of the focus that bought all these people together. And at the same time I went into third year Math and Physics, though finally I decided to drop the physics after that year and went into pure Math and finished that degree.

Kristina: I hear that you were interested in meteorology as well as math and physics during your undergrad? Why didn't you end up pursuing that?

Dan McLeod: Well the thing is that I wasn't subsidized by my parents, I had to earn my own tuition. The fees were relatively low in those days - I think they're a lot higher today - so it was not too hard to achieve. It was possible to get summer jobs through the UBC employment office that were relevant somehow to what you were studying so I managed to get a summer job at the Department of Transport weather station. And I got another job a year later through the Institute of Oceanography. These were just student summer jobs, but they were interesting. We were invited to write a paper and so I wrote a paper and they published it.

Kristina: Are you glad that you studied Mathematics, and were there any things specifically that you enjoyed?

Dan McLeod: I don't regret anything that I did. I sort of lurched from one thing to the next but I think it gave me a perspective, a broader perspective than if I'd just gone into English or just into Physics. And I guess you enjoy anything that you do well in, I did seem to do well in topology so I enjoyed that.

Kristina: In general then, which courses or instructors had an impact on you?

Dan McLeod: I mentioned George, I liked Dean Gage as a personality. He always struck me as more of an entertainer than a mathematician. He had a very entertaining way of communicating, attracted a big following. George Bluman I met at the Department of Transport weather office out at the airport, but he wasn't able to finish the summer - he was called away to do something else. I can't remember if he was ahead of me or behind me, we were one year out of sync. I thought he was ahead of me, but he might just have been ahead of me mentally! Because he did strike me as a brilliant guy.

Kristina: Ok, and then how did the Georgia Straight get started? You started a graduate degree in Mathematics didn't you?

Dan McLeod: I dropped out after one year, I lost interest. There were too many other things going on at the time on the poetry side and I was unhappy with the way things were going. I was very upset about the Vietnam War, which I thought was very unjust and I was starting to think more of the politics of the situation. I believed so strongly and I didn't want to contribute in any way directly or indirectly to the war effort.

I started thinking about what I was going to do when I graduated and such. And at the same time I shared an office with another grad student and he came in one day overjoyed and said "I got a job! I got a job!" After graduating with his Masters, he was going to move to Calgary and work for Shell Oil. And there's another thing, through my poetry involvement I had also become involved with the environmental movement and you know it wasn't even a movement then - Greenpeace was virtually founded out of our office. So that was another reason to do something that I felt was more relevant, rather than just contributing to big oil.

So what was the other option? I could be pure and go into teaching because I was a TA tutoring third year calculus on the side and I thought maybe I could become a professor. But then I'd only be teaching people how to make better submarines to kill people and who knows what other deadly applications and I just thought maybe it's better to do something else.

Kristina: Would you still recommend a Math degree to students today, even if they don't know what they are going to go into or are considered careers in other fields?

Dan McLeod: I don't even know what a Math degree consists of these days. I suppose pure math is not much different, but maybe more of it is now in computer science? If you look at the numbers of people who graduate I think the large majority are Computer Science, it would be interesting to compare percentage-wise how many graduate today in pure Math versus back then.

Kristina: Would you recommend incorporating math into a degree? Or a minor?

Dan McLeod: I think it depends on your abilities, I don't know why anyone would specialize in just pure math unless they were a really confident super genius and really wanted to solve some of the big questions of the day. I don't think

I would have found it very satisfying unless I was able to do that kind of stuff. I don't know if I could've, as I said, I lost interest and maybe I just felt I couldn't do it at a high enough level, or I felt that I could accomplish more at something else.

Kristina: Can you talk about the representation of math in the news today? I think it's becoming much more prevalent these days.

Dan McLeod: Well there's a lot more statistics and infographics, that kind of thing. I wish we had the resources of a paper like the Guardian, they have a whole department that does nothing but infographics, statistical research and math research to illustrate their articles. I think that's very interesting. The Guardian tends to be more intellectual, and I kind of worry about it sometimes because it gets eclipsed totally by something like the Daily Mail - which is just celebrity gossip online, that kind of thing. Also, I fairly recently got into that TV show NUMB3RS. Its kind of hokey but I think it does a really good job of showing that you can make math interesting. Most people never think about it that way. So there's some attention on that kind of thing, although it's still a mystery to most people I guess.

"I don't regret anything that I did. I sort of lurched from one thing to the next but I think it [math] gave me a perspective, a broader perspective than if I'd just gone into English or just into Physics."

Kristina: Do you think people have the sufficient background to express and understand the math that's being broadcast today?

Dan McLeod: I think you need somebody that not only understands the math but they also have to be a really good communicator, and that's where a newspaper or blog can come in to explain something like economics. Although even then the experts disagree wildly; there's no one authority on that kind of thing. And it's a social thing too: it's not just statistics, it depends on the social background of the person that's analyzing it, and that of the person receiving the information.

Kristina: I think right now BC is cutting back, at least recently, in its mathematical curriculum, do you have any thoughts on this?

Dan McLeod: Does that include computer science? Maybe it's increasing in computer science and going down in math. Because it's so essential these days. We didn't have the internet, and we didn't have programmers. And the computer power has increased so much. Now maybe kids will learn with iPads, maybe they'll learn faster from that than from going to school. I think the opportunity is there now. ■



Kristina Nelson

Departmental Seminars and Lecture Series

There is never a dull moment in the UBC Mathematics Department. Opportunities abound for learning the basics and for learning cutting-edge mathematics and applications. Beyond the full formal curriculum of numerous undergraduate and graduate courses, the UBC Mathematics Department offers a multitude of vibrant seminars throughout the year. These include more than a dozen weekly seminar series covering a broad range of research in pure and applied mathematics, a weekly seminar on mathematics education, and a graduate student seminar. In addition to these, each week the Department hosts a Colloquium of more general mathematical interest (Fridays at 3).

There are also several special lecture series during the year. These series bring the most outstanding mathematicians from around the world to UBC. These include the IAM-PIMS-MITACS Distinguished Colloquium Series,

which hosts 6 lectures in applied mathematics, the PIMS-UBC Distinguished Colloquia, which hosts 5 lectures in mathematics ([Page 20](#)), and the Ivan Niven Lectures, which are aimed at the general public.

The Niven Lectures honour Ivan Niven, a world famous number theorist who earned his BSc and MSc at UBC. The 2012 Niven Lecture, given by Lakshminarayanan Mahadevan (Harvard), was entitled "On growth and form: geometry, physics and biology". The 2013 Niven Lecture will be given by Yann Brenier (Université de Nice) in late May. Notices of seminars and special lectures are posted on:

<http://www.math.ubc.ca/Dept/Events>

<http://www.iam.ubc.ca/colloq/>

<http://www.pims.math.ca/scientific/current-events>

Update from the Undergraduate Chair

In this update, we repeat important information from our 2010 Newsletter and highlight our ongoing activities.

Our undergraduate program is vast and undergoes continual evaluation and revision. Here are some statistics:

- 2011-2012 total enrolment was just under 16,000. An unexpected increase in first-year enrolment means 2012-13 total enrolment is likely to be around 17,000, an all-time record. Total enrolment in 2001-02 was around 13,500.
- Math is one of nine departments in the Faculty of Science, but does 20% of its teaching.
- Breakdown of teaching students in different faculties in 2011-12: Science 36%, Applied Science (Engineering) 34%, Arts 15%, Commerce 5%, and other faculties 10%. Applied Science enrolment has grown steadily in the past decade; the first two percentages were 48% and 23% in 2001-02.
- Breakdown by course type: First-year calculus courses 44%, Second-year calculus 12%, first courses in linear algebra and differential equations 18%. The remaining 26% are more advanced third and fourth year courses, many aimed at Math Major and Honours students.

We have the challenge of constantly providing both quality lower-level service teaching on a large scale and advanced courses for some of UBC's very best undergraduates (as detailed below).

For a fuller appreciation of the scope of our teaching, please visit our undergraduate website: <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 started in 2010 thanks to a generous \$2 million donation by Dr. David Cheriton, a UBC Honours Math alumnus, to the Math and Computer Science branches of the CWSEI program. Dr. Cheriton is currently a professor at Stanford University and was a mentor for Google's founders.

Initially we focused on 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 post-doctoral fellows, work with faculty to develop learning goals, revised course materials, and assessment materials for student performance.

Our current efforts are focused on development and tracking of proof skills through the curriculum, courses designed for prospective teachers and an assessment of skills developed in MATH 104. For more on these projects see the article on CWSEI in this newsletter.

Our Programs

The Mathematics Department offers Majors and Honours degrees to students in Science and Arts, with 245 Science and 93 Arts students specializing in Mathematics in 2011. In addition, there were 17 Applied Science students pursuing a “Minor in Honours Mathematics.” 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 Computer Science/Math), Double Majors, Combined Major, and a Co-op option. These options support a variety of directions after graduation, ranging from graduate school to a range of public and private sector jobs, and teaching careers. The Dual Degree Program in Mathematics and Education was created in 2008. This program allows prospective teachers 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. A complete list of winners since 2000 from the Math department is given in the table below.
- In the past decade, 6% of BSc students specialized in Mathematics but 60% 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 extremely well in comparison with students across North America: in the past decade, every year since 2000 the UBC team has placed in the top 20 (see the table below) in the annual Putnam Mathematics Competition, involving around 400 universities and colleges. This contest is widely regarded as the premier mathematics competition for undergraduates in Canada and the United States. Participants attend weekly training sessions led by Greg Martin, with the number of UBC contest participants doubling in the past decade and reaching a record 28 last year.

Our undergraduates get together in many ways, including the Undergraduate Mathematics Colloquium, recently revived under the guidance of Fok-Shuen Leung, and in many activities sponsored by the UBC Math Club.

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 voluntarily lead the UBC Math Circle, bringing roughly 50 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.

For more information on the UBC Math Circle and the school workshops, see the article on Outreach in this newsletter ([Page 14](#)).

Our Instructors and Staff

Our undergraduate program depends on the hard work of faculty, postdoctoral fellows and graduate students who provide excellent instruction. Highly valuable support is also provided by our effective, patient and friendly, office staff, in particular Mar Ness, our front office manager, course registration and scheduling expert, and Verni Brown, our undergraduate secretary.

Over the past decade, nine Mathematics Department faculty members have received the UBC Killam Teaching prize. In addition, Math faculty and staff have won the PIMS Education Prize, the CMS Adrien Pouliot Prize, and the CMS Excellence in Teaching Award. Our most recent awardees are listed in the Awards section of this newsletter. ■



Rajiv Gupta

Governor General's Silver Medalists in Science, 2000 – 2012		
<i>Year</i>	<i>Name</i>	<i>Program</i>
2012	Connor Meehan	Combined Honours Physics and Mathematics
2011	Dennis Huang	Combined Honours Physics and Mathematics
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, 2000 – 2011		
<i>Year</i>	<i>Team Rank</i>	<i>Students in Top 200 and Rank</i>
2011	9	Ruiyuan Chen (43), Karlming Chen (109)
2010	6	Mohammad Bavarian (45), Yuqi Zhu (126)
2009	11	Cedric Lin (49), Karlming Chen (147), Joel Fox (197)
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)
2001	15	Miranda Holmes (130), Max Metlitski (130), Daniel Brox (144)
2000	15	Wayne Grey (140), Jesse Goodman (156)



PIMS-Mprime Probability Summer School Hike



Dean Simon Peacock with Euclid award winners

Undergraduate Awards and Honours

On May 28, 2012, the Department of Mathematics held its annual reception for graduating BSc and BA students. In addition to honouring all of our graduates and partaking in delicious desserts, this event provided the opportunity to present awards to our top undergraduates:



Department Graduation Reception

Connor Meehan (Honours Mathematics and Physics) was awarded the Dr. R.D. James Medal, which recognizes our top graduating student. Connor also won the Governor General's Silver Medal, awarded to the top undergraduate in the Faculty of Science. Connor will start graduate study at the University of Toronto in the fall.

Ting Chen Leo Hsu (Honours Mathematics and Physics) received the G.C. Webber Prize, awarded to an outstanding undergraduate. Leo will start graduate school at UBC in the fall.

Saman Gharib (Honours Mathematics) received a special departmental award for his academic achievements.

Ruiyuan (Ronnie) Chen (3rd year Honours Mathematics and Computer Science) won the Larry Roberts Prize for top performance in the William Lowell Putnam Mathematics Competition. Ronnie placed 43rd among some 4000 competitors. UBC's team, consisting of Ronnie, **Karlming Chen**, and **Aram Ebtekar** placed 9th among the 460 university and college Putnam teams, earning an Honourable Mention and the coveted crown of best team in Canada.

Behrooz Ghorbani (1st year Arts) received the Ralph D. James Prize for the highest standing in MATH 121 (Honours Calculus).

The Department of Mathematics has a new award that targets top mathematics high school students. A generous gift from an alumnus has provided \$15,000 each year for the next 5 years for entrance scholarships to students of exceptional ability and interest in Mathematics. The awards are made on the recommendation of

the Mathematics Department.

We have a number of other scholarships/awards for high-performing entering and continuing students. These awards allow us to attract and retain the best and brightest students. For more information see:

<http://www.math.ubc.ca/Ugrad/ugradScholarship.shtml>



Graduation Cake

Please Tell Us

Please tell us some news about yourself, comments on this UBC Mathematics Newsletter, and/or any articles you would like to see in the future.

E-mail to: newsletter@math.ubc.ca

Mail to: *Newsletter*

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Visit the UBC Math Department webpage:

www.math.ubc.ca

Interview with UBC Math Professor Nassif Ghoussoub



Nassif Ghoussoub is Professor of Mathematics and Distinguished University Scholar at UBC. He has received international recognition for his research on non-linear analysis and partial differential equations, and was the recipient of the Jeffrey-Williams Prize, the highest honour for mathematical research, given by the Canadian Mathematical Society. He was the founding Director of the Pacific Institute for the Mathematical Sciences (PIMS) and currently is the Director of the Banff International Research Station (BIRS). He was first elected as a faculty representative on the UBC Board of Governors (BoG) in 2008 and was re-elected for a second 3-year term in 2011. It was in this role that he was interviewed by Ed Perkins on July 5, 2012.

Ed Perkins is Professor of Mathematics and Canada Research Chair in Probability at UBC. He has won a number of awards for his work in Probability Theory and was an invited speaker at the International Congress of Mathematicians in Zurich in 1994.

Ed: What is the role of a Faculty representative on the BoG?

Nassif Ghoussoub: Not any different from any other Board member. All are expected to represent and act in the best interests of the University as a whole and not see themselves as representing a particular constituency. Having said that, Faculty representatives have the advantage of living the university experience and their immersion in the academic life allows them to bring this first-hand experience to the table.

Ed: What kind of commitment is required?

Nassif Ghoussoub: This past year I may have attended over 20 meetings of the Board and its Committees. It is a major commitment but the work is very rewarding. There was a lot to learn at the beginning. One doesn't come to a Board meeting hoping to change the direction of the proposed initiatives; that has to be done earlier in preparatory sessions and at the committee stage by working with people and convincing them of your point of view. As you know I am impatient and long and protracted diplomatic channels are not my forte, so it took a while to get used to this style. Once one gets to know the Board members better you learn how to work with them, and also learn a lot from them.

Ed: What are some of your main accomplishments on the Board to date?

Nassif Ghoussoub: I would like to think that I have contributed to making the Board more aware of the role, the value, and the overall quality of our faculty, that research is one of the main functions of a first class university such as UBC, that our colleagues are as entrepreneurial and innovative as anyone in society, not only in creating, transmitting and preserving knowledge, but also in bringing substantial financial resources to the university.

I have also chaired a task force dealing with housing on the UBC (Vancouver) campus. The ongoing development of a Housing Action Plan for the Vancouver campus is in response to a crisis we are facing in hiring and retention.

Young faculty (and for that matter senior faculty we may want to recruit, e.g., as CRC's) simply cannot afford the Vancouver housing market. For years, UBC had been building up an endowment based on developing and leasing market housing on campus, with little consideration for the housing challenges of our own Faculty, Staff and Students. We are at a time when our ability to raise our level as an academic institution is being seriously hampered by unaffordable housing. It may not be uniform over all University Departments, but those competing on the world stage for recruiting, and retaining, the very best personnel including Mathematics, feel it acutely. Once the dialogue opened it became clear that this is a fairly widespread problem within the University.

Ed: As a past chair of our Department hiring committee, I have certainly seen offers refused and shortlisted candidates walk, due to housing. What can be done and how quickly?

Nassif Ghoussoub: It is a very complex issue with no easy fix. We studied how the issue is being addressed at NYU, Stanford, Columbia, Irvine, Harvard and UCLA. In Stanford's case the development of a Faculty Housing plan in the 70's was instrumental in their rise to one of the world's top-10 universities. Each is different but all are far ahead of us. For NYU, non-market rental programs make sense in Manhattan, while on the west coast there is a greater desire to own. Irvine has an extensive home ownership program and some of these ideas are being adapted to a proposal for on-campus housing at UBC. The prices would be set substantially below market value, but there would be capped appreciation and resales would be restricted to Faculty. The precise nature of the capping is one issue to be settled. The number of units and nature of the units (How many BR's? Highrise vs. townhouse?) are others. An unknown is the actual demand. On-campus housing has many advantages but many faculty may prefer to live near the amenities of the city. This is why it is important to have a university community which is a highly desirable place to live. We received a lot of input at

public meetings especially this past spring, and are hoping to bring a definitive plan to the BoG in September.

Ed: From a personal perspective how have you found working on the BoG.

Nassif Ghossoub: I have met a lot of great people. After working together and, frankly, often disagreeing on issues affecting the University, one often does develop a healthy mutual respect. This was the case with many of the government-appointed private sector members of the BoG. They obviously have expertise which we academics lack and conversely when it comes to university issues. Some of these are the people who can be our most effective allies in promoting advanced university research to the federal and provincial governments.

Ed: You have committed a huge amount of time to the Board, your leadership role in Canadian mathematics (PIMS, BIRS, MITACS, part of which has now evolved into Mprime which you now lead) and over 300 blog posts in the past year on a variety of topics but many centered on issues affecting the Canadian research community. How is your own research and graduate supervision going?

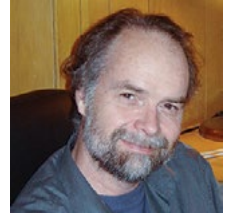
Nassif Ghossoub: It is going well but in a different manner than when I was younger. I no longer sit for weeks with pen and pad and stress out when the answers do not come. It is more a case of letting the ideas come when they do and then working in concentrated bursts. I was also fortunate to have had a number of talented PhD students in recent years. Five have graduated in the last three years.

Ed: Although the housing issue and its implicit hiring and retention problems are one obstruction to our Department reaching the next level of an elite N. American public university, it is not the only one. The recent Departmental Review pointed to the aging physical infrastructure of Mathematics and at a recent Department meeting on the Review it was plain that the Faculty, especially the younger ones, were clearly ready for a new building. From your perspective what is the most effective way to proceed?

Nassif Ghossoub: In my opinion, the state of the mathematics building in this university is a disgrace. It is particularly painful to be on the Board and to see dozens of capital projects approved, when you are not personally convinced that they should be ahead of Mathematics in priority. But, as I said before, Board members cannot/should not advocate for their pet projects. These normally are driven by the Deans and the decrepit math building doesn't seem to make the Faculty's priority list.

I wrote a blog on how best to approach this issue! Having a private donor step forward is the key step which can accelerate this process to the top of the University priority list. Only a fraction of the total cost is often needed here but it is invaluable assistance. It helps greatly to have a champion somewhere in the Administration. We are dealing with a major unit on the UBC campus with significant classroom space so it could be easily justified to the UBC Administration. Provincial funds, CFI funds, corporate donations, private donations for specific lecture

halls and computer labs all help make up the total. Finally, but perhaps most importantly, you need an in-house champion (preferably a megalomaniac) who is willing to pursue this cause through the long run and jump through all the necessary hoops. My experience on the Board can help in advising the Department on what are the hoops and how to surmount them, but I surely cannot advocate. ■



Ed Perkins

USRA

The NSERC Undergraduate Student Research Awards (USRA) provide an opportunity for top undergraduates to engage in independent research in mathematics under the supervision of a UBC faculty member. Students work on a diverse array of projects in pure and applied mathematics. The USRA program is often cited as a pivotal experience for undergraduates in their career development. Each student receives a stipend for 16 weeks of full-time work in the summer.

In addition to research work, USRA students have opportunities to get to know one another through two weekly meetings where students present talks on their work and related material in a seminar organized by Professor Richard Anstee. There are also informal events where students get to know one another, including day hikes. Below is a list of USRA students and projects for summer, 2011. For information on past projects, see:

<http://www.math.ubc.ca/Ugrad/NSERC/ugradUsraRecipients.shtml>



NSERC USRA student hike (2012)

USRA Students Summer 2011

<i>Student Name</i>	<i>Supervisor Name</i>	<i>Year/Program</i>	<i>Research Project</i>
Blackman, Jonathan	Homsy	4th / BSc	Capillary Attraction of Floating Particles
Chen, Karlming	Bennett	2nd / BSc	Egyptian Fraction Representations of One
Chen, Ronnie	Anstee	2nd / BSc	Forbidden Submatrices
Duynstee, Adrian	Gustafson	3rd / BSc	Numerical Study of Soliton Dynamics
Enns, John	Schoetzau	2nd / BSc	A-posteriori Error Estimation for Finite Element Methods
Fadai, Nabil	Balmforth	2nd / BSc	Dynamics of Granular Toys
Gharib, Saman	Karu	3rd / BA	Vector Bundles Over Toric Varieties
Hoskins, Jeremy	Bluman	4th / BSc	Scattering of Waves in a Two-Layered Medium with Smooth Transition
Laguë, Marysa	Edelstein-Keshet	2nd / BSc	Optimal Foraging in Groups
Meehan, Connor	Peirce	3rd / BSc	Adapting the Hermite Cubic Collocation Scheme for Asymmetric Hydraulic Fractures
Ng, Adam	Feng	3rd / BA	Smoothed Particle Hydrodynamics
Ren, Owen	Reichstein	3rd / BSc	Algebraic Points on Hypersurfaces
Solymsi, David	Pramanik	3rd / BSc	Patterns in Sparse Sets
Zhang, Lisa	Barlow	4th / BSc	Simulating Branching Random Walks

Graduate Program

The graduate program in the UBC Mathematics Department continues to provide a highly sought-after opportunity for young researchers in mathematics. The department admitted 39 new graduate students for the fall of 2011, of which 24 were enrolled in the MSc program and 15 in the PhD program. Moreover, 7 of our graduating MSc students continued their mathematical studies in our PhD program. In total, the number of graduate students in the department increased from 115 to 122.

At UBC, students can choose from roughly 40 graduate courses offered each year. Beyond the classroom, there are many seminars and informal events where students can get to know faculty. Perhaps most importantly, UBC Math graduate students are mentored in research by mathematicians who are worldwide leaders in their fields.

In addition to playing a strong role in the facilitation of our undergraduate courses as TAs, graduate students in mathematics also represent the department in activities throughout UBC and Vancouver at large. Such activities range from providing math workshops aimed at developing logic and problem-solving skills with elementary school math clubs to entering in and tying for first place in the UBC spelling competition.

This year the students from the Institute of Applied Mathematics (IAM) elected their first student committee. The role of this committee is to improve communication

between students and administration as well as to enhance student life. Two tangible projects that the student committee initiated were rearranging the desk area, doubling the number of seats available to IAM students, and organizing a pre-seminar series where seminar speakers would have a chance to talk with interested graduate students. The committee also made efforts to strengthen the IAM community: they posted a world map on which students, postdocs, and faculty could place pins indicating where they are from, thus showcasing the multinational diversity of the IAM, and also organized a welcome plan for new students to better integrate them into life at UBC and at the IAM. The IAM student committee is currently comprised of Bernhard Konrad, Erin Moulding, Iain Moyles, William Thompson, and Josh Zukewich. All students interested in starting a project in the IAM or becoming more involved are encouraged to email the committee at stucom@iam.ubc.ca.

The Math Graduate Committee (MGC) continued to organize social events, discuss math graduate student issues, and advocate for math graduate student interests and transparency in department policies. Over the course of the year, the MGC organized two board games nights, four social nights at local pubs, and two barbeques for grad students. Attendance at these events was very good, with as many as 60 students participating. Every other week, the MGC put on the Graduate Student Seminar where students listened to and gave talks about interesting mathematics and

enjoyed a free pizza lunch; this seminar will continue in the coming year. The MGC also met every two weeks to discuss graduate student issues such as RA and TA stipends, teaching appointments, the qualifying



Graduate Student Hike

examinations, and space allocation. Thanks in part to the advocacy of the MGC, the year saw the department vote to increase the RA stipend; the MGC has also been working closely with the department to revise the quals and to systematize the allocation of teaching appointments. Inspired by discussions conducted by

the MGC, a group of graduate students, led by David Kohler, volunteered their time to create an online exam resource for undergraduates.

This year, Kyle Hambrook served as MGC President; Robert Klinzmann and Bernhard Konrad organized the Graduate Student Seminar; Jim Richardson served as the TA Union Representative; and Maxim Stykow was the Graduate Affairs Committee Representative and the Graduate Student Society Representative. David Kohler, David Steinberg, Simon Rose, Iain Moyles, Tyler Helmuth, and Justin Martel were also major contributors to the MGC. Robert Klinzmann and Tyler Helmuth, in their respective roles as VP-Finance in the Graduate Student Society and Executive Member of the TA Union, worked to serve the entire UBC graduate student body. Elections for these MGC positions are held in November each year. The MGC meetings are open not just to elected officers but to all graduate students in the department, and everyone is encouraged to contribute to the enrichment of our graduate student community. All math graduate students who are interested in participating should contact mgc@math.ubc.ca or just show up to the meetings!



Kyle Hambrook Iain Moyles

New Alumni

MSc Graduates

Name	Thesis / Essay	Supervisor	Life After UBC
Bell, Peter	Portfolio management with index insurance	Ekeland	PhD student at University of Victoria
Carlquist, William	A computationally efficient method for solving Min system reaction-diffusion equations within growing and dividing domains that approximate a rod-shaped bacterium	Cytrynbaum	PhD student at UBC
Chandgotia, Nishant	Markov random fields and measures with nearest neighbour Gibbs potential	Marcus	PhD student at UBC
Chen, Yifei	CVaR Optimization and Multivariate Joint Density Modeling	Ekeland	Position at Bloomberg
Cheng, Tao	Hedging Long-Term Commodity Risk with Dynamic Hedging Strategy	Ekeland	Position at China Foreign Exchange Management Center
Culibrk, Ana	The Cohomology of Regular Varieties	Carrell	Position at Columbia College
Hakimi, Koopa	Moduli space of sheaves on fans	Karu	PhD student at UBC
Hambrook, Kyle	Implementation of a Thue-Mahler equation solver	Bennett	PhD student at UBC
Jakobsen, Alexander	Topological Methods of Preference and Judgment Aggregation	Adem	PhD student in Economics at Princeton
Kurella, Venu	Asymptotic Analysis of First Passage Processes with Applications to Animal Movement	Coombs	Working in industry
Li, Zheng	Class Field Theory: A Review of the Classical Approach	Ramdorai	PhD student at UBC
Mi, Yue	An Exploration of International Stock Return Comovement and Portfolio Diversification	Schoetzau	Position at China Merchant

Millien, Pierre	On a Polar factorization theorem	Ghoussoub	PhD student at Ecole Normale Superieure
Moyles, Iain	Thermo-Viscous Fingering in Porous Media and In-Situ Soil Remediation	Wetton	PhD student at UBC
Nguyen, Bich-Ngoc	Induced Maps in Galois Cohomology	Reichstein	PhD student at UBC
Pareja, Daniel	Numbers with Small and Specified Prime Factors	Martin	PhD student at Waterloo
Paton, Kelly	A Study of wave propagation in the FitzHugh Nagumo System	Cytrynbaum	PhD student at UBC
Ronagh, Pooya	Ringel-Hall algebras and applications to Moduli	Behrend	PhD student at UBC
Ross, Carol Jessie	The isoperimetric inequality in \mathbb{R}^n	Fraser	Orienteering in France
Sollazzo, Rhoda Jane	The finite field restriction problem	Laba / Khosravi	PhD student at UBC
Stykwow, Maxim	Riemann Surfaces and Mumford's Conjecture	Reichstein	PhD student at UBC
Tewari, Vasu Vineet	On the computation of Kronecker coefficients	van Willigenburg	PhD student at UBC
Thom, Mark	Square-Free Trinomial Discriminants	Martin	PhD student at University of Lethbridge
Vakil, Ali	Cyclic Steps and Roll Waves	Balmforth	Position at Canada Research and Development
Willoughby, Mark	High-Order time-adaptive numerical methods for the Allen-Cahn and Cahn-Hilliard equations	Wetton	PhD student at UBC
White, Shaun Ryan	The Fifteen Theorem: An Exposition	Vatsal	Planning to study at UIC
Ye, Zichun	Mayer Expansion for Monomer-dimer system	Brydges	PhD student at UBC
Zhai, Sa	Optimal mechanism of the IPO market	Ekeland	Position at China International Capital Corporation
Zhou, Chengchao	Risk Management with Short-Term Futures Contracts	Lazrak	Position at China Zheshang Bank
Zhao, Zian	CDS Pricing Model with Joint Defaults	Ekeland	Position at FINCAD

PhD Graduates

<i>Name</i>	<i>Thesis</i>	<i>Supervisor</i>	<i>Life After UBC</i>
Chipeniuk, Karsten	Structure and arithmetic in sets	Laba	Postdoc at Indiana University Bloomington
Cook, Brian	Equations in the primes	Magyar	Postdoc at UBC
De Zeeuw, Frank	An algebraic view of discrete geometry	Solyomosi	Postdoc at EPFL, Lausanne
Duncan, Alexander	Finite groups of low essential dimension	Reichstein	Postdoc at UCLA
Gill, Hardeep	Some Interacting measure-valued diffusions and their long-term behavior	Perkins	Law school at UBC
Kapoor, Vishaal	Asymptotic formulae for arithmetic functions	Martin	Position at Google, California
Klaus, Michele	Group actions on homotopy spheres	Adem	Postdoc at University of Augsburg, Germany
Morrison, Andrew	Computing motivic Donaldson-Thomas invariants	Bryan	Postdoc at ETH, Zurich
Rose, Simon	Counting hyperelliptic curves in Abelian surfaces with quasi-modular forms	Bryan	Postdoc at Queen's University
Raggi, Miguel	Forbidden configurations	Anstee	Postdoc at Centro de Ciencias Matemáticas, UNAM
Wei, Xiaoxi	Mixed discontinuous Galerkin finite element methods for incompressible magnetohydrodynamics	Schoetzau	Teaching in China

Postdoctoral Fellows

<i>Name</i>	<i>Supervisor</i>	<i>Years at UBC</i>	<i>Life after UBC</i>
Blunk, Mark	Reichstein	2.5	Position in industry
Conway, Jessica	Coombs	3.5	Postdoc at Los Alamos National Laboratory, New Mexico

Postdoctoral Fellows (continued)

Dridi, Raouf	Bluman/Shizgal	2.5	Working in quantum computation
Guigue, Alexis	Loewen	2	Research Engineer, Software Technical Systems, North Vancouver
Holmes, Bill	Coombs/Keshet	2	Research Assistant, Mathematics, University of California, Irvine
Jia, Johnson	Vatsal	2	Position in industry
Karli, Deniz	Slade/Probability Group	3	Assistant Professor, Isik University, Istanbul
Kim, DJun	Kuske/CTLT	3 (RA)	Statistics, UBC
MacDonald, Mark	Reichstein	3	Lecturer, Lancaster University, England
Mantilla-Soler, Guillermo	Vatsal	2	Postdoc at ETH
Mayer, Greg	Kuske / CTLT	1	Postdoc at Georgia Tech
Meyerovitch, Tom	Marcus/Probability Group	2	Assistant Professor, Ben Gurion University, Israel
Pollack, Paul	Martin	1	Assistant Professor, University of Georgia
Rees, Tyrone	Haber	2	Position at Rutherford Appleton Laboratory, UK
Simpson, David	Kuske	3	Lecturer, Massey University, New Zealand
Taghavi, Mohammad	Frigaard	1	Postdoc in Chemical Engineering, University of Michigan
Wielag, Kirsten	Frigaard	7 (postdoc and RA)	ANSYS, Germany

Outreach Activities



Britannia Secondary Transitional Summer Camp

In 2011/12, the Math Department continued to expand its outreach activities. Some highlights follow:

UBC Math Circle

The 2012 UBC Math Circle was held on campus each Monday from 5-7pm, starting in late January and ending in early April. Approximately 50 Metro Vancouver high school students attended. Students were invited primarily based on performance on the Canadian Open Mathematics

Challenge (COMC), sponsored by the Canadian Mathematical Society (CMS). Other students who were recommended by their teachers or who applied to participate were also invited.

During the first hour of each circle there was a presentation by a UBC professor from Mathematics, Physics or Computer Science. Following a pizza break, there were problem-solving sessions run primarily by UBC Math undergrads. During the last weeks, students chose either applied or Olympiad-level problem-solving.

Recently, a UBC Math alumnus initiated generous scholarship support to recruit outstanding high school Math students to UBC who participate in the Circle.

In 2012, UBC student volunteers were led by Owen Ren (4th yr. Honours Math). The volunteers were Dan Brox (Electrical Engineering grad student), Karlming Chen (3rd yr Honours Math), Ronnie Chen (3rd yr Honours Math/CpSc), John Enns (3rd yr Honours Math), Ron Estrin (2nd yr Honours Math/CpSc), Paul Lin (2nd yr Honours Math/Physics), Lauren Mak (1st yr Science), Kristina Nelson (2nd yr Honours Math/CpSc), Arman Tavakoli (4th yr Honours Math/Physics), and Allen Zhang (2nd yr Honours CpSc/Biology). UBC Professor Emeritus Andrew Adler provided valuable assistance.

High school students are welcome to apply to participate in the next UBC Math Circle starting in early January 2013. For further information check our website: http://outreach.math.ubc.ca/sch_olympiad.html

Mathematics Contests

Since 1979 UBC has hosted the BC marking of the Euclid Contest. This event has been a critical link between the UBC Mathematics Department and math teachers around the province. Annually in May, we have hosted Euclid Day, which has brought BC's top 75 Euclid Contest students and teachers from the top 5 schools to UBC for a day of lab tours, an awards luncheon, and an afternoon of problem-solving with a UBC mathematician.

It has become clear to us that participation in the Euclid Contest no longer aligns with the needs of the department's (and UBC's) school outreach activities. In particular, the late timing of the contest (in mid-April) means that high-performing students no longer gain an advantage in UBC's new broader-based admissions process and major entrance scholarship competition.

So, after careful consideration, the Department has taken the decision to become a sponsor of the COMC, the premier national mathematics competition for high school students and to end our involvement with the Euclid Contest. The COMC is written in early November, which means that participants are able to include their results in applications for UBC scholarships and admission. As well, we will be able to better identify excellent students to invite to the UBC Math Circle. We are very excited about our new partnership with the CMS and our COMC partner universities across Canada! We believe this will open up new opportunities for BC students, who traditionally excel in mathematics, to be recognized both locally and nationally.

All of our traditional Euclid activities with schools, high school students and teachers will continue through our involvement with the COMC. In December 2012 we will host a marking day for the BC COMC for top BC math teachers, UBC faculty, and industrial mathematicians. We will have a COMC Day on January 24, 2013, to celebrate the achievements of the top students and schools in BC. We look forward to continuing our strong relationships with BC teachers and students through this new initiative.

First Nations Outreach

The Math Department and PIMS design and implement a variety of outreach programs, primarily aimed for aboriginal students, at several venues in the city. Melania Alvarez, UBC Math Department Outreach Coordinator and PIMS BC Education Coordinator, continues to play a leading role in organizing these initiatives.

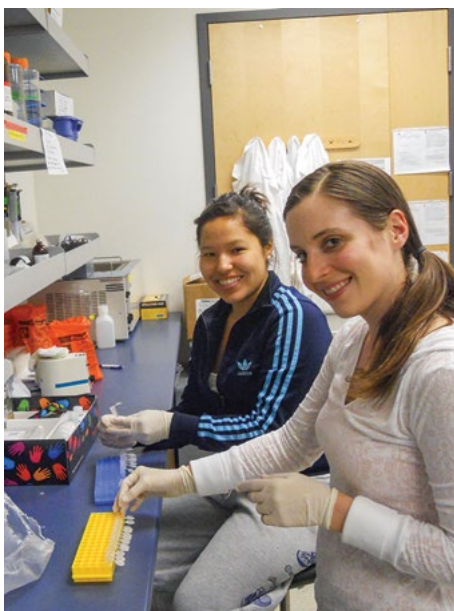
In addition, UBC students participate as volunteer

mentors and tutors in other programs such as the Native Education College (NEC) summer camp, mentioned below.

The main objective is to provide academic preparation for university programs requiring strong performance in Math 12 (e.g., engineering, science, forestry, commerce and medicine) and to increase the number of aboriginal students in these programs.

Scholarships and Other Support

Scholarships are given to students attending programs at Britannia, Templeton, and Windermere and for those attending summer camps. Funding is provided by private donors, including the Vancouver Foundation, PIMS, the Government of British Columbia, the Federal Government (the Paul Martin Initiative and the Urban Aboriginal Strategy), and UBC's Equity Enhancement Fund. Scholarships for students at NEC programs are provided by TD Bank and other private donors.



UBC Emerging Scholar lab intern

Mentorships/Volunteering

Britannia Secondary: in 2011-12, eleven aboriginal students were supported in this program. The contact teacher was Kimberly Leary. In addition, UBC students worked in both the Britannia Alternative and Outreach programs (contact teacher: Mary-Jo Campbell).

Templeton Secondary: fifteen high school students regularly attended the mentorship program (contact teachers: Kerry Handscomb and Lisa Ford).

Windermere Secondary: six students regularly attended this program (contact teacher: Maggie Przyborowska).

Point Grey Secondary: this mentorship program (open to all students) is also sponsored by the UBC First Nations House of Learning and the Musqueam band. About

30 students regularly attended, including 7 aboriginal students. In addition to improving mathematical knowledge and skills for these students, this program brought together groups that in the past had little contact with each other. Sina Motallebi has been the program coordinator for the last year and a half.

Strathcona Community Centre: Six week 'Fun with Figures' project working with a dozen VSB students (including aboriginal students) in Grades 4-6. The students were selected based on their need for extra help in math. This new initiative was coordinated by UBC Math student Marley Macvey through the UBC-Community Learning Initiative for elementary schools in Vancouver.

UBC Student Mentors in 2011/12: At least 26 UBC students volunteered as mentors in these outreach programs in 2011/12: Alexandra Bella, Lucas Berry, Aidan Campbell, Euweng Chan, Angelo Chung, Dallas Clement,

Nicole Couto, Harminder Dhillon, Atoosa Golfar, Julie Harris, Jessica Hoang, Iqra Javed, Ninder Judge, Maryam Kassaian, HyeJin Kim, Michelle Kwan, Caitlin Leahy, Harry Lee, Wilson Lee, Matthew Liu, Ronald Monillas, Afarin Pahlavin, Sarah Reimer, Nolan Reynolds, Esther Rha, and Tanya Roussy.

Summer Camps

Britannia Secondary Transitional Summer Camp: This five-week summer camp sponsored by UBC Math, PIMS and the Vancouver School Board, is for students transitioning from Grade 7 to Grade 8 (elementary school to high school). This transition is particularly difficult for aboriginal students. Students take 90 min-



Math Head presenting diploma to UBC Emerging Scholar

utes of instruction in Math and English every day in the morning and are involved in sport activities in the afternoon. Twenty-two students participated in this program this year.

UBC Emerging Scholars Summer Camp: This five-week summer camp, sponsored by PIMS and the UBC First Nations House of Learning, is for Grade 9-12 students.

The aim of this program is to help students with academics and to offer work experience at UBC. Students take 90 minutes daily of Math and English and work with a faculty member in an area of choice. Classes are held at PIMS and the Long House. Students work as interns at the TRIUMF nuclear accelerator, labs in the UBC biology and chemistry departments, and other venues. Twenty-four students participated in this program this year.

Native Education College (NEC): This Math/English camp runs for five weeks with Maggie Przyborowska (from Windermere Secondary) as the Math teacher. UBC volunteer tutors support the teachers' lessons and also help students stay focused, learn concepts and work on their in-class exercises. At least 3-4 volunteer tutors were on duty at any one time. This program was initiated and continues to be organized by Dr. Rahael Jalan. In 2011, UBC student volunteers in this program

were Vinita Banthia, Angus Cherry, Nick Dyakowski, Philip Edgcumbe, Hailey Gi, Esther Park, Abenezzer Teklemariam, Kendra Wong and Hans Yang.

Academic Highlights

Windermere Secondary: an aboriginal student involved in our mentorship program graduated with Principles of Math (POM) 12 this year.

Templeton Secondary: an aboriginal Grade 11 student completed POM 12 this year with a 90% mark and will take AP Calculus next year. He intends to study Math at UBC.

Britannia Secondary: an aboriginal Grade 11 student who has been participating in our programs since attending



PIMS Math Mania

the transitional summer camp in 2008 has excelled in academic work and should be attending university next year.

Currently we have several students who have taken or will be qualified to take POM 10 and 11 and who, according to their teachers would not have been able to do so without the extra support they received from our programs. Principals, counselors and teachers have been extremely helpful during the implementation of our program.

Other Outreach Activities

- PIMS Math Mania at UBC for 50 elementary students as part of the Experience Science Day on June 8, 2011
- Two JUMP Math workshops for 60 teachers and mentors at UBC. JUMP is a highly recognized program to help children succeed in and enjoy learning math.
- 84 problem solving workshops at schools throughout the Lower Mainland that involved the participation of grad students, postdocs, faculty members, and about 25 undergrads. ■



George Bluman



Complex Fluids Lab Picnic

Recent Activities of MATH-CWSEI

“There is a certain value to small, personal sessions like [the workshops held in MATH 220] that is hard to pin down, but is very real and very, very valued by me. Because the tutorials are small, the instructors are able to get to know me as a student, and can become familiar with my weaknesses and strengths. Then, they are able to ask me specific, targeted questions to draw out misconceptions and to help correct them. This simply can’t happen with regular homework assignments!” said a MATH 220 student in Fall 2011.

The problem-solving workshops in MATH 220 were developed by the Carl Wieman Science Education Initiative (CWSEI), a Faculty-of-Science based program aimed at improving undergraduate science education at UBC. The Mathematics Department has been involved with CWSEI at various levels since 2008, collecting data and implementing changes in a variety of courses, including MATH 220.

Introduction to Proof, or MATH 220, presents major challenges to both students and instructors. It serves as a gateway to abstract mathematics, and it is in this course that students are exposed for the first time to mathematical rigour, high levels of abstraction, and a requirement to prove every statement that is made. Topics in MATH 220 traditionally include elementary logic, basic number theory, various techniques for proofs, sets and functions, cardinality, and beginning analysis. The student population is diverse, with students majoring in Mathematics (both BA and BSc tracks), Statistics, Computer Science, Economics and Engineering. The varied level of preparation and background presents a challenge to even the most experienced instructor.

Earlier assessments of MATH 220 revealed that the course

did not contain enough practice with expert feedback. So in Fall 2011 we developed a set of problem-solving workshops for the course. Initially offered as optional tutorials, the workshops were later incorporated into the regular course schedule. In the second semester, a workshop replaced every fourth lecture, and the analysis content was dropped. Each workshop session was highly interactive: students worked on a set of problems in small groups, while the course instructor and a CWSEI Science Teaching and Learning Fellow circulated around the room and gave feedback. Students came prepared to work, with a homework assignment due at the start of the session. Each workshop ended with a brief feedback session, followed by a short quiz. Problem sets were carefully structured, with exercises selected to bridge the gap from concrete to abstract, illustrate a concept from several directions, and raise student interest in the subject. In addition, students were exposed to “fake proofs” and given the task of finding a masked flaw in logical reasoning.

The workshop environment was of great benefit to students and instructors. Students received instant feedback on reasoning, both from peers and the instructor. Discussion among group members allowed participants to explore ways to approach and solve a problem. The atmosphere was friendly and engaging, with students working in a supportive environment. Making new friends and forming study groups are important benefits, as students often find themselves isolated in the setting of a large university. Quizzes were also an important component of the workshops, communicating early on the level of difficulty and expectations for rigour, as well as providing motivation to work intensively. Instructors obtained valuable feedback as well, probing the level of students’ understanding, uncovering misconceptions, and building a rapport with

the class in a personalized environment. Analysis of un-scaled final exam grades showed a 3% decrease in F's and an 8% increase in A's on the workshop-covered material as compared to the control group. This is an encouraging result, which we plan to investigate further.

Another example of MATH-CWSEI activities in 2011/12 is the work done in MATH 230, Introduction to Finite Mathematics, and its 4-credit version, MATH 335. These courses serve as the only mathematics pre-requisite for admission to the Elementary Education program, and the vast majority of students in these courses list teaching as their future profession. Instructors who teach this course face unusual challenges. In particular, our surveys and interviews show that most students suffer from intense emotional anxiety associated with fear of mathematics. This is particularly worrying, as these students will pass mathematics on to the next generation of elementary students.



Students working in groups during a problem-solving workshop in MATH 220

To aid the instructors, we designed a Diagnostic Test tailored to the course. The test probes knowledge of very basic arithmetic and geometry, as well as student demographics, career plans, and attitudes towards mathematics, thus providing useful information about the student population. The results of the Diagnostic Test were unexpected and alarming: at the start of Winter 2012, of 36 students who took the test in MATH 335, 12 could not add together $\frac{1}{2}$ and $\frac{1}{3}$, 18 did not know how to divide fractions, and 10 could not compute the area of a rectangle with sides 4 and 8. The range of student abilities, however, is varied: some students are quite proficient; this makes the instructor's task ever more difficult. In addition to the Diagnostic Test, we assembled a package of materials and activities that could be used in labs, workshops, and presentations, as well as a set of recommendations for future instructors. The latter included a set of course learning goals, a list of recommended topics, and some pedagogical comments detailing student misconceptions and particular difficulties in instruction. All materials are now available for use by any instructor in MATH 230/335.

In addition to course assessment and instructor support, CWSEI funds research in teaching and learning.

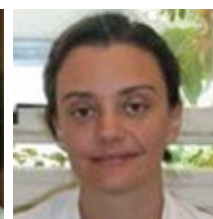
For example, in the fall of 2011 we designed and ran an experiment in MATH 104, a first-year Calculus course for social science and commerce students, to measure the effect of classroom engagement on student learning.

CWSEI promotes high classroom engagement, even in large classroom settings, based on evidence that the more students do (as opposed to what they watch or listen to) during class, the more they learn. Thus, we undertook a careful measurement of higher versus lower engagement in a pair of comparable MATH 104 sections of size 150-200. The class format in both sections was mostly standard lectures with opportunity for students to ask questions. When one instructor was away, a substitute instructor employed higher engagement techniques for a topic (one week of class), drawing on pre-class assignments to foster more student-to-student discussion and desk work during class. The same was done for the other section for a week-long topic later in the term when the other instructor was away. Short quizzes were given for each topic, and in both cases the students in the higher-engagement section performed much better than the students who had seen clear, worked examples. For example, 42% of the students who had done pre-class work, discussion and in-class work could draw the correct tangent line in linear approximation and identify the point used in approximating a specific function value, compared to 21% of the section who had seen a very clear presentation (including well-drawn graphs) in class. Exams are still being reviewed for data, but it appears that this effect persisted in some form later into the term.

For the projects described here, we would like to thank the course instructors who worked with CWSEI: Mark Maclean, Andrew Rechnitzer, Stephanie van Willigenburg, and graduate student David Kohler; as well as those who were indirectly involved: Jim Bryan, Rajiv Gupta, Mahta Khosravi, Izabella Laba, and John MacDonald for letting us work alongside their classes, build materials, interview students, observe lectures, and gather data. We would also like to thank Richard Anstee, Klaus Hoechsmann, and Philip Loewen for insightful conversations and helpful suggestions on teaching and student learning, as well as undergraduate secretary, Verni Brown, for regularly providing us with interesting articles on math education. ■



Warren Code



Costanza Piccolo



Katya Yurasovskaya

Awards and Honours

Faculty Awards and Honours

Jim Bryan has been awarded an NSERC Discovery Accelerator Supplement. These highly competitive awards provide substantial and timely resources to outstanding researchers who have a well-established research program and who are at a key point in their careers at which they can make, or capitalize on, a significant breakthrough.

Ailana Fraser has been awarded the Canadian Math Society's 2012 Krieger-Nelson Prize. The prize was inaugurated in 1995 to recognize female mathematicians who have made outstanding contributions to mathematical research. Professor Fraser works in differential geometry.

Ian Frigaard was the recipient of the 2011 CAIMS/MIT-ACS Industrial Mathematics Prize. This award recognizes exceptional research, conducted primarily in Canada, in any branch of industrial mathematics. He was also elected President of the CAIMS Society. Ian's term runs from 2011 to 2013.

Dragos Ghioca has been named the winner of the 2012 Ribenboim Prize. This prize is awarded every two years by the Canadian Number Theory Association for distinguished research in Number Theory.

Young-Heon Kim has been awarded a 2012 Sloan Research Fellowship. This two year fellowship seeks to stimulate fundamental research by early-career scientists and scholars of outstanding promise. The award recognizes distinguished performance and a unique potential to make substantial contributions to their field. Young-Heon Kim was also awarded the 2012 André-Aisenstadt Prize from CRM, shared with Marco Gualtieri (Toronto). This prize is awarded to recognize talented young Canadian mathematicians. Professor Kim works in partial differential equations.

Fok-Shuen Leung and **Malabika Pramanik** were recipients of 2011-12 Killam Teaching Prizes, recognizing outstanding contributions for teaching and commitment to students. The Math Department has won seven Killam Teaching Prizes in the past six years.

Mark MacLean was the recipient of the 2012 PIMS Education Prize. This prize, awarded by the Pacific Institute for the Mathematical Sciences, recognizes individuals who have played a major role in encouraging activities which have enhanced public awareness and appreciation of mathematics, as well as those who foster communication among various groups concerned with mathematical education at all levels.

Gordon Slade has been elected Fellow of the Institute of Mathematical Statistics. Fellowship in the IMS honors the outstanding research and professional contributions

of its members, recognizing distinction in probability or statistics research and leadership.

The Institute of Applied Mathematics received the Peter Larkin Award for 2011/2012. This award is granted annually to a UBC graduate program or department that has significantly contributed to student development and graduate education.

The Department has continued its representation in many important levels of the UBC administration, including **Richard Anstee** (Faculty Senate), **Nassif Ghousoub** (UBC Board of Governors), **Rachel Kuske** (Senior Advisor to the Provost on Women Faculty), **Philip Loewen** (Associate Dean, FOGS, Graduate Policy & Program Review) and **Mark MacLean** (VP Faculty Association).

Postdoctoral, Staff and Student Awards

Melania Alvarez has been awarded the CMS 2012 Adrien Pouliot Prize. This award is given to an exceptional mathematics educator who has made significant and sustained contributions. Melania was recognized for many contributions, in particular development of new programs for First Nations students.

Jessica Conway has won a Faculty of Science Postdoctoral Travel Award.

The Department Teaching Awards were awarded to one postdoctoral fellow, **Deniz Karli**, and to three graduate students, **Rebecca Hiller**, **Ed Kroc** and **Ali Vakil**. These awards recognize outstanding teaching performances from our postdoctoral fellows and graduate students.

Verni Brown and **David Steinberg** are recipients of 2010-11 Faculty of Science Achievement Awards.

Fellowships

Finally, we are happy to acknowledge that the following students were awarded NSERC/SSHRC graduate fellowships for 2011-12.

PGSM fellowship: **Matthew Coles**

CGSM fellowships: **Jonathan Blackman**, **Meghan Duttot**, **Jeremy Hoskins**, **Adrian Keet**, **Brett Kolesnik**, **Laura Liao**, **Justin Martel**, **Oren Rippel**, **Pamela Sargent**

CGSD fellowships: **Kyle Hambrook**, **Alexander Tomberg**

Vanier fellowship: **Iain Moyles**

SSHRC fellowship: **Alexander Jakobsen**



PIMS/UBC Distinguished Colloquium

All lectures begin at 3:00 pm, preceded by a reception in MATH 125 at 2:30 pm
MATX 1100 at the University of British Columbia

26 September, 2012

Ben Green, Cambridge

Ben Green is the Herchel Smith Professor of Pure Mathematics at the University of Cambridge and a Fellow of Trinity College who has published several important results in both combinatorics and number theory. These include improving the estimate by Jean Bourgain of the size of arithmetic progressions in sumsets, as well as a proof of the Cameron-Erdős conjecture on sum-free sets of natural numbers. He is a Fellow of the Royal Society, and has received many prestigious awards including the Salem Prize.



28 September, 2012

Eva Bayer, EPFL Lausanne

Eva Bayer is a mathematician at École Polytechnique Fédérale de Lausanne. She has worked on several topics in topology, algebra and number theory such as: the theory of knots, lattices, quadratic forms, and Galois cohomology. Along with Raman Parimala, she proved Serre's conjecture II regarding the Galois cohomology of a simply-connected semisimple algebraic group when such a group is of classical type.



26 October, 2012

Marianna Csörnyei, U.Chicago

Marianna Csörnyei works in real analysis, geometric measure theory, and geometric nonlinear functional analysis. She proved the equivalence of the zero measure notions of infinite dimensional Banach spaces. In 2008 Csörnyei was awarded the Philip Leverhulme Prize for Mathematics and Statistics.



15 February, 2013

Béla Bollobás, Cambridge & Memphis

Béla Bollobás has proved numerous important results in mathematical areas including functional analysis, combinatorics, graph theory, and percolation. He has been a Fellow of Trinity College, Cambridge since 1970 and in 2011 he was elected a Fellow of the Royal Society for his major contributions to mathematics.



8 March, 2013

Avi Wigderson, IAS Princeton

Avi Wigderson is a widely recognized authority in theoretical computer science. His main research area is computational complexity theory. This field studies the power and limits of efficient computation and is motivated by such fundamental scientific problems as: Does $P=NP$? Can every efficient process be efficiently reversed? Can randomness enhance efficient computation? Can quantum mechanics enhance efficient computation? He has received, among other awards, both the Nevanlinna Prize and the Gödel Prize.



Department of Mathematics University of British Columbia

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