



# Banff International Research Station

for Mathematical Innovation and Discovery



**Government  
of Alberta** ■



# Welcome to BIRS



Inaugurated in 2003, the Banff International Research Station (BIRS) is a joint Canada-US-Mexico initiative and the result of a remarkable and concerted effort led, at the outset of the new millennium, by the Pacific Institute for the Mathematical Sciences (PIMS, Canada) and the Mathematical Sciences

Research Institute (MSRI, Berkeley, USA), along with the support and participation of the Mathematics of Information Technology and Complex Systems Network of Centres of Excellence (MITACS, Canada). In 2005, Mexico's National Council for Science and Technology (CONACYT) joined Alberta Innovation, the NSF and NSERC as a BIRS sponsor.

BIRS addresses the imperatives of collaborative research, of cross-disciplinary synergy, and of intense and prolonged interactions between scientists. It embraces all aspects of the mathematical, computational and statistical sciences and their applications.

BIRS is located at The Banff Centre, the world-renowned campus in Alberta. It has its own buildings (Corbett Hall and, a recent addition, the TransCanada Pipeline Pavilion) and facilities which allow mathematical scientists a secluded environment, complete with accommodation and board, and the necessary accoutrements for uninterrupted research activities in a variety of formats, all in a magnificent mountain setting.

The principal BIRS activities are its annual series of 48 five-day workshops, each hosting up to 42 researchers in disciplines in which mathematics, computer science and statistics are used in novel ways. The objective of these is to exchange the latest advances in the field and to provide an environment that fosters new collaborations and ideas.

"Canada is proud to be hosting present and future world leaders in the mathematical sciences, in our magnificent Rockies. BIRS is a truly international and a remarkably collaborative enterprise, and represents the best of the human spirit in its quest for discovery, innovation and solutions to global challenges."

- **Karen Prentice**, *Chair of the BIRS Board of Directors*

"BIRS is a centre for intense scientific interaction, where ideas develop and where seemingly unrelated lines of thought can converge. It is also the place where new collaborations and partnerships are forged, crossing national boundaries and disciplines. The Station's doors are wide open to any mathematical scientist in the world who is looking to learn, interact, collaborate, discover and innovate."

- **Nassif Ghoussoub**, *BIRS Scientific Director*

The main emphasis is on the interaction of equals with the goal of optimizing the advancement of knowledge and innovation. BIRS also frequently accommodates two-day events, suitable for promoting industry-academic collaborations, and Research in Teams/Focused Research Groups, who are given the opportunity to live and to do research together in a non-workshop/non-conference style setting for periods of 1 to 2 weeks. BIRS furthermore hosts summer schools and graduate training camps. Every year, the station receives over 2000 visits from researchers from 400 institutions in more than 60 countries who participate in over 70 different programs.

The Banff Centre is already internationally recognized as a place of high culture. Every year its programs in music and sound, the written, visual and performing arts, leadership and management draw in many hundreds of artists, students, and intellectual leaders from around the world. The introduction of BIRS, with its stream of creative and imaginative people, into this rich and fertile environment provided opportunities for some unique synergies. BIRS is therefore uniquely positioned to help in the dissemination of mathematical culture to a wider community and in the promotion of mathematical/scientific writing for the lay public, both of which are desperately needed to heal the gap between the practitioners and the users of modern science/technology.



**Karen Prentice**  
Chair, BIRS Board of Directors



**Nassif Ghoussoub**  
BIRS Scientific Director





## BIRS Scientific Advisory Board

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**Jaques Hurtubise** McGill University

**Lisa Jeffrey** University of Toronto

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**Ed Perkins** University of British Columbia

**Arturo Pianzola** University of Alberta

**Nicholas Pippenger** Princeton University

**Gilles Pisier** Texas A&M University

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**Margaret Wright** New York University

**Jianhong Wu** York University

**Efim Zelmanov** University of California San Diego



## The Review Process

### *Ensuring High-Calibre Research*

Key to the success of BIRS is its ability to attract top scientific proposals and then to have a selection process by peer review at international standards, balanced across all areas of the mathematical sciences. To represent the mathematical sciences in their entirety, the Scientific Advisory Board consists of 30 internationally recognized experts representing as broad a spectrum of the mathematical sciences community as possible.

Every year, an international call solicits proposals for workshops from every field of the mathematical sciences and its applications. A proposal template requires a summary of the present state of the field, a discussion of the leading questions that motivate the proposal, and a justification for the timeliness and appropriateness of the workshop. A preliminary list of potential participants is also requested.

Proposals have so far outnumbered available spots by a ratio of 3:1, with no sign of let-up – in fact, quite the reverse – so the competition is strong and the committees are never short of excellent proposals from which to choose. All proposals are made available to the members of the SAB who then make their comments online. The Scientific Director also solicits additional reviews from outside experts for certain proposals, so that by the end of the process, each proposal has had at least 5 reviews.

The Program Committee meets in November to make the final selection. At the meeting, the committee first reviews each category, linearly ranking the proposals within it. Proposals are then selected by running across the categories. In this way, so long as there are first-rate proposals in each area, a distribution across the mathematical sciences is maintained. The BIRS Program Committee ranks proposals by scientific excellence and relevance alone, without regard for the geographical origin of the proposal. The commitment of the organizers is also a key criterion in the selection process. In return, the limited number of allowed participants forces the organizers to continue adhering to the highest standards.

All of these factors combine to make BIRS a unique centre of excellence, with a substantial scientific return on the investment by its four sponsor governments.

“In only nine years, BIRS has established itself as a leading forum that attracts top international researchers and the rising stars in our graduate students and postgraduate fellows. The people talk of the significant role that BIRS has played in promoting international collaboration and supporting scientific research [...] For some, BIRS has been a starting point in their scientific careers; for others, a turning point. And for all of them, a pivotal moment.”

- **Suzanne Fortier**,  
*President, NSERC*

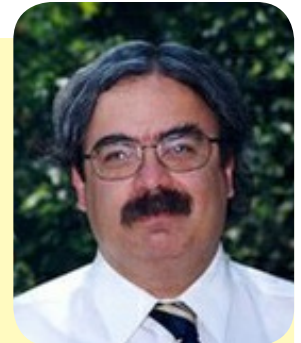


“Good data are important to everyone - unbiased, good data - to the public and to the sciences. It is mathematicians and statisticians who can help surf the data tsunami and find, or mine, the diamonds.”

- **Sastry Pantula**, *Director, Division of Mathematical Sciences, NSF*

“We are aware of the important impact that the programs of BIRS have on mathematics as a global activity, the visibility that the project has given to mathematics in the region, and the unprecedented synergies that Mexican mathematics have developed as a consequence of the participation as a partner in the BIRS project. CONACYT and certainly the mathematical community is proud to participate as a sponsor and collaborator to this essential program, the only science program in the context of the NAFTA region.”

- **José Antonio de la Peña**, *Deputy Director, CONACYT*







## A New Home for BIRS

*New lecture rooms, team rooms, state-of-the-art audio-recording and live-streaming capabilities, and the most recent teleconferencing technologies are only some of the added features of BIRS' new home within The Banff Centre, the TransCanada Pipeline Pavilion.*

This elegant building, with its stunning views onto the Bourgeau Mountains and the Vermillion Lakes Valley, has been a gem of The Banff Centre since its construction. Thanks to the president and CEO of The Banff Centre, Mary Hofstetter, and to its Board of Governors, this beautiful facility will become, starting in September 2011, the new workshops home for BIRS. It will be a tremendous asset to the world's mathematical sciences community.

The Pavilion's forthcoming integrated video technology is particularly exciting, as it will give scientists the ability to record lectures continuously and to broadcast them live on the Internet. Plans for the near future include the addition of teleconferencing technology that will allow remote parties to participate in the workshops at BIRS, which will enable a whole new level of scientific engagement. With the aid of the new facility's communications technology our international research station will soon be more international still.



"When [The Banff Centre] first embarked on a relationship with BIRS, the idea of having dedicated classrooms and a residence building for non-arts programming was a bold adventure, even though we sensed already then a tremendous synergy between BIRS and Banff. Today, we could not imagine our campus without our BIRS colleagues, and the unique perspectives they bring to creativity and the cultural richness and diversity of our campus."

**-Mary E. Hofstetter,**  
*President & CEO, The  
Banff Centre*



## The BIRS Board of Directors

**Chair: Karen Prentice**  
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Scientific Director, BIRS

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Scientific Director, MITACS

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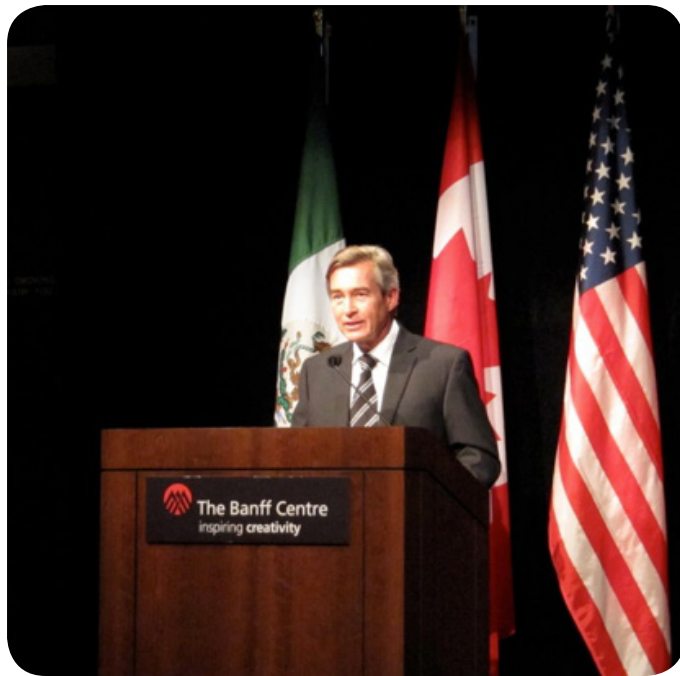
**Jacklyn Sturm**  
VP Finance, Intel Corporation

# North American Governments Renew their Support for BIRS

2010 saw the renewal of support for BIRS by the governments of Alberta, Canada, the United States, and Mexico. The fact that the four North American governments have increased their funding to the Station, during a time of economic uncertainty, is not only an endorsement of BIRS itself, but also speaks volumes of these governments' recognition of the importance of the mathematical sciences in driving progress. As **Calgary Centre MP Lee Richardson** (pictured below) put it in a speech at BIRS' funding announcement event in September, "[i]n the global economy, knowledge, research and innovation are at the heart of economic growth and success". With our renewed funding, BIRS will be able to carry on in just that vein, facilitating groundbreaking developments in the mathematical sciences through our various workshop and research group programs, inspiring researchers across North America and beyond.

Overall, BIRS has been pledged more than \$12m over the next five years. This includes:

- \$3.68m from the government of the United States, through their National Science Foundation
- \$3.4m from the government of Alberta, through Alberta Advanced Education and Technology
- \$3.25m from the government of Canada, through the National Sciences and Engineering Research Council of Canada (NSERC)
- \$250 000 from the government of Mexico through the Consejo Nacional de Ciencia y Tecnología (CONACYT). The government is dedicating a comparable sum to the support of Mexican students and researchers wishing to attend BIRS workshops.
- \$400 000 from the "Mprime network" (formerly the MITACS NCE)
- \$400 000 from the University of British Columbia



Such support should prove a tremendous boost to the mathematical sciences community. As noted **José Antonio de la Peña** of CONACYT, "BIRS represents the only serious joint educational and scientific research program in the NAFTA space". BIRS also marks the first time that the Mexican government has invested in research outwith its borders. The new funding will allow the station to further pursue its internationally minded goal of bringing together the world's brightest mathematical scientists. In addition to the raw funding granted by the four governments involved in BIRS, tremendous thanks must also be given to BIRS' partner universities. The **University of Alberta**, the **University of Calgary**, and the **University of British Columbia** provide untold help to BIRS in terms of human resources, financial management, infrastructure, and so much more. Representatives from these institutions were also present at the celebratory funding announcement event.

"The best science - important science - comes from projects that some people, perhaps with less ambition, qualify as fantasies, as science-fiction, or as having impossibly high budgets. These are the kinds of projects we should try to support. We are glad that today's announcement guarantees the continuation and growth of BIRS programs for the next five years."  
- **José Antonio de la Peña**, Deputy Director, CONACYT



"Alberta's innovation system is all about collaboration. I see that focus reflected in the international and cross-disciplinary character of BIRS. Mathematics is at the core of all science, and basic and applied research are the foundation of any new discoveries."  
- **Hon. Greg Weadick**, Alberta Minister of Advanced Education and Technology





## Life-Saving Science

To celebrate the event and to showcase some of BIRS' work and mission, BIRS hosted a joint funding announcement and gala event last September, featuring a public lecture by the internationally acclaimed academic and public health activist, Dr. Rita Colwell.



The lecture, co-hosted with The Banff Centre, was entitled "Climate, Oceans and Infectious Disease: The Cholera Paradigm", and was extremely well received by both the scientists and the non-experts in the audience. Using the example of her own investigations alongside biologists, meteorologists and statisticians into the prevention of cholera in rural Bangladesh, Dr. Colwell demonstrated how mathematical modeling

can lead to a better understanding of epidemiological processes and can focus responses. Paired with other academic disciplines, it can save lives. For this work, Dr. Colwell was recently awarded the Stockholm Water Prize by King Carl XVI Gustaf of Sweden.

Dr. Colwell, former director of the National Science Foundation (NSF), was warmly introduced by her longtime friend and colleague, former NSERC president Tom Brzustowski. Both have been active in the life of BIRS since its inception. Other speakers participating in the formal funding announcement and throughout the day were:

- Nassif Ghoussoub (MC), Scientific Director of BIRS
- Lee Richardson, MP for Calgary Centre
- Greg Weadick, Alberta Minister of AET
- Suzanne Fortier, President of NSERC
- José Antonio de la Peña, Deputy Director of CONACYT
- Sastry Pantula, Director of DMS, National Science Foundation
- John Hepburn, VPR at the University of British Columbia
- Rose Goldstein, VPR at the University of Calgary
- Arvind Gupta, Scientific Director of MITACS, and
- Mary Hofstetter, President and CEO of The Banff Centre.



(From left to right) Nassif Ghoussoub, Rita Colwell, Suzanne Fortier, and Tom Brzustowski

"I think BIRS represents everything that Dr. Colwell talked about: excellent science, excellent science done in collaboration, and excellent science that's international. And excellent science is always international. I think that the linkages which are created by organizations like BIRS actually have an impact far beyond mathematics. They have an impact on Canada, the US and Mexico."  
- John Hepburn, VP Research, UBC



(From left to right) Javier Bracho, Alejandro Adem, José Antonio de la Peña, and Carlos Castillo-Chavez



# GUIDELINES FOR SUBMITTING A PROPOSAL

- Proposals should be submitted using the online form at <https://www.birs.ca/proposals/>
- Read the description of programs before preparing your proposal.
- Indicate the subject area of your proposal by using the drop-down menus. In rare cases, the codes in the menus may not be adequate. In that case, select “Other” and specify your subject in the Additional Comments field.
- The guidelines allow for only one organizer per institution.
- The text submitted should be plain ascii text. You may use LaTeX syntax for mathematical expressions.
- Provide options for your proposed dates, particularly low-season alternatives. You may use the link [http://www.vpcalendar.net/Holiday\\_Dates/2010\\_2015.html](http://www.vpcalendar.net/Holiday_Dates/2010_2015.html) for a list of holidays to ensure that the dates you indicate as being acceptable do not coincide with an important holiday.
- Suggestions on writing Workshop Proposals
  1. The workshop should be sufficiently innovative and timely that holding it has the potential to make a difference to the subject. Proposals that take advantage of newly emerging links between areas or offer opportunities for groups of participants who do not normally meet are of special interest.
  2. The proposal should be written carefully. The total length of the Short Overview and the Statement of Objectives should run between 2 and 4 pages.
  3. The proposal should avoid being too diffuse, attempting to cover too many areas at once, nor should it be similar to events being held elsewhere.
  4. The proposed participant list should be realistic and coherent with the goals of the event.
  5. At least some of the organizers should have recognized international stature. You may have more than two organizers, but only one will be designated as the main Contact Organizer.
  6. You should include a list of possible participants, their affiliations and departments, and indicate the number of your prospective participants that have been contacted and have expressed their interest in the workshop.
  7. We encourage you to consider opportunities to train young talent (including graduate students and postdoctoral fellows) and to ensure appropriate representation of women and other underrepresented groups in the mathematical sciences.
- Additional Comments
  - Participation in the programs at BIRS is by invitation only. Workshop organizers determine the list of participants, and BIRS sends out the invitations.
  - Confirmation: After you submit your proposal, you will receive an automatically generated message containing the text of your proposal. The BIRS Program Coordinator will send you an e-mail message within one week to confirm that the proposal has been received and is complete. Please contact the Program Coordinator if you do not receive confirmation or if the copy you receive back from us seems to be corrupted.
  - If you have other questions about submissions of proposals, please feel free to contact the BIRS Program Coordinator.

## PROGRAM DESCRIPTIONS

### 5-Day Workshops:

- 5-day workshops are the basic program format of BIRS. They run Monday through Friday (arrival Sunday afternoon, departure Friday midday).
- Accommodation, use of BIRS facilities (lecture halls, Internet facilities, etc.) and meals are provided at no cost to the participants of the workshops.
- The maximum number of participants is 42.
- A small number of half-workshops with 20 - 22 people will be considered.
- The organizers are required to submit, at the completion of their program, a 5-10 page article (possibly written by one of the participants) surveying the status of the subject of the Workshop in the context of the events of the Workshop. These reports are compiled into annual volumes documenting the activities of BIRS. In addition, a number of talks will be recorded for dissemination on the Internet, and for archival purposes. In late 2011, BIRS workshops will also have access to live-streaming and teleconferencing technology.



### 2-day Workshops:

- 2-day workshops run Saturday and Sunday (arrival Friday afternoon, departure Sunday midday).
- The maximum number of participants is 25.
- Accommodation and use of BIRS facilities (lecture halls, Internet facilities, etc.) are provided at no cost to the participants of the workshops. Meals are the responsibility of the organizers and participants.

### Focused Research Groups:

- This program offers teams of up to 8 researchers the opportunity to live and work at BIRS facilities for periods of 1 to 2 weeks. Accommodation and meals are provided.
- Two dedicated discussion rooms with computer terminals are provided for the use of the group.
- Teams should consist of individuals from different institutions.
- Proposals should detail the project, list the team members and their institutions, and justify the case for using BIRS facilities.

### Research in Teams:

- This program offers teams of up to 4 researchers the opportunity to live and work at BIRS facilities for periods of 1 to 2 weeks. Accommodation and meals are provided.
- Each team is provided with its own private workspace and computer terminals.
- Teams should consist of individuals from different institutions.
- Proposals should detail the project, list the team members and their institutions, and justify the case for using BIRS facilities.

### Summer Schools:

- BIRS welcomes proposals for schools of 1 to 2 weeks in duration.
- Schools and Training Camps are pedagogical by definition, but may be aimed at any level from elementary or high school students or teachers, through undergraduate and graduate levels, or preparation for Institute thematic programs, etc. Summer Schools typically run Sunday through Sunday (arrival Sunday afternoon, departure Sunday noon).
- The maximum number of participants is 30.
- Normally, these workshops are held in the summer.

## IMPORTANT INFORMATION

- **DEADLINES**
  - Proposals for 5-day workshops and Summer Schools are usually late September or early October, 15 months before the programming year. For more specific information on deadlines please refer to the website at <http://www.birs.ca/applicants/deadlines/>
  - Proposals for 2-day Workshops, Focused Research Groups and Research in Teams events must be received a minimum of 4 months before the proposed start of the event.
- **SPECIAL NEEDS**
  - BIRS and The Banff Centre more widely are both wheel chair accessible.
  - The Banff Centre dining facility can provide special meals on request.
  - Travel expenses to and from The Banff Centre are the responsibility of the participants/organizers.
- **ONLINE SUBMISSION**
  - All proposals should be submitted online at <https://www.birs.ca/proposals/>
- **WEBSITES**
  - Banff International Research Station: <http://www.birs.ca>
  - The Banff Centre: <http://www.banffcentre.ca>



# BIRS and... the

With a growing global population competing for the same global resources, an increased frequency and intensity of dramatic climatic events, and evidence pointing to more long-term patterns of general climate change, the pressure to comprehend nature and its trends is greater than ever. Leaders in politics, sociology and economics have begun to seriously take

note of issues which before were confined to the natural sciences alone, and mathematical modeling is at the heart of much of the research undertaken. The year 2013 has thus been earmarked by mathematical sciences institutes around the world as a time for a special emphasis on the study of the “Mathematics of Planet Earth” (MPE 13). This theme is to be interpreted as broadly as possible, in the aim of creating new partnerships with related disciplines and casting new light on the many ways in which the mathematical sciences can help to comprehend and tackle some of the world’s most pressing problems. The Mathematics of Planet Earth initiative is being led by **Dr. Christiane Rousseau** of the Université de Montréal. More information about MPE 13’s oversight structure, as well as the global response to and involvement in the initiative can be found online at <http://www.mpe2013.org/index.php>.



BIRS is a full partner in this important initiative, as the goals of MPE 13 are completely in line with the station’s commitment to pursuing innovative research in a broad range of mathematical sciences and applications. BIRS has already planned to host five workshops in 2012 which deal with the themes of MPE 13 , spanning topics from climate change to tissue growth and morphogenesis. BIRS also invites interested applicants to use the opportunities of its 2013 program and submit proposals in line of the MPE 13 theme, in conjunction with BIRS’ regular format for programming. Proposals should be made using the BIRS online submission process.

“My time at BIRS was the very definition of “time well spent”. The monastic setting offered me the unparalleled opportunity to not only meet some of the leaders in the field of inverse theory and tomography (whose papers initiated me into the field years ago) but also to discuss various current problems and ideas with them.”

- **Nicholas Hoell**, *Columbia University*

“This meeting was a tremendous success and multiple participants told me this was perhaps the best scientific meeting they had ever attended. The facilities, support, participants and format of the workshop were obviously significant factors, and the fact that we had absolutely perfect weather all week certainly helped as well [...] As for BIRS, this is a very unique scientific organization with no equal. We feel privileged to have been selected, and hope that the outcomes, collaborations and breakthroughs resulting from this meeting will help ensure the success of BIRS in the future.”

- **David Sept**, *University of Michigan*

“The workshop was a great opportunity for me to be in contact with a community slightly different from that with which I am used to being in permanent contact. The presence of certain people has been crucial [in solving] some problems concerning my most recent publication.”

- **Andres Navas**, *Universidad de Santiago de Chile*

My participation in the BIRS workshop had a high impact on my current research. I had the opportunity to discuss it with other people working in the same area. From these discussions I had new interesting ideas regarding my research.”

- **Maria Buzano**, *University of Oxford*







## Community, Academic and Scientific Leaders Support BIRS at a 2010 Site Visit

A great number of scientists and academic leaders converged on Banff in January 2010. They came to register their support and to make the case for BIRS on the occasion of a site visit to the Station by a panel representing the sponsor governments. BIRS is grateful to the following people for their contribution to the success of the evaluation process.

Alejandro Adem (UBC), Tom Alberts (U.Toronto), James Arthur (U.Toronto), Jacques Belair (UdeM), Jim Berger (Duke), Javier Bracho (UNAM), Fernando Brambila (UNAM), Tom Brzustowski (U.Ottawa), Russell Caflish (IPAM, UCLA), Alice Chang (Princeton), Rita Colwell (U. Maryland), Daniel Coombs (UBC), Octav Cornea (UdeM), Juan Ramon de la Fuente (Int'l Assoc. of Universities), Charmaine Dean (UWO), Renee Elio (AVP-R, U. Alberta), Eric Friedlander (AMS, President-elect), Tomas Gedeon (Montana State U.), Mark Green (UCLA), Robert Gray (Stanford), Arvind Gupta (MITACS), John W. Hepburn (UBC), Mary E. Hofstetter (President, The Banff Centre), Jacques Hurtubise (CMS President, McGill), Mads Kaern (U. Ottawa), Niky Kamran (McGill), Samuel Kou (Harvard), Michael Kozdron (U. Regina), Thomas G. Kurtz (U. Wisconsin, Madison), Rachel Kuske (UBC), Michael Lamoureux (U. Calgary), Mark Lewis (U. Alberta), Robert Masson (UBC), Jonathan Mattingly (Duke), Rafe Mazzeo (Stanford), Sayan Mukherjee (Duke), Kumar Murty (U. Toronto), Hans Othmer (U. Minnesota), Yuval Peres (Microsoft Research), Peter Pfaffelhuber (Freiburg), Arturo Pianzola (U. Alberta), Lea Popovic (Concordia), Karen Prentice (Alberta Securities Commission), Mary Pugh (U.Toronto), Ian Putnam (U. Victoria), Hong Qian (U. Washington), Nancy Reid (U. Toronto), Fadil Santosa (Director IMA, Minnesota), Matthew Scott (U. Waterloo), Panagiotis Souganidis (U. Chicago), Jacklyn Sturm (VP Finance, Intel Corporation), Peter Swain (U. Edinburgh), Selim Tuncel (U. Washington), Paul Tupper (SFU), Gunther Uhlmann (U. Washington), Eric Vanden-Eijnden (Courant Institute), Darren Wilkinson (Newcastle), Ruth Williams (UC, San Diego).

"The atmosphere was very stimulating and conducive to research and I'm very grateful to BIRS for providing it. I also made new contacts in my field and became aware of the work and interests of several young people who are just starting out in their career."

- **Alina Stancu**, *Concordia University*



"The workshop renewed my excitement about the research area. I met a number of people whose papers I had read, and I had the chance to talk to them directly. I have a number of new contacts that I would not have had otherwise. The group discussions were very stimulating, and their content will be a source of inspiration for the next while."

- **Frithjof Lutscher**, *University of Ottawa*



"The conference was a great success. I learned a lot about triangulated categories in different domains of application, especially in algebraic topology, an area which will become increasingly important in my future research. I also made interesting new contacts, and had the opportunity to discuss with experts some ideas related to the work I presented at the conference. This will have a very positive impact on my research in the very near future, and is also likely to result in new collaborations."

- **Wendy Lowen**, *Universiteit Antwerpen*





## First Nations Math Education

BIRS is committed to fully capturing the strength of North America's diversity, and to supporting the quest of making women and other underrepresented groups full participants in its scientific programs. BIRS additionally enjoys playing host to special workshops that further the aim of increasing the depth and breadth of mathematical understanding in all communities. Here is a sample from recent years:

- Training camps for the Canadian Mathematics Olympiad team;
- Workshops for high school math teachers;
- Conferences for Women in Mathematics (WIN);
- Workshops on First Nations math education

Since 2006, three workshops (with a fourth scheduled for 2012) have been held at BIRS to discuss the issues of First Nations math education. This is done in the knowledge that in British Columbia alone, it is estimated that by grade 4 (age 9-10), First Nations students lag behind their non-Native classmates in basic tests of numeracy by around 20%. By grade 10, only 47% of First Nations students meet the expectations in numeracy, versus 77% of non-Native students. Overall, high school graduation rates are 40% lower in Native communities than the provincial average, leaving those who fail to complete grade 12 in a very poor position when it comes to further study or employment. If discrepancies in opportunities and in quality of life are to be redressed between First Nations and the mainstream, then the issue of trends of such poor performance in mathematics will have to be dealt with.

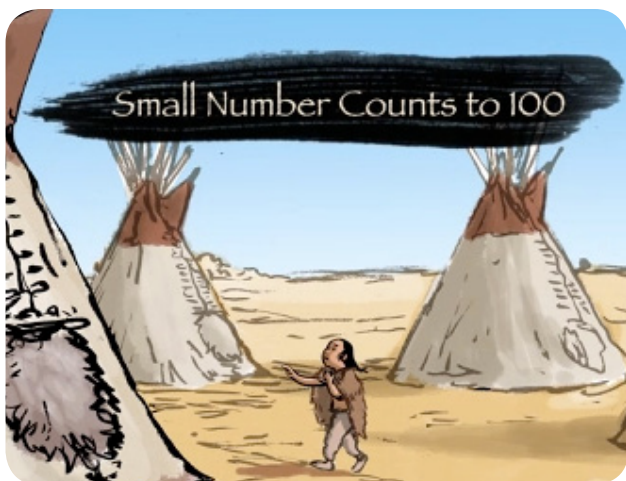
The BIRS workshops thus far have already led to significant recommendations and advances. These events have brought together mathematicians, math teachers and First Nations Elders to discuss both the theoretical and the practical barriers to teaching math effectively to First Nations students of all ages. Discussions were based on extensive academic research, statistics and personal experiences. Elders gave informative talks on traditional uses of and approaches to mathematics in their communities, and helped teachers to come up with examples that drew First Nations history and attitudes into mathematical instruction. For the mathematicians in attendance, a lot was to be gained from a greater understanding of different cultural approaches to mathematical learning and development.

The workshops resoundingly concluded that math is a true centerpiece of traditional First Nations knowledge and that First Nations students should be expected to perform as well in the subject as the rest of the population. Those involved in the workshops saw a need for a much stronger emphasis on teacher training in the Canadian education systems.

The training envisaged would equip teachers both to demonstrate the relevance of math to their First Nations students, but would also more fundamentally encourage teachers themselves to raise their own expectations of the performance of aboriginal students in their classes. Mathematics has a traditional and also a future place in First Nations cultures, and educational systems should reflect that.

### References:

- Alvarez-Adem, Fox and Friesen, "First Nations Math Education: Objectives", 2008, retrieved 15 July 2011 from: <<http://www.birs.ca/events/2009/5-day-workshops/09w5078>>. (statistics)
- Alvarez-Adem, Fox and Friesen, "First Nations Math Education: Final Report", 2010, retrieved 15 July 2011 from: <<http://www.birs.ca/workshops/2009/09w5078/report09w5078.pdf>>. (outcomes)



The workshops on First Nations Math Education have already yielded a significant volume of research and of new and creative teaching materials in mathematics, not least the children's video called "Small Number Counts to 100", which can be viewed at <http://www.birs.ca/blog/2010-07-21/small-number-counts-to-100>.

Written by **Veselin Jungic** (SFU) and **Mark MacLean** (UBC), illustrated by **Simon Roy**, and based on the narrations of **Rena Sinclair** of the Siksika Nation, "Small Number" is the story of a boy whose grandmother wants him to stay outside after his run-in with a skunk. She sets a counting challenge which she assumes will keep him busy for a long time. Not so, when Small Number figures out a mathematical pattern to speed up his task! It is up to the children watching the episode to figure out just what that pattern is...

"From the start, BIRS has been about reaching out - reaching out to other disciplines, reaching out to society, reaching out to government, reaching out to scientists all over the world, and reaching out to young people. In all these ways, BIRS has succeeded like no other institution. In fact, I would argue that similar organizations around the world are now copying what's happening at BIRS. They're realizing that mathematics has a voice in other communities, and it has to express that voice. It has to go out and build those bridges. Because that is the power of mathematics. It has an influence, and can go out and change the world around us."

- **Arvind Gupta**, *Scientific Director, MITACS.*



# Algebraic Combinatorixx: Women on the Frontiers of Mathematics

**B**IRS always seeks to increase the participation of a wider cross-section of society in mathematical research. In May BIRS played host to an all-female workshop on algebraic combinatorics, a broad area of research which dabbles in representation theory, mathematical physics, algebraic geometry, number theory, knots and links, mathematical biology, statistical mechanics, symmetric functions, and invariant theory. This particular workshop, playfully named “Algebraic Combinatorixx” by its organizers, focused on strengthening the participation of women in the field.



The composition of the workshop was diverse, with mathematicians hailing from as far away as France, England, Germany, and South Korea, some being graduate students, some postdoctoral fellows, and some tenured professors.

The differences in age and experience allowed for interesting interactions in matters both academic and personal. The workshop was designed so as to allow maximum communication and collaboration, alternating between conventional lectures, poster sessions and discussions in small groups. Its organizers were **Georgia Benkart** (University of Wisconsin-Madison), **Stephanie van Willigenburg** (University of British Columbia) and **Monica Vazirani** (University of California, Davis).

The participants in “Algebraic Combinatorixx” finished their week on a highly positive note. Much optimism was expressed regarding the workshop’s long-term impact, in particular with respect to its effect on significantly increasing the participation of women in this central mathematical subject and its related fields. The meeting enabled the preliminary development of a research network of potential collaborators, and also increased the visibility of algebraic combinatorics to younger researchers, particularly those who were visiting from smaller colleges or isolated in departments that do not currently have a strong research presence in the area. Given the relatively young age of so many of those attending the workshop, it is expected that the true legacy of the activities of that week will be reflected in the critical role that many of the participants will play in shaping the field for a long time to come.

“Participation in the BIRS workshop Algebraic Combinatorixx led to new research ideas, new research collaborations, and meeting new people. This was a fantastic workshop, well scheduled to really take advantage of being at BIRS. We had many interesting talks, but also plenty of time dedicated to small working groups. This workshop had a secondary theme beyond the research topic. It was an all women’s workshop and time was set aside for [...] discussions [...] of the issues and difficulties facing women in mathematics. I truly appreciate BIRS supporting this additional aspect of the workshop. It is hard to describe the need and positive effect such gatherings have for female mathematicians. Among other things, I was ‘re-charged’ to come home and face the challenges that arose while I was away.”

- **Caroline Klivans**, *University of Chicago*



The *Algebraic Combinatorixx* workshop also featured a visit from the chair of the BIRS Board of Directors, **Karen Prentice**, who spoke with participants and gave them a tour of BIRS’ new facility on The Banff Centre campus. Here, she chats and has coffee with participants in the BIRS lounge.



## Participation Statistics

**B**IRS provides equal access to the world's research community regardless of geographic origin or scientific expertise, as long as it is anchored on solid mathematical, statistical or computational grounds. Applications are selected on a competitive basis, using the criteria of excellence and relevance, by a scientific panel of experts drawn from across the entire breadth of the mathematical sciences and related areas.

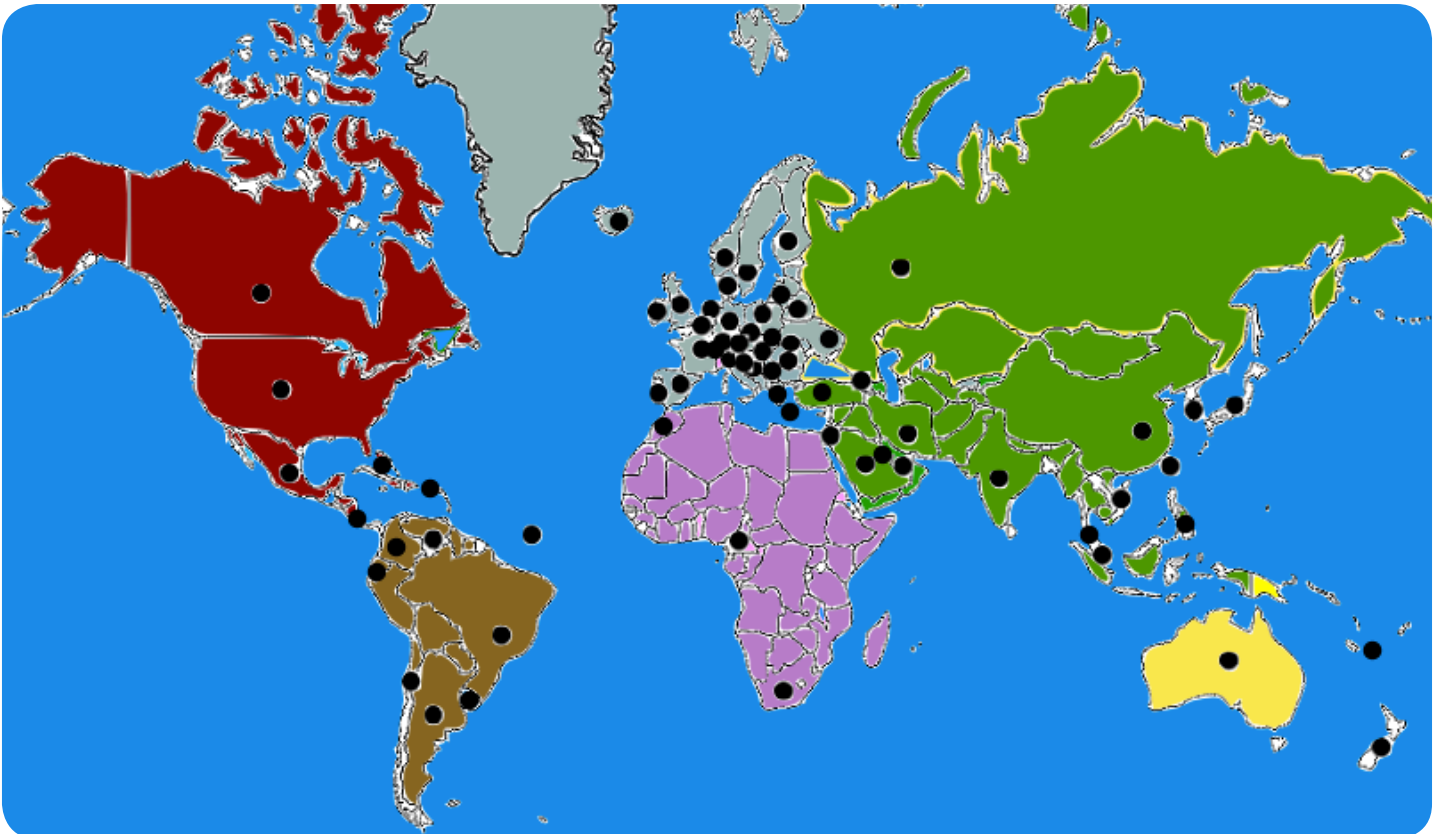
The overwhelming response of the scientific community during the first years of operations led BIRS to expand the North American partnership by involving the Mexican mathematical community in its scientific management, and to increase BIRS opportunities by extending the program from 40 weeks in 2003, to 44 in 2006, to 48 in 2007, and to 49 weeks per year in 2011.

The station now receives over 2,000 visits by researchers every year from hundreds of institutions in more than 60 countries who participate in over 70 different programs spanning almost every aspect of pure, applied, computational and industrial mathematics, statistics, computer science, physics, biology, engineering, economics, finance, psychology and scientific writing.

The extraordinary reaction to the opportunities at BIRS has led to extremely high quality competitions, with over 170 proposed activities competing for the 48 available weeks.

<b>10 012</b>	Total number of visits to BIRS in 2006-2010.
<b>2725</b>	Visitors from Canada
<b>4202</b>	... from the US
<b>140</b>	... from Latin America
<b>2154</b>	... from Central/Western Europe
<b>163</b>	... from Eastern Europe
<b>505</b>	... from Asia
<b>11</b>	... from Africa
<b>112</b>	... from Oceania

### Resident states of BIRS participants, 2006-2011





## BIRS Staff

### Scientific Director

Dr. Nassif Ghoussoub  
Phone: 604-822-1649  
Email: [birs-director@birs.ca](mailto:birs-director@birs.ca)

### Administrator

Danny Fan  
Phone: 604-822-1844  
Email: [birs-administrator@birs.ca](mailto:birs-administrator@birs.ca)

### Scientific Program Coordinator

Wynne Fong  
Phone: 604-822-1694  
Email: [birs@birs.ca](mailto:birs@birs.ca)

### Scientific Program Assistant

Phone: 604-822-5213  
Email: [birs-secretary@birs.ca](mailto:birs-secretary@birs.ca)

### Station Manager

Brenda Williams  
Phone: 403-763-6999  
Email: [birmsgr@birs.ca](mailto:birmsgr@birs.ca)

### Station Facilitator

Caroline Green  
Phone: 403-763-6996  
Email: [birs-facilitator@birs.ca](mailto:birs-facilitator@birs.ca)

### BIRS Vancouver Mailing Address

Office of the Scientific Director  
Banff International Research Station  
University of British Columbia  
200-1933 West Mall  
Vancouver BC V6T 1Z2  
Canada

### BIRS Vancouver Fax

604-822-0883

### Technology Manager

Brent Kearney  
Phone: 403-763-6997  
Email: [brentk@birs.ca](mailto:brentk@birs.ca)

### BIRS Banff Mailing Address

Banff International Research Station  
c/o The Banff Centre  
Corbett Hall Suite 5110  
107 Tunnel Mountain Drive  
Box 1020 Stn 48  
Banff AB T1L 1H5  
Canada

### BIRS Banff Fax

403-763-6990




"This recent workshop was fantastic, certainly the best I have been to this year, maybe in the last three years. I was not bored for a minute [...] Scientifically, it was a perfect blend of mathematics and biology, and the area was very focused [...] This conference marked a point at which experimental biologists did not separate themselves from mathematical colleagues anymore. Needless to say, the site is fabulous."  
- Alex Mogilner, *University of California, Davis*

**Editor:** Hannah J. Toope

This brochure is also available on the BIRS website. Look for it at [www.birs.ca](http://www.birs.ca) under our *Publications*.





"The workshop was a rare moment in my academic life, meeting some of the leading [...] researchers in my area of interest. The lectures were exciting. BIRS facilities are simply excellent! The organization was superb."

- Carlos M. Fonseca, *Universidade de Coimbra*

"This was one of the most productive meetings I have attended. The setting was inspiring."

- Peter Liljedahl, *Simon Fraser University*

"I appreciated both the tutorial talks and the ones on current research - that is a good combination. Also, the informal discussions in the lounge and at meals were very valuable. Logistics and hospitality were tremendous. In my spare time I went swimming and attended the mid-week classical concert - a real treat."

- Robert Krasny, *University of Michigan*

"This was an outstanding workshop with a large fraction of the leading researchers in the field. It was well organized in every regard and the BIRS facilities were ideally suited to its size and scope."

- Greg Fiete, *University of Texas, Austin*

"There was so much research going on between talks and in the evening that I would not be surprised if ten papers came out in the next year from these collaborations. The common room was hopping each evening [...] Thank you for the opportunity to come to BIRS."

- Sara Billey, *University of Washington*

"[My] week in Banff was extremely fruitful, thanks to its outstanding material accommodations and to an excellent scientific program of talks. I met many colleagues for the first time, including French colleagues that I had never before been acquainted with [...] The Banff Centre is really well designed, from both architectural and functional points of view. Running BIRS in that place is a great achievement for mathematics."

- Jean-Pierre Croisille, *Université de Metz*