CMS NOTES de la SMC

IN THIS ISSUE
DANS CE NUMÉRO

FROM THE PRESIDENT'S DESK

Jacques Hurtubise, *McGill University*

HOW ARE WE DOING?

This issue of the NOTES contains some quite moving tributes to Richard Kane; they depict the career of someone who had a deep influence on our collective destiny. I have fond memories of working with Richard, in particular on a previous review of Mathematics in Canada, so it is perhaps appropriate that I write about some of the results of the latest one, which we are in the process of finalising, in particular as Richard's work allowed some of what we found to happen.

Part of the process this time was a survey of our departments, and some of the results are rather interesting. Our enterprise is a large one- we have in our 58 departments about 1050 tenure track mathematicians (excluding statisticians, who have their own Society, and who, prompted by the NSERC long range plan, are doing their own survey); these mathematicians teach about 6000 mathematics majors and honours undergraduates, and another thousand or so in interdisciplinary programs; they have nine hundred Master's students, and another nine hundred doing the PhD; there are two hundred and fifty post-doctoral fellows.

We have divided our departments into large (20 or more tenure track math faculty), medium (10 to 19), and small (less than 10). With this definition, there are 19 large departments, 18 medium size ones, and 21 small. They have, respectively, 680, 250, and 120 mathematics faculty.

The survey requested data from 2000, as well as from 2010, and there are some interesting trends. Over ten years, the number of professors in our departments has increased by 6%; this growth has been concentrated in our large departments, with the medium size ones shrinking by about 5%, and the small ones by 10%. Undergraduate mathematics populations increased by about 15%, and the increases take place across the board, in large, medium and small universities; the interdisciplinary student numbers increased more, by about 45%.

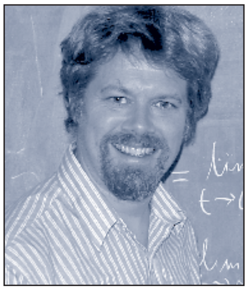
It is in the graduate populations that one has the greatest surprises: MSc student populations are up by 55%; PhD students have doubled in numbers; the number of postdocs has gone up by about 130%. These figures were a pleasant surprise to my friends in university administrations; what wasn't a surprise, as it is common to a large range of disciplines, was the extent of faculty renewal: about 50% of our university faculty were hired in the last ten years. The age distribution of our faculty has become much more evenly spread than it was ten years ago, with about 25% younger than 40, 30% between 40 and 49, 25% between 50 and 59, and 20% over 60.

On the ever-present issue of research funding, the NSERC Discovery grant continues to be the main game in town, representing 56 % of research funding, though there might be some underreporting of other sources. The other funding comes from other NSERC programs, provincial programs, university sources, industrial sources, and MITACS, in commensurate if not identical quantities. The total NSERC Discovery funding to our mathematicians in 2010 was about 15M$, an increase of 40% over ten years; this funding was split between large, medium and small universities in ratios of 78%, 18% and 4%. The overall ratio of grantees to faculty is 71%, with 82% at the large

français page 13
Continued on page 12

by Robert Dawson
Saint Mary's University, Halifax

On a Talk Not Attended



I just got back from the CMS winter meeting in Vancouver. The plenary talks were excellent, and I felt I had learned a lot about several interesting subjects that had somehow escaped my attention until then. The sessional talks required, as usual, some difficult choices. I mainly attended the discrete mathematics session, but the range of appealing talks was wide enough that I often had to decide between two or more options.

There was a talk about recent theories about the Antikythera Mechanism that I particularly regret missing. This strange artifact, dating back to classical Greece, appears to be the remnants of an ancient astronomical analog computer. What is left includes several badly corroded metal gears. It has been studied for about half a century; researchers are starting to make real progress in discovering its secrets.

The fascination, of course, is that there was a period of many centuries after its fabrication when not only the art of its manufacture, but even the knowledge that such a thing had ever been done, was entirely lost. Usually, we think of technical progress as irreversible; a serious retrograde step such as this is contrary to our culture's recent experience. Of course, some technologies have been effectively abandoned; dirigibles, horse-drawn carriages, commercial sailing ships, and slide rules are largely things of the past. In Atlantic Canada, even passenger trains are not as widespread as they used to be. But this is in a sense a voluntary and reversible choice.

In mathematics, too, there are some partially lost arts. Some methods have been abandoned as insufficiently rigorous or inefficient (would anybody today choose to approach orbital mechanics through Euclidean geometry as Newton did?) Some areas (such as classical triangle geometry, or the nineteenth-century "theory of functions" superseded by algebraic geometry) have been more or less mined out. But, at present, to revisit these requires only a walk to the library, or an online search of Google Books or some other digital archive. They are not truly lost, just out of our sight.

For the immediate future, our contemporary science and technology appear to be safe. But we have to be cautious. Ancient manuscripts sometimes (though not always) survived centuries of neglect; and the many libraries of printed books and journals of the last century made it very unlikely that any catastrophe would destroy all copies of a work. It is not immediately obvious that the digital technology towards which we are moving is as robust. Records are stored on a relatively small number of servers, and software is vulnerable to virus attacks. Computers, inordinately complex, are usually designed for a comparatively short working life, and irreplaceable except by the concerted efforts of a host of high-tech industries. What would it take for today's science to follow the Antikythera computer into oblivion? And what can we do to ensure this does not happen?

NOTES DE LA SMC

Les Notes de la SMC sont publiés par la Société mathématique du Canada (SMC) six fois l'an (février, mars/avril, juin, septembre, octobre/novembre et décembre).

Rédacteurs en chef
Robert Dawson, Srinivasa Swaminathan
notes-redacteurs@smc.math.ca

Rédacteur-gérant
Johan Rudnick
jrudnick@smc.math.ca

Rédaction
Éducation : John Grant McLoughlin et Jennifer Hyndman
notes-education@smc.math.ca
Critiques littéraires: Keith Johnson
notes-critiques@smc.math.ca
Réunions : Gertrud Jeewanjee
notes-reunions@smc.math.ca
Assistante à la rédaction : Laura Alyea

Note aux auteurs : indiquer la section choisie pour votre article et le faire parvenir au Notes de la SMC à l'adresse postale ou de courriel ci-dessous.

Les Notes de la SMC, les rédacteurs et la SMC ne peuvent être tenus responsables des opinions exprimées par les auteurs.

CMS NOTES

The CMS Notes is published by the Canadian Mathematical Society (CMS) six times a year (February, March/April, June, September, October/November and December).

Editors-in-Chief
Robert Dawson, Srinivasa Swaminathan
notes-editors@cms.math.ca

Managing Editor
Johan Rudnick
jrudnick@cms.math.ca

Contributing Editors
Education: John Grant McLoughlin and Jennifer Hyndman
notes-education@cms.math.ca
Book Reviews: Keith Johnson
notes-reviews@cms.math.ca
Meetings: Gertrud Jeewanjee
notes-meetings@cms.math.ca
Editorial Assistant: Laura Alyea

The Editors welcome articles, letters and announcements, which can be sent to the CMS Notes at the address below.

No responsibility for the views expressed by authors is assumed by the CMS Notes, the editors or the CMS.

Canadian Mathematical Society - Société mathématique du Canada
209 - 1725 St. Laurent Blvd. Ottawa, ON K1G 3V4 Canada
T: (613) 733-2662 F: (613) 733-8994
notes-articles@cms.math.ca | www.smc.math.ca www.cms.math.ca
ISSN :1193-9273 (imprimé/print)
1496-4295 (électronique/electronic)

 par Robert Dawson
Saint Mary's University, Halifax

Au sujet d'un exposé auquel je n'ai pas assisté

Je reviens tout juste de la réunion d'hiver de la SMC, à Vancouver. Les discussions plénières étaient excellentes, et j'ai eu l'impression de m'être fort renseigné sur plusieurs sujets intéressants qui m'étaient restés inconnus jusqu'ici. Les séances trimestrielles ont exigé, comme d'habitude, des choix difficiles. J'ai assisté principalement à la séance de mathématiques discrète, mais il y avait un éventail suffisamment important de sujets intéressants que j'ai dû bien souvent faire des choix.

En particulier, j'ai eu le regret de rater l'entretien au sujet des dernières théories concernant le mécanisme Antikythera. Cette étrange relique datant de l'âge classique grec, semble être le restant d'un ancien ordinateur analogue pour l'astronomie. Il n'en reste que plusieurs engrenages métalliques fort rouillés. On l'étudie depuis une cinquantaine d'années environ; les chercheurs commencent maintenant à percer ce mystère.

L'objet fascine, bien entendu, parce que pendant de nombreux siècles après sa fabrication, la technique de sa fabrication et même l'idée qu'on ait pu créer un pareil mécanisme ont été oubliées. On imagine habituellement que les progrès techniques sont irréversibles; un tel pas en arrière est contraire à l'expérience récente de notre culture. Bien entendu, certaines technologies ont en effet été abandonnées; les dirigeables, les chariots tirés par des chevaux, les voiliers commerciaux et les règles à calcul sont choses du passé, en général. Dans le Canada atlantique, même les trains de passagers ne sont plus aussi courants qu'avant. Mais tout cela est, dans une certaine mesure, un choix volontaire et réversible.

On compte aussi en mathématiques des techniques en partie oubliées. Certaines méthodes ont été abandonnées parce qu'elles n'étaient pas suffisamment rigoureuses ou étaient inefficaces (choisirait-on aujourd'hui d'aborder la mécanique des orbites en appliquant les principes de géométrie euclidienne, comme l'avait fait Newton?). Certains domaines (tels que la géométrie triangulaire classique ou la « théorie des fonctions » datant du 19e siècle supplantée par la géométrie algébrique) ont été plus ou moins éliminés graduellement. Mais pour s'y baigner une fois de plus aujourd'hui, il suffit de se rendre à une bibliothèque, de faire une recherche en direct de Google Books ou de parcourir d'autres archives numériques. Ces notions n'ont pas vraiment disparu; elles ne sont que mises de côté.

Pour l'avenir rapproché, notre science et notre technologie contemporaines semblent en sécurité. Mais la prudence est de mise. Des manuscrits anciens ont parfois (mais pas toujours) survécu pendant des siècles de négligence; et, grâce aux nombreuses bibliothèques d'ouvrages et de revues spécialisées imprimés qui ont été aménagés au cours des 100 dernières années, il est très peu probable qu'une catastrophe quelconque vienne détruire tous les exemplaires d'un même ouvrage. On ne peut affirmer avec certitude que la technologie numérique vers laquelle nous évoluons est aussi robuste. Les dossiers sont stockés dans un nombre relativement peu élevé de serveurs, et les logiciels sont vulnérables aux virus. Machines trop complexes, les ordinateurs sont habituellement conçus pour durer pendant une période comparativement courte et sont irremplaçables, sauf si d'énormes efforts concertés sont consentis par un grand nombre de secteurs de haute technologie. Que faudrait-il qu'il arrive pour que la science d'aujourd'hui emprunte la même voie du néant que l'ordinateur d'Antikythera? Et que pouvons-nous faire pour éviter que cela ne se produise?

Letters to the Editors
Lettres aux Rédacteurs

The Editors of the NOTES welcome letters in English or French on any subject of mathematical interest but reserve the right to condense them. Those accepted for publication will appear in the language of submission. Readers may reach us at notes-letters@cms.math.ca or at the Executive Office.

Les rédacteurs des NOTES acceptent les lettres en français ou anglais portant sur un sujet d'intérêt mathématique, mais ils se réservent le droit de les comprimer. Les lettres acceptées paraîtront dans la langue soumise. Les lecteurs peuvent nous joindre au bureau administratif de la SMC ou à l'addresse suivante : notes-lettres@smc.math.ca.

Duel at Dawn

by Amir Alexander,
2010, Harvard University Press,
307 pp, US$29, £21.95, €26.10, ISBN 978-0-674-04661-0.

Reviewed by Peter M Neumann,
The Queen's College, Oxford

If the title of this book does not make a mathematician of sense and sensibility wince, its contents will. It has a sort of subtitle 'Heroes, martyrs, and the rise of modern mathematics'. This is not a subtitle in the ordinary sense. It appears on only one of the three title pages; it is not printed on the cover of the book, though it appears on the paper jacket, down in the bottom right corner, well separated from the title.

It seems to serve as a substitute for a preface and may help mathematicians and non-mathematicians alike to get some idea what the book is about.

According to the author the book belongs to "the new field of mathematics and culture" (p. 299). What is this new field? Is mathematics not a part of culture? He writes (p. 1): the central argument of this book is simple and can be stated briefly: the duel that ended the life of young Galois marks the end of an era in the practice of mathematics and the beginning of another. In a word, it marks the birth of modern mathematics.

Is modern mathematics, then, such a well-defined concept that it can be said to have been born on 30 May 1832? Of course not. Mathematics evolves. Even its precisely formulated theorems are usually the product of a long period of evolution.

The author compares (p. 3) the story of Galois with those of Abel, János Bolyai, Ramanujan, Nash, Gödel, Grothendieck and Perelman: Among modern mathematicians, it seems, extreme eccentricity, mental illness, and even solitary death are not a matter of random misfortune. They are, rather, almost signs of distinction, reserved only for the most outstanding members of the field.

So were Hilbert, Poincaré, Burnside, Hardy, Littlewood, Emmy Noether, Philip Hall, Hodge, Feit not among the most outstanding members of our field? And what about those who, with sanity intact, are still with us, such as Serre, Atiyah, Hirzebruch, Thompson, Wiles? Depending on the force of the word 'almost' and the scope of the word 'only' the logic of the above passage may have no such implication, but it comes perilously close to doing so. Besides, is not outstanding mathematical ability eo ipso a form of eccentricity? This passage is followed (p. 5) by: Remarkably, the new persona of the tragic mathematical misfit and the new practice of pure

and insular mathematics came on the scene at precisely the same time [the early decades of the nineteenth century]. The central argument of this book is that this is no coincidence: the mathematical legend that appeared in the age of Galois is inseparable from the new mathematical practice that transformed the field in those years.

This 'new mathematical practice' near the beginning of the nineteenth century is pure mathematics 'unsullied by the crass realities of the world around us' (p. 4).

The principal characters treated in the book are d'Alembert, Galois, Abel, Cauchy and János Bolyai. Each of these gets a chapter to himself (with the titles "The Eternal Child", "A Habit of Insult: The Short and Impertinent Life of Évariste Galois", "The Exquisite Dance of the Blue Nymphs", "A Martyr to Contempt", "The Gifted Swordsman" – if this is culture then what is kitsch?). In between are three other chapters: "Natural Mathematics", on the Enlightenment and the thesis that all eighteenth century mathematics is based on providing a description of how the world works; "The Poetry of Mathematics", which compares mathematicians with other artists but underrates Shelley and overlooks Büchner, Rimbaud, Verlaine, for example, and fills a much-needed gap in the literature; "Purity and Rigor: The Birth of Modern Mathematics", in which 'Cauchy Reinvents the Calculus' and Galois solves 'The Mystery of the Quintic Equation'.

Preceding the eight chapters is an introduction summarising their contents, and following them is a conclusion entitled "Portrait of a Mathematician" in which portraits of various people, some mathematicians, some not, are discussed and related to the theses propounded in the main body of the work. Presenting the gentle sketch of Galois aged 15 that was first published by Paul Dupuy in 1896 the author focuses on the eyes (p. 256):

Dark and piercing, they burn with a fire that testifies to fierce passions within and reaches out to distant and profound truths. They look upon us with an ironic skepticism that belies their owner's tender years, and they convey clearly that he is not truly interested in us, who stand before him. What he sees lies far beyond our horizons.

Continued on page 12

Complex Multiplication

By Reinhard Schertz
Cambridge University press,
376 pp, $106.95 (US), ISBN 978-0521766685

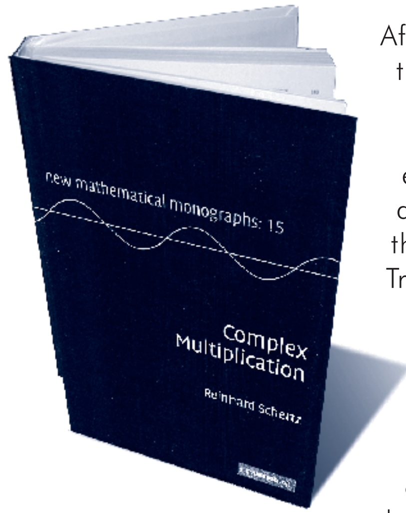
Reviewed by David McKinnon, University of Waterloo

The phrase "complex multiplication" arises in many mathematical contexts, from high school algebra to the cutting edge of algebra and geometry. The book under review, *Complex Multiplication*, by Reinhard Schertz (Cambridge University Press), is about some of the deep algebraic aspects of complex multiplication. In particular, it is about using certain elliptic and modular functions to generate abelian extensions of imaginary quadratic extensions of Q. If you're looking for a book to describe the theory of elliptic curves with complex multiplication, or (heaven forbid!) trying to figure out how to multiply complex numbers together, then do not pass GO, do not collect $200, and proceed directly to the next book on the shelf.

On the other hand, if you're interested in some beautiful mathematics that is in the process of lifting the description of abelian extensions of Q onto an imaginary quadratic pedestal, then check this book out. The book is intended to be self-contained, and although this is a notoriously slippery notion, the author does indeed cover a lot of ground. The book begins with a two-chapter description of how to make an elliptic curve out of C and a lattice, and fairly extensive material on elliptic and modular functions. These sections are pleasant and clear.

The third chapter is a review of algebraic number theory and class field theory. This review is considerably brisker than the previous two chapters. For example, the review of class field theory is only eight pages long, which contrasts sharply with the leisurely pace of the first two chapters, and indeed with the beginning of the third chapter itself, in which the author recalls, for example, the definitions of the product and norm of an ideal.

After the first three chapters, the author has finally marshalled the forces to attack the results he's really aiming for, about generation of abelian extensions and class number formulae. Factorisation of special values of special modular functions are the starting point, followed by discussions of a Reciprocity Law and applications of all this to all manner of questions of field and ring generation. This, in my view, is the heart of the book, and is the place where the most impressive results are to be found. The exposition in these sections is, like that of the first two chapters, clear and detailed.



After the main event, the author includes a chapter on cryptography, and there are scads of excitingly huge numbers and polynomials scattered throughout the text. Tragically, a few of the most impressive solutions of these numerical calculations are abridged in the text, and the reader must content himself only with the knowledge that the answers are inspiringly large.

I will readily confess that I am not expert in this particular field, so I can't really comment on the accuracy or depth of the most advanced notions in this text. However, the exposition in the book is clear and starts from the level of an advanced undergraduate or beginning graduate student, so it does provide a path from an accessible starting point to a very advanced finish line.

My biggest pedagogical quibble with the text is that some of the very deep and beautiful mathematics in the introductory chapters is presented in a fairly speedy way, without any broader context. I am sympathetic to the author's desire to have a text that contains as much of the background as possible, and I understand that the author could not give a properly comprehensive description of all the background material in context, but I do wonder if it would have been better simply to refer the reader to standard texts in, for example, class field theory or algebraic number theory.

The citations in the book are also somewhat idiosyncratic. Results are cited often, but with less precision than I'm used to. For instance, on page 155, there is a reference to "Schertz (1978)", but there are two different papers in the bibliography that were written by Schertz in 1978. And section 4.4 is entitled "A result of Dorman, Gross, and Zagier", but poor Dorman's name is not mentioned anywhere else; all the results in the section are referenced to works of Gross and Zagier alone!

Reinhard Schertz's Complex Multiplication is a book that drives to the top of a very high mountain, and the view from there is terrific. If you're looking for a way to get there, then you should definitely give this book a closer look.

BRIEF BOOK REVIEWS

by Keith Johnson
Dalhousie University, Halifax, NS.

Algebraic Curves and Cryptography

By V. Kumar Murty, ed.
Fields Institute Communications #58,
American Mathematical Society, Providence R.I., 134 pp.,
ISBN 978-0-8218-4311-6

One consequence of the explosive growth of information technology in recent decades has been the parallel growth of interest in methods of insuring information security. Research in the mathematical aspects of these methods flourishes at several universities in Canada, including at the GANITA lab at the University of Toronto (GANITA is both the sanskrit word for computation and an acronym for Geometry, Algebra and Number Theory and their Information Technology Applications). A selection of reports from the lab's weekly seminar form the content of this volume, together with a short introduction by the editor. All of the reports concern some aspect of counting points or performing arithmetic in the Jacobians of curves over finite fields, the basis for many public key cryptosystems. The topics include Schoof's algorithm, the Denef-Vercauteren/Kedlaya algorithm, Grobner bases, C_{ab} curves and zeta functions. Together they give a good introduction suitable for prospective graduate students.

Moonshine – the first quarter century and beyond

By James Lepowsky, John McKay, Michael P. Tuite, eds.,
London Mathematical Society lecture note #372
Cambridge University Press, Cambridge, UK
404 pp. $78.00 (US) ISBN 978-0-521-10664-1

It was John McKay who first observed, to John Conway, that 196884, the coefficient of q in the Fourier series of $j(\tau)$, was 1 more than the dimension of the smallest faithful complex representation of the monster simple group. Conway's reply at the time was that this was "moonshine" however from this beginning he and Simon Norton developed a sequence of conjectures linking the monster group to modular functions which were published in 1979 under the title "monsterous moonshine". The later history of these conjectures, and the new mathematics they led to was the subject of a workshop at Herriot-Watt University in Edinburgh of which this volume is the published record. It includes, of course, an account of Borcherd's proof of the conjectures which led to his Fields medal in 1998 but there is much more as well with articles on vertex algebras, representation theory and links with mathematical physics.

Roads to Infinity: The Mathematics of Truth and Proof.

By John Stillwell, A.K. Peters Ltd., Natick MA 2010,
203 pp. $39.00 (US) ISBN 9781568814667

One topic which never fails to fascinate serious mathematics students on their first encounter is that of infinity and the way the idea is refined, with Cantor's diagonal argument distinguishing between countable and uncountable and leading to the idea of ordinal numbers. Many students, indeed many mathematicians, don't pursue the matter beyond this point, but for those who wish to this volume by John Stillwell would make a clear and succinct guide. The path leads almost immediately from set theory into logic and Gödel's theorem and its variations and consequences. One interesting feature of the book is the careful treatment of two of the less famous contributors in this area – Emil Post and Gerhard Gentzen, who, respectively, anticipated Gödel's incompleteness theorem and found the minimum additional assumption necessary to prove the consistency of number theory. The book concludes with a discussion of unprovable assertions which arise naturally in mathematics.

A Historian Looks Back: The calculus as algebra and selected writings

By Judith V. Grabiner, MAA Spectrum,
Mathematical Association of America, Washington,DC,
287 pp, $62.95 (US) ISBN 978-0-88385-572-0.

Most popular accounts of the history of calculus usual skip from its invention by Newton and Liebnitz in the 1680's to Cauchy's contributions in the 1820's where, in his Cours d'Analyse, he gave a reasonably sound foundation to the subject. In the main essay in this collection the author considers the development which occurred between these two events, concentrating on the work of J.L Lagrange in the second half of the 18th century.

Lagrange's aim was to reduce calculus to algebra and his method was based on assuming that all functions had power series expansions. While his successors in the 19th century rejected this faulty approach most of his results were adapted and placed on rigorous foundation. All this is described with enough detail to place Lagrange in the larger frame of the 18th century enlightenment. In addition to this main article there are also 10 shorter pieces, most of them prize winning articles by the same author from Historica Mathematica or the American Mathematical Monthly, some of which enlarge on the main essay ("The changing concept of change", "Who gave you the epsilon?") and some concerned with larger philosophical issues ("The centrality of mathematics in the history of western thought.")

CALL FOR NOMINATIONS / APPEL DE MISES EN CANDIDATURE

Prix Coxeter-James Prize Lectureship — 2012

The Coxeter-James Prize Lectureship recognizes young mathematicians who have made outstanding contributions to mathematical research. The recipient shall be a member of the Canadian mathematical community. Nominations may be made up to ten years from the candidate's Ph.D: researchers having their PhD degrees conferred in 2001 or later will be eligible for nomination in 2011 for the 2012 prize. A nomination can be updated and will remain active for a second year unless the original nomination is made in the tenth year from the candidate's Ph.D. The prize lecture will be given at the 2012 CMS Winter Meeting.

Le prix Coxeter-James rend hommage aux jeunes mathématiciens qui se sont distingués par l'excellence de leur contribution à la recherche mathématique. Cette personne doit être membre de la communauté mathématique canadienne. Les candidats sont admissibles jusqu'à dix ans après l'obtention de leur doctorat : ceux qui ont obtenu leur doctorat en 2001 ou après seront admissibles en 2011 pour le prix 2012. Toute mise en candidature est modifiable et demeurera active l'année suivante, à moins que la mise en candidature originale ait été faite la 10e année suivant l'obtention du doctorat. La personne choisie prononcera sa conférence à la Réunion d'hiver SMC 2012.

Prix Jeffery-Williams Prize Lectureship — 2012

The Jeffery-Williams Prize Lectureship recognizes mathematicians who have made outstanding contributions to mathematical research. The recipient shall be a member of the Canadian mathematical community. A nomination can be updated and will remain active for three years. The prize lecture will be given at the 2012 CMS Summer Meeting.

Le prix Jeffery-Williams rend hommage aux mathématiciens ayant fait une contribution exceptionnelle à la recherche mathématique. Cette personne doit être membre de la communauté mathématique canadienne. Toute mise en candidature est modifiable et demeurera active pendant trois ans. La personne choisie prononcera sa conférence à la Réunion d'été SMC 2012.

Prix Krieger-Nelson Prize Lectureship — 2012

The Krieger-Nelson Prize Lectureship recognizes outstanding research by a female mathematician. The recipient shall be a member of the Canadian mathematical community. A nomination can be updated and will remain active for two years. The prize lecture will be given at the 2012 CMS Summer Meeting.

Le prix Krieger-Nelson rend hommage aux mathématiciennes qui se sont distinguées par l'excellence de leur contribution à la recherche mathématique. La lauréate doit être membre de la communauté mathématique canadienne. Toute mise en candidature est modifiable et demeurera active pendant deux ans. La lauréate prononcera sa conférence à la Réunion d'été SMC 2012.

The deadline for nominations is June 30, 2011. La date limite de mises en candidature est le 30 juin 2011.

Nominators should ask at least three referees to submit letters directly to the CMS by September 30, 2011. Some arms-length referees are strongly encouraged. Nomination letters should list the chosen referees, and should include a recent curriculum vitae for the nominee, if available. Nominations and reference letters should be submitted electronically, preferably in PDF format, by the appropriate deadline, to the corresponding email address:

Les proposants doivent faire parvenir trois lettres de référence à la SMC au plus tard le 30 septembre 2011. Nous vous incitons fortement à fournir des références indépendantes. Le dossier de candidature doit comprendre le nom des personnes données à titre de référence ainsi qu'un curriculum vitae récent du candidat ou de la candidate, dans la mesure du possible. Veuillez faire parvenir les mises en candidature et lettres de référence par voie électronique, de préférence en format PDF, avant la date limite, à l'adresse électronique correspondante:

Coxeter-James: cjprize@cms.math.ca
Jeffery-Williams: jwprize@cms.math.ca
Krieger-Nelson: knprize@cms.math.ca

Coxeter-James: prixcj@smc.math.ca
Jeffery-Williams: prixjw@smc.math.ca
Krieger-Nelson: prixkn@smc.math.ca

EDUCATION NOTES

By John Grant McLoughlin and Jennifer Hyndman
University of New Brunswick *University of Northern British Columbia*

Jennifer recently attended the Chairs' meeting of the *Canadian Mathematical Society* where they talked about the long pipeline for students taking mathematics. This motivated her to write the book review below of *Go Figure*, a book designed to entice children to be interested in mathematics. The idea of the long pipeline and how the mathematical community can work together to transform it into a smoother process is illustrated in Dragana Martinovic's article on activities of the *MathEd Forum of the Fields Institute*.

MathEd Forum of the Fields Institute: The Whole that is Greater than the Sum of Its Parts

Dragana Martinovic, University of Windsor

This note is about the Mathematics Education Forum (MathEd Forum or Forum), one of the programs of the Fields Institute for Research in Mathematical Sciences. The mission of the Fields Institute includes promoting research in the mathematical sciences, providing a supportive and stimulating environment for mathematics innovation and education, and promoting broader use and understanding of mathematics in Canada. The Fields Institute is thus a place where mathematics ideas emerge and/or are discussed, scientific and outreach events are organized, and groups from various mathematics disciplines congregate. The Fields Institute is also vitally interested in the development of young mathematicians, as well as being committed to improving mathematics education of all youth, with an understanding that they need to be well equipped with appropriate knowledge, skills and attitudes to prosper in the modern knowledge economy.

As a consequence, one of the programs of the Institute is the MathEd Forum, which has monthly meetings to discuss issues related to mathematics education at all levels. The Forum is held at the Institute and is open to the public; anyone may attend without invitation. As such, the Forum has both regular attendees and those who attend when the opportunity arises. These individuals come from a wide spectrum of education and non-education sectors: university/college professors and graduate students from mathematics departments and faculties of education; teachers and mathematics coordinators from school boards; textbook publishers; freelance consultants; government officials; as well as members of the general public, who are interested in mathematics education. It is the goal of the Forum to consider objectively new ideas and diverse views in mathematics education, to facilitate consensus and to promote the enhancement of mathematics education in Ontario and Canada (see Figure 1).

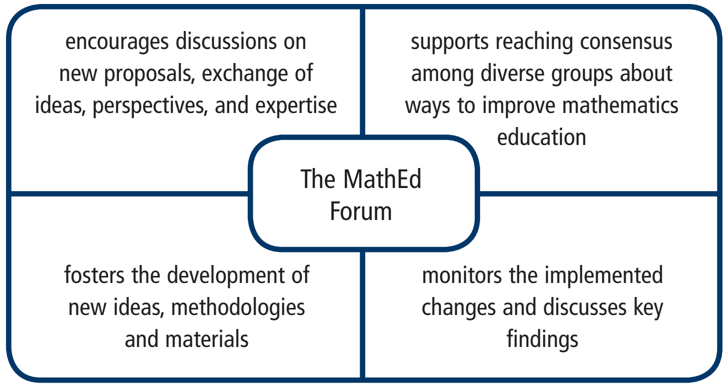


Figure 1. Roles of the MathEd Forum in improvement and promotion of mathematics education.

Historically, the Forum was envisioned to consist of about 30 representatives from various professional and interest groups, or individuals invited to participate. However, during the last 10 years, it has become more fluid and open, while remaining diverse and connected to various organizations (e.g., OAME – Ontario Association for Mathematics Education; OMCA – Ontario Mathematics Coordinators Association; OCMA – Ontario Colleges Mathematics Association; CMESG – Canadian Math Education Study Group). The Forum is governed by the Steering Committee, a group that represents its diverse membership body. The Steering Committee members organize the Forum monthly meetings (plan the meeting agendas, invite guest speakers and guests, serve as facilitators of the meetings) that are rich in content, timely and interesting to its audience. In addition, the Steering Committee makes decisions on involvement of the Forum in the various broader discussions on mathematics education, writing review documents or recommendations, organizing symposia or workshops, and providing support to new initiatives.

One of the major contributions of the Forum was to the 1998 revision of the Ontario high school mathematics curriculum, carried out through a contract of the Fields Institute with the provincial Department of Education. The Fields-Nortel White Paper (1997), which was the result of the *Fields-Nortel Workshop on Mathematics Education for the 21st Century*, provided recommendations to the Ontario Ministry of Education and Training that integrated six broad themes: assessment, curriculum, implementation plan, integration of technology, professional development, and resources.

In 2001, the Forum formed several task forces that were given the mandate of, for example: producing resources for teachers in the implementation of the new Ontario secondary school mathematics course, The Mathematics of Data Management (*MDM4U Task Force*); exploring issues and producing a statement concerning the teaching and learning of mathematics via the World Wide Web (*Online Task Force*); exploring the issues associated with transition of mathematics students from school to college and university, especially in view of the changed 4-year high school curriculum

(*Transition Task Force*); and compiling information for future teachers (*Mathematics Teacher Education Task Force*). Presently, together with the OMCA and OAME, the Forum representatives are involved in the next cycle of discussions around the new curriculum reform.

Attendance in the Forum usually ranges from 20 to 45, and participants come regularly from as far as Ottawa, Kingston, Peterborough, London, Windsor, and St. Catharines. Among the recent guest speakers the Forum had a variety of scholars from abroad (e.g., South Africa, England, Australia, the US, Brazil) as well as from Canada (e.g., Manitoba, Quebec, British Columbia, Ontario), which allowed for wide dissemination of ideas, concerns and best practices. The Forum also encourages active participation of graduate students, who often present their research results and invite feedback on their emerging research questions.

The sessions cover the newest results from areas such as developmental and cognitive psychology (e.g., how young children learn mathematics, how number sense develops in children), technology adoption (e.g., interactive white boards, clickers, mathematics software), and instructional technologies that are related to providing support to teachers of mathematics (e.g., lesson study, action research, instructional coaching) or students of mathematics (e.g., students-at-risk, transition to college/university). Questions that often arise in the discussions concern how to improve teaching and learning of mathematics; how to better prepare mathematics teachers; how to stimulate interest in studying and teaching mathematics; and how to improve communication between mathematics educators at all levels?

Recently, it became a tradition to organize the October meeting outside of Toronto. In 2008, the Forum was organized at University of Ottawa; in 2009, at Trent University; and in 2010, at University of Windsor. These meetings were well attended and attracted audiences that usually do not attend the Forum, as well as providing a place-specific focus.

Future initiatives involve increasing the visibility of the Forum, which includes starting the *Fields Mathematics Education Journal* (*FMEJ*). This international peer-reviewed online journal will provide open access to the range of themes that attract attention of the mathematics education community in Ontario, Canada and internationally. While this periodical will stimulate discussions, reflections, research, and commentaries about mathematics education within and between different interest groups, it will particularly encourage submissions of manuscripts related to presentations at the Fields MathEd Forum.

Words from the Members: *Why the Fields MathEd Forum has been and continues to be successful and productive*

Eric Muller (Brock University):

> Ontario is fortunate to have a significant number of individuals who are interested in working on issues connected with education in mathematics across the artificially drawn borders between elementary, secondary, college, university and the private sector. Their interest is such that many of its members are prepared to dedicate one Saturday a month to mathematics education activities in a centre away from their own home and institution. For some participants attending these meetings involves substantial travel. The programs are developed by a Steering Committee that is representative of the various sectors of the membership and that is elected on an alternating two year rotation (www.fields.utoronto.ca/programs/mathed/charter.html). This structure has helped the Forum to evolve and address both timely and also longer term issues which are of importance and of interest to the membership. In the early years of the Forum there were major changes in the Ontario secondary school curriculum and new approaches were being developed between Faculties of Education and Mathematics Departments. These provided wonderful opportunities for a number of Task Forces (www.fields.utoronto.ca/programs/mathed/task_forces/index.html). One of these made important contributions to a new mathematics course at the Grade 12 level, another raised issues of transition from school to university mathematics and a third was responsible for a poster and website campaign, in all Ontario secondary schools, to encourage students to consider mathematics teacher education at all levels. The Forum has played an important but nearly invisible role in Ontario. Its members, with their knowledge, collaborative experiences, and their interest in a wide range of mathematics education issues at all levels, have been called to contribute to a wide range of initiatives that have a mathematics education component.

John Kezys (Mohawk College):

> As college faculty I value the opportunity to meet mathematics educators from all levels within the Ontario education system. When we meet, we exchange ideas which come from diverse experiences. Recently I participated in a Fields organized symposium to identify the Big Ideas of Mathematics to be included in the next round of K - 12 Ontario math curriculum revisions. It was interesting to observe the dynamics of this meeting. We as participants without any preparation proposed topics for discussion, members self identified as group facilitators and what followed were a series of reasoned passionate discussions on issues of mathematics education. For instance, I was a member of a small group which considered "Reasoning and making sense with manipulatives." We were crouched around a table and I recognized that a university professor sat next to a high school principal, who sat next to a retired psychologist, who sat next to a grade school teacher. What followed was an intense development of thinking on the value and current practice of using manipulatives to teach mathematics. When we leave a Fields MathEd Forum event we are charged with ideas which we enthusiastically exchange with our school colleagues.

When I asked Shirley Dalrymple (Thornhill Secondary School, YRDSB), why she has been attending the Forum, she replied (see also Figure 2):

> I have so enjoyed the dialogues with such a diverse group...many topics push me to think more deeply about how kids learn, how to help them understand, how to teach more effectively. The meetings have provided me with opportunities to be part of a learning community that spans elementary, secondary, college, university and community members with a vested interest in mathematics education.

As a MathEd Forum representative, Shirley was part of the Grade 7-12 Policy Document writing team; for two years she served as co-chair of the MDM4U Data Management Task Force, before implementation of the course began; and she planned and worked on the on-line learning symposium. Some of the events Shirley vividly remembers are:

- Being a part of the white paper regarding new directions in mathematics education to support the curriculum changes;
- The Canadian Mathematics Education Forum (CMEF) meetings in Montreal, Toronto and Vancouver, [where she] was able to participate because of support from Fields; and
- The "Big Ideas" symposium to provide input to the task force working on the next revision of the mathematics curriculum.

What am I taking out from the Forum, or contributing to it?
I take away valuable perspectives about the emerging issues in mathematics education
I learn about what the research is telling us about what's going on in mathematics classrooms
I have opportunities to work with leaders in other panels, which I really enjoy
I sometimes present data, student work, or other aspects of the ongoing issues at meetings to share the high school perspective
I help select meeting themes, sometimes help plan for specific meetings as part of the steering committee
I take away energy, new ideas and knowledge of what's going on in mathematics

Figure 2.
Reasons for involvement in the MathEd Forum of the Fields Institute.

To conclude, this article provides the CMS Notes readership with a glimpse of activities related to the MathEd Forum of the Fields Institute. Those who are fortunate to attend the meetings note the enthusiasm, energy and dedication to mathematics education of the Forum members. This lively open community is always willing to contribute its expertise and time to improve conditions for teaching and learning of mathematics, as well as the mathematics students' outcomes. As such, the Forum demonstrates that, indeed, the whole can be greater than the sum of its parts.

Book Review by Jennifer Hyndman, UNBC

Go Figure! A totally cool book about numbers

By Johnny Ball, Published by DK Publishing, Inc., 2005
ISBN #13 978-0-7566-1374-7, hardcover, 96 pages, $18.99

When I first picked up this book I was simultaneously thrilled and disappointed: thrilled, because it was going to be perfect for my ten-year-old niece; disappointed, because all the ideas I had thought about for a mathematics book for children were already in it so I wasn't going to be writing my own book. I still enjoy reading it several years after I first saw it.

The book is comprised of 90 pages of colourful pictures that illustrate both facts and activities to explore. The four sections of the book are titled: *Where do NUMBERS come from?; MAGIC numbers; SHAPING up; and The world of MATH*. Imagining a world without numbers, Ball writes of an Olympic Athlete winning gold in high jump as "She beat the previous record of very high indeed by jumping a bit higher still." Many wonderful facts about numbers appear in the book, such as, some tribes count one-two-many, base 10 comes from having ten fingers and thumbs, the Babylonians used tokens to count, and the flooding of the Nile made Egyptians expert surveyors and timekeepers.

Ball describes in the section on magic numbers how to make your own magic squares, where Fibonacci numbers occur, and how weird infinity is. The golden ratio, π, and Pascal's triangle also show up. The history of the concepts also finds its way into the book as fascinating fact.

The section on shapes provides a paper tearing exercise to prove the sum of the interior angles of a triangle add to 180 degrees. Paper folding and cutting problems give pop-up dodecahedrons and Mobius strips. Topology is described as "rubber sheet geometry" and the reader is challenged to determine which shapes are topologically equivalent to a donut, a football, or a double box wrench. Symmetry is introduced with mirrors and mazes leading to the seven bridges and two islands problem of Königsberg.

The last section introduces everything from the probability of a particular hand of cards, through chaos theory and hurricanes, to fractal vegetables and logical paradoxes. The art of M.C. Escher and illusions are a must for this type of book and are also there.

Mathematics, where it occurs, and history are all woven together in tantalizing morsels. The activities range from very easy to quite hard so there is something for everyone. This is a wonderful book appropriate for adults and children who love mathematics and for someone who might need to be encouraged to be interested in mathematics.

CALL FOR NOMINATIONS / APPEL DE MISES EN CANDIDATURE

Prix Adrien-Pouliot Award — 2011

Nominations of individuals or teams of individuals who have made significant and sustained contributions to mathematics education in Canada are solicited. Such contributions are to be interpreted in the broadest possible sense and might include: community outreach programs, the development of a new program in either an academic or industrial setting, publicizing mathematics so as to make mathematics accessible to the general public, developing mathematics displays, establishing and supporting mathematics conferences and competitions for students, etc.

Nominations must be received by the CMS Office no later than **April 30, 2011**.

Please submit your nomination electronically, preferably in PDF format, to apaward@cms.math.ca.

Nomination requirements:

- Include contact information for both nominee and nominator.
- Describe the nominated individual's or team's sustained contributions to mathematics education. This description should provide some indication of the time period over which these activities have been undertaken and some evidence of the success of these contributions. This information must not exceed four pages.
- Two letters of support from individuals other than the nominator should be included with the nomination.
- Curricula vitae should not be submitted since the information from them relevant to contributions to mathematics education should be included in the nomination form and the other documents mentioned above.
- If nomination was made in the previous year, please indicate this.
- Members of the CMS Education Committee will not be considered for the award during their tenure on the committee.

Renewals

Individuals who made a nomination last year can renew this nomination by simply indicating their wish to do so by the deadline date. In this case, only updating materials need be provided as the original has been retained.

Nous sollicitons la candidature de personne ou de groupe de personnes ayant contribué d'une façon importante et soutenue à des activités mathématiques éducatives au Canada. Le terme « contributions » s'emploie ici au sens large; les candidats pourront être associés à une activitée de sensibilisation, un nouveau programme adapté au milieu scolaire ou à l'industrie, des activités promotionnelles de vulgarisation des mathématiques, des initiatives, spéciales, des conférences ou des concours à l'intention des étudiants, etc.

Les mises en candidature doivent parvenir au bureau de la SMC avant le **30 avril 2011**.

Veuillez faire parvenir votre mise en candidature par voie électronique, de préférence en format PDF, à prixap@smc.math.ca.

Conditions de candidature

- Inclure les coordonnées du/des candidats ainsi que le(s) présentateur(s).
- Décrire en quoi la personne ou le groupe mise en candidature a contribué de façon soutenue à des activités mathématiques. Donner un aperçu de la période couverte par les activités visées et du succès obtenu. La description ne doit pas être supérieur à quatre pages.
- Le dossier de candidature comportera deux lettres d'appui signées par des personnes autres que le présentateur.
- Il est inutile d'inclure des curriculums vitae, car les renseignements qui s'y trouvent et qui se rapportent aux activités éducatives visées devraient figurer sur le formulaire de mise en candidature et dans les autres documents énumérés ci- dessus.
- Si la mise en candidature a été soumise en l'année précédente, s'il vous plaît indiquez-le.
- Les membres du Comité d'éducation de la SMC ne pourront être mise en candidature pour l'obtention d'un prix pendant la durée de leur mandat au Comité.

Renouveler une mise en candidature

Il est possible de renouveler une mise en candidature présentée l'an dernier, pourvu que l'on en manifeste le désir avant la date limite. Dans ce cas, le présentateur n'a qu'à soumettre des documents de mise à jour puisque le dossier original a été conservé.

Really? That is not what I see there. And why does the author not compare with the other extant picture, a sketch made from memory by Alfred Galois in 1848, sixteen years after his elder brother's death? To me that one shows a shifty-eyed, untrustworthy scamp. Oh dear!

The narrative of this book is based upon a small amount of mathematics and a considerable amount of history of mathematics. Neither is reliable. On pp. 202–206, for example, there is a horribly garbled account of Galois' main contributions to the theory of equations. It is neither mathematically nor historically correct. As far as history goes, the thesis that Abel, Cauchy and Galois were men who introduced a kind of mathematics that was 'not derived from the physical world but was, rather, a world unto itself' (p. 4) ignores the efforts of the many mathematicians of the two preceding centuries (and, indeed, of earlier times) who had developed much thoroughly 'pure' mathematics in, for example, the theory of equations and the theory of numbers. It also ignores the fact that Cauchy, for example, contributed at least as much to our understanding of differential equations, mathematical physics and mechanics as he did to 'pure' mathematics and its ways of thinking. Furthermore, insofar as Cauchy is credited with the construction of "a new kind of mathematics, strictly circumscribed, but pure and rigorous on its own terms" (p. 185), it belittles (pp. 187–191) the achievements of Cauchy's predecessors and over-rates his own. He was a great mathematician, but he was just one contributor to a long-lasting effort to pin down what a function is, what continuity and differentiability are, what a real proof in Analysis is, that began in the early eighteenth century and progressed far beyond Cauchy's own quite primitive ideas of rigour later in the nineteenth century.

To some extent the author distances himself from the mathematics and its history by examining the development of myths about his romantic heroes alongside his treatment of their lives and mathematical contributions. But it does not work. In my opinion there is little of any value in the book. I cannot recommend it.

Reprinted with permission from the Newsletter of the London Mathematical Society.

FROM THE PRESIDENT'S DESK *continued*

universities, 61% at the medium universities, and 35% at the small ones. Some of these grantees are adjuncts, emeriti, etc, and if one subtracts a guesstimate of 40 or so of these across the country, the proportion of faculty funded is about 67%. (This is before the effect of NSERC's program changes really kicks in…)

The study also reviews mathematics as a subject across Canada. Our traditional areas of strength e.g. number theory, functional analysis, combinatorics, continue to thrive, and indeed grow in line with international developments in their fields. In parallel one has quite remarkable growth in applied mathematics, most particularly in mathematical biology; it seems as if no university is complete now with a research centre in the area. Some areas of pure mathematics have grown remarkably: algebraic geometry and p.d.e. are two which come to mind.

Our institutional framework is strong, in a way barely conceivable twenty years ago. The three Institutes, BIRS and AARMS have had a major impact on the field in our country. For one thing they have internationalised it: Canada is more than ever a place to come and do mathematics. This internationalisation is manifest in our departments, in its new faculty: of the 47 Canada Research Chairs in our subject in Canada, about half were recruited from outside the country; the last decade also saw 15 of our new recruits win Sloan fellowships. Another Institute effect is the increase in the number of post-docs, of which more than half receive Institute funding. Finally, the Institutes, along with MITACS, have pushed the broadening of the discipline in the country, and have certainly contributed to the growth of applied mathematics.

What can one conclude from all of this, in particular in the perspective of the NSERC long range plan? Well, a first thing is that we have used the resources available to us in a remarkably efficient way. Our community has grown and is an important actor in the international stream of the discipline: it has delivered the goods. We will need more resources- all those graduate mouths to feed, and all those new scientific careers to nurture. Our institutions will need continued care and maintenance, and this is not a given; MITACS for one is due to go off its grant for funding industrial mathematics. Finally, a healthy research community requires that there be a wide access to research funds- our engine should have the fuel required to fire on all its cylinders, not just numbers three, four and six. There is still work to do.

DU BUREAU DU PRÉSIDENT

Jacques Hurtubise
McGill University

COMMENT ÇA VA?

Cette parution des Notes contient des témoignages émouvants sur Richard Kane, que je vous recommande. J'ai de très bons souvenirs de mon travail avec Richard, en particulier sur une étude des mathématiques au Canada, et il peut-être de mise que je parle ici de quelques résultats de l'étude en cours, tout particulièrement parce que le travail de Richard a permis à certaines des choses que nous avons constatées cette fois de se produire.

Un des éléments de l'étude en cours était un sondage de nos départements, et les résultats sont intéressants. Notre entreprise est de taille- nous avons dans nos 58 départements environ 1050 professeurs réguliers en mathématiques. (Les statisticiens sont exclus du sondage- ils ont, après tout, leur propre société, et en fait, à cause du plan à long terme au CRSNG, mènent leur propre sondage.) Ces professeurs de mathématiques enseignent à quelque 6000 étudiants en mathématiques au premier cycle, et à un autre mille dans des programmes interdisciplinaires. Ils ont 900 étudiants de maîtrise, et un nombre semblable au doctorat, avec en plus 250 boursiers post-doctoraux.

Nous avons divisé nos départements en trois catégories : les grands, avec 20 professeurs en mathématiques ou plus; les moyens, avec entre 10 et 19; et les petits, avec moins de 10. Avec ces définitions, il y a 19 grands départements, 18 moyens, et 21 petits; ils ont, respectivement, 680, 250 et 120 membres de leurs corps professoral mathématique.

Le sondage portait sur le profil en 2000, ainsi qu'en 2010, et plusieurs tendances intéressantes se sont manifestées. Sur dix ans, le nombre de professeurs de nos départements a augmenté de 6%; cette croissance a été concentrée dans nos grands départements, car les moyens ont vu une décroissance d'environ 5%, et les petits d'environ 10%. Par contre, les populations au premier cycle en mathématiques ont augmenté d'environ 15%, et ce dans toutes les tailles d'institution. Le nombre d'étudiants interdisciplinaires a augmenté de 45%.

C'est au deuxième et troisième cycle que les progrès ont été les plus spectaculaires : la population d'étudiants de maîtrise a augmenté de 55% et celui d'étudiants de doctorat a doublé. Mes amis dans l'administration universitaire ont été agréablement surpris de ce résultat; par contre, celui qui décrivait un taux de renouvellement du corps professoral d'environ 50% pendant la dernière décennie était moins étonnant, car c'est le cas pour bien des disciplines. La distribution démographique de nos départements est maintenant plus uniforme, avec 25% en bas de 40 ans, 30% entre 40 et 49, 25% entre 50 et 59, et 20% en haut de 60.

Sur la question omniprésente des fonds de recherche, on constate que les subventions à la découverte du CRSNG restent la source principale de nos revenus, avec 56% du total, quoiqu'il se peut que les autres sources aient été sous-recensées. Les autres fonds viennent des autres programmes du CRSNG, des provinces, des universités, de l'industrie, et de MITACS, dans des proportions commensurables, sinon égales. Le total des subventions à la découverte de nos mathématiciens en 2010 était d'environ 15M, une augmentation d'environ 40% sur dix ans ; ces fonds ont été partagés entre nos universités grandes, moyennes et petites dans des proportions de 78%, 18% et 4% respectivement. Si on divise le nombre de subventionnés dans nos départements par le nombre de professeurs, on arrive à 71%, avec 82% pour les grandes, 61% pour les moyennes, et 35% pour les petites universités. Certains de ces subventionnés sont émérites, ou associés, et si on estime leur nombre à environ 40, la proportion de professeurs subventionnés serait de 67% (avant que l'effet des changements au CRSNG se fassent sentir…).

L'étude recense aussi les mathématiques comme sujet à travers le Canada. Nos zones traditionnelles de force, telles que la théorie des nombres, l'analyse fonctionnelle et la combinatoire, continuent de prospérer, et de se développer dans la ligne des tendances internationales de leurs domaines. En parallèle, on voit une croissance remarquable en mathématiques appliquées, tout particulièrement en biologie mathématique; il semble que chaque université doit avoir son centre dans le sujet. Certains domaines des mathématiques pures ont aussi vu une croissance importante : la géométrie algébrique et les e.d.p. sont deux exemples qui viennent à l'esprit.

Notre cadre institutionnel est fort, d'une façon qui serait inimaginable il y a vingt ans. Les trois instituts, BIRS, et AARMS ont eu un impact majeur sur notre discipline dans notre pays. D'abord ils ont poussé son internationalisation; de plus en plus, le Canada est un endroit où on vient faire des mathématiques. Cette internationalisation se voit dans nos départements, par son corps professoral; des 47 Chaires de Recherche du Canada recrutées depuis dix ans, environ la moitié l'ont été de l'extérieur du pays; la dernière décennie a aussi vu 15 de nos jeunes professeurs recevoir des bourses Sloane. Un autre effet institut se voit dans l'augmentation du nombre de post-docs, dont la moitié reçoivent des fonds des Instituts. Finalement, les instituts, ainsi que MITACS, ont poussé l'élargissement de la discipline au pays, et ont contribué au développement des mathématiques appliquées.

Suite page 17

RÉUNION D'ÉTÉ SMC 2011 CMS SUMMER MEETING

June 3-5 juin 2011
University of Alberta, Edmonton

Prizes | Prix

Krieger-Nelson Prize | Prix Krieger-Nelson
Rachel Kuske (UBC)

Jeffery-Williams Prize | Prix Jeffery-Williams
Kai Behrend (UBC)

Excellence in Teaching Award - to be announced
Prix d'excellence en enseignement - à venir

Public Lecture | Conférence publique

Gerda de Vries (Alberta)

Plenary Speakers | Conférences plénières

Leah Edelstein-Keshet (UBC)
Olga Holtz (UC Berkeley; TU Berlin)
François Lalonde (Montréal)
Bjorn Poonen (MIT)
Roman Vershynin (Michigan)

Scientific Directors | Directeurs scientifiques:

Volker Runde (Alberta)
vrunde@ualberta.ca, phone: 780-492-3526

Hassan Safouhi (Alberta)
hassan.safouhi@ualberta.ca, phone: 780-485-8631

Sessions

Aperiodic Order | Ordre apériodique
Org: Elaine Beltaos, Nicolae Strungaru (Grant MacEwan)

Applicable Harmonic Analysis and Approximation Theory | Analyse harmonique appliquée et théorie d'approximation
Org: Bin Han (Alberta)

Asymptotic Geometric Analysis and Convex Geometry
Analyse géométrique asymptotique et géométrie convexe
Org: Alexander Litvak, Nicole Tomczak-Jaegermann, Vlad Yaskin (Alberta)

Banach Spaces and Operators Between Them
Espaces de Banach et des opérateurs entre eux
Org: Edward Odell (Texas), Thomas Schlumprecht (Texas A&M), Vladimir Troitsky (Alberta)

Combinatorial Matrix Theory
Théorie combinatoire des matrices
Org: Shaun Fallat (Regina), Kevin N. Vander Meulen (Redeemer College)

Computational Toric Geometry
Géométrie torique computationelle
Org: Charles Doran (Alberta), Andrey Novoseltsev (Alberta), William Stein (Washington)

Dynamical Systems | Systèmes dynamiques
Org: Arno Berger, Hao Wang (Alberta)

Geometry and Physics | Géométrie et physique
Org: Charles Doran, Vincent Bouchard (Alberta)

Homotopy and Categories | Homotopie et catégories
Org: Pieter Hofstra (Ottawa), George Peschke (Alberta), Dorette Pronk (Dalhousie)

L-Functions and Number Theory
Functions L et théorie des nombres
Org: Clifton Cunningham, Matthew Greenberg (Calgary)

Lie Theory | Théorie de Lie
Org: Terry Gannon, Nicolas Guay (Alberta)

Mathematical Finance | Finance mathématique
Org: Tahir Choulli, Alexander Melnikov (Alberta)

Mathematics Education | Éducation mathématique
Org: Tiina Hohn (Grant MacEwan)

New Mathematical Tools for the Modeling of Cellular Processes
Nouveaux outils mathématiques pour modélisation des processus cellulaires
Org: Thomas Hillen (Alberta)

Operator Algebras | Algèbres d'opérateurs
Org: Berndt Brenken (Calgary), George Elliott (Toronto), Cristian Ivanescu (Edmonton)

Turbulent Flow and Its Mathematical Foundations
Turbulence et ses fondations mathématiques
Org: John C. Bowman, Xinwei Yu (Alberta)

Contributed Papers | Communications libres
Org: to be confirmed | à venire

Graduate Student Poster session
Présentations par affiches pour étudiants
Org: Thomas Hillen (Alberta)

In Memoriam / En mémoire

In Memory of Jerrold E. Marsden

We are deeply saddened by the death of Jerry Marsden, September 21 2010 at his home in Pasadena, after a battle with cancer. Jerry was a founder and true friend of the Fields Institute. He served as our first Director from 1992 to 1994, and organized several of our major programs over the years. Our prestigious Marsden Postdoctoral Fellowship is named in his honour.

Jerry Marsden was a friend and mentor of many people in the Canadian mathematics community and around the world. His ideas and inspiration will live in his mathematical works and those of his students and colleagues. A press release about Jerry and information about making donations in his memory can be found at www.cds.caltech.edu/~marsden/remembrances

Reprinted from the Fields Notes

Graham Wright Award for Distinguished Service
Prix Graham-Wright pour service méritoire

2011

In 1995, the Society established this award to recognize individuals who have made sustained and significant contributions to the Canadian mathematical community and, in particular, to the Canadian Mathematical Society. The award was renamed in 2008 in recognition of Graham Wright's 30 years of service to the Society as the Executive Director and Secretary.

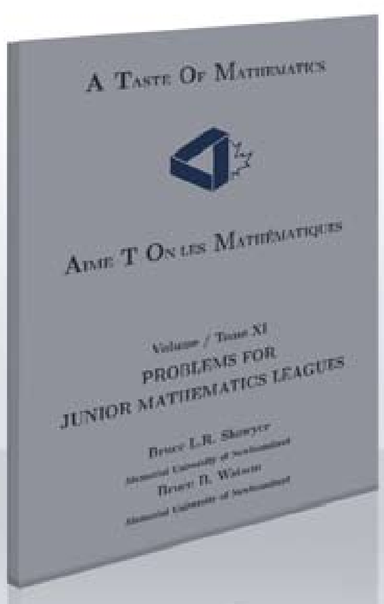
Nominations should include a reasonably detailed rationale and be submitted by **March 31, 2011**.

All documentation should be submitted electronically, preferably in PDF format, by the appropriate deadline, to gwaward@cms.math.ca.

En 1995, la Société mathématique du Canada a créé un prix pour récompenser les personnes qui contribuent de façon importante et soutenue à la communauté mathématique canadienne et, notamment, à la SMC. Ce prix était renommé à compter de 2008 en hommage de Graham Wright pour ses 30 ans de service comme directeur administratif et secrétaire de la SMC.

Pour les mises en candidature prière de présenter des dossiers avec une argumentation convaincante et de les faire parvenir, le **31 mars 2011** au plus tard.

Veuillez faire parvenir tous les documents par voie électronique, de préférence en format PDF, avant la date limite à prixgw@smc.math.ca.



NEW ATOM RELEASE!

A Taste of Mathematics (ATOM) Volume 11 – Problems for Junior Mathematics Leagues by Bruce L.R. Shawyer and Bruce B. Watson is now available. Order your copy today at **www.cms.math.ca**

NOUVEAU LIVRE ATOM!

Aime-T-On les Mathématiques (ATOM) Tome 11 – Problems for Junior Mathematics Leagues par Bruce L.R. Shawyer et Bruce B. Watson est maintenant disponible. Commandez votre copie dès aujourd'hui au **www.smc.math.ca**

LET ME TAKE IT DOWN
THE MATHEMATICS BEHIND THE MOST FAMOUS EDIT IN ROCK 'N' ROLL[1]

Jason I. Brown, Dalhousie University and Robert Dawson, St. Mary's University

The song *Strawberry Fields Forever* was a landmark in the musical landscape of The Beatles. Lennon[2] wrote the song while vacationing in Spain in 1966, and the fresh air must have done him good. A number of takes of the song were done in the studio. John was in a quandary after listening and relistening to the takes. He liked the first part of Take 7, and the second part of Take 26, and passed the problem of melding the two together onto the record producer, George Martin. Martin was in a bit of a fix, as the keys were different. Take 7 was in the key of A, while Take 26 was up a whole tone, in the key of B. A further problem Martin encountered was that the tempos of the two takes were different. Take 7 was at a tempo of about 85 beats per minute, while Take 26 was recorded at about 107 beats per minute.

Today, digital sound editing software allows anybody to change pitch and tempo independently. But in the 1960's, the state of the art was varispeed audiotape technology, which allowed the playback (or recording) speed to be selected precisely. A faster playback would increase both the pitch and the tempo of Take 7; slowing the tape would decrease both for Take 26. Could some combination of these be used to fix both problems?

To answer this question, we need to represent pitch and tempo in comparable fashions. Tempo is usually measured in beats per minute (BPM); it usually ranges from about 40 (a very slow beat) to about 200. The human ear cannot easily distinguish changes of less than about 7%; experiments have shown still lower sensitivities for increases in tempos below about 100 BPM. Apart from this, the

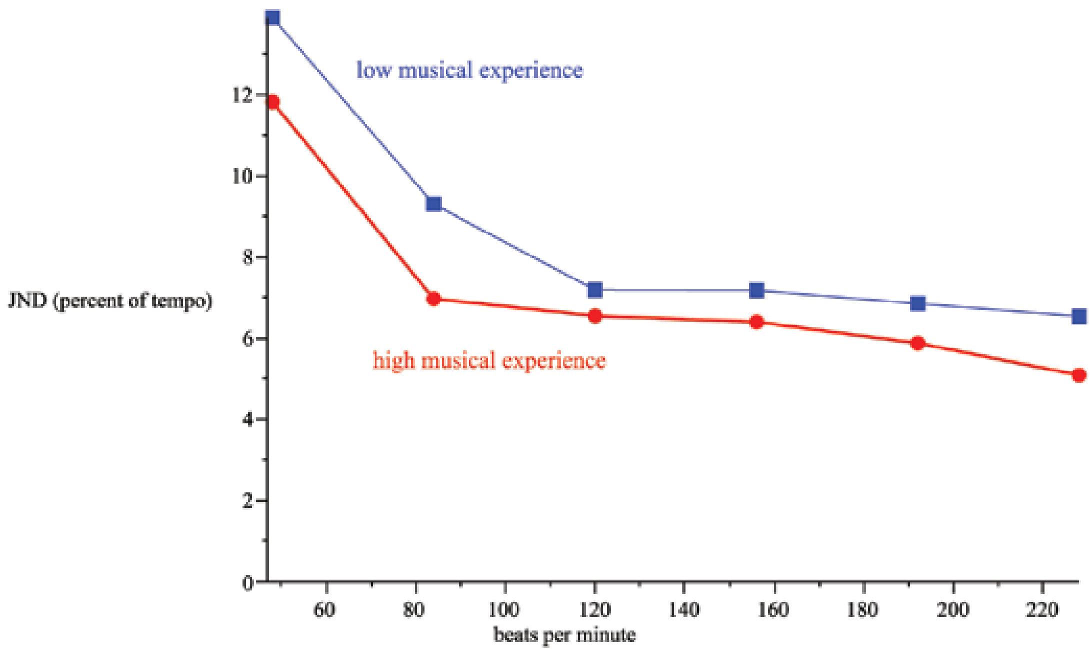


Figure 1: Just Noticeable Differences for Increasing Tempos (based on [1]).

"just noticeable difference" is roughly constant across moderate to fast tempos, with slight differences between experienced musicians and nonmusicians (see figure 1). Larger differences are also roughly proportional; the effect of putting triplets into a 4/4 beat is similar at any speed. We conclude, then, that subjective tempo is logarithmic.

While musicians usually represent pitch using note names and octaves, for scientific purposes it is more usefully represented in "frequency", measured in cycles per second. To a scientist, tempo is also a frequency, though much slower (much as radio, microwaves, light, and X-rays are all electromagnetic radiation). While a musician would not usually need to do it, tempo (in BPM) can be converted to pitch (in cycles per second) by multiplying by 60; dividing converts in the other direction. As with light and radio, the ranges do not really overlap; the lowest note on a piano, A0, corresponds to a dizzy 1650 BPM! (Speed drummers do approach this range.)

Musical intervals that we hear as identical at different pitches are not the same number of cycles per second wide; they represent the same ratios. In particular, an octave always represents a frequency ratio of

(1) We dedicate this article to what would have been John Lennon's 70th birthday this year.
(2) While John didn't excel in school when he was young, one of his favourite authors was Lewis Carroll, which was the pseudonym of Charles Lutwidge Dodgson, a mathematician. John's appreciation for the logical puzzles and word play in Carroll's books pops up in a number of Beatles' songs, most notably in *I Am The Walrus*.

2:1. A semitone (the difference in pitch between two adjacent keys on a piano keyboard) is always a ratio of $\sqrt[12]{2}^i:1 \approx 1.06$. So pitch perception, too, is logarithmic. Conveniently for George Martin, this means that if a tune is played back at a different (but constant) speed, the apparent intervals do not change, so it sounds like the same tune.

Interestingly, we discriminate pitch much better than tempo. The JND for tempo represents the same ratio as the easily-distinguished semitone interval. At some frequencies the human ear can distinguish notes a twentieth of a semitone apart or less, though again this deteriorates at low frequencies.

Moving frequencies up by *i* semitones (with *i* being positive when you move up and negative when you move down) corresponds to multiplying frequencies, and hence tape speed, by $\left(\sqrt[12]{2}\right)^i$. So, for example, to change the key of Take 7 from A to B, the tape speed would have to be multiplied by $\left(\sqrt[12]{2}\right)^2 = \sqrt[6]{2}$, which is about 1.12 (that is, 12% faster). Unfortunately, this doesn't get the tempo right! Speeding an 85 BPM track up by this ratio leaves it at about 95 BPM, still significantly slower than the 107 BPM of Take 26.

Because of the human ear's better pitch acuity, leaving some mismatch in the pitch in order to get a closer tempo match was (as George Martin realized) not an option. So what was there to do? In his book *All You Need Is Ears* [2], Martin wrote "I thought: If I can speed up the one, and slow down the other, I can get the pitches the same. And with any luck, the tempos will be sufficiently close not to be noticeable. I did just that ..." He moved Take 7 gradually up one semitone, starting from the beginning of Take 7 until the big edit point about 1 minute later, arriving at the key of Bb, and spliced in Take 26 at the appropriate point, down one semitone to the same key – a natural way to try to solve the problem by meeting in the middle. What happened to the tempos? The tempo of Take 7 moved up from 85 to $85 \cdot \sqrt[12]{2} \approx 90$ beats per minute, while Take 26 slows down from 107 to $107/\sqrt[12]{2} \approx 101$ beats per minute.

Not a perfect match, but close enough to fool many listeners. The change in tempos at the edit point, 11 beats per minute or about 12%, is over the just noticeable difference, which is approximately 9% at that tempo for most people (see figure 1). For more experienced and musical listeners, the just noticeable difference at that tempo is around 7%, and the change obviously bothered Paul McCartney [3], who has an impeccable sense of rhythm: "We could hardly hear the join, but its one of those edits where the pace changes slightly; it goes a bit manic for the second half of the song." Proportionally, it was just the same change as if Take 7 had been sped up by 12%, or Take 26 slowed down! Any change that makes the pitches match would leave the tempos differing by more than the JND.

Experimental data do suggest one solution — but not an artistically viable one. George Martin could have hidden the tempo difference if he elected to slow down the tapes more significantly, past the range of logarithmic response. If he had slowed one take by about an octave, and the other slightly more, the new tempo would have been around 43 beats per minute. For such slow tempos, the JND is much larger, and even Paul might not have noticed. Of course, then the song would change from a 4 minute song to one of 8 minutes, and indeed it would have felt like Strawberry Fields *Forever!*

So why did George Martin choose to move one take up one semitone, the other down one, when other choices would do? From reading his book, it seems most likely that he was happy to split the difference, key-wise, and the fact that the tempos were close was good enough. Sometimes luck and mathematics are both on the side of brilliant people.

I mean it must be high or low. That is, you can't, you know, tune in but it's all right.

That is I think it's not too bad.

Acknowledgements

This article was partially supported by a grant from the Natural Sciences and Engineering Research Council of Canada.

References

[1] M. Ellis, Thresholds of Detecting Tempo Changes, Psychology of Music 19 (1991), 164–169.

[2] G. Martin and J. Hornsby, *All You Need is Ears*, St. Martins Press, New York, 1979.

[3] K. Ryan and B. Kehew, *Recording the Beatles*, Curvebender, Houston, 2008.

DU BUREAU DU PRÉSIDENT *suite*

Que conclure, en particulier dans la perspective du plan à long terme du CRSNG ? La première chose est que nous avons utilisé les fonds qui nous ont été confiés de façon remarquablement efficace. Notre communauté s'est agrandie, et est désormais un acteur important dans le courant international du sujet; en bref, nous avons livré. Nous aurons besoin de plus de ressources- tous ces étudiants à nourrir, et toutes ces nouvelles carrières à développer. Nos institutions continueront à avoir besoin de soin et de maintien, et ceci n'est pas un acquis; MITACS, par exemple, arrive à échéance dans quelques années, dans la partie de son portefeuille qui subventionne les mathématiques industrielles. Finalement, une communauté de recherche en bonne santé présuppose une distribution assez large de fonds recherche- notre moteur doit avoir l'essence pour tous ses cylindres, pas seulement les cylindres numéro trois, quatre et six. Encore du pain sur la planche.

Richard Michael Kane, 1944-2010

Richard Kane passed away in London, Ontario on October 1, 2010. He was 66 years old, and the cause of his death was cancer. He is survived by his wife Jo-Ann, his son Michael, his daughter Jennifer, and his sister Margaret.

Richard Kane

Richard received his BA from the University of Toronto in 1967 and his PhD from the University of Waterloo under the direction of Peter Hoffman in 1973. In 2003, the University of Waterloo awarded him its Alumni Achievement Medal.

He is the author of the books The *Homology of Hopf Spaces* (North Holland, 1988) and *Reflection Groups and Invariant Theory* (CMS Book Series, Springer-Verlag, 2002). Both books are highly regarded expositions. He is the author of approximately thirty research papers on subjects in Algebraic Topology, and is well known for his results on torsion in the cohomology of Hopf spaces. His methods were varied, ranging from a deep study of Steenrod operations to applications of extraordinary cohomology theories.

In the course of his career, he held visiting positions at the Institute for Advanced Study in Princeton, Aberdeen, the Centre de Recerca Matematica and the Universitat Autonoma in Barcelona,the Max Planck Institute in Bonn, San Diego, Sydney, Singapore, and Vrije Universiteit in Amsterdam.

He was a full professor at the University of Western Ontario since 1983, and served two terms as the Chair of the Department of Mathematics. He was the recipient of the Faculty of Science Florence Bucke Prize (1988) and was named a Distinguished University Professor at the University of Western Ontario in 2008. He was a Fellow of the Royal Society of Canada and a Fields Institute Fellow.

Richard has a distinguished history of service to his university and to Mathematics in Canada.

Graham Wright says that "Richard was a remarkable colleague who will long be remembered by all of those who knew him. His outstanding record of service for the Canadian Mathematical Society spanned more than 20 years and demonstrated the considerable depth and breadth of his contributions to the Canadian mathematical community. He served as President from 1998 to 2000, Vice-president (1993-95), and was chair and member of the Society's Executive, Research, Finance, International Affairs, Nominating and Fund Raising Committees. He also served as an Associate Editor for the CMS Books in Mathematics Series, a series co-published with Springer-Verlag. Richard's gentle approach and ability to deal with complex issues with tact, diplomacy, thoughtfulness and respect for all those involved, meant that he was the person often sought after to handle matters in a courteous, efficient and productive manner. In 2006, his outstanding career and service to the Canadian mathematical community were recognized when he received both the David Borwein Distinguished Career Award and the CMS Distinguished Service Award. The Society has lost a most valued member."

Richard Kane possessed a strong serene integrity. He was a loyal, gracious and steady presence to his family, to his friends, to his colleagues, and to his students. He will be missed by all who knew him.

Richard Kane, by Kenneth R. Davidson, FRSC

Richard Kane suffered an untimely death, but he lived a rich and rewarding life, both personally and professionally. I knew him mostly in a professional capacity, going back to 1990 when we served together on the NSERC Mathematics Grant Selection Committee. Over the years, he was a rock on which the Canadian Mathematics community supported itself. I will recount a few of the major events of the time that placed Richard on the front lines.

Richard showed his true mettle during the volatile period beginning in early 1995 when the first NSERC reallocation review came back with very negative marks for Mathematics. This resulted in a huge outcry and the formation of a "war-cabinet" to mount a response. Early in 1996, after many communications with NSERC, a Liaison Committee (Jon Borwein, John Chadam, Nassif Ghoussoub, Steve Halperin and Jacques Hurtubise) met with NSERC officials in Ottawa. A number of things came out of that meeting and subsequent negotiations. A crucial outcome was that NSERC would finance a major international review of Mathematics in Canada. Richard agreed to be the point man on this operation. Together with NSERC, a panel was formed, headed by Jean-Pierre Bourguignon, the Director of the Institut des Hautes Etudes Scientiques in France. Richard arranged to pull together a huge amount of data, arranged for every strong group of researchers to put together a profile of their presence in Canada, compiled it all, organized the site visit, and produced the final report. The whole process took about a year from March 1996 to 1997.

As you can imagine, tempers flared and sharp words were spoken during this period. Many salvos were aimed at NSERC miles away, but there was by no means a consensus about how to proceed. Richard stood out as a calm but firm voice that could bring things back to order. He had the ability to positively strike peace when war raged around him. His demeanour was important to the stability of our community.

In 1997, it was time to produce a new reallocation document for NSERC. Who better to lead the charge than Richard Kane, who now knew the ins and outs of our community better than anyone? I recall working with him on that for months leading up to the January 1, 1998 deadline. The Mathematics community document was ready at the December CMS meeting, except for the fact that funding for the three Mathematics research institutes had to be included. This part of the budget was a serious bone of contention between the directors at the time, and PIMS was very new and was not yet funded by NSERC. Many long hours of work were required to find a compromise position, which was only reached at the eleventh hour. I remember compiling the final document and emailing it to NSERC on New Year's Day.

Richard continued to be a peaceful ambassador to the Mathematics community as President of the CMS from 1998–2000. The previous president had instituted a group of task forces to examine all aspects of CMS operations. In what must have been some sort of deja vu, it was left to Richard to shepherd these through to completion and decide how to act on the advice.

Richard's record is one of service. He served two stints as chair of his department. He chaired many committees of the CMS. He served on the NSERC GSC. In addition, he was a strong mathematician. He was elected a Fellow of the Royal Society of Canada in 1988. He wrote two books, "The homology of Hopf spaces" in 1998, and "Reflection groups and invariant theory" which appeared in the CMS book series in 2002. He received, and thoroughly merited, the very first David Borwein Distinguished Career Award in 2006. The same year, he received the CMS Distinguished Service Award.

I know that many of us mourn Richard Kane's passing. The Canadian mathematics community will surely miss him.

Remembering Richard Kane, by Joe Neisendorfer

Richard Kane was born on 27 June 1944 in Danbury, Connecticut. His father was American and his mother was Canadian. In 1947, his father died and his mother settled the family in Guelph, Ontario. He grew up there with dual citizenship but, in 1963, he chose Canada.

Few mathematicians knew that Richard Kane was a devout Catholic and had attended St. Augustine's Seminary in Toronto for one year. After he left the seminary, he completed in 1967 a BA in Philosophy and Mathematics at the University of Toronto. He then spent a year studying Philosophy at Cornell before he decided that Mathematics was his true calling. But he retained his faith and his interest in Philosophy, Theology, and History all his life. He was an avid reader. For the most part, he did not choose to read what was easy. Similarly, in Mathematics, he did not choose easy problems.

Richard's career began with post doctoral positions at MIT and Oxford. Then it became time to look for a permanent position.

I first met Richard when he, Clarence Wilkerson, and I were all candidates for the same position at Syracuse University. In its wisdom, Syracuse decided not to hire any of us. In those days finding a good permanent position was not easy.

Richard went on to a position at the University of Alberta in Edmonton. He felt isolated from colleagues in his field and he was very far from his family. He did not seem to fully appreciate the enormous opportunity for cross country skiing.

It was at this time that I got to know Richard well. We were both temporary members of the Institute for Advanced Study in Princeton. The Topology seminar there was run by the distinguished permanent member John Milnor, who was on leave at the time. The Institute needed someone to run the seminar for a year, and they chose two young undistinguished fellows to run it in his absence. Richard and I were thus given positions of responsibility at a world center of Mathematics. It was good for both of us and for our careers. I worked and slept late but I could always count on Richard to be alert and to introduce the speakers.

Richard and I always got along well. We never worked on the same problems and our techniques were very different. Nonetheless, our work was close enough in content that we could both appreciate and respect the other's work. After all, we both worked on aspects of torsion in Algebraic Topology.

Before I met Richard, he was described to me as a "good man". This meant that he was a strong mathematician doing good work. This judgment is very important to young people just starting out. Over the years, I was to learn how true this assessment was and also to learn that Richard was a good man in the other sense. He possessed integrity, responsibility, and generosity. This was all wrapped in his gentle good humor and good judgment.

Richard left the Institute to take up a position at the University of Western Ontario in 1980. It was to be his base for the remainder of his career. His appointment came about because of a review of the Mathematics department there. The review was led by the distinguished, strong opinioned, and insightful Frank Adams of Cambridge University. Frank said that the mathematics department needed to be strengthened in the then flourishing area of Algebraic Topology. He recommended that they appoint Victor Snaith to lead this development. Vic's first action was to hire Stan Kochman, now at York, and Richard Kane. Together they hired other strong people who made Western into a center of Algebraic Topology during the early 1980s. Rick Jardine, still there, and Paul Selick, now at Toronto, were among the first. Eddy Campbell was a young post doc there at that time.

Together with Steven Halperin at the University of Toronto and Ian Hambleton at McMaster University, these people led a blossoming of Algebraic Topology in Canada. They created the Ontario Topology Seminar which met regularly at various nearby locations, sometimes even outside of Canada at places like Rochester and Wayne State. Speakers and audience came from far and near to attend these lively and current talks.

Richard was very involved in the leadership of this seminar. He also was deeply involved with the Fields Institute, now in Toronto.

Fields of mathematics rise and fall in their level of activity. This is the natural result of two factors. Some central problems are solved and other problems may have demonstrated a too strong resistance to solution. If a gold mine has been worked for a while, then there are no more large nuggets which are easy to find. It is time to write a provisional summation.

Richard summed up the current state of development of his first main specialty in the his book "The Homology of Hopf Spaces". This excellent book is unfortunately out of print. It was written in the years before the existence of Tex, and would therefore require a little effort to republish it now. But it would be worthwhile to do so. It is not just an excellent description of a mature field. It also exposes many techniques which apply to the problems of today.

Sometimes a redirection is required in order to give new life. Richard was one of the first to realize this in his chosen field. Hence, he returned to the classical roots of his subject in the field of Lie groups and invariant theory. Among other things, he authored a splendid book "Reflection groups and Invariant Theory." It has appeared in a series published jointly by Springer and the CMS. I quote: "A clear exposition of a truly beautiful area of mathematics. ... This is a very lovely book to read."

It is worth mentioning that in writing this book, Richard has touched on the work of the very distinguished Canadian mathematician H.M.S. Coxeter. I know that Richard hoped to address some of the problems of his youth by connecting them with this classical work.

Richard's work was centered on the solution of central, deep, and difficult problems in his field. He combined that with the ability to write attractive, clear, and informative descriptions of extensive areas of mathematics.

When my parents were still alive, I would travel from Rochester to Chicago via Canada in order to spend Christmas with them. Often I would stop to visit the Kanes in London on my way. Sometimes I would plan to rush by without stopping. Many times I would phone and say: "Richard, I am stuck in a blizzard near Woodstock on the 401. Can I stop and spend the night?" The answer was always yes. I would receive a warm meal, good conversation, and a nice bed. In the morning, Richard would make coffee and, with a mischievous Canadian smile, offer me a maple or blueberry bagel.

After my parents died, I began to spend Christmas with the Kanes, Richard, his wife Jo-Ann, son Michael, daughter Jennifer, and sister Margaret. It has been a privilege to spend time with this wonderful family.

We will miss Richard's wise and gracious counsel.

In Memoriam of Richard Kane – Nassif Ghoussoub

Richard Kane passed away on October 1, 2010. He was a very dear friend, a friendship that was based on a common purpose of making Canadian Mathematics a major player on the international scene. His distinguished research career, his incredible dedication to the community over the last 25 years and his unique and defining role in its emergence over the last 15 years, makes our loss too difficult to bear. Many of us relied on his strong serene integrity, all the way till the last days of his life. I spoke regularly with him on the phone since he was diagnosed with cancer in January 2010, and I was utterly overwhelmed and humbled by the serenity and dignity with which he faced his last challenge. I later learned that he was the one who nominated me for the David Borwein Distinguished Career Award, and that he was planning to come to Vancouver for the ceremony in December 2010. A trip that he will not make, and an event that will prove difficult to celebrate without his gentle presence.

Richard was the very first recipient of the David Borwein Distinguished Career Award in 2006, and in my opinion, there is no Canadian mathematician more worthy of this award. It is a fact that our community has been blessed with a healthy number of mathematicians who have shown over the years a great deal of commitment and dedication to the development of our discipline, but Richard Kane holds a very special place in this elite group to whom we owe so much. This is because what Richard accomplished and did for the rest of us couldn't have been done by anyone else. More often than not, our community called upon him to lead and to serve because he was simply the only one that could. It is hard to find someone whose role was as indispensable as Richard's for the unity of our community over the years. The tasks were always ultra-sensitive and extremely delicate, but he never shied away when called upon. It is for the generosity of his spirit, for his great sense of loyalty to his community and for his unique contributions that we feel so acutely this enormous loss.

I first met Richard in 1990 while he was chairing the CMS Research committee striving to honour the best talent of Canadian mathematics, while at the same time chairing the Synge committee working hard to get more of them elected into the Royal Society of Canada. He had of course done his share chairing the math GSC at NSERC, chaired the math department at Western and was on his way to be the President of the CMS. Now many Canadian mathematicians did their share of this type of service for the community but there was to be only one person who could do what Richard did over the decade that followed. It was a period of unprecedented growth and successes, but the potential for divisiveness and chaos was great. It is during that period that Richard's contributions were the most defining and unique.

The international review of Canadian Mathematics (1995): Right after the first re-allocation exercise in 1994 when Mathematics suffered a humiliating last place among NSERC's supported disciplines, a liaison committee was struck to deal with the challenges of getting our community out of the situation. Ensuing discussions with NSERC led to the initiation of a comprehensive review of the state of Canadian Mathematics. The international committee was to have one Canadian resource to lead it through the various complexities of the Canadian landscape while handling the thorny issues created by NSERC's allocations report. I still remember vividly the exclamation of Steve Halperin: "there is only one person in Canada who can do this. It is Richard Kane".

The problem with Richard (or is it with Canada?) was that he got stuck over and over again being the only person capable of "doing the delicate missions" for the rest of us, and there were many to follow. His integrity, even-handedness and strong sense of fair play always made him the consensus candidate to any position requiring national leadership. He always obliged.

The second NSERC re-allocation exercise (1998): Soon after, our community was faced with the challenge of participating in the second re-allocation exercise. It was a distinctly sensitive moment in our community's history: How to recoup from the losses incurred in the first one? How to secure the funding for the two older institutes (Fields and CRM) while trying to make the case to fund a nascent one: PIMS? Regional interests were at a feverish pitch and the unknowns were threatening the unity of the community: Are we splitting a small pie in a zero-sum game, or will we be showcasing a dynamic community riding a great vision? Only Richard could lead the community to make its case, diligently, conscientiously and with his legendary fairness.

The third re-allocation exercise (2002): Successes followed and success often needs to be managed as delicately and seriously as failure, and who else but Richard Kane could lead us through the third re-allocation exercise in 2002. Here again, his methodical and steady hand was a key factor and our community (GSCs, institutes and statisticians included) was the big winner among twenty competing disciplines. Not an easy feat.

The Banff retreat (2004): In the fall of 2004, a three-day retreat was held at BIRS to discuss present and future priorities and directions for the Canadian mathematical sciences community. It was time to reflect on the times ahead and to anticipate future hurdles for our discipline. Richard understood fully the importance of the juncture. In the ensuing document, he wrote:

"The mathematical sciences community is now poised to build on its current achievements by making significant new contributions to the growing needs of Canadian society with respect to the mathematical sciences, an enhanced role, both nationally and internationally, for the Canadian mathematical sciences should be a major priority for governments, granting agencies and universities in Canada".

This was a glimpse of a forward looking document that I –as a junior partner– co-authored with Richard, a call for a new era for our community where we can all move forward together with new ideas and with a renewed sense of purpose. It was vintage Richard. He put his heart and soul in it, knowing very well the importance of the moment.

The latest NSERC-Mathematics interactions: Though clearly identified by the BIRS retreat — the new challenges to our community did not wait long to surface. NSERC is now restructuring and the resulting impact on our GSCs and institutes could be cataclysmic. It is time again to regroup and to coordinate our community's vision with NSERC's de-facto more bureaucratic approach. Richard is not around anymore to lead us out of another situation where conflicting interests, albeit institutional, regional or personal, can reverse all the gains of the last decade. But his spirit will hopefully prevail.

I shall miss the calm and stabilizing hand of Richard Kane. His exemplary life will always serve as my moral compass. My deepest condolences to his wife Jo-Ann, his son Michael, his daughter Jennifer, his sister Margaret, but also to the hundreds of his friends, colleagues and students.

Richard M. Kane, an appreciation of his mathematics, by John R. Harper

Richard Kane produced a substantial body of results in algebraic topology, with much of his work centered on the study of *H*-spaces. Recall that a topological space X with a basepoint e is called an *H*-space if there is a map $m : X \times X \rightarrow X$ such that both maps of X given by left and right translation by the basepoint e are homotopic to the identity map of X. This "multiplication" m is not assumed to be associative or commutative, even up to homotopy, unless specified otherwise. Much of Richard's work treats *H*-spaces where the space has the homotopy type of a finite complex, "finite-*H*-spaces".

This note focuses on that part of Richard's work that involves the torsion coefficients of homology, because there we find his most profound contributions. The report will fail to do justice to the influence of Richard's thesis advisor, Peter Hoffman or to the influence of an early collaboration with John Hubbuck. Nor will I discuss his excellent books.

To put this work in context, some background information may be helpful. Let me jump in with the work of Armand Borel on the algebraic topology of compact Lie groups. Here and throughout this note, I assume that spaces are simply connected. For finite *H*-spaces, this entails that they are 2-connected. Now the cohomology algebra over a field for any space is associative and commutative up to sign. Borel's structure theorem for any finite *H*-space asserts that the cohomology algebra over the field F_p with p an odd prime is isomorphic to the tensor product of exterior algebras on elements of odd dimension and truncated polynomial algebras on elements of even dimension, with the truncations occurring at heights a power of p. In particular, non-zero torsion coefficients require generators in even dimensions. There is a corresponding statement for $p = 2$. This result depends only on the existence of a multiplication. Moreover, it asserts nothing about the induced structure on homology, known as the Pontryagin algebra. Borel used his theorem together with his mastery of all the available structure to develop comprehensive information for all compact Lie groups. Of particular signicance for later work is the discovery that p-torsion in the homology of Lie groups forced non-trivial commutators in the Pontryagin algebra for odd primes.

Three other results from the 50's and early 60's should be mentioned because they frame the work to come. There is Raoul Bott's theorem that the integral homology of the space of loops on a compact Lie group is torsion free. There is J. Frank Adams' solution of the Hopf invariant one problem with the consequence that only spheres of dimensions 1,3,7 can support *H*-structures. There is William Browder's work on the Bockstein spectral sequence for finite *H*-spaces where much of the machinery that will inform finite *H*-space theory first appears, and where the connectivity result mentioned in the paragraph above is proved. But we cannot leave this era without mentioning that there was a sense among experts that perhaps the only finite *H*-spaces were those already known, Lie groups, the 7-sphere and certain quotients.

All that changed in 1968 when Peter Hilton and Joseph Roitberg discovered examples differing in homotopy type from the classical examples. Inspired in part by this work, the theory of localization for topological spaces came of age to produce hosts of new examples. Moreover, work by Alexander Zabrodsky, augmenting Browder's work, supplied a technique that was to be central to the next achievements.

In the wake of these discoveries, it was clear to many workers, including Richard, that the central problem was the "loop space conjecture", which states that the integral homology of the space of loops on a simply connected finite *H*-space is torsion free. With the aid of the Eilenberg-Moore spectral sequence, several people, including Richard, observed that for p odd, the absence of p-torsion in the homology of the loop space is equivalent to the statement that the even dimensional generators in the Borel structure theorem lie in dimensions congruent to 2 mod $2p$ and can be chosen to have the form

$$x_{2np+2} = \beta \circ P^n(x_{2n+1}) ,$$

where β is the Bockstein, P^n is the Steenrod operation, and subscripts indicate the dimensions of the generators. For $p = 2$, the absence of 2-torsion in the homology of the loop space is equivalent to the statement that there are no even dimensional generators in the mod 2 cohomology algebra of the H-space.

In these equivalent forms, the loop space conjecture for $p = 2$, was proven by Richard, and for p odd, it was proven by Jim Lin. In both results there are no assumptions made concerning the Pontryagin algebra.

This abrupt declaration does not do justice to the intense and independent efforts by both mathematicians; who nevertheless shared their work and absorbed each novel step with scrupulous acknowledgments, in an exemplary spirit of scientic integrity.

But Richard was not finished with the subject. In order to explain what comes next, let me bring in a refined statement of what was proved for p odd.

In addition to the even dimensions that can occur in the Borel structure theorem, we note that the number of odd dimensional generators is a homotopy invariant called the rank. This number is also the dimension of a maximal torus for a compact Lie group and equals the number of spheres in the rational homotopy type for any finite H-space. Let us write $d_j = 2(1+p+...+p^j)$ for twice the sum of the displayed consecutive powers of p and $e_{k,j} = d_j + p^{(j+2)} \times d_k, j,k >= 0$. Then it is proven that even generators are restricted to dimensions of the form d_j for j at least 1 and e_j,k for non-negative integers j,k. Generators of the d-kind are truncated at heights at most p^2 and those of the e-kind are truncated at height p. For the purposes of this report, I will call the d-dimensions with j not 1, and the e-dimensions with either j or k non-zero, "spurious". Thus the non-spurious dimensions are just $2p + 2$ and $2p^2 + 2$.

Here is what we know regarding spurious dimensions. For $p = 3$, Yukata Hemmi and Jim Lin prove that there are no generators with spurious dimensions assuming that the Pontryagin algebra is associative, and Lin goes on to classify the possible cohomology algebras over F_3. Of course Richards work is part of this story.

Richard looks at these dimensions in two ways. In the first, found in the three papers [1] he assumes that the generators in the Borel theorem can be chosen so that the mod p cohomology algebra, regarded now as an algebra over the Steenrod algebra, has the form $U(M)$, where M is a module over the Steenrod algebra and $U(M)$ is the universal algebra generated by M (in particular, if the generators are primitive, then the cohomology algebra has this form). Under this assumption he proves that no generators of the e-kind can occur and all truncations occur at height p. In the papers [2], [3] he examines the consequences if generators of the e-kind are present. For p at least 5 he proves that the rank must be at least $3/2p^2 - 7/2p + 4$, provided that the Pontryagin algebra is associative and truncations in cohomology are at height p. At the present time, for p at least 5, only dimensions $2p + 2$ occur in examples, but these occur for any prime p.

Richard's detailed results suggest the "spurious dimension problem", whether generators with even dimensions in the mod p cohomology algebra, p at least 5, of a simply connected finite H-space can occur only in dimension $2p + 2$. These deep accomplishments do not exhaust the supply of Richard's results for finite H-space theory. Recall the earlier remark concerning Borel's observation on torsion and commutators in the Pontryagin algebra. A general explanation was sought. First Browder, using the classifying space BG for the Lie group G, and then Zabrodsky, assuming only homotopy associativity of the multiplication, explained Borel's observation in general terms. Building on Zabrodsky's work. Richard proves in [4] that for p odd, the presence of p-torsion and a homotopy associative multiplication forces the rank to be at least $2p - 2$. This result informs the recent classication of p-compact groups (formerly known as mod p-loop spaces), by restricting the torsion coefficients to 2,3,5.

Borel's study of torsion in the homology of Lie groups includes the observation that non-zero p-torsion corresponds to the presence of non-toral elementary abelian p-groups E. These E are not subgroups of maximal tori. In the paper [5] written with Dietrich Notbaum, a general explanation is provided assuming the presence of a generator in dimension $2p + 2$. I think Richard expected that there is more to say on this topic.

A hallmark of Richard's research is his use of generalized cohomology theories. This work is not just a matter of grabbing low hanging fruit, but includes the development of novel features. The work appears in two memoirs [6], [7].

One of the main results in [6] is the theorem for arbitrary spaces with p-torsion free homology that if the Steenrod operation P^{p^k} acts non-trivially, then there is non-trivial action by each P^{p^j} for $0 \leq jk$. In the memoir [7], where Richard proves the mod 2 loop space conjecture, he also makes a new conjecture concerning Bockstein spectral sequences involving Morava K-theory and ordinary cohomology theory. This conjecture would have the full loop space theorem as an easy consequence.

Richard Kane has left a substantial body of results that are firmly in the minds of people working in the field. Moreover, tantalizing problems remain for which Richard's work represents the frontier.

Richard Michael Kane, 1944-2010 *continued*

References

[1] Richard Kane, *The cohomology of finite H-spaces as U(M) algebras I,II,III*. Math. Proc. Camb. Phil. Soc. Vol. 89 (1981) 473–490, Vol. 90 (1981) 113–125, Vol. 94 (1983) 461–471.

[2] Richard Kane, *Finite H-spaces and the U(M) property*. Amer. Math. Soc. Contemporary Math. Series, no. 37 (1985) 73–85.

[3] Richard Kane, *The homology algebra of Finite H-spaces*. J. Pure Appl. Algebra. Vol. 41 (1986) no.-2-3, 213–232.

[4] Richard Kane, *Torsion in homotopy associative H-spaces*. Illinois J. Math, Vol. 20 (1976) 476–485.

[5] Richard Kane, *Elementary abelian subgroups of Lie groups*. Publ. Res. Inst. Math.Sci. Vol.27 (1991) no. 5, 801–811.

[6] Richard Kane, *Operations in connective K-theory*. Memoirs Amer. Math. Soc. no. 254 (1981).

[7] Richard Kane, *Implications in Morava K-theory*. Memoirs Amer. Math. Soc. no. 340 (1986).

An afterword, by Rick Jardine

I knew Richard Kane for a very long time. I believe that I first met him at a conference at UBC in 1979, and then we worked together in the same department from the time that I came to the University of Western Ontario in 1984. In fact, I knew of him much earlier, because we were both students of Peter Hoffman at Waterloo in the early 1970s: he was a PhD student and I was working on a Master's degree. I don't recall meeting Richard then, probably because I was too caught up in the youth culture of the day to be bothered with other students. It appears, from pictures taken of Richard during that period, that we may have shared some attitudes.

When I finally got to know Richard after coming to the University of Western Ontario, it was immediately obvious that the man could be very funny in a dry, quiet way, and I came to think of him as the Bill Murray of Mathematics. I shall not forget coming into the Department one day, to the spectacle of Richard and Vic Snaith moonwalking backwards down the hall. For almost twenty years, whenever he saw her, usually at department parties, Richard would ask my wife how she was coming along with reading Vic's novel "The Yukiad"; she had read it years ago, but she would play along. The two of them always enjoyed some fiction.

The middle 1980s was an exciting period in our department, with the ferment in the topology group of the day: we would work hard, talk, argue, laugh, and drink together, and mount somewhat improbable joint expeditions to conferences. But the members of the group moved on, one by one, until Richard and I were the only topologists left at Western, up to about ten years ago. Richard and I did not occupy the same corner of Algebraic Topology, but I would ask questions of him now and then to tap into his vast storehouse of classical technique.

We had to grow up: Richard became Chair of the Department in 1989, then after five years under Peter Cass I became Chair, and then Richard became Chair again. Richard's first term as Chair seemed a bit bumpy to me at the time and we didn't always see eye to eye, but I was to learn later that being Chair is always bumpy if anything is getting done. Richard was a strong and steady supporter during my own term as Chair, and I reciprocated as best I could. We developed, over the years, the habit of periodic, rambling and often useful discussions on the state of the Department, or the goings on in Canadian Mathematics, or Life, the Universe and Everything.

Well, apparently we didn't cover all of the last bit: Richard and I shared a strong sense of personal privacy. The last time that I saw him was last Spring, just before I left for the West Coast. He was in good spirits, and we chatted for a little while. I asked him how he was, and got the typical Canadian "fine" response, but it was clear that there had been serious loss of weight. I expected to see him again — everybody did — but the end came swiftly.

I shall miss him.

Albert John Coleman
1918 – 2010

His father was a worker on the Canadian Pacific Railway and with the help of a scholarship John gained admission in 1935 to the University of Toronto. In 1938, the team of John Coleman, Nathan Mendelsohn and Irving Kaplansky gave Toronto the top score in the inaugural Putnam exam. Following that he obtained an MSc at Princeton (1940) and a PhD at Toronto in Relativistic Quantum Mechanics under the supervision of J.L Synge and then Leopold Infeld. He spent 10 years as Assistant and Associate Professor at Toronto, and in 1960 began his 20-year tenure as Head of the Department of Mathematics and Statistics at Queen's University.

Mathematics
From 1973 to 1975 he was the President of the Canadian Mathematical Society, and in 1995 he won its Distinguished Service Award. From 1973-77 he was a member of the Science Council of Canada and in 1975 he was the senior author of the Science Council Report (#37) on the Mathematical Sciences in Canada. Between 1974 and 1982, John was first Chairman and then Treasurer of the Commission on Exchange and Development of the International Mathematical Union (IMU).

When asked whether he was a mathematician or a physicist, John would reply that he was a quantum chemist. He published over 50 papers and gave lectures in Dublin, Princeton, Moscow, Leningrad, Jilin (China) Hong Kong, Shanghai, to name a few cities. He was made an Honorary Professor at the University of Shandong in Jinan, China. In the 1970's and 80's he was a leading player in the scientific exchange program between Canada and the USSR.

Mathematics Education
In the early 60's, John was senior editor of the Gage series of school mathematics textbooks which effectively brought the "New Maths" to Canada. One of the recommendations of his Science Council Report led to the establishment in 1977 (made "official" at the next meeting in 1978) of the Canadian Mathematics Education Study Group, the founding members being John, David Wheeler and William Higginson. CMESG is the envy of many from other countries who attend its annual meetings as it brings together university mathematicians and math educators, graduate students and teachers for 3-4 days of vigorous workshops and talks.

As a teacher, much revered by his students, he rambled over rich and beautiful and often chaotic worlds and then focused sharply on his point, leaving us to reconstruct the technical development. In this regard he was a true disciple of his mentor Alfred North Whitehead, whose Aims of Education was one of his bibles. [This extraordinary collection of essays, written in the 1920's, is more relevant today than it has ever been.]

Theology (the other bible).
In his undergraduate days, John was secretary of the Student Christian Movement at Toronto. From 1945-49 he was University Secretary of the World Student Christian Federation in Geneva, visiting 100 universities in 20 countries and writing a book on The Task of the Christian in the University. At that time he met his wife, Marie Jeanne de Haller, a Swiss Theologian, and a remarkably kind, gentle and wise woman, who died in 2006. In 1978 he was the only Canadian layman to participate in the Lambeth conference in Canterbury. [The big issue that year was the admission of women to the clergy.]

Starting in 1960, and for many years thereafter he ran a seminar at Queen's for 12 students in their second year. The summer before, we had the task of reading a number of books: Dostoyevsky, Crime and Punishment, J B Phillips Letters to young churches, Dietrich Bonhoeffer, Letters and Papers from Prison, and others, and during the year we met every second week at his home to take turns presenting papers on the books. It was an extraordinary and formative experience for all who were fortunate enough to take part.

The Man
John was a remarkable man. His idiosyncratic style, a child-like directness, distanced him from some but won the passionate allegiance of so many others. As a Head, he had a firm and open leadership style. As a colleague and a friend, he was generous with his time, a superb listener, and always interested in the tales that his companion had to tell. He was a devout man, with a strong faith in a just God. He even had a fine run as a politician, almost taking the Kingston federal seat from Flora MacDonald. In these uncertain, morally ambiguous times, I am struck by how much the world now needs people of his wisdom, clarity, and integrity. In the early morning of September 30th 2010, John died quietly in hospital in Kingston at the age of 92. The week before he had been keen to have a young undergraduate I had told him about come to his bedside so he could talk to him about Whitehead's theory of relativity.

Peter Taylor
Queen's University
October 21, 2010

CALENDAR OF EVENTS / CALENDRIER DES ÉVÉNEMENTS

FEBRUARY 2011 FÉVRIER

7 – 12 Complex Geometry – Extremal Metrics: Evolution equations and stability (CIRM, Marseille, France)
www.latp.univ-provence.fr/geom2011/index.php/welcome/week2

14 – 19 Workshop on Mathematical Methods in Quantum Mechanics (University of Padova, Bressanone, Italy)
www.mmqum.unimore.it

25 – Mar 5 The Homotopy Interpretation of Constructive Type Theory (Oberwolfach, Germany)
www.mfo.de

MARCH 2011 MARS

2 – 5 Integration, Vector Measures and Related Topics IV. Dedicated to Joe Diestel (University of Murcia, Murcia,Spain)
www.um.es/beca/Murci2011/

14 – 19 International Conference on Operations Research (Kowloon, Hong Kong)
www.iaeng.org/IMECS2011/ICOR2011.html

17 – 19 The 45th Annual Spring Topology and Dynamical Systems Conference (University of Texas at Tyler, Texas)
www.math.uttyler.edu/sgraves/STDC2011

21 – 25 AIM Workshop: Hypergraph Turan Problem (AIM, Palo Alto,CA)
http://aimath.org/ARCC/workshops/hypergraphturan.html

28 – Apr 1 International workshop: Unlikely intersections in algebraic groups And Shimura Varieties (Scuola Normale Superiore, Pisa, Italy)
http://aimath.org/ARCC/workshops/zilberpink.html

APRIL 2011 AVRIL

2 – 3 Midwest Graduate Student Topology & Geometry Conference (Michigan State University, East Lansing, MI)
mathchair@math.msu.-edu

11 – 15 Arithmetic Statistics (MSRI, Berkeley, CA)
arithstat@msri.org

18 – 22 Computational Statistical Methods for Genomics and Systems Biology (CRM, Montreal, QC)
www.crm.umontreal.ca/Stat2011/

MAY 2011 MAI

1 – Aug 31 MITACS International Focus Period on Advances in Network Analysis (locations in Canada)
www.mitacsfocusperiods.ca

2 – 4 Statistical Issues in Forest Management, (Laval, QC) (CRM, Montreal, QC)
www.crm.umontreal.ca/Forest11/index-e.php

9 – 13 Causal Inference in Health Research (CRM, Montreal, QC)
www.crm.math.ca/Stat2011/en

16 – 19 Analysis of Survival and Event History Data (CRM, Montreal, QC)
www.crm.umontreal.ca/Stat2011/

16 – 19 SIAM Conference on Optimization, (Darmstadt, Germany)
www.siam.org/meetings/op11

25 – 28 6th International conference on Dynamic Systems (Atlanta, GA)
www.dynamicpublishers.com/icdas6.htm

JUNE 2011 JUIN

3 – 5 **CMS Summer Meeting**
University of Alberta, Edmonton, AB
www.cms.math.ca

7 – 9 **4th International Workshop on Symbolic Numeric Computation (San Jose, CA)**
www.cargo.wlu.ca/SNC2011/

16 – 18 Lorenz Geometry in Mathematics and Physics (Strasbourg, Fr)
www-irma.u-strasbg.fr/article1044.html

22 – 25 26th Annual IEEE Symposium on Logic in Computer Science (Fields Institute event at the University of Toronto)
www.fields.utoronto.ca/programs/scientific/10-11/lics11

19 – 25 49th International Symposium on Functional Equations (Graz, Austria)
jens.schwaiger@uni-graz.at

JULY 2011 JUILLET

4 – 10 Conference on Topology and its Applications (Islamabad, Pakistan)
icta@comsats.edu.pk
http://ww2.ciit-isb.edu.pk/math

26 – 29 Harmonic Analysis and PDE (Eric Sawyer) (Fields Inst., Toronto, ON)
www.fields.utoronto.ca/programs/scientific/11-12/PDE/

SEPTEMBER 2011 SEPTEMBRE

7 – 9 IMA Hot Topics Workshop: Instantaneous Frequencies and Trends for
Nonstationary Nonlinear Data (Minneapolis, Minnesota)
www.ima.umn.edu/2011-2012/SW9.7-9.11/

19 – 23 IMA Workshop: High Dimensional Phenomena (Minneapolis, Minnesota)
www.ima.umn.edu/2011-2012/W9.19-23.11/

OCTOBER 2011 OCTOBRE

IMA Workshop: Large Graphs, Modeling, Algoritms and Applications (Minneapolis, Minnesota)
www.ima.umn.edu/2011-2012/W10.24-28.11/

Tarifs et horaire 2011 Rates and deadlines

Deadlines for receipt of material are as follows / Les dates limites pour la réception des annonces sont les suivantes

Issue date/ date de parution	Content deadline / Date limite pour contenu
February / février	December 1 / le 1 décembre
March/April / mars/avril	January 28 / le 28 janvier
June / juin	March 30 / le 30 mars
September / septembre	June 30 / le 30 juin
October/November / octobre/novembre	August 30 / le 30 août
December / décembre	September 29 / le 29 septembre

Net rates / tarifs nets	Institutional Members / Library Membres institutionnels / Bibliothèques	Corporate Members Membres Organisationels	Others/Autres
Full page / page complète	260.00	485.00	645.00
3/4 page	240.00	445.00	595.00
1/2 page	160.00	295.00	395.00
1/4 page	95.00	175.00	235.00
Back cover	325.00	615.00	815.00
Inserts	195.00	375.00	495.00

For more than 4 pages, or for the printing and inserting of camera ready material, please send a sample to the CMS Notes for a quote.
Surcharges apply for prime locations - contact `notes-ads@cms.math.ca`. Subscription to the Notes is included with the CMS membership. For non-CMS members, the subscription rate is $82 (CDN) for subscribers with Canadian addresses and $82 (US) for subscribers with non-Canadian addresses.

Pour plus de 4 pages, ou pour l'impression et l'inclusion d'une copie prête à la reproduction, veuillez envoyer un exemple aux Notes de la SMC afin d'obtenir un estimé.
Des suppléments sont applicables pour des places de choix - communiquer avec `notes-ads@smc.math.ca`. L'adhesion à la SMC comprend l'abonnement aux Notes de la SMC. Le tarif d'abonnement pour les non-membres est de 82 $ CDN si l'adresse de l'abonné est au Canada et de 82 $ US si l'adresse est à l'étranger.

If undelivered, please return to:
si NON-LIVRÉ, prière de retourner à:

CMS Notes / Notes de la SMC
209 - 1725 St. Laurent Blvd
Ottawa, ON K1G 3V4 Canada