QUEEN'S MATHEMATICAL
COMMUNICATOR
FALL 2019
An aperiodical issued by the
Department of Mathematics and Statistics
Queen s University, Kingston, Ontario, Canada K7L 3N6

WELCOME FROM THE HEAD, JAMIE MINGO

This Fall the Department will begin a search for a new faculty member in data science and statistics. While many faculty members already research and teach in areas that impinge on data science this appointment will sharpen the Department's focus on this exciting new field. New applications of statistics and mathematics are always arising and the Department is always evolving to lead our students, both graduate and undergraduate, into these new realms.

Another enhancement to our student experience will be the opening of the Professor A. John Coleman Undergraduate Lounge on October 19th this year. This has been made possible through the very generous gift of Tom Higgins (ArtSci '79). The Coleman Lounge will be a space for Arts and Science students in Mathematics and Statistics to study and collaborate.

This year we welcome two new faculty members Dr. Giusy Mazzone and Dr. Yanglei Song. Dr. Mazzone works in fluid dynamics and will add to our thriving Mathematics and Engineering program. Dr. Song works on sequential analysis and will join our statistics group which has seen strong growth in its enrolment in recent years. There is more on the work of Drs. Mazzone and Song in this issue.

We also welcome Jeananne Vickery as our new Department Manager. She replaces Claire O'Brien who provided excellent service to the Department for the last two years and is now working in the Arts and Science Faculty Office.

One of our younger faculty members, Dr. Bahman Gharesifard, has had a very successful year. He received the CAIMS-PIMS Early Career Award. This prize is awarded jointly by the Canadian Applied & Industrial Math Society and the Pacific Institute for the Mathematical Sciences. Dr. Gharesifard also received a Humboldt Research fellowship from the Alexander von Humboldt Foundation.

Congratulations to Mathematical Physics (MAPH) student Erin Crawley who won the Governor General's Academic Medal for the highest academic standing in a Bachelor degree program at Queen's in the June graduation. Congratulations to Prof. Ram Murty who was awarded the designation of Distinguished University Professor earlier this year. Professor Murty also received the 2018 Award for Excellence in Graduate Student Supervision.

This year marks 50 years of service of Prof. Peter Taylor to the Department. We have all been impressed by Peter's dedication to the Department and the University. Peter has served as Head of Department and is our incoming Undergraduate Chair for Arts and Science. Peter has written a reflection on his years at Queen's for this issue.

We have just finished hosting the Canadian Undergraduate Mathematics Conference. This is an annual meeting organized by and for undergraduate mathematics students. Students gathered here from across Canada to present their research and hear the work of others. We will have a full report in our next issue.

It is with sadness that I have to report the death of Malcolm Griffin in November 2018. We have an article on Malcolm in this issue.

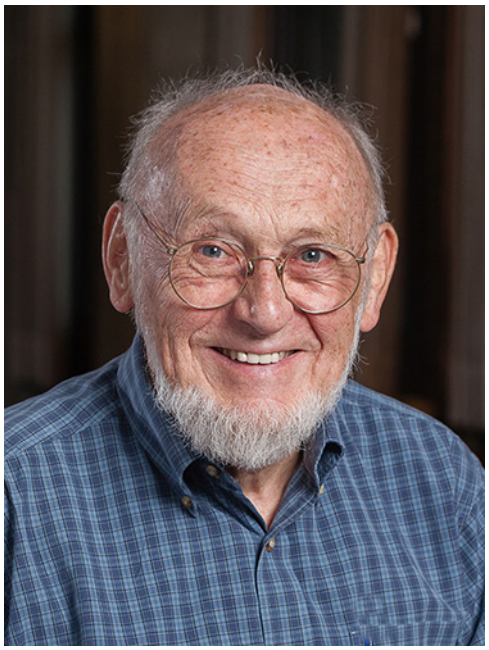
FEATURE ARTICLE: DAVID THOMSON

David's retirement was celebrated at a Canadian Statistical Institute Workshop held at Queen's University in August 2018. With the title Modern Spectral Methods in Time Series Analysis: Applications in Physical Science, Environmental Science, and Computer Modeling, the workshop showcased the work of David's collaborators and students over a period of some 50 years. The sessions featured speakers who have developed methodology and applications of spectral methods in time series analysis in areas including Seismology, Oceanography, Stellar Physics, Geophysics, and Environmental Science.

Wenyu Jiang presenting flowers to David with Maja-Lisa at his side

DAVID THOMSON AND HIS MULTITAPER METHOD

By Bob Erdahl



From the very start, David Thomson was fascinated by the miracle of modern communications. As an undergraduate at Acadia, David had a fortunate perch from which to follow this interest; he had a part-time job in Acadia's Physics library. From this vantage point, he developed his interests in probability theory, statistics, and communications theory. He gained some familiarity with Tukey's tapering method for the power spectrum of a time series, a topic that made a deep impression, and would later serve to motivate the creation of David's greatest legacy, the multitaper method. He pondered about how the multitude of signals on the communications network, could faithfully be decoded at the receiver end to recover the content encoded earlier, many thousands of miles away.

After graduating from Acadia in the Spring of 1965, David applied for, and got a job at Bell Labs at Murray Hill, New Jersey.

He initially was assigned to work in a group that was studying wave guides; his other assignment was to apply for graduate studies at Brooklyn Polytechnical University, and get a PhD in communications theory.

Throughout the early part of David's career, Bell Labs was developing cell phones, a project that was started many years earlier, but had not yet been able to produce a commercially viable product. By the mid-seventies a prototype had been produced and was undergoing field trials in Chicago. Many difficulties were uncovered during the trials, including: dropped calls, unreliable reception of calls, unreliable switching so that signals are directed toward their final destinations. The phones themselves were bulky, weighing about ten pounds, and designed to be mounted inside a car; there was an additional box mounted in the trunk bringing the total weight to over thirty pounds.

With hopes that a final push would turn the Bell cell phones into a reliable product, David joined the cell-phone group in 1977; he stayed with the group until 1984 when the bulky prototype finally became reliable.

By 1984, David had his name on six patents that represented key steps in achieving this success.

These patents were all on components of circuit boards neatly stashed in the small structures, the cell sites, located at the base of cell towers; David's innovations have remained as basic components of the cell sites where the magic of cell phones recurs with each incoming call. With David's innovations, the cell phone project was brought to a successful conclusion (of the 26 Bell patents on which David has his name, often as the sole inventor, twelve are on components of the cell-phone system).

It is in the cell-sites at the base of the towers, that the signals broadcast by the numerous cell phones within a twenty-mile radius, are digitalized and sent on their way along the telephone network. The problem is that there are thousands of incoming signals that must be identified, and associated both with their sending cell-phone, and with their ultimate destination along the network; this identification problem is difficult because these signals are typically corrupted by bending around buildings or other obstructions, or interfered with by other incoming signals. The problem of signal identification is resolved by distinguishing each signal separately through the characteristics of its power spectrum (frequency spectrum); this must be accomplished with little effort.

The analysis that David used to identify signals through the power spectrum, was further developed, and summarized in his multitaper method, described in his 1982 paper "Spectrum Estimation and Harmonic Analysis" in the IEEE Proceedings.

The multitaper method was partially motivated by Tukey's tapering method, and is also a broad generalization of this method. The multitaper method partitions the power spectrum into components, and these individual components can be interpreted. Interpreting these components is of course a challenge to the user, but also adds to the importance and strength of the method. The components serve as a signature of the signal, as in the case of the identification problem for incoming calls in the cell phone case, or, can be used to physically interpret a part of the signal as in the two cases described below. The multitaper method is one of David's greatest legacies; it has become a standard tool in the analysis of the power spectrum of a time series.

A program for the multitaper method is now a part of MatLab.

In the period 1983 to 2000, David involved himself in climate research, and was able to give the first statistical proof of global warming in 1997. This involved a thorough understanding of several temperature records, one being the Central England Record which stretched back to 1659. To achieve the desired accuracy attention had to be paid to minute details; the Central England Record had to be corrected to accommodate the switch from the Julian to the Gregorian calendars in 1752.

One of the components accompanying the multitaper analysis showed a linear trend, and this component could be identified with the accumulation of CO2 in the atmosphere following the Industrial Revolution. It is this particular component that played the star role in establishing that the Earth is warming.

Studying the vibrational modes of the sun is another line of investigation, and is on-going. David has investigated two types of vibrational modes, namely the p- and g-modes; the p-modes are the vibrations on the surface of the sun, and can be observed optically as storms. The other g-modes occur deep in the dense core of the sun, where the most energetic reactions are taking place; these cannot be observed optically. Both of these modes have been observed indirectly, and in a reliable and spectacular way – through a detailed study of the vibrations of the earth! This required the analysis of seismic data provided by the seismologist Frank Vernon of the Scripts Institute; Frank had records from an extremely sensitive instrument that he constructed by connecting an array of seismological instruments. It was the background "noise" from this instrument that David and Frank analyzed. A multitaper analysis of this noise produced components with characteristics that looked suspiciously like those for both the g- and the p-modes. The mechanism by which the vibrations present in the sun reappeared in the background "noise" of a seismic record is remarkable. The charged particles streaming out of the sun, the "solar wind," carried these vibrations to the ionosphere surrounding the earth, which in turn coupled to the magnetic pole of the earth, which caused minute vibrations of the Earth appearing in the background noise"– a most remarkable mechanism.

Also, a most remarkable alliance between experimental and theoretical science, the supersensitive instrument of Frank Vernon's combined with the multitaper method of David's. David and Frank have been long-term collaborators.

The multitaper method – a remarkable contribution made by a remarkable scientist.

Department News

Bahman Gharesifard

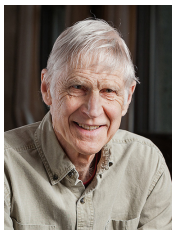
Bahman Gharesifard was awarded the 2019 CAIMS/PIMS Early Career Award in recognition of his cutting edge work on the advancement of theory in the network sciences, and for novelty and breadth in applications in social, biological, and economic networks. Bahman received a prize of $1,000 and delivered a plenary lecture at the CAIMS Annual Meeting in June. CAIMS is the Canadian Applied and Industrial Mathematics Society. Bahman's research interests lie within the areas of systems and controls and intersects with network sciences and graph theory, stochastic processes, algorithm design, machine learning, social and economic networks, and game theory.

Ram Murty

Ram Murty has been named a Distinguished University Professor . The award is Queen's highest research-related honour and this year was given to nine faculty members. It celebrates an outstanding and sustained research record, teaching excellence, and significant and lasting contributions to Queen's, Canada, and the world.
Ram has also received the 2018 Award for Excellence in Graduate Student Supervision. Over the course of his 20-year career at Queen's, he has mentored 26 master's students, 21 PhD students and more than 23 post-doctoral fellows. The caliber and competence of his guidance is attested by the fact that two of his PhD students won the Canadian Mathematical Society doctoral prize and a third received the Governor General's Academic Gold Medal for his doctoral thesis. Ram's mentorship has helped his students to go on to have successful careers in academia, industry, and the public sector. Beyond this, he is credited for deeply and positively shaping his students' lives.

Ram Murty receiving his award at Convocation June 2019.

Three Queen's Math professors have been named Fellows of Canadian Mathematical Society



Congratulations to **Ram Murty**, **Greg Smith** and **Peter Taylor** who were placed on the list of 49 inaugural Fellows of the Canadian Mathematical Society. The Fellows Program was instituted to recognize mathematicians who have made very significant contributions to the profession and to the CMS, particularly through research, teaching, or exposition.

Alan Ableson

As part of a Multidisciplinary Blended Learning Statistics Team, **Alan Ableson** has received a **Curriculum Development Award** for the development of a statistics course that could serve students in Math & Stats, Biology and Psychology. In addition to gaining efficiencies, this presented an opportunity to rethink how statistics was taught relative to contemporary and evidence-based pedagogy. The course is delivered using blended learning with a focus on active learning. The multidisciplinary course was developed and is delivered using a collaborative team-based approach. The team includes faculty members from multiple departments, an instructional designer, a learning management specialist, multimedia specialists and undergraduate and graduate assistants. Students are first guided through statistical concepts with interactive online materials, followed by attending a weekly lecture and face-to-face tutorials where they work in small groups to solve problems using data from real case studies. Importantly, the course emphasizes instructor-learner interaction through weekly tutorials where instructors lead and facilitate groups working on 'real-world' problems, and Monday-Friday drop-in help sessions with faculty.

THE LORNE CAMPBELL LECTURESHIP

Last November saw the first in a lecture series named in honour of Lorne Campbell, emeritus professor in the department. This was made possible by a generous donation from alumnus Vijay K. Bhargava, Professor of Electrical and Computer Engineering at the University of British Columbia.

The inaugural lecture was delivered by Dr. Frank Kschischang's, Distinguished Professor of Digital Communication at the University of Toronto. Dr. Kschischang's topic was the Mathematics of Modems, and he reviewed the theory and development of error-correcting schemes, now found in virtually all our modes of communication today.

Dr. Kschischang

At Dr. Kschischang's lecture. Lorne Campbell appears in the third row at the right-hand side.

WE WELCOME TWO NEW MEMBERS OF FACULTY

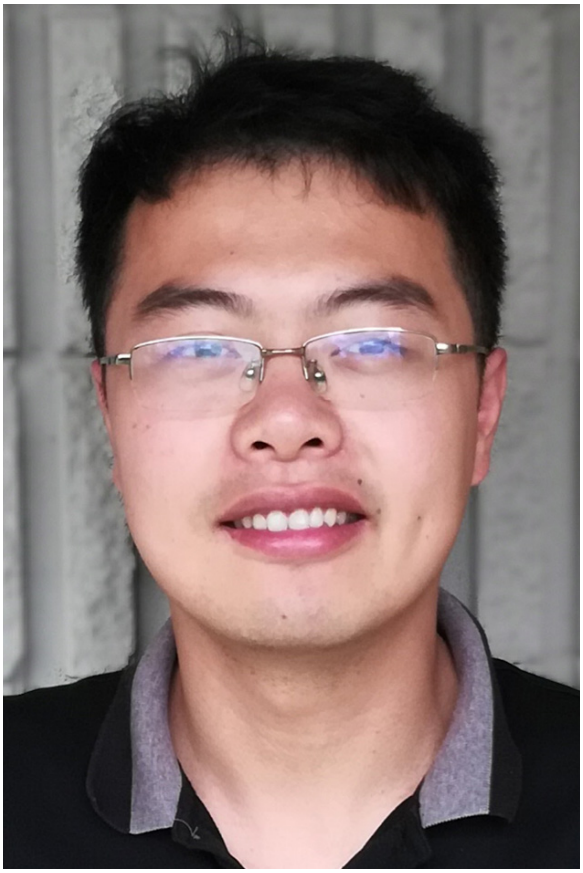
GIUSY MAZZONE

Giusy Mazzone was appointed Assistant Professor on July 1, 2019. She graduated from Università degli Studi di Bari, Italy, with a BSc and a Master degree in Mathematics. Giusy received a PhD in Mathematics from Università del Salento, Italy, and a PhD in Mechanical Engineering from the University of Pittsburgh, USA. She then joined Vanderbilt University as Assistant Professor of Mathematics (NTT).

Giusy's research focuses on the analysis of partial differential equations and their applications in fluid mechanics and mathematical physics. In the past few years, she has investigated several aspects of fluid-solid interactions. Current research projects involve the study of the Navier-Stokes and Euler equations and of geophysical problems aimed at describing the mechanisms within Earth's interior that generate the geomagnetic field (geodynamo).

One of Giusy's past projects focused on a phenomenon observed by Russian scientist, mathematician and engineer N.Ye. Zhukovskii. In 1885, Zhukovskii stated that a viscous incompressible fluid enclosed in a rigid body (e.g., a gyroscope, spinning top or pendulum) has a stabilizing effect on the motion of the solid: it suppresses wobbling motions (like precessions and oscillations) of the solid. Giusy and her collaborators have mathematically proved the truthfulness of Zhukovskii's statement. Their results are also supported by numerical and experimental tests.

Outside of math, Giusy enjoys reading novels. Her favorite readings are classics and historical mystery novels from the 19th and 20th century. Giusy's other diversions are photography, performing arts and music.



YANGLEI SONG

Yanglei Song was appointed Assistant Professor at Queen's University on July 1, 2019. Yanglei graduated from Tsinghua University (Beijing, China) with a B.E. in Electronic Engineering and received M.Sc. in Mathematics and Ph.D. in Statistics both from the University of Illinois. His research mainly investigates statistical problems where the data are collected sequentially over time. Specific projects include sequential hypothesis testing, quickest change detection, and multi-armed bandit problem. He is also interested in high dimensional statistics, in particular, distribution approximation for high-dimensional U-statistics and suprema of U-processes.

Outside Statistics and before the birth of his daughter, he enjoyed hiking, travelling and movies.

PETER TAYLOR LOOKS BACK 50 YEARS

This past summer I celebrated my 50th year as a professor in the Math&Stats Department. I feel hugely privileged to have been able to spend so many years in such good work with so many good colleagues.
I began this journey at Queen's as a Math/Physics major (Art's 65), got a Harvard PhD in pure math, and returned to Queen's in that famous summer that the undergrads occupied the administration building in Harvard Yard, that my first daughter Kate was born, that Jeffery Hall opened its doors, and that we stepped onto the moon.

And now the times are changin'.
Look at everything that's come and gone.
Sometimes when I play that old six-string.
I think about you, wonder what went wrong.

(Bryan Adams, 1984, Summer of '69)


The Globe and Mail

CANADA LIFE

MAN ON MOON

'The Eagle has landed'

Neil Armstrong takes first step

APOLLO 11 LANDING SITE

Luna orbits nearer moon

Over the years my interests have journeyed through the valleys of animal behavior and evolutionary game theory and over the rugged mountains of secondary school math curriculum change. In all parts of this journey my faithful guide has been the power and beauty of mathematics itself.
Over the past few years an increasing amount of my time and energy has been devoted to the nature of curriculum itself, and when I wonder, as did Bryan Adams, "what went wrong", I think about both the structure and the objectives of the current curriculum model. In terms of the structure I want a curriculum that is more project-oriented based on what might be called sophisticated works of art, more like curricula in English or the creative arts. In term of objectives I think that we have been too much affected by the crazy "Math Wars" debate at the elementary school level, so that our focus has been overwhelmingly technical and we have lost the real nature of the discipline which is engaging, human and collaborative.
Interestingly enough when I use that word "collaborative" folks often respond by claiming that they can't really do math "with their neighbor" that they always hated that "group-work" part of the course, that they needed to be able to think on their own. Well in many ways that's true for me as well but that's only one piece of the process of doing mathematics. When I talk about projects, my favorite analogy is to a group of drama students preparing to mount a sophisticated production. There are lots of different kinds of activity and these can involve a wide variety of background and ability. I think a pretty good model for that was the "math and poetry" course, IDIS 303, that I co-taught for 20 year, first with Bill Barnes, and then after he died, with Maggie Berg.
The challenge for my curriculum team over the next few years is to construct a curriculum of this kind for grades 9-12 that meets the technical expectations laid out in the Ministry guidelines. A recent article describes the objectives of this project. Details are found at rabbitmath.ca.

Peter at the Queen's "long service" dinner with his guests (L to R) Michaila Landon-Brace (Math&Engineering '19), Marnie Landon (Math '81) and Andie Burazin, Assistant Professor, Teaching Stream, University of Toronto Mississauga.

2019 GRADUATES

Arts and Science - Mathematics and Statistics 2019

Mathematics and Engineering 2019

ERIN CRAWLEY BSC 2019 MATHEMATICAL PHYSICS

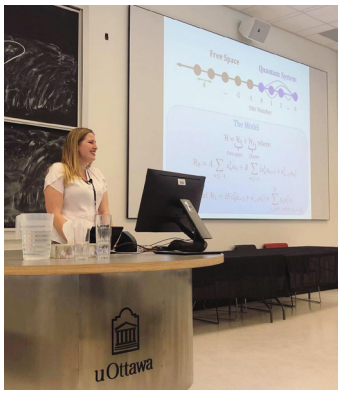
At convocation, Erin received The Governor General's Academic Medal for the highest academic standing in any Bachelor degree program at Queen's, The Prince of Wales Prize for the highest academic record in the Arts and Science BSc program, the Medal in Mathematics and Statistics, and the Medal in Physics.

Erin writes: "When I look back on my time at Queen's, one of the most meaningful parts has been the warm spirit of camaraderie and collaboration within the Math and Stats department. On our first day of Greg Smith's linear algebra course, students were actively encouraged to work with others and cite them as collaborators on homework assignments. From the beginning, this set the tone that mathematics is inherently collaborative, and it emphasized how much students could learn from each other.

As I progressed through my degree, it remained very easy to connect with others over the shared goal of finding an elegant solution to a problem. This idea extended to my research and teaching pursuits as well. Over my four years at Queen's, I taught in both the Physics and Math Help Centre, where I helped students implement group problem solving and discussion. Through this, I saw students gain understanding, problem-solving tools, and often a newfound appreciation for the subject. In turn, I was able to develop new perspectives and tools from teaching students.

The benefits of collaboration have also stayed with me through several research experiences. While many aspects of research need to be driven by the individual, I found discussions with supervisors and classmates to be invaluable in developing the skills to effectively communicate ideas, whether it be an informal discussion or conference presentation. And, when I reached a tough spot, I found that picking up a piece of chalk and talking through the sticking points with others was often the best way to find the answer – or to determine if you're asking the right questions in the first place!

Next year, I will be starting a PhD program at Harvard University, to pursue Quantum Gravity research. I am excited to bring the spirit of collaboration instilled in me at Queen's to this new, challenging environment."



Erin giving a talk at the University of Ottawa

At convocation: From left to right, Joshua Margles, Lily Summers, Nour Moustafa-Fahmy, Erin Crawley, Anna Jaroszynski and Daniel Cloutier.

MEDAL IN MATHEMATICS & ENGINEERING

EDWARD (TED) BURSEY

Awarded to the student in the program with the highest academic standing.

Following my graduation from Queen's, I will be joining Boston Consulting Group in Toronto as an Associate. I was introduced to consulting through recruiting events for engineers on campus and I was further motivated to apply after conversations with Queen's Engineering - and Apple Math - alumni. My goal as a consultant is to take my math and engineering problem-solving skills and understand how they can be applied to business opportunities.

As for my long-term goals, I am happy to see where my current role at BCG takes me. I would like to spend time exploring different industries and developing my professional skills before diving into something else. I have been considering the possibility of one day completing an MBA abroad -- as a chance to both learn the fundamentals of business and explore a new part of the world. Between now and then, I hope to spend time traveling and staying active.

I only have great things to say about my time at Queen's. I choose Queen's Engineering because I was unsure of which engineering path to take. The first-year program gave me insights into different disciplines and allowed me to choose the discipline that best suits my skills. The Mathematics and Engineering Program allowed me to learn alongside the brightest students from top professors, all while keeping my options open after graduating. The friends I've made in the Applied Math program pushed me to try my hardest academically but also encouraged me to have fun and take breaks. While difficult and sometimes even stressful, the Applied Math program compelled me to develop a strong work ethic that will help me to succeed beyond the classroom.

ANNIE BENTLEY LILLIE PRIZE IN MATHEMATICS

FERNANDO CAMACHO CADENA (MTHE)

Awarded to graduating student in program in Mathematics and Engineering who has highest average on courses in Mathematics in final year.

During my years at Queen's I learned to love math. It started in first year during linear algebra classes. I had no clue that I was going to end up in Apple Math (for a while it wasn't even an option), but it turned out to be a great decision. Along the way, I also became interested in space exploration. I got to have some experience with a few teams, but ultimately decided that pursuing math would be more exciting for me. This happened mostly because of the classes I had the chance to take. There were many moments when I was surprised by the results, and fascinated by the topics we covered. It made math exciting, and as if one could really go out and explore what would happen in the worlds you never knew existed.

Fady Alajaji, Johana Ng, Fernando and family at the Convocation Reception

I ended up choosing to go to the University of Zurich for a Master's in math this coming September. Although I am still unsure of what specific area I will dive into, I know I am interested in dynamical systems. There is something about objects evolving through time that catches my attention. I would have never thought that I could go into (what I feel and hope will be) a fulfilling career, let alone travel around Europe at the same time. Even though I am excited for this next step, I will truly miss my times at Queen's. People at the math department, both professors and staff at the office were always welcoming and helpful. Yet what I think impacted me the most were the friendships during these years. Not only was it a supportive group to get through the program, but also a great group to be with outside of it.

AGNES BENIDICKSON TRICOLOUR AWARD

BENJI CHRISTIE (MTHE)

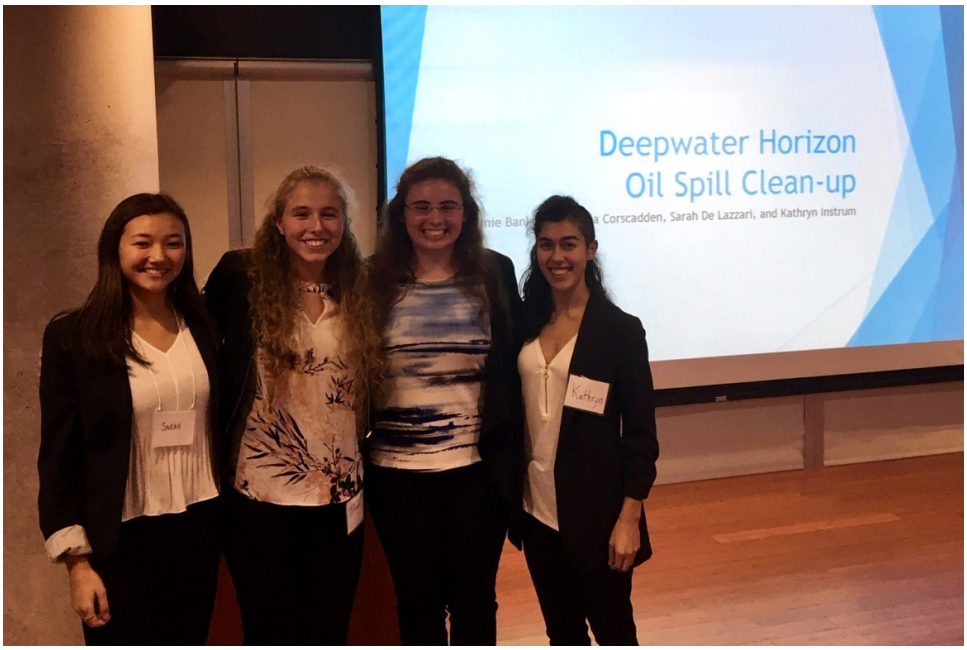
Admissions to the Tricolour Society through the Agnes Benidickson Tricolour Award is the highest honour given to a Queen's student for non-academic, non-athletic activities. Recipients are chosen by their fellow students. The award is named after Dr. Agnes Benidickson who was Chancellor of Queen's University from 1980 to 1996. It is bestowed in recognition of the valuable and distinguished service of outstanding individuals to the University.

- Interests: travelling, languages, volunteering, data science, ASOIAF, basketball
- Future plans: short term - Management Consulting at Deloitte starting in September. long term - hoping to pursue entrepreneurial ventures in the field of data science
- About me: I love coffee and a good conversation even more. If you're in Toronto come September, I'd be happy to grab a brew!

ALL-FEMALE ENGINEERING STUDENT TEAM NETS TOP PRIZE AT PROJECT MANAGEMENT CONFERENCE

Sarah de Lazzari, Tiffanie Bankosky, Serena Corscadden and Kathryn Instrum

They arrived at the 2018 International Project Management Day in Toronto ready for most things. They came to compete in a paper competition for project management professionals and students. But they weren't quite ready for the first question they were asked on arriving at the venue…"are you sure you're in the right place?"
By the end of the day, they had answered with a resounding "yes", beating out other students and professionals to take the $2000 top 2018 prize. Their team was the youngest in the competition.
After a focused course in Global Project Management last summer at the Bader International Study Centre, they worked as a team to examine lessons learned from the clean up of the Deepwater Horizon oil spill.



CUMC 2018

Riley Becker, Lily Summers, Fernando Camacho-Cadena, Troy Giorshev, Chelsea Crocker, Matthew Spragge

Last summer, the Department of Mathematics and Statistics supported 6 undergraduate students to attend the Canadian Undergraduate Mathematics Conference (CUMC) in Saskatoon. They are now part of a committed group of Queen's students who are bringing CUMC 2019 to Queen's! See full report next year.

BECCA BONHAM CARTER "APPLE MATH" 2019

I was born in B.C. but moved to New Zealand when I was 5. The high school curriculum there put emphasis on larger problems and projects, which I believe made starting engineering less of an adjustment. I think I also benefitted from doing correspondence school for my first few years of schooling. My family was living on a boat sailing around the Pacific at the time, so my education was a little more free form. The correspondence program let students make decisions on curriculum pace and content, which I think meant that I picked up skills for learning independently and critically a little earlier.

Queen's

Going to Queen's has put a lot of different opportunities in my path. When it came to choosing a degree, I wasn't set on engineering. I originally thought I would study biology, physics, or literature. But ultimately, engineering seemed like a good inter-disciplinary option. Funnily enough, math wasn't really on my radar at the time. It was 1st year Linear Algebra that changed my mind. I remember thinking "someone might actually pay me to do this?" Math has remained my primary academic interest ever since. I've loved the program for the courses and the people. The culminating design project was definitely a highlight; I was on a team supervised by Professor Yüksel who helped us tackle a project on optimizing the design of a brain-activity-controlled prosthetic arm given a channel capacity constraint

Exchange

Through the program, I also had the opportunity to go on a yearlong exchange at the University of Edinburgh. Though this meant I took 5 years to finish my degree it was well worth it. I was able to get more out of my time at Queen's, including being a Speakers' Coordinator for the Queen's Space Conference and competing in the CAN-RGX Challenge in which our team was able to put a fluid dynamics experiment on the NRC's parabolic jet. Edinburgh was an incredible place to study/live. I went hiking or climbing in the highlands almost every weekend and took some great courses including Robotics and Computer Vision (in which I discovered my interest in behavioral robotics) and my favourite course of the year: Musical Analysis using Fourier Theory and Digital Signal Processing.

Research

I worked with Professor Gharesifard after 2nd year on sparse stable systems and graph theory, and each summer since I've alternated research and tree planting in Northern B.C./working on my grandparent's sheep farm.

Last summer I worked in France with Professor Rachid Deriche at the French National Institute for Computer Science and Applied Mathematics (Inria) on improving the mathematical machinery being used in a model brain function, which was fascinating work. This summer I am doing one final undergrad summer research position, working with Professors Gharesifard and Cellarosi on Rough Path Theory.

What's next?

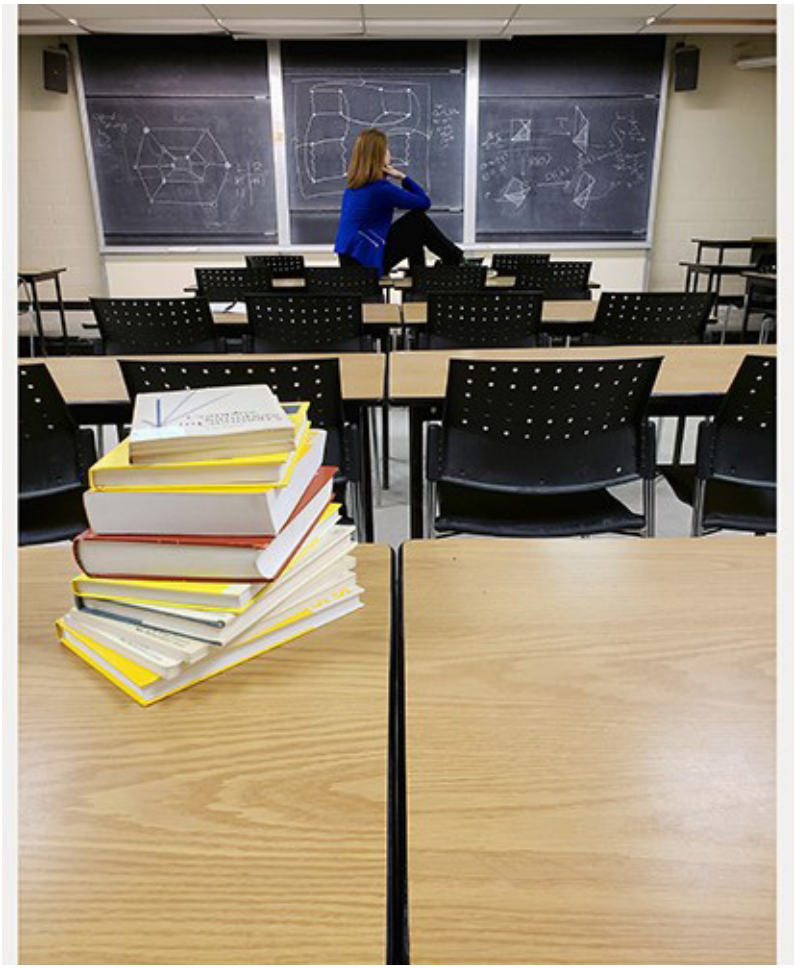
In September, I'm returning home to NZ to spend time with family and work in industry for a year, hopefully in aerospace or robotics, though any job that requires some nice mathematical analysis would be fantastic. After I plan to apply to graduate school hoping to pursue a degree in Applied Mathematics. I am currently interested in intersections between graph theory, dynamical systems, control theory, and information theory. I also find applications of mathematics to robotics, music, neuroscience, geology, aerospace, and bio-inspired design very fascinating and hope to work in some of those areas in the future.

On Other Interests

Beyond my interest in math, I love being outdoors and try to go hiking, climbing, skiing and diving as much as possible. I try to spend the rest of my free time listening to/playing music, especially folk, soul and blues, and cooking good food. I'll also never turn down a good science fiction or philosophy book.

PHD STUDENT STEFANIE KNEBEL TAKES TOP PRIZE IN THE COMMUNITY PHOTO CONTEST

Prizes were awarded to the top submission in each of six categories: Community Collaborations, Invisible Discoveries, Out in the Field, Art in Action, Best Description, and People's Choice. An adjudication committee of representatives across the university selected the winners and an online poll (1,100 votes) of the Queen's community determined the People's Choice winner.



Here is Stefanie's commentary:
Mathematical thinking is about finding patterns and structure. As a woman in the mathematics PhD program, I hope to inspire young women to follow their passion and find beauty in mathematics. At Queen's we offer the MathQuest camp for high school girls. As captured in the photo, I am brainstorming ways to teach game theory and linear algebra. This is also a part of my research with Peter Taylor, where we work with teachers across Ontario looking for innovative ways to incorporate mathematical thinking in education. We hope to change the math curriculum by making it a more engaging, positive and memorable experience.

Alumni

SUE CHARLESWORTH (MCDOUGALL: MATH '78, LAW'81)

APPOINTED TO THE NUNAVUT COURT OF JUSTICE

Photo taken at Pond Inlet July 2015

Last Fall we met Sue in Jeffery Hall at her 40th reunion and she talked about her new appointment. Her recent work had been with Queens' Legal Aid and she said that this has prepared her for this new role.

"Unlike most jurisdictions in Canada, in Nunavut there is only one level of court: the Nunavut Court of Justice," she explains, "and so it does everything! I will be looking at cases ranging from theft with a guilty plea to murder requiring a jury trial, from family law and estates to constitutional issues."

As the Director of Queens' Legal Aid, she worked with law students on files ranging from landlord-tenant issues to small claims court to traffic violations – an entire gamut of issues that will have relevance going forward.

The announcement left her "a bit nervous, a bit overwhelmed, but mostly happy and excited". This new position meant resigning from her role with Queens' Legal Aid, as an appointed judge cannot provide legal advice.

Still, she is very happy with this next stage of a journey that began in 2013 with a first trip to the north to spend two years as a criminal defence lawyer while on leave at QLA – and now, five years later, returning to help shape its judicial future.

Sue is happy to hear from classmates or anyone else interested in hearing about the joys of living and working in Nunavut. Just email her at: suec@additional.com

Naujaat (formerly Repulse Bay) Arctic Circle Arch – straddling the Arctic Circle, Nov/18.

Events

MATH 9-12 CURRICULUM WORKING GROUP HARD AT WORK THIS SUMMER

By Peter Taylor

We have been developing new curriculum resources over many years but the time has come to put a coherent curriculum into the classroom and we are spending the summer preparing a Grade 11 curriculum that we will put into selected classrooms this Fall.

Our curricular objective is not specifically the behaviour of polynomials or the formula for sin(A+B) but to give our students experience in the analysis of complex systems. Years of teaching first-year courses at Queen's have made it clear that this is the main source of difficulty for most of our students. This is likely the case, not only in math, but in all their subjects, but it turns out that mathematics, with its emphasis on the abstract study of structure, is an ideal subject to give students experience in working with complex systems.

Back (L-R) Peter Taylor, Luke Steverango, Mike Cabral, Stefanie Knebel. David Stocks.
Front (L-R) Victoria Wu, Skye Griffiths, Rebecca Carter, Chelsea Carlson, Neil MacVicar. (Abs. Yfan Duan).

I referred above to the abstract nature of mathematical study, but our pedagogical approach is very much hands on. Some of our projects interact with physical systems (even music) but along with that, the use of technology to design and build animations and simulations is a major component of our curriculum. The students will work in a Jupyter Notebook environment using the Python programming language.

In a word, our aim is to bring real mathematics into the high school classroom.

MATHQUEST 2019 AUGUST 19-22

In March 2019, Siobhain Broekhoven gave a talk at the Fields Institute about MathQuest, our math camp for high school girls. "Why is it," she asked, "that females (who studies show have equal ability to males) are not transitioning into STEM fields at similar rates?" This CMS speciality program at Queen's University is designed to motivate and engage this underrepresented demographic. This talk looked at the design of sessions that are low-floor high-ceiling, experiential and more collaborative (less competitive) and that lead to a growth mindset. Such experiences relieve math anxiety and connect mathematics to current careers, to the arts, and to real world applications —all the while building community.

Siobhain Broekhoven is an Intermediate-Senior math, physics and Special Education Specialist with Algonquin Lakeshore CDSB, currently working with youth at risk. Her interests lie in helping students to build resilience and look to a positive future. She is shown here with one of our campers.

IN MEMORIAM

MALCOLM GRIFFIN 1939-2018

By Peter Taylor

Malcolm died last November after a 5-year battle with cancer. He earned his PhD at Queen's in 1965 studying algebra under Paulo Ribenboim. He went to teach in New Zealand, his native land, but returned to Queen's in 1969 just as Jeffery Hall was completed and John Coleman was building up the Department. He is remembered for his passion for teaching, his zest for life, his inquisitive mind, his efforts to protect the environment, and his compassionate concern for justice.

Malcolm and I were in fact students together at Queen's in the early 60's, his future wife Sharon and I as undergraduates in Arts '65 and Malcolm as a PhD student. I remember Malcolm telling me the ugly truth about the Vietnam War. In 1969, both having returned to Queen's, we were senior dons together at the opposite ends of a long hallway –Judith and I in Gordon House, and Malcolm and Sharon in Brockington. We each had a newly born first child. Both of us were pure mathematicians, Malcolm in algebra, I in analysis. In fact, we used to debate which of the two was the most elegant. Perhaps elegance is only half the story, as after some years Malcolm switched to Statistics, and I to Mathematical Biology.

From that time, over almost 50 years, we shared ideas and stories about our research and our teaching and increasingly about life and faith and friendship and what it means to be human in an increasingly complex and chaotic world. We belonged to a book club together and the best conversations we had were probably at those wonderful discussions. In fact one of the books we used was written by one of Malcolm's sons, Daniel. Two Roads Home is Dan's first novel and it is the story of Pete, a young man who was caught up in the Clayoquot Sound protests against clear-cut logging in British Columbia. Things went wrong and the book tracks his flight through the forest and his resulting evolving relationship, based initially on a lie, with Inez, an artist living with her young son in a remote community on the coast.

Life is fleeting, but what richness it can bring.

HOMECOMING 2019 -
PROFESSOR A. JOHN COLEMAN UNDERGRADUATE LOUNGE

John Coleman and Marie-Jeanne at their Howe-Island cottage 2004

We invite you to join us to celebrate:

The grand opening of the Professor A. John Coleman Undergraduate Lounge
Saturday, October 19th @ 11:00 a.m.
Jeffery Hall, Rm. 220

We look forward to welcoming many alumni and friends to join us in the opening of this beautiful new space!

The inspiration and major donor behind this project is Tom Higgins, Artsci'79. Tom discovered a love of math early in life. As a young boy, he spent many summers at his family cottage with his uncle, a professor at MIT. "He showed me that math is everywhere. And he made it fun, so I really didn't need much encouragement to pursue it."

Tom Higgins and Peter Taylor walking the Capilano River Canyon

After Queen's, Tom went on to make his career in numbers, first in investment banking, then in securities trading. He feels that his aptitude and training in math, including his time as an undergraduate student at Queen's, led to success: "Math is fundamental to solving some of the world's biggest challenges – climate change, food sustainability, clean water, and national security. We need to do a much better job of getting children excited about math."

Math had played such a central role in Higgins' own life; he wanted to share his passion with others. That's why he is once again supporting Math Quest, a summer camp for girls at Queen's. Led by female mathematicians, statisticians, and physicists, students come from across Canada to participate. When the girls are asked to give feedback on the camp and its leaders, the praise is glowing: "Math Quest has made me feel like I have a place, and a responsibility to push myself to the limits of pursuing my potential. I hope one day to become one of these powerful, educated ladies, and spark as flaming a fire in the hearts of those like me."

But his vital support doesn't stop there. Tom made a gift to Math and Stats to revitalize the undergraduate student lounge in Jeffrey Hall. With this gift, the dated and low-tech room will transform into a welcoming space that draws students together to encourage group learning and friendship. As an homage to one of his favorite professors, the lounge will bear the name of Professor A. John Coleman and will officially open this Fall during Homecoming celebrations.

In speaking about John, Tom reminisces: “He would give us one problem a week for homework. It was never in any of the textbooks, and he didn’t show us how to do it. At first, I wouldn’t have a clue how to solve it, but then I realized it was important to get that problem in my head, go do something else, and come back to it in a few days. Then, most times, I’d be able to figure it out. That lesson was enormous for me,” Tom says now. “There are a lot of problems in life that seem impossible to solve. If you don’t see a solution right away, it’s ok. Don’t worry about it. Let your brain work on it in a different mode, and then come back to it.”

An enormous thank you to Tom Higgins for formally recognizing a Queen’s legend and making learning more enjoyable for our students. Dr. Jamie Mingo, head of the department says, “Donors like Tom Higgins have demonstrated a commitment to Queen’s by generously providing a space for students to expand their abilities and develop the esprit de corps that will carry them to positions of leadership.”

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