Faculty of Mathematics and Science
Celebration of Excellence

Thursday, January 22, 2015
A message from Ejaz Ahmed, Dean

I am delighted to gather today to celebrate the Faculty of Mathematics and Science. I am proud of our Faculty and grateful to everyone for their contribution because the impact that we have on Brock, Niagara, and the greater scientific community is a collective achievement.

As Dean it gives me great pleasure to introduce our awards program to honour and recognize individuals for their commitment, dedication and service. I extend sincere congratulations to each of our award recipients.

I am also pleased to provide you with this booklet that enables you to learn more about each of the departments, centres and units that comprise the Faculty. It illustrates our strength in research and scholarship and our dedication to the student experience at Brock. You will also learn about our faculty members who have received institutional, national and international recognition.

Thank you for joining us today at this our inaugural Celebration of Excellence. I am confident that each year we will only have more and more reasons to celebrate our accomplishments.

Sincerely,

S. Ejaz Ahmed,
Dean, Faculty of Mathematics and Science
A message from Jack Lightstone, President

As we take time to celebrate the excellence of our Faculty of Mathematics and Science, I’m pleased to express my congratulations and sincere gratitude to all of the faculty and staff whose dedication helps Brock University take its place on Canada’s teaching and research landscape.

We are completing a season of events marking Brock’s 50th anniversary, and it is interesting to consider how many of our noteworthy programs have been added over the course of that first half-century. The sciences, however, have been part of Brock’s essence since the beginning. They were in the vision of the Brock Founders’ Committee, and indeed one of the very first faculty hires was the physicist John Hart.

Brock in the 21st century is blessed with a growing scope of modern facilities. They are the envy of many, and enable Brock to continually expand the potential impacts and benefits of its teaching and research.

But a university can only be as good as its people, and when I see the commitment and intellectual inspiration that characterizes the Faculty of Math and Science, I am reassured about Brock’s future.

Congratulations, and thank you.

Jack Lightstone,
President and Vice-Chancellor
A message from Neil McCartney, Provost

Congratulations and sincere thanks to each of the award winners for the impact you are making. I also want to thank the Dean for establishing this program that brings us together to celebrate the excellence of our Faculty of Mathematics and Science.

My vision for Brock, since assuming the role as Provost, has been to build on our momentum as a leading mid-sized Canadian university, and ensure that the highest standards of quality are brought to our research and academic missions. This is a Faculty whose commitment, service and dedication will continue to serve Brock’s strong foundation of excellence in teaching as well as growth in research reputation.

We must also further develop Brock’s role as a leading collaborator with our neighbours in Niagara, as well as with partners across Ontario and Canada. When I reflect on the exceptional people whose work defines the Faculty of Mathematics and Science and our other six Faculties, I am confident that Brock will continue to make a positive impact.

Congratulations again.

Neil McCartney,
Provost and Vice-President, Academic
A message from Gary Libben, Vice-President, Research

The inaugural Faculty of Mathematics and Science Celebration of Excellence is a wonderful and timely initiative.

Brock University has seen great growth in its research mission over the last number of years. New and very much needed infrastructure has been built. New avenues of research have been developed. And, alongside this development, we have seen great growth in the culture of research leadership across campus and the strengthening of our graduate mission.

Brock University is emerging as one of Canada’s newest and most innovative research institutions. And, the creative and rigorous research conducted in the Faculty of Mathematics and Science is playing a leading role. Individuals and teams within the Faculty have been extremely successful in obtaining funds, in developing both pure and applied research, in creating transdisciplinary teams, and in building new innovation initiatives.

I congratulate all these individuals and teams on their achievements. I also congratulate the Faculty of Mathematics and Science as a whole for developing and supporting the focus on research and the commitment to research excellence that have made these developments possible.

Sincerely,

Garry Libben,
Vice-President, Research
A message from John Suk, Chair, Brock University Board of Trustees

I take great pleasure in extending my best wishes to the Faculty of Mathematics and Science — not just on behalf of the Board of Trustees, but also because I’m an alumnus of your Faculty (honours BSc ’73, Biological Sciences).

The University’s mandate is to impact lives in the Brock community, across the Niagara region and beyond; to demonstrate leadership and innovation in teaching and learning; and to grow knowledge through research, scholarship and creativity. These goals also define some of the values of the Faculty of Math and Science.

In an era when Brock’s community partners invest in our potential by helping create world-class facilities like the Cairns Family Health and Bioscience Research Complex, you respond with a passion and determination that reinforces Brock’s role as a committed partner with our surrounding host communities.

I am proud to be associated with the character that has defined the Faculty, and excited to think of the achievements you will realize in the years ahead.

Surgite!

Sincerely,

John Suk,
Chair, Board of Trustees
Faculty of Mathematics and Science vision and mission

Faculty of Mathematics and Science Vision Statement

The Faculty of Mathematics and Science is a recognized Canadian leader in scientific research, scholarship and education. We strive to enhance our quality and reputation in pure and applied research, innovative and engaging teaching, and service to the community.

We aim at establishing ourselves as a prominent centre of excellence for the creation and dissemination of scientific knowledge, an institution of choice for students, faculty and staff, and a principal agent of economic development.

Faculty of Mathematics and Science Mission Statement

The Faculty of Mathematics and Science creates and disseminates scientific knowledge and skills through discovery and teaching in an environment that fosters excellence, innovation, creativity, respect, citizenship, and the achievement of each member’s goals and potential.

We promote undergraduate and graduate students’ engagement in research, practical experience outside the classroom, and accessibility to professors. We foster state-of-the-art and interdisciplinary programs, research clusters in key areas of discovery and innovation, collaboration among the faculty, and collegiality in the sharing of resources. We will continue to develop responsive links with the community and contribute to its development.
Undergraduate Programs

The exceptional quality of education offered to our undergraduate students is the result of the efforts and dedication of talented faculty members and staff embracing fundamental values distinctive to the Faculty of Mathematics and Science: a privileged and close student/faculty interaction, adherence to the highest academic standards, the extraordinary opportunities for experimental training and hands-on expertise across the curriculum, the opportunities to engage in undergraduate research, on-the-job learning through co-op placements in leading corporations, all cemented by a sense of belonging to a family bound by the ideal of scientific excellence.

With undergraduate programs enrolling 1,834 majors in 2014 (30.5 per cent growth since 2009), we continue to improve our offerings in support of Brock’s Strategic Mandate Agreement with upcoming new transdisciplinary programs in Life Sciences (joint with Applied Health Sciences) and Gaming (joint with Humanities).

Hichem Ben-El-Mechaiekh, Associate Dean, Undergraduate Programs

Graduate Studies and Research

The Faculty has a very strong history in graduate education. Starting with MSc programs in Biology and Chemistry (1966), Physics (1970) and Geology (1978), our offerings have since expanded to four PhD and seven MSc programs, all very successful. We currently supervise 104 MSc and 68 PhD students. A new MSc in Materials Science will commence very soon and two more programs are in preparation.

The strength of our research programs is illustrated by our members receiving more than $4.5 million in grants and contracts in 2012-13. Excellence is exemplified by the appointment of Liette Vasseur as the University’s first UNESCO Chair as well as faculty being awarded fellowships in the Royal Society of Canada (Tomas Hudlicky), the Royal Society of Chemistry (Ian Brindle and Georgii Nikonov), and the Freiburg Research Institute for Advanced Studies (Art van der Est). Several faculty members also serve on NSERC grant panels and on editorial boards of leading journals.

Our most recent faculty appointments have very strong records, a guarantee that research and teaching excellence will continue unabated.

Alan Castle, Associate Dean, Graduate Studies and Research
Our department offers a highly successful undergraduate program in Biology and has participated in interdisciplinary teaching for decades, starting with Biochemistry in 1978. Since then we have established integral roles in Neuroscience, Biotechnology, Biomedical Sciences and Oenology and Viticulture. We have taken a leading role in the development of Life Sciences and are working with colleagues in Health Sciences on a new Microbiology and Immunology stream of the BMed program. A new Laboratory Plus program will be available to students in all of our programs soon. Students will graduate with a certificate in laboratory training, which will be a strong asset to their future employment success.

Faculty members currently supervise close to 60 graduate students in the Biology and Biotechnology MSc and PhD programs. All undertake collaborative research, mostly with international partners. We continue to increase our success in external grant funding. For 2013-14, our faculty members brought in $4,499,512, or 27 per cent of the total external grants funding received by Brock. The funding rate per faculty member of $250,000 per year compares extremely well with any university in Canada. International recognition is exemplified by citation frequencies. In fact, our 18 faculty members were cited 4,746 times in 2013 and 2014, a rate of 132 citations per faculty member per year.
Our department provides all of its students in the BSc Honours, BSc Honours (Co-op), MSc and PhD programs with close interaction with their professors and opportunities to gain hands-on experience and develop analytical, technical and critical thinking skills. Our graduates are well prepared for advanced degree programs and are highly competitive in the workforce.

• 40 per cent of BSc fourth-year academic credits consist of intensive training in a research lab.
• 23 undergraduate students held paid positions in chemistry research labs in summer 2014.
• 2014 Don Ursino Award for Excellence in Teaching Large Classes (Lydia Chen).
• 2003 Faculty of Math & Science Award for Excellence in Teaching (Heather Gordon).
• Accreditation by the Canadian Society for Chemistry for the BSc Honours, BSc Honours Co-op, and the BSc Combined Majors Chemistry/Physics.

Our department features state-of-the-art infrastructure and instruments, including the best-equipped and most widely used EPR facility in southern Ontario.

Members of our department publish an impressive amount of world-class research papers and are on numerous editorial boards of leading journals. Many have also won numerous prestigious research awards and have secured significant research funding over the years ($1,377,602 in 2013-14 alone). The department includes a Fellow of the Royal Society of Canada who is also a Tier I CRC Chair, two Fellows of the Royal Society of Chemistry, Cambridge, U.K., a former Tier II CRC Chair, and a Fellow of the Freiburg Research Institute for Advanced Studies in Germany.
Department of Computer Science

We offer a full range of undergraduate programs, including several cross-disciplinary programs, and are preparing for new specialized degrees in the near future. Our graduate program enhances the research culture of the University by making contributions in one of the newest scientific disciplines. Our programs are continuously adapted to ensure conformity with the expectations of a rapidly changing field. We constantly innovate in our use of learning technology.

Our programs’ high quality is demonstrated by student successes:

- Graduate employment rates (100 per cent within six months) exceed the University’s average and compare very favourably with other Ontario Computer Science departments.
- Our students have had great success in major computing and technology contests.
- Our graduates work in every leading technology company (IBM, Google, Microsoft, etc.) as well as in a wide variety of computing roles in other industries.
- Our co-op program is in huge demand, with a 100 per cent placement rate for many years.
- Many undergraduates have showcased their software innovations from coursework at conferences, and this year are working on projects proposed by BioLinc.
- A number of MSc students have received awards for their research.

The number of majors is steadily rising (50 per cent since 2010). Students have a tight and supportive social network. Our accessible faculty members work closely with students to ensure great success in coursework and research.

Our department is establishing itself as a centre of excellence in Computational Intelligence, greatly differentiating ourselves from other CS departments while producing exceptional research in computer science and transdisciplinary research applied to many fields. Faculty members participate in many different roles in conference organization and on editorial boards.
Department of Earth Sciences

Our department offers BSc programs in Earth Science and Environmental Geoscience, with co-op options, structured to meet the knowledge requirements established by the Association of Professional Geoscientists of Ontario, and they prepare our students to practise as professional geoscientists in industry, government and academia. Our courses are heavily experiential, with laboratories being an important component of all and field trips a key component of many.

About 33 per cent of our fourth-year students and 10 per cent of our third-year students are engaged in faculty members’ research programs in various capacities and have access to research-quality microscopes and analytical instruments, including one of the last remaining petrographic thin-section facilities and the only micromorphology lab in Canada.

Our students in the MSc in Earth Sciences have a strong research publication record in international journals. They are supported by faculty members with strong research programs and achievements that include Uwe Brand, a past recipient of a Chancellor’s Chair for Excellence in Research, and Mariek Schmidt, a member on the Curiosity Mars rover science team. Our department has exceptional strengths in planetary science (Frank Fueten and Rick Cheel are also involved in studies of Mars) and palynology (Martin Head, Francine McCarthy, and cross-appointed Michael Pisaric).

Other strengths include:

- Geochemistry (with Uwe Brand, past editor-in-chief of Chemical Geology and Nigel Blamey).
- Volcanology and igneous petrology (Mariek Schmidt)
- Stratigraphy (Martin Head, Chair of the International Subcommission on Quaternary Stratigraphy).
- Glacial geology and micromorphology (John Menzies, author of Modern and Past Glacial Environments).
- Environmental geoscience, dendrochronology and lichenometry (Dan McCarthy and Michael Pisaric).
Department of Mathematics and Statistics

We offer a flexible Math and Stats BSc program with five concentrations (MICA, Statistics, Pure Mathematics, Applied and Computational Math, and Math Education). The flagship Mathematics Integrated with Computers and Applications (MICA) continues to be closely watched and studied by the mathematics education community as a brilliant and distinctive example of mathematics training for the 21st century. Our program expands the traditional syllabus to fully integrate students’ engagement and ownership of the learning process with the benefits of technology that include experimentation, modeling, programming and applications.

• Each MICA major creates a total of 14 computer environments for investigating mathematical conjectures, concepts, or real-world applications, three of which are on a topic of their own choosing (see original examples at brocku.ca/mathematics/studentprojects).
• Co-op programs students’ placements are with leading corporations (Canadian Tire Corp., Statistics Canada, Hydro One, BlackBerry, Unitron, and John Deere).
• $269,460 received for 51 Experience Works projects in grants to students between 2005-13.

Our MSc program continues to thrive and attract stronger students nurtured by the high quality and the international impact of faculty research and scholarship.

• Faculty have a strong research publication record.
• Membership on editorial boards for 26 leading journals.
• The department includes a Fellow of the American Statistical Association.

Our department is home to the well-established and very active Mathematics Learning Centre, whose mission is to support students’ transition into first-year, improve retention and boost students’ progression.
Department of Physics

Our department offers degrees in both Biophysics and Physics, as well as a unique program in Applied Optics offered in collaboration with Niagara College. The students in our department receive award-winning instruction, including from Ed Sternin and Bozidar Mitrovic, winners of the 2008 and 2011 Faculty of Math & Science Award for Excellence in Teaching.

Our faculty members have received more than $560,000 in funding since 2012 to pursue research on a variety of topics, including Vitamin E, superconductivity, and manufacturing problems of interest to local industries (Decora Powder Coatings and Resolute Forest Products). This enthusiasm for scientific discovery has created an environment that encourages our students to participate in groundbreaking research. This motivation has resulted in our undergraduate and graduate students co-authoring 37 papers with faculty members in highly regarded journals since 2012.

Two of our PhD students, Drew Marquardt and Michelle Przedborski, have received prestigious Vanier Canada Graduate Scholarships in recent years. More than 80 per cent of MSc graduates have gone on to pursue PhDs at universities across Canada while others are working at Environment Canada and high-tech companies such as Tornado Medical and Unitron Hearing based in Kitchener-Waterloo. Our BSc, MSc and PhD students are well-placed to pursue careers in industry, education, government research, and academia.
Centre for Biotechnology

This interdisciplinary centre has faculty members from Biological Sciences and Chemistry and supports both research and teaching with undergraduate and graduate programs. Our strength is the MSc and PhD programs with about 30 students enrolled annually, including many international students. The Biotechnology programs provide students with a skill set that includes extensive hands-on experience. Our researchers have obtained grants that have brought in millions of dollars of equipment such as a new fluorescent microscope, inverted microscopes, spectrophotometers, and biological safety cabinets. We also have strong links with companies such as Norgen Biotek and Entomogen that provide industrial opportunities for students. This experience prepares students for careers in academic or industrial settings.

We are strongly committed to research as all faculty members involved in the Biotechnology program have strong research programs and are externally funded. The involvement of the centre in Brock’s Institute for Advanced Biomanufacturing has enabled partnerships with private companies to be developed, and our alignment with BioLinc has positioned Brock to be an innovator of potential biotechnological and pharmaceutical collaborations. The success and international reputation of faculty members has also ensured that Brock is a preferred place to work and study.
Centre for Neuroscience

The centre is a shining example of interdisciplinary studies at Brock. We oversee the undergraduate Neuroscience program, an interdisciplinary and integrative program that provides education in all basic sciences needed to understand brain functions. We offer a number of specialized courses about brain and behaviour and functions of the nervous system at the levels from single nerve cells to the entire brain and behaviour. Currently 140 students are registered in the program. The program has established Neurobiology, Neuropsychology, and Neuromotor Streams and developed a further Neurocomputing Stream last year. Our 22 core faculty members come from five academic departments (Psychology, Biological Sciences, Kinesiology, Linguistics, and Computer Science) representing three academic Faculties.

The centre is proud of its very experienced faculty, with 25 per cent having won prestigious teaching awards (nine in total) and 81 per cent having won research awards (78 in total). Six members (27 per cent) serve as journal, book and handbook editors, and sit on editorial boards, while three are on governing boards of international societies. Among faculty, 95.5 per cent have received a total of $8 million in external research grants in the last five years (total of 70 grants) and run active laboratories. Publication activity is also high with 950 articles in peer-reviewed journals and books (average of 43 articles per researcher).
Technical Services

This area includes electronics, machine and glassblowing shops, all integral parts of Mathematics and Science since 1965. Shops provide their own expertise but often combine their skills to provide support for teaching, research and external ventures. Technical Services was created to service existing scientific equipment, develop new and innovative equipment for both teaching and research labs, and provide technical expertise within the Faculty. We now provide support to the Faculties of Social Sciences and Applied Health Sciences as well as Facilities Management, IT Services, and Research Services. The shops also support science mentorship and co-op education for local high school students, as well as community, entrepreneurship and partnerships at Brock.

Project examples include constructing three Differential Thermal Analysis (DTA) systems for USDA Cornell, USDA West Virginia and Penn State University, in addition to developing software and hardware used as part of the CCOVI Vine Alert outreach program for the grape and wine industry.

Science Stores

In 2004, Chemistry Stores and Biology Stores amalgamated to form Science Stores to better serve all units in Mathematics and Science and subsequently Applied Health Sciences, and Social Sciences. Science Stores provides a cost-effective and quick supply of materials, chemicals, equipment and administrative support for research and teaching programs. This is achieved by handling more than 2,000 purchase orders and over 5,000 walk-up requests annually. Records for more than 130 research grants and contracts are maintained. Other responsibilities include administration of swipe and proxy access to labs in the Mackenzie Chown building and the Cairns Complex, inventory control using Facility Focus, and University-wide hazardous waste removal on a biweekly basis. Science Stores is an essential support system for research and teaching at Brock University.