Faculty of Science
Faculty Retreat, Spring 2018

Meeting Report

May 8, 2018
Section 1 – Welcome and Context
Dean MacDonald welcomed and thanked all participants for their attendance, and set the context for the day. She referenced some statistics on enrolment, faculty size and highlighted the fact that McMaster is Canada’s most research-intensive university. She continued by presenting the vision, mission and budget highlights of the Faculty. The Dean shared that the day’s discussions would focus on looking ahead for the next 5 years.

Dean MacDonald also reviewed the objectives for the day:
1. Bring together all members of the Faculty of Science to review recent progress
2. Provide a forum for all faculty to give initial input into the next Academic and Strategic Research Plan
3. Help to frame opportunities for the Faculty of Science in the upcoming Brighter World Strategic Research Initiative

Dean MacDonald then introduced facilitator Nora Sheffe who provided additional logistical details for the day.

Section 2 – Participant Discussion on Key Strategic Questions
Participants provided input on six questions focused on the next Academic and Strategic Research Plan. The key ideas for each question with respect to truths, trends, and unique ideas are listed below.

**Question 1 - What is our greatest achievement as a Faculty in the past 5 years?**

<table>
<thead>
<tr>
<th>Truths</th>
<th>Trends</th>
<th>Unique Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balancing budget</td>
<td>Refined budget process - Positive outcomes and</td>
<td>Research reputation</td>
</tr>
<tr>
<td>Nothing $\rightarrow$ lack of communication</td>
<td>Transparent process</td>
<td>Equity</td>
</tr>
<tr>
<td>Survival</td>
<td>Growth in interdisciplinary activity (res. and teaching)</td>
<td>Cooperation/morale</td>
</tr>
<tr>
<td>Interdisciplinary research and teaching</td>
<td>Increased student focus</td>
<td>Innovative teaching</td>
</tr>
<tr>
<td>Research excellence</td>
<td>Recognition</td>
<td>Outreach</td>
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</table>
**Question 2** - What are the big and interesting trends in Science? Who are the thought-leaders who are changing the course of teaching, curricula, interdisciplinarity, student recruitment, etc.?

<table>
<thead>
<tr>
<th>Truths</th>
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</tr>
</thead>
</table>
| • Big data  
• A.I.  
• Interdisciplinarity  
• Environment/climate change | • Ageing and personalized medicine  
• Teaching faculty  
• Genomics  
• Origins  
• Communication  
  o And reproducibility  
  o Open science | • Quantum science  
• Applications of chemistry  
• Community-driven science  
  o Inclusion  
  o Indigenous science  
• Student-driven learning  
• Experiential/lab courses integrating research into teaching |

**Question 3** - How could we evolve, change, refocus, anticipate and be future facing within our faculty?

<table>
<thead>
<tr>
<th>Truths</th>
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</table>
| • Interdisciplinary research  
• Hire new faculty  
• Undergraduate experience  
  o Research  
  o Sci literacy  
  o Experiential  
  o Day-to-day life  
• Two-way communication, consultation  
  o Faculty ↔ admin  
• Partnerships  
  o Community  
  o Industry | • Fundamental research  
• Curiosity-driven  
  o Foundational Resources  
• Risk taking  
• Big science  
• Computing  
  o A.I.  
  o Big data  
• Diverse faculty  
  o Research  
  o Outreach | • Enhance teaching excellence  
  o Tech  
  o Reduce teaching load  
  o Large classes  
• Central support  
• Peer improvement  
• Online MOOCs  
• More U/G research  
• Promote skills and career development for students  
  o Careers for grads outside academy  
  o Applied industry skills  
  o Computing and coding  
  o Experience  
  o Communication skills  
• Truly unique ideas  
  o Move in direction of Health Science  
  o Promote work/life balance or integration for faculty (resilience)  
  o Additional grad student spots |
**Question 4** - What will our students be looking for in 5-10 years time?

<table>
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<tr>
<th>Truths</th>
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</thead>
<tbody>
<tr>
<td>• Skills</td>
<td>• Personalized learning opportunities</td>
<td>• Diversity</td>
</tr>
<tr>
<td>- Job (applied)</td>
<td>- Using non-traditional methods</td>
<td>- Multiple facets</td>
</tr>
<tr>
<td>- Soft (communication)</td>
<td>- Flexibility</td>
<td>- Global learning experiences</td>
</tr>
<tr>
<td>- Transferable</td>
<td>- Undergraduate research opportunities</td>
<td>- Cost to student</td>
</tr>
<tr>
<td>- Fundamental science skills (i.e. analysis, data, compute)</td>
<td>- Interdisciplinary learning</td>
<td></td>
</tr>
<tr>
<td>• Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Flexibility - in learning strategy and environment and Career</td>
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</table>

**Question 5** - Our current vision is, “to be the leading Faculty of Science in Canada and among the world’s best in strategic areas of strength through innovation, creativity, and excellence in research, education, scholarship, and service”. Our current mission is, “to advance scientific discovery and knowledge, and to promote scientific literacy and understanding in our community”. Do these statements resonate with you? What changes would you suggest to reflect our aspirations as a Faculty?

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<tbody>
<tr>
<td>• Mission and Vision generally resonates</td>
<td>• Links to community</td>
<td>• Community engagement + work with media + advancement re: fundamental science and societal problems</td>
</tr>
<tr>
<td>• Too broad – should be more focused</td>
<td>• Which peer group do we compare to</td>
<td>• Increased partnerships both within Faculty and with industry</td>
</tr>
<tr>
<td>- Does not evoke action</td>
<td>• Emphasize interdisciplinarity</td>
<td>• Focus on environment</td>
</tr>
<tr>
<td>• Mission and Vision may be too rich and require more resources than we have</td>
<td>• Emphasize fundamental research</td>
<td>• Emphasize student learning opportunities, e.g. experiential/research/other growth opportunities</td>
</tr>
<tr>
<td>• Statements should include collaboration + interdisciplinarity</td>
<td></td>
<td>• Equity and inclusion, including engagement with local community</td>
</tr>
<tr>
<td>• Language is unclear</td>
<td></td>
<td>• Wording suggestions</td>
</tr>
<tr>
<td>- Define “areas of strength”, “innovate”, “best”</td>
<td></td>
<td>o “Researchers” instead of “research”</td>
</tr>
<tr>
<td>• Mission and Vision should include student literacy</td>
<td></td>
<td>o “Advance and support” instead of “advance”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o “Education” and “service” may be unnecessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Thematic lecture series on basic science</td>
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</tbody>
</table>
**Question 6** - What are the barriers we are facing to achieving excellence? How can we address these challenges?

<table>
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</table>
| - Funding (fundamental and applied research)  
  - Operational  
  - Individual  
- Faculty renewal (strategically planned)  
- Risk taking (inadequate support)  
  - University support  
- More recognition/reward | - Time and support for research and teaching  
  - Access to various research offices, NICO, etc.  
  - Being pulled away from core mission  
  - Admin function  
    - Logistics  
    - Spread too thin  
  - Collaboration and communication across departments  
  - Incentives to collaborate  
    - Space?  
    - Recognition?  
  - Enrolment and class size  
  - Infrastructure  
  - Inflexibility in university structures (duties, units, merit, etc.)  
  - Conflation of productivity vs. excellence  
  - Too prescribed  
  - Too siloed  
  - Poor morale (budget related) | - Faculty support and mentoring  
- Enhanced support for fundamental research  
- Impaired student experience  
  - Knowing  
  - Mental health  
  - TA support  
- Improved communication and knowledge mobilization  
  - Outside MAC  
  - Within faculty/departments  
  - Visibility of faculty of science  
  - With students  
  - Visibility outside MAC  
- Recruitment of excellent grad students |

**Section 3 – “When World Collide”: Science (Fiction) and the Art of Development**
In the afternoon, the group heard from Lorna Somers, Assistant Vice President, Development to provide an overview on fundraising and the success and approach of seeking donors for major projects.

**Section 4 – Framing the BWRI**
Mary Williams, VP Advancement, spoke to the group, framing the discussion on the BWRI and the significance of the opportunity to enhance the research agenda.

**Section 5 – Participant Discussion on McMaster’s Strategic Plan for Research**
In department/school-specific groups, participants discussed new ideas their department/school could address if resources were no object. Key ideas from each department/school are summarized below.
Department of Biology

- Biological resilience
  - What is it?
  - + Organism
  - How do increase it?
- Bio-diversity environment
  - Human health
  - Indiservs
  - Synthetic biology ➔
    - Plant products ➔
    - Institute ➔
    - N-fixing ➔ (Plant products)

Department of Chemistry and Chemical Biology

- Radio-chemical nuclear reactor
  - Medical isotopes
    - Chemical oncology
  - Small molecules and isotopes
  - Modular nuclear reactors
- Neural degeneration
  - Protein misfolding; psychiatric drugs
  - Synth and modes of action
- Molecules 2 materials
  - Nano materials, sensing, electronics
- Agri-chemical research
  - Green chem
    - Herbicides/antifungal
  - Polymer remediation
School of Geography and Earth Sciences
- Sustainable resource extraction
- Sustainable environments
- Water quality
- Social impacts of environmental change

Department of Kinesiology
- Leveraging undergrad KIN laboratory data for a longitudinal study involving citizen science
- Interdisciplinary study of physical activity to optimize health across the lifespan
- International undergrad dual degree opportunity

Department of Mathematics and Statistics
- Transformative hire (future Fields medalist)
- Risk: Prediction and early warning
- Chair in foundations of machine learning
- Network of Mathematics

Department of Physics and Astronomy
- National neutron source
- Emergence of the universe
- Origins of life and humanity

Department of Psychology, Neuroscience, and Behaviour
- Social dynamics in groups
- The genetic and neural basis of consciousness
- Genes and environment in the development of healthy minds

School of Interdisciplinary Science
- Exploratorium
  - A learning space for students and a place for community engagement
- Sci com hub
  - A centre for science communication education – undergrad, grad, and beyond
- Undergrad Research Institute (URI)
  - Program that brings together thesis students from different disciplines
  - Student-led with faculty advisers
Section 6 – BWRI Discussion

Following the focus on department initiatives, each department then considered new research projects that aligned with the 8 themes from the Brighter World Research Initiative (BWRI). After identifying prospective projects, the participants moved into inter-departmental groups and discussed how they could combine their ideas into bigger, interdisciplinary ideas and then considered potential partners and prospective funding sources. Within the 8 BWRI themes, some groups identified 2 big ideas whereas other groups identified 3 big ideas. The input is summarized below:

**BWRI Theme 1 – Addressing the Growing Burden of Chronic Disease**

**Big Idea 1.1**
Conduct a longitudinal study of physical activity to promote brain and body health across the lifespan

<table>
<thead>
<tr>
<th>Potential Partners</th>
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</thead>
<tbody>
<tr>
<td>Kinesiology</td>
<td>Biology</td>
<td>Chem/Bio FHS</td>
</tr>
<tr>
<td>PNB</td>
<td>Math</td>
<td></td>
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**Prospective Funding Sources**

- CIHR
- Philanthropy
- MIRA
- Public Health Canada

**Big Idea 1.2**
Pathology of rare diseases

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<td>Biology</td>
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</tr>
<tr>
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<td>Kinesiology</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Prospective Funding Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genome Canada</td>
</tr>
<tr>
<td>MDA</td>
</tr>
<tr>
<td>Grand Challenges</td>
</tr>
<tr>
<td>MDC</td>
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**Big Idea 1.3**
Biomarker discovery and translation

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</tr>
</thead>
<tbody>
<tr>
<td>Chem/Bio CLSA</td>
<td>Biology</td>
<td>Kinesiology</td>
</tr>
<tr>
<td>PNB</td>
<td>Chem/Bio PHRI</td>
<td>Physics</td>
</tr>
<tr>
<td>HHSC</td>
<td></td>
<td>Math</td>
</tr>
</tbody>
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**BRIGHTER WORLD**

McMaster University
Prospective Funding Sources
- Grand Challenges
- Philanthropy
- Bruce Power
- Genome Canada
- CIHR

**BWRI Theme 2 – Advanced Materials and Manufacturing**

**Big Idea 2.1**
National neutron source and facility
- Materials – probing hidden structures
- Radio isotopes
- Quantum phenomena

**Potential Partners**
- Physics
- Chemistry
- Engineering
- OPG
- CANMET
- Bruce Power
- AECL
- BIMR
- TRIUMF
- MDS – Nordion
- CPDC
- MNR
- JCC

**Prospective Funding Sources**
- CFI
- Industry Canada
- Established themed chairs through private donations
- Proprietary industrial research

**Big Idea 2.2**
Collaboratively expand molecules to materials (M2M) research at McMaster towards a broad range of applications.
- Device fabrication
  - Sensors
  - Computer chips
  - Medical devices
  - Batteries
  - Solar
- New polymers
- Smart drugs
- New genetic materials

**Potential Partners**
- Chemistry/Chem Bio
- Chemical Engineering
- CEDT
- Physics
- Biochemistry
- MNR
- Engineering Physics
- BIMR

**Prospective Funding Sources**
- CFI
- NSERC (strategic, CRD)
- ORF-RE
- CSA
- Industry
**BWRI Theme 3 – Aging Across the Lifespan**

**Big Idea 3.1**
Education on healthy aging
- Intergenerational experiences inform:
  - Citizen science project to study predictors of aging
  - Research methods and communication of science to older adults

**Potential Partners**
- HA + Society Department
- Alumni Office (for follow-up)
- Community (PACE, City of Hamilton)
- Office of community engagement (CE)

**Prospective Funding Sources**
- MIRA
- City of Hamilton

**Big Idea 3.2**
Impact of plants + micros/molecular on human health for optimal aging, aging well
- Epigenetics
  - Genome integrity and biomarkers
- Nutrition
- Brain linkages
- Behaviour/social
- Stress, impacts

**Potential Partners**
- Labarge → Aging (MIRA)
- Biology
- PNB
- H Sci
- Social sciences
- Art
- CARP
- Chemistry
- Kinesiology
- Retirement and nursing
- SIS

**Prospective Funding Sources**
- Labarge/MIRA
- Government/private benevolent donors
- Health partners/Thrive
- Able Living

**Big Idea 3.3**
Optimal brain health to enhance quality of life

**Potential Partners**
- MIRA
- Gilbrea
- CARP
Prospective Funding Sources
- Alzheimer’s Society
- Joint program in neurodegenerative diseases (CIHR + EU)
- CIHR
- Private donations

**BWRI Theme 4 – Data, Artificial Intelligence, and the Digital Society**

**Big Idea 4.1**
Leveraging big data in Biology to understand and predict complex systems from cells to (rare diseases)
- BDB – “-omics”
- Dynamic simulation of processes and multiple biological levels
- Clinical data
- Artificial life
- Simulations across biological scales and linking it to complex biological databases

**Potential Partners**
- Biology
- Chemistry/Chem Bio
- Math/Stats
- Biophysics
- Biochemistry
- Computer Science

**Prospective Funding Sources**
- Donors with links to rare disease
- Google (computational support)
- Rare Disease network
- Amazon
- Compute Canada

**Big Idea 4.2**
Taming and exploiting big data
- Data harmonization and integration
  - Different instruments and simulations
    - Astrophysics
    - Remote sensing
  - (Near) real-time analytics

**Potential Partners**
- Compute Canada
- NRC
- NASA
- Physics + Astronomy
- Health Sciences
- CADC
- Mac Data
- CSA
- SGES
- ESRI
- CLSA
- Math and Stats
- Engineering- ECE, CAS
Prospective Funding Sources
- CFI
- NR Can
- Mitacs
- Insurance Companies
- Tri Council
- UN
- Resource Sector
- IBM
- CIFAR
- Simons
- Health Sector

BWRI Theme 5 – Environment and Energy

Big Idea 5.1
New approaches for sustainable energy and resource use
- Energy materials
- Reclamation
- Remediation
- Mitigation
- Modeling (risk)
- Sensing
- Biotech
  - Synthetic Bio
  - N fixation

Potential Partners
- SGES
- Physics
- Biology
- Math
- Chemistry

Prospective Funding Sources
- Governments
- Corporate
- Hydro-One

Big Idea 5.2
Pure whole Earth sensing
- Environment ↔ Human Impact
  - New paradigms
  - Biology impact on habitable planet
  - Climate modeling

Potential Partners
- GWF
- Physics
- Engineering
- Fisheries
- Environment Canada
- SGES
- Chemistry
- CSA
- OMNR
- RBG
- Biology
- Math
- Indigenous Studies (knowledge)
- DFO
- UNEP

Prospective Funding Sources
- Yuri Milner – Breakthrough
- UNEP
**BWRI Theme 6 – Equitable, Prosperous, and Sustainable Societies**

**Big Idea 6.1**
Ecosystem drivers for human health and society
- Chemical and biological diversity
- Social interactions and mental health
- Synthetic biology and natural products
- Water quality and food security

**Potential Partners**
- Biology
- PNB
- Fac. Social science
- Chemistry
- PNB
- Psychiatry + behaviour
- Geo + Earth Science
- Chemical Engineering
- Neuroscience

**Prospective Funding Sources**
- Agri-chem co.
- Water treatment + quality industry
- Big Pharma
- Enviro Canada
- Health Canada
- Agri Canada

**Big Idea 6.2**
Understanding the social factors that affect equitability and the mental health impact of inequitability. Then, designing educational constructs that address these results/ideas and increase flexibility in higher education.

**Potential Partners**
- PNB + SIS
- Business, local employers (to develop career-facing assessment + curricular structures)
- Health Sci?
- Social Sci
- Student wellness

**Prospective Funding Sources**
- Spencer Foundation
- SSHRC

**Big Idea 6.3**
Global risk science

Values:
- Environmental
- Economic
- Society
- Health

**Potential Partners**
- Math/Stats
- Faculties: health sci, social sci, business
- Environmental Science
- Institutes
- Kinesiology

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**McMaster University**

**BRIGHTER WORLD**
Prospective Funding Sources
- Insurance/finance
- Gates foundation etc.

**BWRI Theme 7 – Indigenous Knowledge and Research**

*Big Idea 7.1*
Co-creation of education initiatives in Science/Math + Stats for Indigenous students

**Potential Partners**
- 6-Nations reserve
- Indigenous Studies Department
- Math + Stats Department (faculty + students)
- MIRI

**Prospective Funding Sources**
- Philanthropists/foundations
- Government (federal)
- SSHRC

*Big Idea 7.2*
Co-creation of questions in: water quality and security.

**Potential Partners**
- 6 Nations Reserve
- Ontario Reserves
- MIRI

**Prospective Funding Sources**
- Government (federal)

**BWRI Theme 8 – Understanding and Responding to Infectious Disease**

*Big Idea 8.1*
Forecasting infectious disease epidemics.

**Potential Partners**
- Institute for Infections Disease Research (IIDR)
- Pathology + Molecular Medicine
- CSE
- Biology
- HRMEI
- Anthropology
- Math + Stats

**Prospective Funding Sources**
- CIHR
- NIH
- PHAC

*Big Idea 8.2*
Brain and behaviour changes in response to infectious disease

**Potential Partners**
- Immunology
- PNB
- OBI
- Infectious Disease
- Aging
- Drug companies
- Psychiatry
- MINDS
- Charities
Prospective Funding Sources
- CIHR/NSERC
- Charities
- OBI
- Drug companies

Big Idea 8.3
Environmental impact on infectious disease
- Human, plants, ecosystems, pests
- Impact to humans
- Causes: climate change, anthropomorphic

Potential Partners
- Infectious Disease Inst. (IIDR)
- SGES
- Biology
- Math + Stats
- Chemistry
- Mac Institute for Climate Change

Prospective Funding Sources
- Industry
- Governments
- CIHR
- AAFC

Section 6 – Wrap Up and Next Steps
Dean MacDonald thanked everyone in the room for their participation. She summarized next steps, including the sharing the meeting report. The Dean also shared the date of the next faculty general meeting (at which the budget will be reviewed), and encouraged participation in the upcoming convocation ceremonies.