



## MEMORANDUM

**To:** Executive Committee of Faculty Council (October 5, 2020)  
Faculty Council (October 23, 2020)

**From:** Professor Ramin Farnood  
Vice-Dean, Research and Chair, Research Committee

Professor Milos Popovic  
Institute of Biomaterials & Biomedical Engineering

**Date:** October 1, 2020

**Re:** Establishment of the CRANIA NeuroModulation Institute (CNMI) as an Extra-Departmental Unit, Type C (EDU:C)

---

## REPORT CLASSIFICATION

This is a major policy matter that will be considered by the Executive Committee for endorsing and forwarding to Faculty Council for vote as a regular motion (requiring a simple majority of members present and voting to carry).

## SUMMARY

The establishment of the CRANIA NeuroModulation Institute as an EDU:C is proposed to help unite disparate neuromodulation education streams and disciplines and to cultivate research and education and scholarly interest in this field.

Details are provided in the attached proposal.

## RECOMMENDATION FOR FACULTY COUNCIL

THAT the Faculty establish the CRANIA NeuroModulation Institute (CNMI) as an Extra-Departmental Unit, Type C (EDU:C) as described in the attached proposal, effective November 1, 2020.

# **Proposal to Establish the CRANIA NeuroModulation Institute as an Extra-Departmental Unit, Type C**

Prepared by

Milos R. Popovic, Professor  
Institute of Biomaterials & Biomedical Engineering  
Faculty of Applied Science & Engineering

Taufik A. Valiante, Associate Professor  
Department of Surgery  
Faculty of Medicine

October 1, 2020

## **1. INTRODUCTION**

Neuromodulation is the process of altering or modifying the brain, spinal cord or nerve function using advanced devices that interface with specific areas of the central or peripheral nervous system. Neuromodulation-based therapeutics are already helping those with Parkinson's disease, epilepsy, stroke, depression, chronic pain, spinal cord injury, bladder dysfunction, anorexia, and Alzheimer's disease – conditions that affect millions of Canadians. The field is experiencing unprecedented growth as technologically-advanced therapies, resulting from the convergence of machine learning, optical interfaces, electronics, mathematics, material sciences, image-guided surgery, neuroscience and big data analyses are being rapidly developed and deployed.

Despite this overwhelming progress, the full potential of the neuromodulation field has yet to be realized, requiring the need to bring together knowledge within an interprofessional education environment, as well as diverse skills, technologies and know-how from disparate yet intersecting fields and disciplines.

**We therefore recommend the creation of the CRANIA NeuroModulation Institute (CNMI) as an Extra-Departmental Unit: Type C within the Faculty of Applied Science & Engineering.**

Through the establishment of the CNMI, the University of Toronto has the potential to become a key player in a collaborative drive towards technologically-advanced neuromodulation therapeutics. We are clinical pioneers in neuromodulation research for brain disorders; leaders in computing and advanced manufacturing infrastructure; a home to deep learning and artificial intelligence; a hub for collaborations to transform the field; and a home to the top engineering departments in the world. Additionally, the University of Toronto's key role in the Vector Institute reflects the university's position as a leader in computing and deep learning, with facilities across the university and its fully-affiliated health care institutions such as the

University Health Network's Center for Advancing Neurotechnological Innovation to Application (CRANIA).

The creation of the CNMI will also address the strategic priorities of the University of Toronto and the Faculty of Applied Science & Engineering (see Section 4).

## **2. ESTABLISHMENT OF THE CRANIA NEUROMODULATION INSTITUTE**

We propose the establishment of the CNMI as an EDU:C, effective November 1, 2020, to help unite disparate neuromodulation education streams and disciplines and to cultivate research and education and scholarly interest in this field.

The CNMI will:

- Train students including future MDs, dental specialists, neurosurgeons and neurologists, alongside future engineers, computer scientists and material scientists.
- Create an environment that enables researchers with multiple education/research backgrounds to solve critical problems in neuromodulation.
- Provide both clinicians and engineering students with hands-on experience in neuromodulation research, which is currently not offered by the Institute of Biomaterials & Biomedical Engineering.
- Provide students with equal exposure to a neuroscientist or clinician, and an engineer or computer scientist, which will allow them to work interchangeably as roles require.
- Foster integrative thinking in the neuromodulation space.

Presently, individuals are trained in specific disciplines such as engineering, physiology, medicine and dentistry, rather than working interdisciplinarily across these disparate fields. Our objective is to remove this barrier and specifically and intentionally develop neuromodulation professionals instead of training engineers or clinicians. This new generation of integrative thinkers will be able to operate seamlessly in the neuromodulation space in clinical/engineering environments.

The Faculty of Applied Science & Engineering will be the Institute's lead Faculty, assuming active administrative and budgetary responsibility for the Institute. Other Faculties and affiliated health care institutions have committed to participate and their involvement is essential to the success of the Institute. These include but are not limited to:

- Faculty of Arts & Science – which includes a number of relevant disciplines, such as mathematics, computer science and psychology.
- Faculty of Dentistry – which has a well-established focus on pain/neuroscience research
- Faculty of Medicine – home to a number of neuroscientists and clinical experts who contribute to the field.

- University Health Network – whose clinical sites and affiliated hospitals will provide access to the requisite patient population so that treatment can be delivered under the guidance of a clinician or neuroscientist according to established protocols.

Appendix A provides a list of confirmed and potential partners.

### 3. MISSION

The CNMI's mission is to **engineer the next generation of brain scientist**<sup>1</sup> by providing students an opportunity to develop the strong background necessary to be competitive in this expanding field. This will be achieved by educating students to develop, validate, test and commercialize advanced neuromodulation technologies, and enabling them to participate in neuromodulation-based research activities in fully-affiliated health care institutions throughout Toronto.

### 4. STRATEGIC ALIGNMENT

The CNMI's neuromodulation-related education and research directly supports the following themes from the *University of Toronto's Strategic Research Plan 2018-2023*:

- **Promote: Healthy People, Healthy Communities, Healthy World** is supported by the CNMI's goal to improve health and quality of life of patients and their families through the development of neuromodulation-based therapeutics.
- **Innovate: Technologies for the Future** is supported by the CNMI activities that will create the next generation of neuromodulation devices through advancing manufacturing (including nanomanufacturing), computing and technologies to enable real-time, responsive human-computer interactions.
- **Mind, Brain, and the Human** (sub-theme) is supported by the CNMI's goal to train students to develop therapeutic strategies that will simultaneously provide fundamental insights to human brain function.

The CNMI also supports the following strategical goals of the *Faculty of Applied Science & Engineering's Academic Plan, 2017-2022*:

- **Increase our support of transformative cross-disciplinary collaborative research that inspires innovation.** Access to state-of-the-art facilities, equipment and researchers will inspire students to seek the answers to fundamental questions.

---

<sup>1</sup> Litt B. 2015. Engineering the next generation of brain scientists. *Neuron*. 86:16–20.

- **Lead impactful multi-institutional research collaborations in strategic areas that will address global needs, in addition to creating new technologies that will act as an engine of prosperity and economic development.** By educating future neuromodulation professionals and creating related jobs, the CNMI will assist the Faculty of Applied Science & Engineering in achieving its goal of increasing economic development and impact.
- The CNMI will be the first research institute of its kind. **It will increase our reputation and visibility, and be recognized for excellence and the impact of our contributions.**

## 5. ACADEMIC RATIONALE

To realize the full potential of the neuromodulation field requires great interdisciplinarity, collaboration and integration among discipline fields of research. This will enable us to move forward from our fragmented understanding of the field to a more robust scientific and scholarly base. There is also a need to develop more comprehensive education, training and infrastructure to better prepare and empower the highly qualified personnel that are essential to advance the field. As Canada's leading university, the University of Toronto has a distinctive role to play in bringing together the diverse skills, technologies and know-how from its disparate fields, disciplines and affiliated health care institutions that traditionally do not work together and lack support for collaborative work.

The CNMI will connect the University of Toronto departments and institutes, health care institutions, and research institutes and clusters to reduce boundaries between key disciplines. The multidisciplinary crosstalk it will enable will allow the neuromodulation field to flourish. It will lead and contribute to exciting changes in neuromodulation by engaging in educational activities that foster a new generation of scientists who will be capable of creating devices to improve brain, spinal cord and peripheral nerve health, and improve the quality of life of those suffering from neurological conditions.

## 6. FACULTY PARTICIPATION

As an EDU:C, the CNMI will hold non-budgetary cross-appointments of tenure- and teaching-stream faculty, and clinical faculty appointed under the *Policy for Clinical Faculty* (December 16, 2004). Participation in the CNMI will be based on multi-disciplinary partnerships of faculty members from the Faculty of Applied Science & Engineering, the Faculty of Arts & Science and the Faculty of Medicine, and fully affiliated health care institutions with expertise in at least one of the following research areas:

- Artificial Intelligence
- Computer Science
- Electrical Engineering
- Large Scale Computing
- Material Science & Engineering
- Mathematics
- Mechanical Engineering
- Nanotechnologies
- Neural-engineering
- Neurology
- Neurophysiology
- Neuro-regeneration
- Neurosurgery
- Psychiatry
- Psychology
- Rehabilitation
- Rehabilitation Engineering

Appendix B lists the initial University of Toronto faculty members who will actively participate in the CNMI and those who are interested in the CNMI's activities. Additional faculty members are anticipated to participate in the CNMI after it has been established.

Active Faculty members will be involved in conducting seminars, workshops, conference participation, and research. The CNMI will also seek to develop partnerships with other institutes at key neuromodulation hubs.

## **7. EDUCATION MANDATE AND ACTIVITIES**

The establishment of the CNMI will bring together disparate but related educational fields to spark the imagination of graduate and undergraduate students within the field of neuromodulation.

The education mandate of the CNMI is to:

- 1) Train engineers and basic and clinician scientists to become highly qualified neuromodulation experts who can seamlessly navigate the broad spectrum of disciplines and sectors at the nexus of neuromodulation education and research.
- 2) Bridge the communication gap between neuromodulation-related basic research fields, applied/clinical research fields, research groups, institutions and industries.
- 3) Position the University of Toronto as the leading hub for neuromodulation education and the development of neuromodulation technology in North America and throughout the world.

The CNMI will expose students to a multidisciplinary field that involves engineering, medicine and basic sciences, and which focuses on developing technologies for rapid implementation into clinical settings. For the first time, students will work with patients with brain disorders and highly integrated teams (within established protocols) and will experience how technology impacts patient care.

It is anticipated that undergraduate and graduate education-related activities of the CNMI will include:

- Creation of a hands-on one-week workshop to demonstrate the creation of cell cultures that form neuronal networks; electrical recordings from these neural networks; signal process of the data they collect and/or pre-existing data sets; and training of the neural networks they have recorded from to perform simple computations in a biological neural network.
- Attendance at the CRANIA annual conference, comprised of keynote speakers, parallel workshops on neuromodulation and an industrial-style case competition.
- Co-supervision by an engineer or computer scientist, and a neuroscientist or clinician scientist in participating graduate units who will jointly supervise a student on a cross-disciplinary neuromodulation-related research project.
- Development of additional for-credit courses, seminars and workshops for a broad range of end-users including students, researchers and industry and government professionals. These courses will be administered and governed by the home department.

As an EDU:C, the CNMI will not offer academic programs, but will offer core or elective courses in appropriate programs such as minors and collaborative specializations.

### **7.1 Undergraduate Education**

The CNMI will contribute to undergraduate education in the area of neuromodulation at the University of Toronto by:

- Creating for-credit neuromodulation courses for eventual inclusion in existing Faculty of Applied Science & Engineering minors (e.g., Bioengineering).
- Developing an undergraduate minor in neuromodulation in partnership with the Faculty's Cross-Disciplinary Programs Office and in consultation with participating departments from the Faculty of Applied Science & Engineering, the Faculty of Arts & Science and the Faculty of Medicine.

### **7.2 Graduate Education**

The CNMI will contribute to graduate education in the area of neuromodulation at the University of Toronto by:

- Offering graduate courses in neuromodulation through participating graduate units, including lectures from neuromodulation experts.
- Developing and housing a graduate collaborative specialization in neuromodulation.
- Creating an emphasis in neuromodulation for MAsc and PhD students consisting of existing half-year neuromodulation-relevant courses established in Faculty of Applied Science & Engineering and partner Faculties. Students will be expected to take at least two courses from this curriculum, one of which must be the half-year seminar course discussed above.
- Coordinating industry internships and networking.
- Providing graduate students with domestic and international opportunities for industry

internships through collaborative projects funded by industry partners and organizations such as Mitacs, Ontario Centers of Excellence, NSERC, and Ontario Brain Institute. Well-established linkages with established and start-up companies will further enhance the educational experience of students while enabling them to gain valuable experience working with technology transfer offices to ensure protection of intellectual property.

- Requiring that students in existing graduate programs be supervised by at least two faculty members from participating graduate units, one from engineering or computer science, and the other a clinician or neuroscientist, to promote cross-disciplinary skills.

## **8. RESEARCH MANDATE AND ACTIVITIES**

The CNMI will facilitate the research, development, clinical validation and commercialization of innovative neuromodulation products and therapies – highly translational and collaborative activities that are currently being limited by institutional barriers – by focusing its research and technology development activities in the following key multidisciplinary research areas:

- 1) Neural Targets: develop advanced surgical navigation technologies, advanced imaging and electrophysiological measurement techniques to identify disease-relevant regions or “targets” in the nervous system.
- 2) Electronics, Electrodes and Computing: establish computational tools, bio-compatible electrodes and housings, implantable electronics, and wireless cloud-based data transfer technologies to capture and analyze neural activity.
- 3) Validated Closed-Loop Devices: combine knowledge from 1) and 2), and linear and nonlinear control theory and practice, to create intelligent monitoring devices capable of synthesizing and analyzing neurological activity data in real-time to provide closed-loop strategies for stimulation of neural targets in a responsive manner.

The CNMI will leverage and expand the capabilities of research initiatives across the University of Toronto and its fully affiliated health institutions by providing graduate students the opportunity to participate in existing commercialization efforts, randomized control trials and/or patient care efforts. The commercialization efforts will be carried out under the umbrella of the University of Toronto’s Health Innovation Hub (H2i) and the University Health Network’s Technology Development and Commercialization (TDC) office. Following their graduation, these students will be equipped with the tools necessary to work in neuromodulation design and manufacturing facilities, and to provide care to patients at the bedside.

More broadly, the CNMI will facilitate the research, development, clinical validation and commercialization of innovative neuromodulation products and therapies by:

- Promoting multi-disciplinary collaboration, resource sharing and the development and retention of highly-qualified personnel that are essential to advance the field in research

facilities such as:

- Krembil Discovery Tower – located at Toronto Western Hospital, houses the University of Toronto cross-appointed researchers who specialize in areas relevant to neuromodulation, including neurosurgery, neurology and neurological disorders. It will also house the Institute’s administrative offices.
- KITE Institute – the former research division of the University Health Network’s Toronto Rehabilitation Institute and home to CRANIA, KITE Institute houses the University of Toronto cross-appointed neural engineers and is the home of the Challenging Environments Assessment Laboratory, a world class facility that can be used to simulate the daily activities of patients with neuromodulation devices, such as driving a car, taking a shower, walking on a busy street, or walking in snow and in low temperature conditions. These challenging environments can be used to investigate neurological responses of the patients with and without the implant, and help develop new generations of neuromodulation implants and technologies that will allow patients to function well in challenging situations.
- Establishing an industry consortium with a membership fee to support collaborative research projects involving academic researchers and industry partners.
- Completing industry-funded research contracts, which allow the CNMI members and industry to develop products and services, create jobs and bring Canadian products and services to the global market quickly and efficiently.

## **9. ADMINISTRATIVE STRUCTURE**

A Senior Management Team comprised of the CNMI Director and the Associate Director, Operations and Academics will interact daily and hold formal monthly meetings to facilitate all policy development and administrative and financial decision-making.

### **9.1 Director**

Professor Taufik Valiante, Associate Professor in the Division of Neurosurgery and in the Institute of Biomaterials & Biomedical Research, will serve as the Interim Director of the CNMI. Upon establishment of the Institute, the Dean of the lead Faculty, Applied Science & Engineering (“lead Dean”), in consultation with the Academic Steering Committee, will appoint a Director for a fixed term of not more than five years, renewable once by the lead Dean. A review of the Director will be commissioned by the lead Dean normally near the end of the Director’s term.

The Director will be responsible to the lead Dean or designate for administrative and financial operations and policy development within the Institute. In collaboration with the Associate Director, Operations and Academics, the Director will facilitate decision-making regarding relationships with clinical, academic and industry partners, linkages to technical and TAHSN support services, training, collaborations, financial status and infrastructure.

Because the Director of an EDU:C is not appointed under the *Policy on Academic Administrative Appointments*, the Director does not have signing authority. As a consequence, the CNMI may

not administer research funds or enter directly, and on its own authority, into commitments, agreements, or contracts. All monies and research funding will flow through the lead Faculty in line with its normal practice. Any research contracts or agreements similarly require approval from the Office of the lead Dean.

### **9.2 Associate Director, Operations and Academics**

The Associate Director, Operations and Academics reports to the Director. This individual will serve as a bridge between the Director and other personnel to coordinate the day-to-day operations of the Institute. Although the lead Dean is responsible for overseeing the disbursement of advancement funds, a key responsibility of this role is to work with the

Divisional Advancement Office to create a sustainable funding base by attracting funds through peer-reviewed grants and philanthropy.

### **9.3 Academic Coordinator and Executive Assistant to the Director**

The Academic Coordinator and Executive Assistant to the Director reports to the Associate Director, Operations and Academics. This individual (0.75 FTE) will facilitate daily operations of the CNMI and will be responsible for:

- Providing dedicated support for the initiatives of the Senior Management Team, including special projects and awards.
- Coordinating educational activities of the Institute.
- Managing internal and external communications, including website and newsletter content creation and dissemination.
- Managing the Director's calendar, drafting correspondence on the Director's behalf, taking minutes of meetings, etc.

### **9.4 Executive Committee**

Governance and oversight responsibility for the EDU lies with its Executive Committee. Members of the Executive Committee are appointed by the lead Dean on the advice of the Director for four years, renewable thereafter on an annual basis. The Dean may terminate membership before the end of a four-year term. The Executive Committee will meet at least three times per year, or more frequently as required and called by the Chair. Membership of the Executive Committee consists of:

- CNMI Director (chair) (1)
- One faculty representative from each of the Faculty of Applied Science & Engineering, the Faculty of Medicine and the Faculty of Arts & Science, appointed by their respective Deans (3)
- KITE Institute Director (1)
- Vice-President, Research - UHN or designate (1)

The mandate of the Executive Committee is to guide the direction of the Institute while ensuring that the strategic goals of the Institute are upheld.

## 9.5 Advisory Board

In accordance with the *Provost's Statement on the Role of Advisory Bodies* (April 30, 1998), the lead Dean, with input from the Director and the Executive Committee, will establish an Advisory Board consisting of senior industry, government and public utility representatives with a direct interest in neuromodulation, to provide non-binding advice. The Advisory Board will include a Chair who will be invited to participate, in an advisory, non-voting role, in meetings of the Executive Committee as necessary. Board members will fill one or more primary roles:

- Provide strategic connections between researchers and industry/government leaders in their sector.
- Fund research within the CNMI through industry research contracts and partnership programs.
- In coordination with the Divisional Advancement Office, raise philanthropic funds for the CNMI.

Continued service on the Advisory Board will require tangible contributions in one or more of these three areas. The value proposition for Advisory Board members will include access to leading-edge research and to trained highly qualified personnel (HQPs) for recruitment.

## 10. BENCHMARKS AND MEASURES OF SUCCESS

The CNMI is well positioned to help unite disparate neuromodulation education streams and disciplines and cultivate research and scholarly interest in this field.

Consistent with the mission outlined in this proposal, a five-year strategic plan and a detailed implementation plan, including timelines and milestones, will be developed for approval by the Executive Committee and the lead Dean or designate during the first year of Director's term. In addition, annual reports outlining the Institute's progress against these milestones will be prepared and submitted to the lead Dean or designate for review.

Metrics and key performance indicators will be developed as part of the strategic planning process and approved by the Executive Committee. These may include:

- Quality of the Institute's educational programming.
- Success of the Institute in attracting faculty, undergraduate and graduate students, e.g., to participate in the proposed undergraduate minor or in research projects and seminars/workshops/conferences.
- Number of new research collaborations that begin as a result of the Institute's activities.
- Total revenues, including research funding.
- Research publications and citations by the Institute's affiliated faculty.
- Organization of events such as seminars, workshops, and the annual industry showcase.
- Mentions in social and news media.

## **11. RESOURCES**

Start-up funds for the CNMI's operations will be secured from the Faculty of Applied Science & Engineering via the Dean's Strategic Fund and from a five-year financial commitment from the Faculty of Arts & Science. These funds will cover the establishment of the CNMI seed funding program, seminar series and workshops, website, industry consortium with membership fee, and the completion of industry-funded research contracts. Additional resources have been secured through the University Health Network's CRANIA that will cover the provision and maintenance of critical clinical and engineering facilities, salary costs of some administrative staff, and the provision of administrative space at the University Health Network's Krembil Discovery Tower.

A budget for the proposed EDU:C will form part of the Memorandum of Agreement, not attached to this proposal.

The ongoing success of the CNMI will depend on securing continuing operating funds and support. This will be achieved by:

- Using existing teaching labs at the University of Toronto and affiliated hospitals to deliver curriculum.
- Working with the Divisional Advancement Office to attract funds through peer-reviewed grants and philanthropy.
- Annual industry consortium and membership fees.

## **12. CONSULTATION**

Extensive consultations were undertaken in the development of this proposal; feedback was positive and enthusiastic, and recommendations have been incorporated. Overall, support from partner health care institutions, partner Faculties and their departments and institutes, as well as individual faculty members engaged in neuromodulation, has been universal and letters or emails indicating support from the Faculty of Arts & Science, the Faculty of Dentistry, the Faculty of Medicine and the University Health Network are on file in the lead Dean's Office. Specifics on those consulted are provided in Appendix C.

## **13. GOVERNANCE AND REVIEWS**

The creation of the EDU:C requires governance approval of the lead Faculty (Engineering) and Faculties who are providing financial support to the Institute (the Faculty of Arts & Science under decanal authority). Approval of the EDU will be reported to the Office of the Vice-President and Provost for information and for inclusion in the university's list of extra-departmental units. Roles of partners providing financial support or support in kind will be described in a Memorandum of Agreement, not attached to this proposal.

In line with normal practice, an EDU:C is subject to periodic review at fixed intervals (normally every five years), conducted by the lead Dean. This would typically coincide with the term of the EDU Director. As part of this review process, the EDU Director is required to submit a self-

study report to the Dean or designate summarizing progress against the EDU's five-year strategic plan goals. Any review would normally assess the EDU's sustainability, performance and achievements relative to the goals set out at its establishment. Possible outcomes of the review could include closure.

An EDU:C is also expected to report annually to the Dean or designate on the progress made toward its goals.

## **APPENDIX A: PARTNERS**

The CNMI will drive the field of neuromodulation forward by bringing together currently isolated departments and institutions, hospitals, research institutes and research clusters as listed below (confirmed partners are noted with an asterisk).

### **University of Toronto Departments and Institutes**

- Faculty of Applied Science & Engineering (*lead Faculty*)
  - Biomaterials & Biomedical Engineering\*
  - Electrical & Computer Engineering\*
  - Institute for Aerospace Studies
  - Material Science & Engineering
  - Mechanical & Industrial Engineering\*
  
- Faculty of Arts & Science
  - Biological Sciences
  - Chemistry\*
  - Computer Science\*
  - Mathematics\*
  - Psychology\*
  
- Faculty of Dentistry\*
  
- Faculty of Kinesiology and Physical Education
  
- Faculty of Medicine
  - Medicine\*
  - Occupational Science and Occupational Therapy
  - Pharmacology
  - Physiology
  - Rehabilitation Sciences Institute (RSI)
  - Surgery\*
  - Tanz Centre for Neurodegenerative Disease (Tanz CRND)

### **Hospitals and Research Institutes**

- University Health Network
  - Krembil Research Institute\*
  - KITE Institute (formerly the Research Division of Toronto Rehabilitation Institute)\*
    - Center for Advancing Neurotechnological Innovation to Application (CRANIA)
    - AGE-WELL

## APPENDIX B: FACULTY PARTICIPATION

As an EDU:C, the CNMI may only hold non-budgetary, cross-appointed faculty. The following University of Toronto faculty members are involved in neuromodulation research and have confirmed their interest in participating in the Institute (“active” denotes members who are committed to CNMI versus those who are interested in its activities). This is an initial list, cultivated primarily through departmental and institute consultations or email confirmations from individuals interested in participating and is not exhaustive. It is anticipated that additional faculty members will participate in the CNMI after it has been established.

Members Engaged in CRANIA NMI	Budgetary Home Unit (%)	Main Appt. (for Clinical Non-Budgetary Cross Appointments)	Appt. Category (Stream or Rank)	Appt. to Other Units	Participation in CNMI	
					Active	Interested
Adve, Ravi	ECE		Professor	CNMI		X
Aitchison, Stewart	ECE		Professor	CNMI		X
Bardakjian, Berj	ECE 51%; IBBME 49%		Professor	CNMI	X	
Barfoot, Tim	UTIAS		Professor	CNMI		X
Carlen, Peter	KRI	Neurology	Professor (clinical)	IBBME; CNMI	X	
Chen, Robert	KRI	Neurology	Professor (clinical)	CNMI	X	
Craven, B. Catherine	Medicine		Associate Professor	HPME; CNMI	X	
Davis, Karen	KRI	Surgery	Professor (clinical)	IMS; CNMI	X	
Downar, Jonathan	KRI	Psychiatry	Assistant Professor (clinical)	CNMI	X	
Duncan, Katherine	Psychology		Assistant Professor	CNMI	X	
Eleftheriades, George	ECE		Professor	CNMI		X
Fasano, Alfonso	KRI	CNMI (active)	Clinical			X
Fehlings, Michael	Surgery		Professor	IMS; CNMI	X	
Fernie, Geoffrey	KITE	IBBME	Professor (clinical)	CNMI	X	
Furlan, Julio	KITE	Physical Medicine and Rehabilitation	Assistant Professor (clinical)	CNMI	X	
Genov, Roman	ECE		Professor	CNMI	X	

Members Engaged in CRANIA NMI	Budgetary Home Unit (%)	Main Appt. (for Clinical Non-Budgetary Cross Appointments)	Appt. Category (Stream or Rank)	Appt. to Other Units	Participation in CNMI	
					Active	Interested
Guenther, Axel	MIE		Associate Professor	CNMI	X	
Gulak, Glen	ECE		Professor	CNMI		X
Hamani, Clement	KRI	Surgery	Associate Professor (clinical)	IMS, CNMI	X	
Hassouna, Magdy	Surgery		Professor	CNMI	X	
Hatzinakos, Dimitris	ECE		Professor	CNMI	X	
Hodaie, Mojgan	KRI	CNMI (active)	Clinical			X
Hutchison, William	KRI	Physiology, Surgery	Associate Professor (clinical)	Surgery; IMS; CNMI	X	
Kalia, Lorraine	KRI	Neurology	Associate Professor (clinical)	LMP; CNMI	X	
Kalia, Suneil	KRI	Neurosurgery	Assistant Professor (clinical)	CNMI	X	
Koudas, Nick	Computer Science		Professor	CNMI	X	
Krings, Timo	KRI	Medical Imaging	Professor (clinical)	CNMI	X	
Lang, Anthony	Medicine		Professor	IMS; CNMI	X	
Lefebvre, Jeremie	KRI	Mathematics	Assistant Professor (clinical)	CNMI	X	
Levi, Ofer	IBBME 51%; ECE 49%		Associate Professor	CNMI	X	
Liscidini, Antonio	ECE		Associate Professor	CNMI		X
Lozano, Andres	Surgery		Professor	CNMI	X	
Marquez Chen, Cesar	KITE	CNMI	Clinical		X	
Masani, Kei	KITE	IBBME	Assistant Professor (clinical)	CNMI	X	
Mihailidis, Alex	Occupational Science and Occupational Therapy		Professor	OT; CNMI		X
Morshead, Cindi	Surgery		Professor	IBBME;	X	

Members Engaged in CRANIA NMI	Budgetary Home Unit (%)	Main Appt. (for Clinical Non-Budgetary Cross Appointments)	Appt. Category (Stream or Rank)	Appt. to Other Units	Participation in CNMI	
					Active	Interested
				IMS; CNMI		
Musselman, Kristin	KITE	Physical Therapy	Assistant Professor (clinical)	CNMI	X	
Nachman, Adrian	ECE; Mathematics		Professor	CNMI	X	
Naguib, Hani	MIE, MSE		Professor	CNMI; IBBME	X	
Plataniotis, Konstantinos	ECE		Professor	CNMI	X	
Poon, Joyce	ECE		Professor	CNMI	X	
Popovic, Milos	IBBME		Professor	CNMI	X	
Richards, Blake	Biological Sciences (UTSC)		Assistant Professor	CIFAR		X
Rudzicz, Frank	KITE	Computer Science	Associate Professor (clinical)	Vector Institute; CNMI	X	
Santerre, Paul	Dentistry 51%; IBBME 49%		Professor	CNMI	X	
Scardovi, Luca	ECE		Associate Professor	CNMI		X
Schlichter, Lyanne	Physiology		Professor	CNMI		X
Sheikholeslami, Ali	ECE		Professor	CNMI (active)	X	
Skinner, Frances K.	KRI	Neurology	Professor (clinical)	Physiology; CNMI	X	
Strafella, Antonio	KRI	Neurology	Associate Professor (clinical)	IMS; CNMI	X	
Sun, Yu	MIE		Professor	CNMI		X
Valiante, Taufik	KRI	Neurosurgery	Associate Professor (clinical)	IBBME; IMS; CNMI	X	
Wennberg, Richard	Medicine		Professor	CNMI		X

Members Engaged in CRANIA NMI	Budgetary Home Unit (%)	Main Appt. (for Clinical Non-Budgetary Cross Appointments)	Appt. Category (Stream or Rank)	Appt. to Other Units	Participation in CNMI	
					Active	Interested
Wheeler, Aaron	Chemistry		Professor	IBBME; CNMI	X	
Wong, Willy	ECE		Associate Professor	IBBME; CNMI	X	
Yoo, Paul	IBBME 51%; ECE 49%		Associate Professor	CNMI	X	
Zadeh, Gelareh	KRI	Surgery	Assistant Professor (clinical)	IMS; CNMI	X	
Zariffa, Jose	KITE	IBBME	Assistant Professor (clinical)	CNMI	X	
Zhang, Liang	KRI	Surgery	Associate Professor (clinical)	CPIN; CNMI	X	

## APPENDIX C: CONSULTATIONS

### University of Toronto

Unit	Department/Division/Institute	Name	Date
Applied Science & Engineering	Chemical Engineering & Applied Chemistry	Grant Allen, Chair	Sep 2019 (for info)
	Civil & Mineral Engineering	Brent Sleep, Chair	Sep 2019 (for info)
	Materials Science & Engineering	Glenn Hibbard, Chair (previously Jun Nogami)	Sep 2019
	Mechanical & Industrial Engineering	Markus Bussmann, Chair	Sep 2019
	Engineering Science	Will Cluett, Chair	Sep 2019 (for info)
	Electrical & Computer Engineering	Deepa Kundur, Chair (previously Farid Najm)	Sep 2019
	Studies in Transdisciplinary Engineering Education & Practice	Greg Evans, Director	Sep 2019 (for info)
	Biomaterials & Biomedical Engineering	Warren Chan, Director (previously Chris Yip)	2016-Sep 2019
	Aerospace Studies	Chris Damaren, Director	Sep 2019
Arts & Science	Dean's Office (for consolidated feedback)	Melanie Woodin, Dean; Jay Pratt, Vice-Dean Research; Jamie Stafford, Vice-Dean Interdivisional Partnerships	Jul 2018-Sep 2019, Mar 2020
Dentistry	Dean's Office (for consolidated feedback)	Daniel Haas, Dean; Bernard Ganss, Vice-Dean Research	Sep 2019, Mar 2020
Medicine	Dean's Office (for consolidated feedback)	Trevor Young, Dean; Sal Spadafora, Acting Dean; Richard Hegele, Vice-Dean Research	Oct 2017-Sep 2019, Mar 2020
UTRHCI	University of Toronto Relations with Health Care Institutions	Trevor Young, Vice-Provost; Lynn Wilson, Acting Vice-Provost	Sep 2019, Mar 2020

## Hospitals and Research Institutes

<b>Hospitals</b>	<b>Unit</b>	<b>Name</b>	<b>Date</b>
University Health Network	KITE Institute (formerly Research Division of Toronto Rehabilitation Institute), home to CRANIA	Milos Popovic, KITE Institute Director; CRANIA Co-Director	2016-present
	Krembil Research Institute (KRI)	Gelareh Zadeh, Medical Director, Krembil Neuroscience Centre	May-Dec 2018
	University Health Network Science & Research	Bradly Wouters, Executive Vice-President Research	Sep 2018, Mar & Oct 2020
	University Health Network Education and Chief Medical Office	Brian Hodges , Executive Vice President	Nov 2018, Mar & Oct 2020