UNIVERSITY OF TORONTO

OFFICE OF THE GOVERNING COUNCIL

FOR ENDORSEMENT AND FORWARDING | **PUBLIC** | **CLOSED SESSION**

TO: Executive Committee

SPONSOR: Scott Mabury, Vice-President, University Operations
CONTACT INFO: scott.mabury@utoronto.ca

PRESENTER: See sponsor
CONTACT INFO:

DATE: October 9 for October 22, 2014

AGENDA ITEM: 3 (b.)

ITEM IDENTIFICATION:

Capital Project: Faculty of Applied Science and Engineering and Faculty of Medicine Translational Biology and Engineering Laboratories in the MaRS Centre Phase 2 Tower: Report of the Project Planning Committee, Project Scope, and Sources of Funding.

JURISDICTIONAL INFORMATION:

Under the *Policy on Capital Planning and Capital Projects*, proposals for capital projects exceeding $10 million must be considered by the appropriate Boards and Committees of Governing Council on the joint recommendation of the Vice-President and Provost and the Vice-President, University Operations. Normally, they will require approval of the Governing Council. Execution of such projects is approved by the Business Board.

GOVERNANCE PATH:

A. Project Planning Report:

1. Planning and Budget [for recommendation] (September 17, 2014)
2. Academic Board [for recommendation] (October 2, 2014)
3. **Executive Committee [for endorsement and forwarding] (October 22, 2014)**
4. Governing Council [for approval] (October 30, 2014)

B. Execution of the Project:

1. Business Board [for execution of the project] (September 22, 2014)

PREVIOUS ACTION TAKEN:

No previous action taken.

HIGHLIGHTS:

The proposed project is to fit out the 16th floor at the MaRS Centre Phase 2 tower on University Avenue at College Street (661 University Avenue) to accommodate the research needs of the proposed U of T Translational Biology and Engineering Laboratories [TBEL]. The TBEL is supported by the Institute of Biomaterials and Biomedical Engineering [IBBME], the Faculty of Applied Science and Engineering, the Faculty of Medicine and the Faculty of Dentistry. IBBME is an Extra-Departmental Unit (category EDU:A) governed in partnership under a Memorandum of Understanding among the three Faculties.

The TBEL is an integral component of the proposed establishment of a Centre for Heart Research in partnership with the Hospital for Sick Children and University Health Network. The administrative Directorate for Centre of Heart Research is planned to be located at one of the partner Institutions but is not incorporated into the scope of this TBEL project.

This report identifies a total TBEL space program of 2,220 net assignable square meters (nasm) consistent with the space planning principles of the Faculty of Applied Science and Engineering, Faculty of Medicine and the Council of Ontario Universities (COU) standards.

The Project Planning Committee was struck in Spring 2014. Membership included representatives from the Faculty of Medicine, the Faculty of Applied Science and Engineering, IBBME, the Faculty of Dentistry, University Planning, Design and Construction, Facilities Services and the undergraduate student body. The members met to inform the direction of the proposed project, as detailed in the Project Planning Report. Consultation included bi-weekly Project Planning Committee meetings as well as additional focus meetings with the committee chair, planners and user groups.

This project will help to address the space concern raised by the external reviewers of IBBME (Decanal Review, November 19-20, 2012). They stated in the review report that: “There is critical need for both short term and long term space to support the growth of the program. The lack of space puts the Institute at risk of losing junior faculty and limits its ability to attract top-notch faculty, particularly senior faculty with large laboratories, research budgets, and students.” They also wrote in the Research section that: “More specifically, the biomaterials and tissue engineering research themes are well positioned for international leadership and sustained growth... To better integrate and accelerate the excellent research programs it seems logical to consider strategic core facilities that can be implemented immediately while the space situation is still in flux.” This proposal demonstrates the Faculty of Medicine’s ongoing collaboration with other units and its work in strengthening its research vision.

FINANCIAL IMPLICATIONS:

Discussion of overall costs and sources of funds can be found in the *in camera* document for this project.

RECOMMENDATION:

Be It Resolved

THAT the following recommendation be endorsed and forwarded to the Governing Council:

1. THAT the Project Planning Committee Report for the Faculty of Applied Science and Engineering and Faculty of Medicine Translational Biology and Engineering Laboratories in the MaRS Centre Phase 2 Tower, dated August 6, 2014, be approved in principle; and

2. THAT the project scope to accommodate the Translational Biology and Engineering Laboratories in the MaRS Centre Phase 2 Tower, totalling 2,220 net assignable square metres (nasm) (3,675 gross square metres (gsm), to be funded by the Capital Campaign, the Faculty of Applied Science and Engineering and the Faculty of Medicine, be approved in principle.

DOCUMENTATION PROVIDED:

Report of the Project Planning Committee for the Faculty of Applied Science and Engineering and Faculty of Medicine Translational Biology and Engineering Laboratories in the MaRS Centre Phase 2 Tower, dated August 6, 2014.

PROJECT PLANNING COMMITTEE REPORT

FACULTY OF APPLIED SCIENCE AND ENGINEERING AND FACULTY OF MEDICINE TRANSLATIONAL BIOLOGY AND ENGINEERING LABORATORIES IN THE MaRS CENTRE PHASE 2 TOWER

Facilities and Infrastructure Planning, Faculty of Applied Science and Engineering,
Facilities Management and Space Planning, Faculty of Medicine

and

Campus and Facilities Planning
University of Toronto

August 6, 2014

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I. EXECUTIVE SUMMARY

The proposed project is to fit out the 16th floor at the MaRS Centre Phase 2 tower on University Avenue at College Street (661 University Avenue) to accommodate the research needs of the proposed U of T Translational Biology and Engineering Laboratories [TBEL]. The TBEL is supported by the Institute of Biomaterials and Biomedical Engineering [IBBME], the Faculty of Applied Science and Engineering, the Faculty of Medicine and the Faculty of Dentistry. IBBME is an Extra-Departmental Unit (category EDU:A) governed in partnership under a Memorandum of Understanding among the three Faculties.

The TBEL is an integral component of the proposed establishment of a Centre for Heart Research in partnership with the Hospital for Sick Children and University Health Network. The administrative Directorate for Centre of Heart Research is planned to be located at one of the partner Institutions but is not incorporated into the scope of this TBEL project.

This report identifies a total TBEL space program of 2,220 net assignable square meters (nasm) consistent with the space planning principles of the Faculty of Applied Science and Engineering, Faculty of Medicine and the Council of Ontario Universities (COU) standards.

The total project cost estimate includes consulting fees, construction and relocation costs for the fit-out of the 16th floor at the MaRS Centre Phase 2 tower.

An Offer to Lease (10 years plus renewal rights) between MaRS Phase 2 Inc. and The Governing Council of the University of Toronto is under negotiation at this time. The intent is to proceed with the TBEL project in the very near term so that the TBEL could be fully functional by the late summer or early fall of 2015.

RECOMMENDATIONS:

That the CaPS Executive Committee recommends:

(i) The Project Planning Committee Report for the planning and outfitting of the shelled 16th floor at MaRS Centre Phase 2 tower to establish TBEL be approved in principle, and

(ii) The project scope as identified in the Project Planning Committee Report be approved in principle with funding from the identified sources.

II. PROJECT BACKGROUND

a. Membership

Ron Venter [Chair],	Professor Emeritus, Department of Mechanical & Industrial Engineering, Faculty of Applied Science & Engineering
Steve Miszuk,	Director, Facilities & Infrastructure Planning, Faculty of Applied Science & Engineering
Heather Taylor,	Director, Facilities Management & Space Planning, Faculty of Medicine
Tim Neff,	CAO, Office of the Dean, Faculty of Medicine
Alison Buchan,	Vice Dean, Research & International Relations, Faculty of Medicine
Christopher Yip,	Director, Institute of Biomaterials & Biomedical Engineering (IBBME)
Craig Simmons,	Associate Director, Research, IBBME
Paul Santerre,	Professor, IBBME, Faculty of Dentistry
Rodrigo Fernandez-Gonzalez	Assistant Professor, Institute of Biomaterials & Biomedical Engineering
Milica Radisic,	Professor, IBBME, Faculty of Applied Science & Engineering
Carol Laschinger	Research Associate, IBBME, Faculty of Applied Science & Engineering
Gail Milgrom,	Director, Campus & Facilities Planning
George Phelps,	Director, Project Development, University Planning, Design & Construction
John Smegal,	Real Estate Analyst, Real Estate Operations
Sarah Hinves,	Planner, Campus & Facilities Planning
Alan Webb,	Planner, Campus & Facilities Planning
Soror Sharifpoor	Post-doctoral Fellow, Faculty of Dentistry
Kyle Battison,	Ph.D. Graduate Student

b. Terms of Reference

The Project Committee must address the following items:

1. Report on the detailed space program and floor plan to accommodate the research activities of the TBEL (a key component of the new Centre for Heart Research) in the new MaRS Centre Phase 2 tower located at 661 University Avenue.
2. Demonstrate that the proposed space program will take into account the Council of Ontario Universities' and the University's own Space Standards.
3. Plan to realize maximum flexibility of space to permit future reallocation as programmatic needs change.
4. Determine the secondary effects of the project and the resource implications of relocating activities as required.
5. Determine a total project cost (TPC) estimate for the project, including costs of implementation in phases if required, and costs associated with secondary effects.
6. Identify all sources of funding for the capital project and anticipated operating costs once the project is complete.

c. Background Information

The project scope is to outfit the entire 16th floor within the MaRS2 tower on University Avenue at College Street (661 University Avenue) to accommodate the research needs of the planned UofT Translational Biology and Engineering Laboratories [TBEL]. An anticipated donation to the University of Toronto, the Hospital for Sick Children and the University Health has presented the opportunity to establish the TBEL in support of the University of Toronto participation in the Centre for Heart Research. An administrative Directorate is to be established, and both the Hospital for Sick Children and the University Health Network will each independently address their infrastructure requirements in support of this unique initiative to further strengthen the research partnership between the three Institutions.

The University of Toronto gifting is directed to the Faculty of Applied Science and Engineering, the Faculty of Medicine and through the Institute of Biomaterials and Biomedical Engineering [IBBME], TBEL will actively include researchers from both Faculties as well as the Faculty of Dentistry.

The TBEL objectives are best described in the broader context of the IBBME collaborative initiatives which have been effectively nurtured with the enthusiastic support of the Faculty of Applied Science and Engineering, the Faculty of Medicine and the Faculty of Dentistry over the past decades since it was established.

IBBME is recognized as having innovative pedagogical programs combined with high impact research within a unique trans-disciplinary environment. The Institute's **mission** focuses on providing the University of Toronto and its GTA clinical partner institutions with programs that deliver an excellent and comprehensive education for its trainees, and performing internationally acclaimed research in biomaterials and biomedical engineering, with an emphasis on establishing impact of clinical relevance and innovation in the biomedical field.

The Institute has a significant advantage in its ability to cross a broad spectrum of disciplines and translate its work clinically owing to its unique relationship with three Faculties. Further, the Institute thrives at the level of other top international biomedical engineering programs through the strong collaborative network that the Institute has established with many partners in the GTA over the past decades. This strategic approach will be enhanced significantly by the TBEL, with its multi-Faculty support and integration of researchers from multiple institutions and disciplines.

The TBEL will also meet several priorities of the current IBBME Academic Plan, including:

- To "establish the Institute's marketing and advancement strategy to enable new joint programs for the tri-faculty partnership of Applied Science and Engineering, Dentistry, and Medicine, which make up IBBME's funding core. Of particular interest is the recruitment of outstanding students, and faculty who have innovative research agendas and an ability to execute on these agendas"
- To meet priorities within the IBBME Biomaterials, Regenerative Medicine, and Tissue Engineering research theme to collaborate and integrate with other themes (e.g.., Engineering in a Clinical Setting); establish facilities for large animal imaging (available through partner institutions in the TBEL); and establish new laboratory space to enable the hiring of new faculty members

More broadly, IBBME's strategic priorities enabled by TBEL, are well aligned with areas of growth identified by the University, most notably (text from the Boundless Campaign website):

- **Human development and health:** *We have unprecedented opportunities to pre-empt, modulate and even eradicate some of the world's most common illnesses. At the same time, the challenges we face are daunting: the rising tide of chronic disease,…the complexity of translating new scientific knowledge into viable treatments and the long-term sustainability of health care systems are just some of the vexing problems we will confront in the years to come.*

- **Invention and innovation:** *As the country's largest driver of innovation in management, science and technology, the University of Toronto is a wellspring of new ideas in the rapidly evolving fields of information and communications technology, digital media, nanotechnology, bioengineering and biopharmaceuticals. … The Campaign will nourish the creative minds that are developing the next wave of technologies with the potential to change the world..., it will support an emerging generation of managers and entrepreneurs with the imagination and foresight to transform inventions into innovative products and services for domestic and global markets.*

TBEL is planned to provide new consolidated laboratory and office space to accommodate the research activities of eight existing Principal Investigators (PIs), with the capacity to add two potentially endowed Chairs[1] in the future, for a total of ten PIs in steady state. A tentative list of PIs has been identified in Appendix E; a significant sub-set of these researchers were consulted during this planning exercise and have served on the Project Planning Committee.

The Faculties above are currently developing a collaborative business plan that will identify the commitment and contribution of each; for the Faculty of Applied Science and Engineering this will require commitments from IBBME and participating Departments for all PI's active in TBEL. The same principle will extend to the other participating Faculties, notably the Faculty of Dentistry. It is noted and respected that each Faculty has a different internal management models regarding space matters.

It is important to emphasize that the partnership culminating in the Centre for Heart Research includes elements of collaborative research, education and innovation.

[1] Two endowed Chairs at the University of Toronto are envisaged in the areas of Immuno-Engineering and Cardiac Tissue and Cellular Systems Marketing. Additional Chairs are to be established at the Hospital for Sick Children and the University Health Network.

d. Space Requirements

Occupant Profile

At this time, eight existing PIs, and two new PIs, have been included in the planning for the new TBEL space. It is anticipated that each PI will have either a full appointment or cross-appointment to IBBME, the Faculty of Applied Science and Engineering, the Faculty of Medicine or the Faculty of Dentistry.

For planning purposes, each research team will be comprised of one PI, along with 12 to 14 researchers and/or graduate students. The TBEL space is categorized as either dry laboratory or wet laboratory, level II space. The dry laboratory space will include all PI offices, researcher/graduate student carrels, meeting rooms, a conference room, a lounge/ kitchenette and a receiving area. The wet laboratory, level II facilities will include a 1,000 nasm open concept laboratory, supported by 15 ante-rooms [average size of 30 nasm] with defined functions, and 5 service rooms.

The Directorate for the Centre for Heart Research for the three partner institutions (UHN, SickKids, U of T) which, as noted previously, is not accommodated at the MaRS2 location, will require accommodation for the Director, an Administrative Assistant, a Business Officer, an IT Coordinator, and a Public Relations Officer. This accommodation is outside of the scope of the TBEL project.

Type	**Proposed** (FTE)
Principal Investigator [PI]	10
Tech. Coordinator	1
Researchers/ Graduate Students	120

Using the occupant profile above, a nominal space program was developed guided by the Council of Ontario Universities (COU) Building Block guidelines modified according to University of Toronto planning practice. The total space generated using the guidelines is 3,421 net assignable square metres (nasm), the space program was developed at 2,220 nasm (detailed on the following page), to be contained within usable floor plate of 2,888 square metres.

Space, generated and proposed, as noted is one of two categories: Wet Research Laboratory, Type II; or Dry Research Laboratory (office and project space)

		Generated Space (nasm)	**Proposed Space** (nasm)	**Input Measure**
Dry Lab	Standard Office	132	132	11 FTE, 10 PI and 1 Tech
Dry Lab	Carrel Rooms and Lockers	480	405	120 FTE graduate students
Dry Lab	Office Support Space	191	158	25% of office space
Wet Lab, II	Open Laboratories, Ante and Service Rooms	3,135	1,525	10 PI + .5(120) graduate students
	TOTAL	3,938	2,220	56%

Note that the proposed laboratory space appears to fall well below the space generated. However, the COU input measure for Wet Lab, Level II space considers extensive service space such as animal facilities, glass washing facilities etc. not required in this program. The critical measure of the space required is the bench allocation per researcher. This has been determined as a minimum of five linear feet (1.5m) for 120 researchers, 600 linear feet (183m), which can be contained within the proposed 1,000 nasm open laboratory allocation. If the floor-plate permits an increase in the 2,220 nasm above, then this space should be directed entirely to increasing the open laboratory floor area.

III. PROJECT DESCRIPTION

a. Vision Statement

This particular project to establish TBEL is a direct result of a major donation to the University of Toronto, the University Health Network and the Hospital for Sick Children that will establish a Centre for Heart Research. The vision is entirely consistent with the academic mission of the IBBME, the Faculty of Applied Science and Engineering and the Faculty of Medicine.

A Vision for the Centre for Heart Research and TBEL

The Centre will transform and dramatically improve the future of heart health for children, adults and families across Canada and around the world. Heart disease impacts the lives of millions of Canadians and represents a major economic and social burden on society. It does not have to be this way.

Breakthroughs in genomic medicine are enabling the early detection of heart failure, making it possible to treat patients before irreversible damage occurs. Novel therapies, based on regenerative stem cells and bioengineered tissues, are opening up new frontiers of treatment, whereby heart failure can be addressed in compromised patients. Advances in telecommunications and cloud computing are making it possible to manage heart disease from the home rather than the hospital clinic or emergency room.

The proposed Centre for Heart Research will capitalize on these revolutionary breakthroughs and bring together leading experts in the areas of personalized medicine, stem cells and tissue engineering and cardiovascular care to redefine treatment for the 21st century. The scope and impact of this initiative will be unprecedented. The Centre will be the first institution in the world to bring together research, education and innovation in congenital heart disease, regenerative medicine and paediatric and adult heart disease under one umbrella and a single focus: addressing heart failure across the entire life span from children to adults.

Only Toronto has both the depth of research excellence across the cardiovascular spectrum and the ability to align and harness this excellence in a single platform that bridges multiple institutions. With a transformation investment, the donor's **Foundation, the Hospital for Sick Children, the University Health Network and the University of Toronto** will change the face of Cardiac care and advance Toronto's reputation as an international leader in scientific innovation and discovery.

The Partnership: The partnership that unites the Hospital for Sick Children, University Health Network and the University of Toronto is what makes the Centre for Heart Research unique. To understand what each partner brings to this initiative, the particular strengths of the partners are summarized:

Personalized Geonomic Medicine: **led by the Hospital for Sick Children.** SickKids will harness the power of genomic science to decode the genetic foundations of cardiac disease. This will lead to the prediction of heart disease before it occurs and enable individualized therapies for children and adults, based on the unique genome of each patient.

Translational Biology and Engineering**: led by the University of Toronto.** U of T will harness stem cell technology to drive the regeneration of heart muscle, coronary vessels, and heart valves, as well as engineer new devices for the home to allow remote monitoring of cardiac function and improve patient health outcomes.

Integrated Program for Excellence in Heart Function: **led by the University Health Network.** UHN will improve quality of life and reduce re-admission to hospital for patients with heart failure. By leveraging leading edge home-based health and lifestyle monitoring technologies, which connect to a secure electronic medical record and communication platform, UHN will develop innovative personalized patients care algorithms. Clinicians will also investigate how the treatment of various diseases such as cancer, diabetes and arthritis impair heart function, and develop new tools to prevent and treat heart failure. This will lead to conducting 'first-in-human' clinical trials for novel devices and implants to deliver new standards of care.

TBEL at the University of Toronto

The gifting to establish the Centre for Heart Research has provided the stimulus and opportunity to launch TBEL.

The TBEL will bring together researchers with expertise in cardiovascular biology, stem cells, and biomaterials to regenerate heart muscle, blood vessel, and heart valve tissue. The highly interdisciplinary nature of this work necessitates collaborations between researchers from diverse fields. All of the proposed TBEL PIs currently collaborate with one another and/or with other researchers in the broader UofT community.

The consolidated TBEL space and resources will not only enhance existing collaborations between its PIs but also will catalyze new collaborations between its researchers working side-by-side at the bench. The close proximity of the MaRS2 tower to the Hospital for Sick Children and the University Health Network will eliminate the physical barriers that currently stifle interaction between UofT campus PIs and those in the hospitals. Growth of the TBEL team will be rapid, facilitated by the hiring of two new Chairs into TBEL and by the broad impact of the Centre and the state-of-the-art TBEL facilities and shared resources, all of which will attract top researchers and graduate students to the team.

While the bulk of the research will take place in MaRS2, collaborations with other researchers at UofT will continue, capitalizing on relevant expertise in stem cell engineering, biomaterials, and micro-technologies in the IBBME and in other departments in all of the involved Faculties and across campus. In total, the integration of multiple complementary research groups within the TBEL will generate synergies and opportunities that would not be possible otherwise, but are essential to achieving the common goal of repairing damaged hearts.

b. Space Program and Functional Plan

Space Program

The tables below provide a space program with a total area of 2,220 nasm (3,675 gsm) for TBEL. The proposed program anticipates 10 Principal Investigators (PI's) and a complement of researchers, graduate students and staff. The TBEL facility is primarily Wet Laboratory level II space.

Nominal Space Program		Proposed Rooms	Per unit (nasm)	Proposed Space (nasm)	Data sheet I.D.
Dry Lab (TBEL)	Standard Office (PI)	10	12	120	SP-1
	Standard Office (Tech. Coordinator)	3	12	36	SP-1
	Carrel Rooms	8	48[2]	384	SP-2
	Lounge/Kitchen	1	40	40	SP-5
	Lockers (128)		0.17	21	SP-6
	Receiving/ Storage	1	30	30	SP-7
	Conference Room	1	40	40	SP-8
	Meeting Rooms	2	12	24	SP-9
Wet Lab, II	Ante Rooms: Tissue Culture	6	30[3]	180	
(TBEL) 1	Human Stem Cells - Pluripotent				SP-3.1
2	Human Stem Cells - Adult				SP-3.1A
3	Cell Lines				SP-3.1B
4	Animal Primary Cells & Tissues				SP-3.1C
5	Bacteria Room				SP-3.1D
6	Transfection Room				SP3.1E
	Ante Rooms, Generic	9	30	270	
7	Analytic Room I				SP-3.2
8	Analytic Room II				SP-3.2A
9	Chemical Distillation				SP-3.3
10	Surface Coating & Electro Spinning				SP-3.4
11	C-14 Radiolabel Handling				SP-3.5
12	Gene Analysis				SP-3.6
13	Microscopy I				SP-3.7
14	Microscopy II				SP-3.7A
15	Histology				SP-3.8

[2] This is an average value and a 48 nasm room will house 16 researchers [3 nasm per individual]. These rooms can change in size to suite the floor plate, within reason. A typical unit space for a chair and table is a desk, 4-5 feet wide, by 6 feet to allow for a chair and a walking aisle.

[3] This is an average value for each of the 15 proposed ante-rooms; it may be necessary to marginally increase the size of selected high demand ante-rooms, specifically the Human Stem Cells- Pluripotent [ante-room #1] and the Animal Primary Cells and Tissue [ante-room 4]. Once the initial laboratory layout has been completed; it will be useful to reconsider which ante-rooms need to be marginally increased in size or decreased in size. It is also a possibility that within the total 450 nasm assigned to accommodate the 15 x 30 ante-rooms that some ante-rooms could be duplicated or reduced in size but all within the 450 nasm allocation for this activity.

Nominal Space Program (cont.)		**Proposed Rooms**	**Per unit** (nasm)	**Proposed Space** (nasm)	**Data sheet I.D.**
Wet Lab, II	Service Rooms	5	15[4]	75	
(TBEL) A	R O Water				SP-3.11
B	Cold Room I				SP-3.12
C	Cold Room II				SP-3.12A
D	Fly Work Room				SP-3.13
E	Glassware Pick-up & Storage				SP-3.14
Wet Lab, II	Open Laboratory[5]	1	1,000	1,000	SP-4
	TOTAL	47		2,220	

Room Data Sheets, providing detailed requirements and reference SP-1 through to SP-9, have been prepared for each room identified in the TBEL space program.

[4] This is an average value.

[5] The Open laboratory could be designed as three distinct zones and will depend on how the floor-plate is used. Whatever the final design might be it is important that each of the zones have the equivalent infrastructure, i.e. it is required that there be at least one or more fume-hood(s), of the seven fume-hoods planned for the Open Laboratory, within a zone

Functional Plan

The research Space Program is essentially two types of space, namely the *wet laboratory Level II space* and the *dry laboratory space*, which does not require the Level II classification.

The TBEL Wet Laboratory, Level II 1,525 nasm
The wet laboratory, Level II space will comprise a large open concept laboratory supported by fifteen specialized ante rooms adjacent to the open laboratory and five service rooms. The open concept laboratory could be contained within one defined area or, given the unique footprint of the 16th floor, be subdivided into one, two or even three open laboratory zones.

It should be noted that the specialized ante-room and service room facilities are intended to be supportive of the entire open laboratory, i.e. all areas of the open concept laboratory so that it is preferable to keep the number of zones to a minimum and not to exceed a maximum of three. It is anticipated that Ante and Service rooms will be clustered together close to the service core; some of these rooms specifically request a preference for no windows. Given the nature of the planned activity in the various Ante-rooms it is required that Anterooms #7, #8, #9, #10, #11, #12 and #15 be grouped together to address their specific air handling requirements.

12 fume-hoods (seven within the Open Laboratory and five in the Ante Rooms) are included in the project. If the Open laboratory is designed as more than one zone, but less than three, fume hoods must be distributed proportionally, by nasm, to each of the zones. Furthermore, the positioning of the fume-hoods within the Open Laboratory (s) should be such as to minimize the length of ducting required for the exhausts.

Other requirements of note include:

- The five Anterooms that require fume-hoods are: #7 Analytical Room I, #8 Analytical Room II, #9 Chemical Distillation, #10 Surface Coating & Electro Spinning and #15 Histology. These requirements are identified in their respective Specification Sheets.
- Within the Open Laboratory [or zones thereof] it is recommended that an internal passageway or corridor could conveniently be used to house the freezers and or fridges thereby using the corridor space to access these facilities; this practice to establish a *cold corridor* appears to be used at other facilities that were visited and which are referred to in this Report. The current equipment list includes some 9 freezers and 15 fridges and the majority of these are to be located within the Open laboratory.
- Emergency power is required in the TBEL facility. It will be noted in the specification sheets that each Ante-room has been assigned some level of emergency power plus the Service room D for a total capacity of 32 kW. The balance of the installed capacity of 110kW, i.e. 78 kW is to be distributed within the open laboratory with some 50% servicing the *cold corridor.*
- Chemical Storage is required to be provided in the Open Laboratory within chemical storage cabinets. Recommendations on whether these cabinets are to be located in an enclosed area with suitable venting are to be clarified.
- The location of all safety showers and eye washers in the Open Laboratory need to be carefully optimized. Specifically it is not the intent or requirement to install showers in any of the ante-rooms; however it would be beneficial were a safety shower to be located close to ante-rooms #9:Chemical Distillation and #10:Surface Coating & Electro Spinning.

The TBEL Dry Laboratory 695 nasm

The dry laboratory areas comprise all support services that do not require Level II space and include the offices, carrel space (all outside the open laboratory) for researchers to write up results etc., meeting rooms, conference room, a lounge & kitchenette, lockers and space to handle deliveries and storage of such items. These support facilities are best located with window exposure in the narrower confines along the building periphery, allowing these areas to benefit from natural light with interior glazing into the corridors and beyond, and allowing the Level II space to be accommodated in the larger core areas of the floor where most of the ante and service rooms do not require windows. PI offices should ideally be adjacent to the wet labs, but with proximity to the elevator core and windows as a priority.

Non-assignable Space: 620 m^2 allowance

The rentable floor area is 39,560 sq. ft. [3675 m^2]
The usable floor area is 31,086 sq. ft. [2,888 m^2]

The difference in these two measurements accounts for all existing core elements: washrooms, elevators, stairs and vertical ducting shafts, etc. The net assignable area is defined by MaRS to be 2,840 m^2 and must accommodate the required space program (2,220 nasm) plus non-assignable space.

The non-assignable spaces, beyond that provided on the floor, include the supplementary mechanical service room (no more than 100 nasm), corridors linking the various spaces and connecting to core elements, and a 8-10 nasm communication room (if required to supplement the existing core communications room.)

If the floor-plate design and subsequent layout can accommodate an increase above the 2,220 nasm as stipulated above, then this space should be directed entirely to the open laboratory floor area. In the event that the planned space program cannot be suitably accommodated on the floor, then the total space assigned to the creation of carrel rooms will be marginally reduced.

c. Building Considerations

The MaRS Centre Phase 2 tower is located at 661 University Avenue, at the College Street within a short walk of the St. George campus. It is a new 20 storey research laboratory building with a street level concourse, 2 levels of underground parking and a loading dock that provides receiving and shipping services for TMDT and MaRS.

Construction of the MaRS Phase 2 Tower was completed in 2013. Current occupants include the Ontario Institute for Cancer Research and Public Health Ontario.

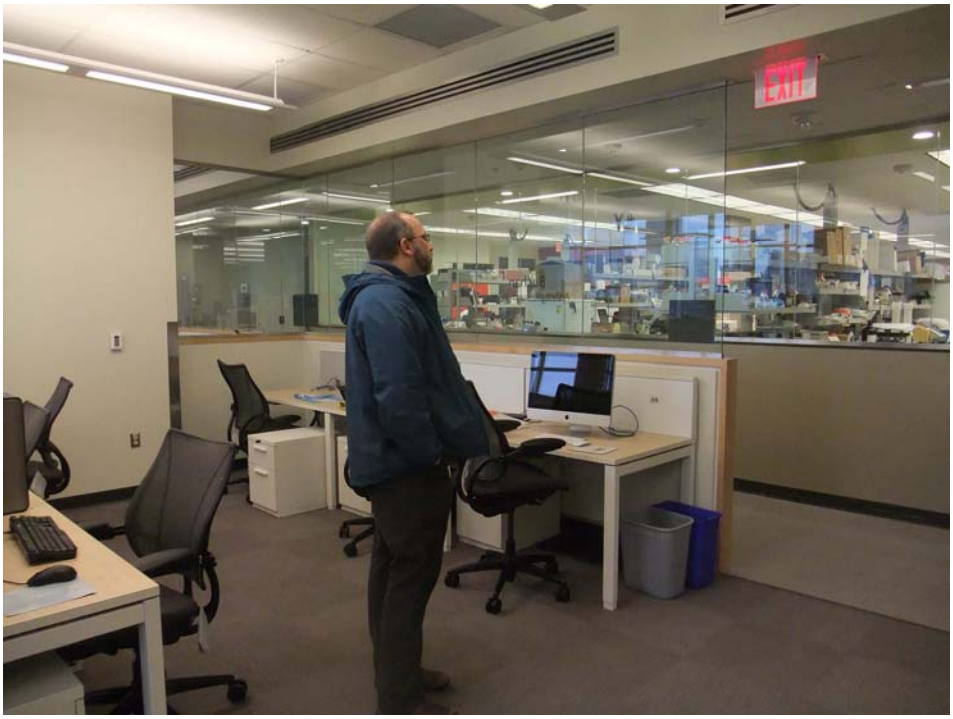
An L-shaped floor plate with a central service core includes 4 passenger elevators and 3 service elevators. The building is a reinforced concrete structure, designed for live loads of 80 psf. The existing clear height (floor to US of structure) is 13'-2" (4 m), with a 9' (2.74 m) height to ceiling anticipated, rising to 11' (3.4 m) at the perimeter. Greater than 9' is desired where possible and as such, above ceiling coordination drawings should be included in the consulting fees. Note that a ceiling is required in laboratory space to comply with level II classification.

The building exterior utilizes a curtain wall enclosure to allow as much natural light into the building as possible from all compass points. The building was designed as a dedicated research laboratory building.

d. Building Construction

The space is required to be functional and durable and robust with a consistency throughout that can be efficiently maintained. Good quality space that is both attractive and welcoming; the space must feel comfortable, airy, and light. Glazing can and should be used in corridors for light transmission and to achieve an open look, but where required, interior glazed walls should be half-height, above desk or counter level, to hide cables and boxes as well as the backside of computer screens from corridor viewing. With the exception of Microscopy Rooms, natural light is desired in the Ante Rooms and may be achieved with glazing in doors and/or sidelights.

Peer Building:
The Krembil UHN laboratory space at the Toronto Western Hospital is comparable to the level of finish and furnishing; desire for natural light; and adjacencies between dry and wet research areas expected for this project. The open laboratory concept and the layout of movable laboratory benches at this location are outlined on the next page.



Krembil UHN laboratory space: View from dry research 'carrel' area to wet lab beyond

The photograph above shows a view from dry lab 'carrels' area to level II wet laboratory beyond. The half-height glass walls, and a similar level of finish and furnishing, are desired on this project. The carrels in this project are required to have shelving above the writing surface.

Krembil UHN laboratory space: dry research ‘carrel’ area

Krembil UHN laboratory space: typical wet lab bench corridor

Acoustics:

- full-height, acoustic GWB partitions to U/S of structure for office and meeting rooms
- acoustic ceiling tile in Admin Unit and dry laboratory areas; wet laboratory, Level II areas require hard surfaces that can be cleaned.

Networking:

- wireless throughout the facility.
- researchers need to operate on the University of Toronto grid [operate as if they were located on the St. George Campus]. IPO at MaRS is linked into U of T networks. All labs and researchers sites to be networked. There is an existing communications room/closet on the floor.

Emergency Power:

Emergency power is required, specifically for low-temperature freezers, incubators and selected bio-safety cabinets within all six tissue culture ante-rooms and other equipment within the open laboratory as well as the balance of the ante rooms and one service room. Two options are currently under consideration: installation of a natural gas generator on the penthouse, which would serve the 16th floor independently, or rely on the existing generator (landlord-supplied power). Based on an estimate of 4 watts per gross square foot and a wet lab area of 2,475 gsm (26,639 sq.ft.), a generator capacity of 125 Kw is required.

Interior Glazing:

- half-height glazed walls between open labs and corridors or adjacent dry research spaces
- half-height glazed walls between dry research areas and corridors or adjacent open lab spaces
- sidelights and/or clerestory glass between perimeter offices and other areas.
- glazing in doors and/or sidelights desired for Ante Rooms (except Microscopy)

Finishes:

- high quality, durable finish throughout
- local materials where possible
- durable, attractive hard surface material required in high traffic public spaces
- black, phenolic laboratory bench surfaces
- durable seamless floors in lab and work spaces. Request recommendations.

Fittings and equipment:

- see datasheets and equipment lists

Mechanical:

Heating Supply/Cooling Supply

Steam supply for heating and Enwave Deep Lake cooling system are part of the infrastructure in place. Expand with minor supplemental requirements beyond the infrastructure in place. It is estimated that the required HVAC equipment will need some 80-100 square metres of additional space [non-assignable]. A key requirement is to address the installation and operation of twelve 6 feet wide fume-hoods, planned to be installed within the Open Concept Laboratory and selected Ante rooms.

Refer to Appendix C: Schedule “A”

Compressed Air and Vacuum
Laboratories will also require 100 psig compressed air and vacuum in laboratories. It is proposed to house both such facilities within the Supplemental Mechanical Plant and to pipe these services to a number of locations within the Open Laboratory and selected Ante-Rooms.

Natural Gas
Natural Gas is required to be piped into the Open Laboratory and to be provided at each of seven fume-hood locations plus two additional sites within the Open Laboratory

Security, Automation:
Security on the floor needs to conform to the specific building standard. A card reader system that will provide secure access to the open concept laboratory facility with provision for individual researcher access to be granted to selected ante-rooms is anticipated.

Research files are to be stored in secured cabinets within the open concept laboratory and/or ante rooms as required.

Display with negative pressure alarm and colour-code is required at entry to all 15 ante rooms.

As per Appendix C: Schedule "A"

Plumbing:

Compressed air, vacuum, natural gas, hot and cold water, RO water with polishing facilities at lab bench sites are to be provides at locations within the Open Laboratory. An RO water facility is to be located in a Service Room, but, depending on the location of the supplemental mechanical plant it might be preferable to locate the RO water facility in this supplemental plant.

Safety showers w/ eyewash stations and drains are required in the Open Lab space(s); eyewash stations may be required in Tissue Culture rooms as well as hands-free sinks and lab sinks in each room. Floor drains are not to be provided in ante rooms.

Other Lab requirements:

- Lab Bench Modules: The Open Laboratory provides for lab bench space and it is a requirement in the design layout to demonstrate the linear footage of bench space that can be achieved with the layout. See illustration above.
- Benches: Laboratory Benches are to be movable, but will generally be fixed in position with the ability to move. There will be no sinks installed on the laboratory benches; however, sinks will be required in the Open Laboratory space, either at the end of the island benching or at the perimeter walls. Selected ante rooms and/ or service rooms will also require sinks.
- Fume-hoods: It is also required to include12 fume hoods, each 6 foot wide, seven within the Open Laboratory and five in the Ante Rooms; this will require some 72 linear feet. There is no requirement for any walk-in fume-hood capacity.
- Freezers: It will be necessary to position freezers within the Open Concept Laboratory as well as within either Ante Rooms and or Service Rooms. Freezers could also be accommodated along a hidden but easily accessible *cold corridor(s)*. Freezer temperature requirements are

-150, -80 and -20 degrees Centigrade. A detailed listing of freezers available is being assembled and is provided in the Equipment Listing; currently 15 fifteen fridges and 9 freezers have been identified. Two cold rooms are required and are essentially Service Rooms I and II, each 15 nasm in size.

- Glass washing: No glass washing facility is required. All glass items to be collected on a trolley located within a Service room. A contract for glass washing with UHN is anticipated.
- Gas bottles: The bottled gases to be used in the facility include: oxygen, nitrogen, propane, carbon dioxide, air, helium and argon. These will be delivered to the site and suitably stored and secured within the Service room until required to be used in either the Open Laboratory and or Ante-rooms. All gas bottles will be required to be secured when stored and or in use consistent with environmental health and safety guidelines.
- Safety Showers: These are required to be distributed throughout the Open Laboratory at regular intervals, accompanied by floor drains. Eye washes to be located at sinks where required.

e. Key Building Components

Refer to Appendix C: Schedule “A”

f. Sustainable Design and Energy Conservation (LEED)

The MaRS2 structure conforms to LEED Silver and LEED Silver Certification is a requirement of the lease agreement.

Refer to Appendix C: Schedule “B”

g. Environmental Health and Safety

TBEL laboratory, ante room and support space design and specifications must comply to all applicable governing body safety regulations, including the University of Toronto’s Office of Environmental Health and Safety Lab Protocols and Resources, and Laboratory Hazardous Waste Management and Disposal Guidelines.

All Level 2 spaces must satisfy Public Health Agency of Canada’s requirements for Containment Level 2 Compliance in accordance with Canadian Biosafety Standards and Guidelines.

TMDT is registered through MaRS with the Ontario Ministry of Environment and has a Certificate of Compliance detailing use of chemicals and base building mechanical systems. Chemical hazards are managed through utilization of variable flow fume hoods and UHN’s ‘Shut the Sash’ program ensures fume hoods are closed when not in use. Chemical storage for hazardous solvents and acids are provided with fume hoods, however additional storage if required is to be provided by research teams. Biological containment is achieved through use of recirculating Biological Safety Class II Cabinets. Loading dock staff receives annual training on the hazards of materials typically received and used in a research laboratory building. Spill kits are maintained and available in the loading dock area.

h. Secondary Effects

Principal Investigators identified in the Faculty of Dentistry and the Faculty of Applied Science and Engineering currently conduct research or have offices in the Dentistry, Wallberg, Rosebrugh, and the Lassonde Mining Buildings. The current space, 600 nasm, will be repurposed within the Divisions.

Principal Investigators from the Faculty of Medicine were identified on June 5^{th,} 2014; any space to be repurposed has yet to be defined.

i. Schedule

The following is the proposed project schedule:

CaPS Executive Approval	August 18, 2014
University Governance Approval, Cycle 1	October 31, 2014
Architect/consultant RFP issue	post-Executive CaPS Approval – 4 weeks
Architect/consultant selection complete	4 weeks – September 18, 2014
Project Design and Documentation	3 months – December 18, 2014
Tender issue	6 weeks [includes Christmas holiday break]
Contract award	January 30, 2015
Access for renovations	post-CaPS approval [conditional on gifting]
Construction	February, 2015 to Summer, 2015
Move in	up to 4 weeks
Lease start/Occupancy	late Summer, 2015

IV. RESOURCE IMPLICATIONS

a. Total Project Cost Estimate

A preliminary construction cost estimate was prepared by the firm of A. W. Hooker Ltd., and was based on the scope of work as outlined in this report, and the preliminary room specification (data) sheets.

The total estimated cost for the project includes estimates or allowances for:

- Construction
- Contingencies
- Taxes
- Permits and insurance
- Professional fees: architect, engineer, misc. consultants, project management.
- IT and Telecom requirements
- Moving and staging
- Acquiring new lab benching and misc. furnishings
- Miscellaneous costs [security, other]
- Commissioning

The project delivery method will be traditional (Design-Bid-Build), requiring a stipulated lump sum contract.

b. Operating Costs

The total Operating Costs comprise two components, namely i) a Base Rent and ii) an Occupancy Cost. The latter includes the costs dictated by the landlord, specifically conveyed in the terms of the lease agreement, on a cost per rentable square foot for services pertaining to management, cleaning, insurance, maintenance of elevators, washrooms etc. + the cost per rentable square foot of the utilities, specifically the hydro that is required to be independently metered.

Other pertinent Occupancy Costs are realty taxes (from which the University is exempt) and the variable costs pertaining to and anticipated for glass washing[6], use of vivarium[7], hazardous waste disposal and emergency power.[8]

[6] Glass washing to be contracted with UHN services and is on a piece by piece basis, and attributable to the PI.

[7] Vivarium access will continue in existing on campus facilities (MSB, CCBR); additional vivarium facilities may be available through UHN in MaRS 1.

[8] It is possible to purchase emergency power within the MaRS2 tower as a central 2,000 kW capacity generator was installed. The hook-up cost for the required 110kW at $1250/kW is $137,500 + $1,100 per month [$13,200 per year] service charge. The preferred option is to acquire and install an independent gas fired facility on the roof at an estimated capital cost of $150,000.

Below, the Base Rent, and the Occupancy Costs for TBEL re tabulated and compared with Occupancy Costs for on-campus facilities such as the CCBR.

		TBEL 39,600 rsf[1]	**TBEL 2,220 nasm**	**CCBR**
	Cost /rentable sf	Annual cost	Cost /nasm /yr	Cost /nasm /yr
Base Rent (years 1 - 5)[2]	$22.50	$891,000	$401	NIL
Occupancy Costs (Estimated)				
Landlord:	$19.50	$772,200		
Utilities (Hydro):	$10.00	$396,000		
Subtotal	$29.50	$1,168,200	$526	$392
Total (Base rent plus occupancy costs)	**$52.00**	**$2,059,200**	**$927**	**$392**

[1]rsf - rentable square feet

[2]Increasing to $25.40 years 6 - 10

The total occupancy cost when reduced to the annual cost per nasm, as noted above, is 34% greater than the equivalent costs for the CCBR; the larger impact is the cost of the Base Rent which is not directly comparable with University cost structures as no Base Rent is paid and, if included, the overall difference is 137% greater.

A 10 year lease plus renewal rights is currently under negotiation between The Governing Council of the University of Toronto and MaRS Phase 2 Inc. The cost estimate is based on a total of 39,600 rentable square feet, which for the TBEL is equivalent to 2,220 nasm. The annual cost to operate TBEL is therefore $2,059,200 and this includes the annual estimated utility cost of $396,000.

c. Funding Sources

Overall costs and sources of funds can be found in the *in camera* document for this project.

V. RECOMMENDATIONS

Be it recommended to the Academic Board:

1. THAT the Project Planning Committee Report for the for the Faculty of Applied Science and Engineering, and Faculty of Medicine, Transitional Biology and Engineering Laboratories in the MaRS Centre Phase 2 Tower, dated August 6, 2014, be approved in principle; and

2. THAT the project scope to accommodate the Transitional Biology and Engineering Laboratories in the MaRS Centre Phase 2 Tower, totalling 2,220 net assignable square metres (nasm) (3,675 gross square metres (gsm)) to be funded by the Capital Campaign, the Faculty of Applied Science and Engineering and the Faculty of Medicine, be approved in principle.

VI. APPENDICES

A. Existing Space Allocation, On Campus

B. Floor Plans

C. Offer to Lease (Schedules)

D. Total Project Cost Estimate (available upon request to limited distribution)

E. Principal Investigator Profile

F. Room Specification Sheets and Master Equipment List (to date) (available upon request)

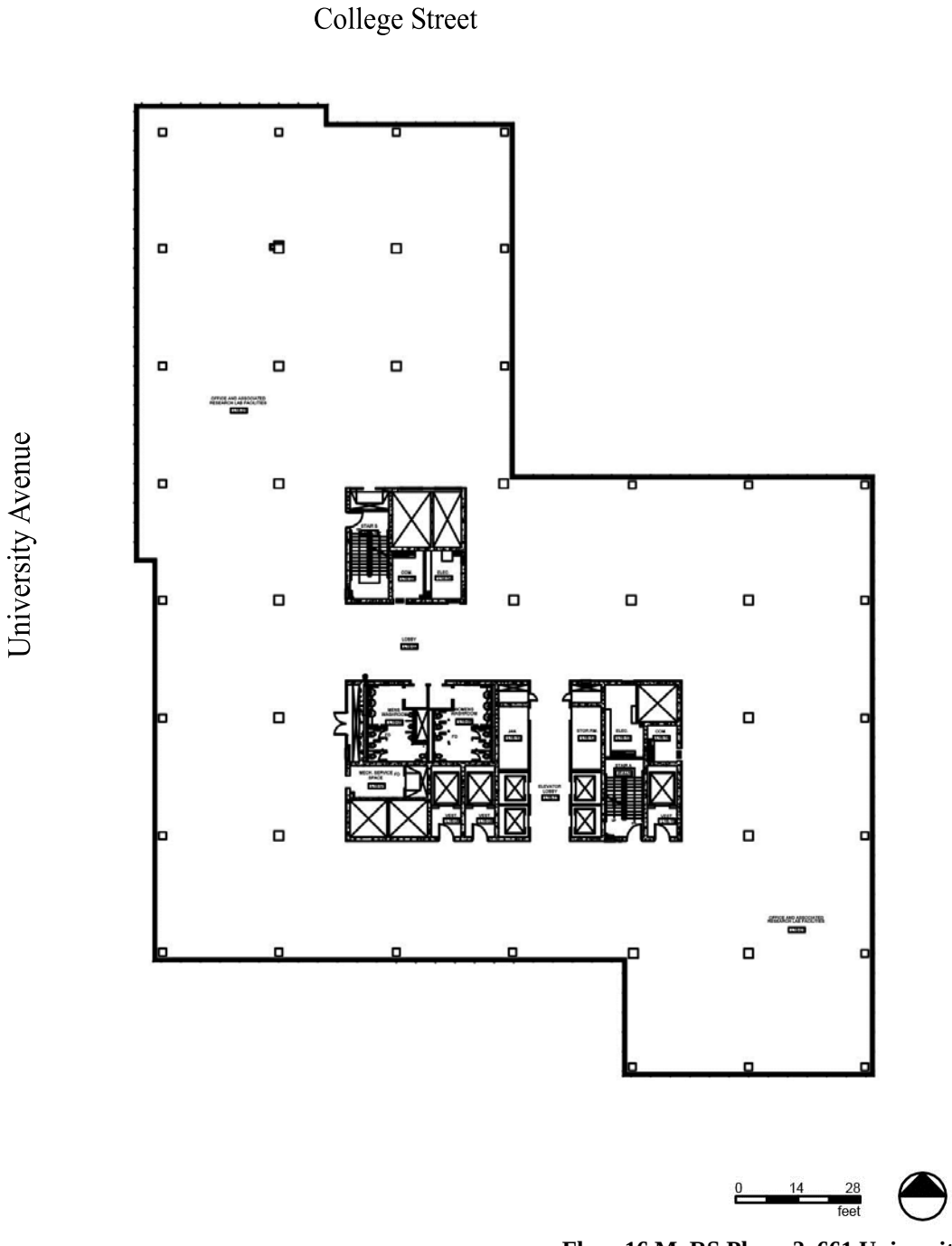
G. Links to U of T Standards and Policies, and Institute of Biomaterials and Biomedical Engineering (IBBME)

Appendix A. Existing Space Allocation, On Campus

Room	Division Name	Cat Code	Description	Area (sqm)
DN 457	Faculty of Dentistry	03.2	Chemical Lab	36.48
DN 461	Faculty of Dentistry	03.1	Dental Materials Lab	45.71
DN 461A	Faculty of Dentistry	03.2	Computer Room	8.16
DN 461B	Faculty of Dentistry	03.2	Lab Equipment Storage	18.43
DN 461C	Faculty of Dentistry	03.1	Clean Lab	13.2
DN 522	Faculty of Dentistry	04.3	Graduate Office Multi	14.63
WB 222	Faculty of Applied Science and Engineering	03.1	Research Lab-Grad Student	18.91
RS 403	Faculty of Applied Science and Engineering	03.2	Lab Freezers	20.07
RS 405	Faculty of Applied Science and Engineering	04.1	Faculty Office Single	13.75
RS 410	Faculty of Applied Science and Engineering	04.3	Graduate Office Multi	62.94
RS 421	Faculty of Applied Science and Engineering	03.1	Quantative Morphogenisis Lab	64.88
RS 421A	Faculty of Applied Science and Engineering	03.2	Microscopy (Quantative Morphogenisis Lab)	8.91
MB 301	Faculty of Applied Science and Engineering	03.1	Functional Tissue Engineering Lab	48.99
MB 317	Faculty of Applied Science and Engineering	04.3	Graduate Office Multi	7.47
MB 317	Faculty of Applied Science and Engineering	04.4	Supp Admin Office Single	7.47
MB 317A	Faculty of Applied Science and Engineering	04.1	Faculty Office Single	22.91
MB 318	Faculty of Applied Science and Engineering	03.1	Functional Tissue Engineering Lab	41.46
MB 322	Faculty of Applied Science and Engineering	03.1	Cellular Mechanobiology Lab	92.88
MB 322A	Faculty of Applied Science and Engineering	03.1	Cellular Mechanobiology Lab	28.86
MB 322B	Faculty of Applied Science and Engineering	03.1	Tissue Culture Lab	37.13

Appendix B. Floor Plans

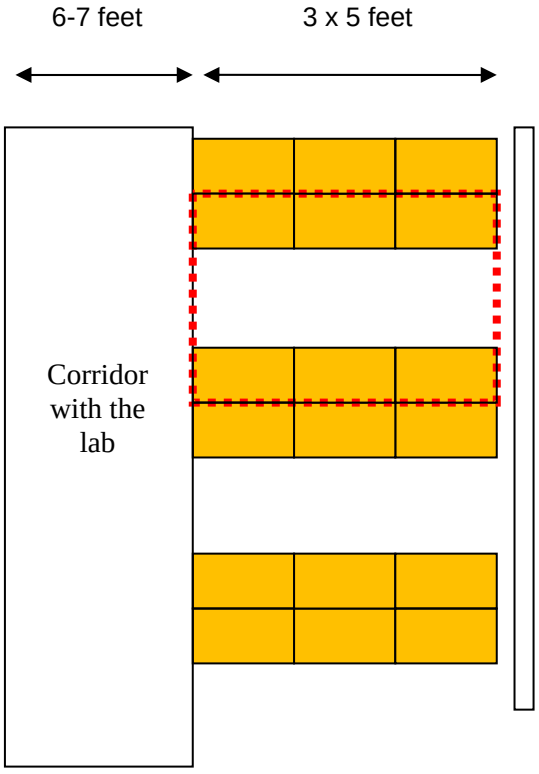
The floor plate below provides 2,840 nasm for the 2,220 nasm space program and an allowance for non-assignable space: M/E Plant, corridors, and communications room. The plan is based on a 9.6m x 9.6m (31’6” x 31’6”) structural bay.



Floor 16 MaRS Phase 2, 661 University Avenue

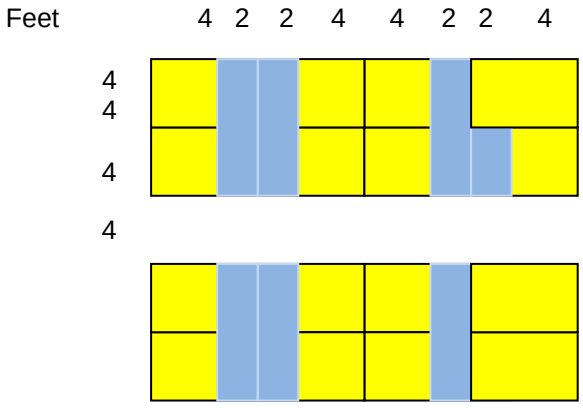
Wet Lab bench module

The unit laboratory bench is 2 feet 6 inches deep by 5 feet wide. These benches are positioned side by side to a length of 15 feet [3 benches, but could be more] and placed back to back with an equivalent set of three benches so that the dimensions of the 6 benches would be 15 ft in length by 5 feet wide. These islands are placed in rows spaced 5-6 feet apart [aisle width], see illustration below.



The dashed repetitive unit is 15 feet wide x 10 feet between bench centres which totals 150 square feet and produces 30 linear feet of laboratory bench space, i.e. some 15 nasm of laboratory area, using this layout or repetitive *module*, produces 30 linear feet of lab bench space. This value of 2 linear feet/nasm will decline as lab corridors are introduced or the spacing between benches is marginally increased, but is unlikely to drop below 1.4 linear feet of bench space per nasm.

Dry Lab carrel module



24 feet x 20 feet room seats 16 [7.3m x 6.1 m] approx 8m x 6m

Appendix C. DRAFT Offer to Lease between: MaRS Phase 2 Inc. and Governing Council of the University of Toronto (Schedules only)

SCHEDULE "A"
LANDLORD'S WORK

ARCHITECTURAL

GENERAL BUILDING

- Total building area of 780,000 rentable square feet.
- 20 storey lab/office building, generally designed as 60% lab space and 40% office space.
- Connected to the adjacent MaRS Heritage Building and towers through an aligning atria and concourse Food Court.
- Direct connection to TTC's Queen's Park Subway Station and Toronto General Hospital.
- level underground car parking garage with dedicated bicycle parking and showers.
- Thermally broken high performance unitized aluminum and double-glazed curtain wall with laminated glass accent fins.
- 62' high glazed skylight atrium featuring an illuminated glass ceiling, metal mesh and terracotta walls and stone flooring.
- One of Toronto's most prominent addresses for research and development located within the middle of the Discovery District.
- Building designed to achieve LEED® Silver Certification.

TYPICAL FLOOR

- Area: 38,500 sf to 41,500 sf per floor (rentable)
- Ceiling Heights: Designed for 9' high susp. ceiling (by tenant)
- Planning Module: Average 31'6" x 31'6" bay size
- Window Size: Floor to ceiling glass with 5' x 11 ' high vision glass.
- Core to Window Depth: Generally 51' to 56' with some lower dimensions within the north-south direction

STRUCTURE

- Floor Loading:
    - 80 lbs. per sq. foot (live load).
    - 15 lbs. per sq. foot ceiling and mechanical load allowance.
    - 20 lbs. per sq. foot partition load allowance.

- Poured in place reinforced concrete superstructure. Concrete floors level to have a tolerance of plus or minus 8mm/3metres ready for tenant flooring.

- Shallow floor framing system (typical 12" slab plus 10” drop panels) maximizing available ceiling zone for services distribution.

- Lateral loads resisted entirely by the reinforced concrete core.

MECHANICAL

COOLING

- Enwave Deep Lake Water Cooling System provides environmentally conscious cooling to the building.

- Each floor is provided with valve and capped connections to chilled water risers at two core locations.

- Tenants to utilize the chilled water provided for their own on-floor HVAC system (fan coils, chilled beams, etc.). Tenant supplied HVAC system shall be sized to satisfy space occupancy, lighting allowance, equipment allowance and envelop heat gains.

- Base building lighting and equipment allowance (per floor) for chilled water cooling:

    - Office (40% of typical floor) = 1.2 W/sf + 2 W/sf = 3.2 W/sf
    - Lab (60% of typical floor) = 2 W/sf + 8 W/sf = 10 W/sf

- Roof space and riser sleeves exist for tenants to install their own supplemental air-cooled chilled water systems.

HEATING

- Enwave District Steam provides environmentally conscious heating to the building.

- Each floor is provided with perimeter hot water baseboard heating convectors, each structural grid (approximately 30 feet) is a temperature control zone.

- Hydronic heating is provided by the base building as follows: Valved and capped heating water pipe connections are provided at the building core on each floor for the tenant’s re-heat requirements. The base building ventilation air temperature will be reset down to a minimum of 57F when air-side economizer operation is available. Each floor is provided with a 2” valved and capped piping provisions with an allocation for 43 usgpm/floor. Supply heating water temperature is 140F and return is 120F. Allowable tenant hydronic pressure drop on the system is 40 ft.wg.

PROCESS STEAM

- Each floor is provided with a valved and capped connection to high pressure (+100 psig) steam and high pressure condensate.

AIR HANDLING

- Each floor is provided with connections to central, outdoor air ventilation supply risers at two core locations. Outdoor air is filtered and pre-conditioned for distribution to the tenant’s HVAC system. Ventilation air will vary in temperature throughout the year. Ventilation air will vary

between 57F in the winter to 70F in the summer. The Building Automation System (BAS) will determine the optimal ventilation air temperature to minimize the building's energy consumption as a whole. Outdoor air ventilation system is variable air volume and will require tenant supplied volume control devices.

Outdoor air systems operate on emergency power in the event of a power failure.

- Base building outdoor air ventilation allowance (per floor):

  - Office (40% of typical floor) = 0.2 cfm/sf
  - Lab (60% of typical floor) = 10 ACH based on 9 foot ceiling
  - Net (Typical floor) = 31,000 cfm of tempered outdoor air

- Each floor is provided with connections to central, general laboratory exhaust risers at three core locations. Laboratory exhaust risers are standard galvanized construction. All downstream laboratory exhaust ductwork is supplied and installed by the tenant. General laboratory exhaust systems operate on emergency power in the event of a power failure.

- Base building general laboratory exhaust allowance (per floor):

  - Lab (60% of typical floor) =10 ACH based on 9 foot ceiling
  - Net (Typical floor) = 29,700 cfm of exhaust

- Central outdoor air ventilation system and general laboratory exhaust system form part of the Ontario Building Code prescribed "Smoke Control" and "Venting to Aid Fire Fighting" systems. As such, smoke dampers connected to the building fire alarm system are located at each floor connection. Any modifications to the systems must be tested and coordinated with the building fire safety systems.

- Roof space and riser sleeves (350 mm) exist for Landlord to offer tenant installation of two (2) special exhaust systems (duct and fan) per typical floor.

PLUMBING AND DRAINAGE

- Each floor is provided with a valved and capped connection at one location at the core for domestic water service. Downstream domestic water distribution and domestic heating water system for on-floor use (except base building washrooms) shall be supplied and installed by the tenant. Base building domestic water allowance (per floor):

  - One 38 mm (1-1/2 inch) connection

- Each floor is provided with a valved and capped connection at two locations at the core for laboratory water service. Laboratory water service is City water and will require tenant provided backflow prevention devices. Any downstream purification systems would be supplied and installed by the tenant. Downstream domestic water distribution and domestic heating water system for on-floor use shall be supplied and installed by the tenant. Base building laboratory water allowance (per floor):

  - Two at 32 mm (1-1/4 inch) connection

- Each floor is provided with a valved and capped connection at one location at the core for natural gas. Base building natural gas allowance (per floor) at 7" - 14" of water column:

  - One 38 mm (1-1/2 inch) connection

- Each floor is provided with a capped connection to sanitary drain and vent at one location at the core.

- Each floor is provided with capped connections to the laboratory drainage and vent risers located at 8 locations on the floor (at columns). The laboratory drainage material is polypropylene. The laboratory drainage risers connect to a central acid neutralization system (consisting of solids interceptors and acid neutralization tanks) prior to discharge to City drains.

- Each floor is provided with capped connections to a radio-isotopic drainage and vent riser located at one location on the floor. The radio-isotopic drainage material is borosilicate glass. The radio-isotopic riser connects to the main building sanitary at the location of exit from the building.

- Tenant is allowed to install purified water systems, specialty lab gases, lab compressed air, or lab vacuum as required within the mechanical chases.

BUILDING METERING AND AUTOMATION

- All base building systems including perimeter heating are controlled through the base building BAS system.
-
- Tenant shall provide on-fIoor control system and provide BACNET interface at Tier 1 level to interface with base building control system.

- Tenant shall provide meters to building specifications to connect to the base building system for measuring electricity, chilled water, steam, domestic water, and natural gas consumption.

FIRE PROTECTION

- Provide a wet sprinkler system and standpipe system to be designed and installed in accordance with the OBC and NFC and the NFPA requirements for tenant occupancy.

- Provide on-floor sprinkler system to the tenant based on open ceiling. Tenant shall modify to suit layouts. Sprinkler coverage shall meet base building Ontario Building Code requirements.

ELEVATORS AND ESCALATORS

- 3 Low Rise Passenger Elevators: Serving Floors – Ground, 2 to 6 with a rated speed of 350 fpm and design carrying capacity of 3,500 lb or 26 persons.

- 4 Mid-Rise Passenger Elevators; Serving Floors – Ground, 6 to 13 with a rated speed of 500 fpm and designed carrying capacity of 3,500 Ib or 26 persons.

- 4 High Rise Passenger Elevators; Serving Floors – Ground, 13 to 20 with a rated speed of 800 fpm and designed carrying capacity of 3,500 Ib or 26 persons

- 2 Parking Passenger Shuttles: Serving Floors - P2, P1 and Ground, with a rated speed of 125 fpm and designed carrying capacity of 3,500 Ib or 26 persons.

- 1 TTC Barrier Free Passenger Access Shuttle: Serving Floors P1 and Ground with a rated speed of 125 fpm and designed carrying capacity of 2,500 Ib or 19 persons.

- 2 Dedicated Service Elevators: Serving Floors - Ground, 2 to 20 with a rated speed of 350 fpm and a designed capacity of 4,500 Ibs or 33 persons. These cars are designed to

accommodate power truck concentrated loading. Cab interior size 5'4” wide x 8’7” deep. Although duplex in configuration these two (2) service elevators are contained within their own separate hoistways and related elevator lobbies. Each car operates in a simplex mode of operation with its own dedicated hall call push button riser.

- 1 Dedicated Service Elevator: Serving floors - P2, P1, Ground, Mezzanine, 2 to 20 and 21 (Penthouse) with a rated speed of 450 fpm and a designed capacity of 4,500 Ibs or 33 persons. This car is designed to accommodate power truck concentrated loading. Cab interior size 5'4" wide x 8'7" deep. This car is designated as the fire-fighters' car.

- 2 Escalators: Serving floors - P1 (TTC connection) to Ground. Escalators are double lane type, 48" wide balustrade or hip width, 100 fpm operating speed, Heavy Duty Type with solid balustrade construction.

- All passenger elevators equipped to accommodate card reader access provisions, CCTV camera monitoring, and centralized remote control.

- All service elevators equipped with card reader access provisions, CCTV camera monitoring, and centralized remote control.

- All elevators equipped with an automatic emergency recall feature to react to building fire alarm conditions, emergency power operation and two-way duplex emergency voice communication. All elevators and escalators designed in accordance with the latest adopted edition of ASME A17.1/CSA B-44 and all other applicable code requirements including TSSA.

ELECTRICAL

LIGHTING

- Provisions for Tenant supplied 347 volt lighting system.

- Centrally controlled low voltage lighting control system with one relay panel in the north electrical room of each floor (system can be expanded to accommodate additional tenant supplied panels).

POWER

- Base building lighting and equipment allowance (per floor):
  - Office (40% of typical floor) = 1.2 (lighting) W/sf + 2 (equipment) W/sf = 3.2 W/sf

- For a lab/office use mix:
  - Lab (60% of typical floor) = 1.2 (lighting) W/sf + 8 (equipment) W/sf= 9.2 W/sf
  - Office (40% of typical floor)= 1.2 (lighting) W/sf + 2 (equipment) W/sf = 3.2 W/sf

EMERGENCY POWER GENERATING SYSTEM

- One 2,000 kW Diesel Generator, located in the penthouse, supports all of the life safety loads and critical base building loads.

- One 2,000 kW diesel generator, located in the penthouse, is available for the Landlord to offer power to Tenants at designated rates.

- Provisions exist within the penthouse for the addition of an additional diesel generator to offer power to Tenants at designated rates.

ELECTRONIC TENANT METERING SYSTEM

- In each electrical room, connection points to the base building metering system have been provided for the monitoring of tenant loads.
- Tenant is to provide all transducers and electronic metering devices for connection to the base building system.

FIRE ALARM

- Two Stage Addressable fire alarm system which is expandable for tenant connection points or for dedicated tenant panels.

- Speakers in the typical floor space are provided at a rate of 1 speaker per structural bay. The base building master fire alarm system will be capable of handling additional speakers as required.

So long as the building is not approved by the City of Toronto for occupancy and the landlord is the Constructor, the Landlord will provide a fire watch on the Tenant's floor as required at no cost to the Tenant until sprinkler system is approved by the City of Toronto.

SCHEDULE "B"
LEED Requirements

Office Premises

In order to preserve the Landlord's LEED certification of the base building, the tenant must comply with the credit requirements listed below. To ensure LEED requirements specified within this manual are properly integrated into tenant fit-up, the Landlord's consultant will review and approve tenant drawings at tenant cost.

Carbon Dioxide Monitoring

The Tenant must install a permanent carbon dioxide monitoring system that provides feedback on space ventilation performance to ensure that ventilation systems maintain design minimum ventilation requirements and in a form that affords operational adjustments. The Tenant must configure all monitoring equipment to generate an alarm if underventilation is detected, via either a building automation system alarm to the building operator or via an alarm that alerts building occupants.

For Mechanically Vented Spaces: Monitor carbon dioxide concentrations within all densely occupied spaces (those with a design occupant density great than or to 25 people per 93 m_2 (1,000 SF). CO2 Monitoring locations shall be between 0.9 m (3 ft) and 1.8 m (6 ft) above the floor. For each mechanical ventilation system serving non-densely occupied spaces, provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor airflow rate with an accuracy of plus or minus 15% of the design minimum outdoor air rate, as defined by ASHRAE 62.1-2004.

Daylight & Views – Views for 90% of Spaces

The Tenant shall achieve a direct line of sight to the outdoor environment via vision glazing between 0.76m and 2.3m above finish floor for building occupants in 90% of all regularly occupied areas. Areas directly connected to perimeter windows must have a glazing-to-floor area ratio of at least 0.07. Determine the area with direct line of sight by totalling the regularly occupied square footage that meet the following criteria:

- In plan view, the area is within sight lines drawn from perimeter vision glazing.
- In section view, a direct sight line can be drawn from the area to perimeter vision glazing at a recommended height of 1.1 m, representing the average seated height, or at an otherwise appropriate height as determined by the design team.

Line of sight may be drawn through interior glazing. For private offices, the entire square footage of the office can be counted if 75% or more of the area has direct line of sight to perimeter vision glazing. In all other cases, if the view area of any applicable room exceeds 90%, the entire square footage of the room can be counted.

Lighting Controls

In all perimeter non-lab areas (offices, meeting rooms, support areas, etc.) provide continuous dimming daylight sensors to control the lighting fixtures within an area 15' from the windows. In all perimeter lab areas provide occupancy sensors. In all core areas (defined as more than 15' from the windows), provide occupancy sensors.

Office Ventilation Controls

For non-lab systems, for each compartment unit or for each fan coil provide a constant volume box and associated controls capable of limiting the outdoor air rate to the minimum required by ASHRAE 62.1-2004 as calculated by the ventilation rate procedure. For each VAV terminal box (in the case of

compartment units) or for each fan coil unit, provide a CO2 sensor and associated controls to implement demand control ventilation.

Office HVAC Systems

For non-lab compartment unit systems, provide NEMA premium efficiency fan motors and limit the compartment unit static pressure to 3". For non-lab fan coil systems provide ECM ("brushless") motors.

Lighting Density Allowance

The building and its systems have been designed to perform efficiently and to reduce environmental and economic impact associated with excessive energy use. The Tenant must provide lighting with a maximum lighting power density of 1.2 W/sf in lab and office spaces.

Lab Premises

In order to preserve the Landlord's targeted LEED certification of the base building, the tenant must comply with the credit requirements listed below. To ensure LEED requirements specified within this manual are properly integrated into tenant fit-up, the Landlord's consultant will review and approve tenant drawings at tenant cost.

Carbon Dioxide Monitoring

The Tenant must install a permanent carbon dioxide monitoring system that provides feedback on space ventilation performance to ensure that ventilation systems maintain design minimum ventilation requirements and in a form that affords operational adjustments. The Tenant must configure all monitoring equipment to generate an alarm if underventilation is detected, via either a building automation system alarm to the building operator or via an alarm that alerts building occupants.

For Mechanically Vented Spaces: Monitor carbon dioxide concentrations within all densely occupied spaces (those with a design occupant density great than or to 25 people per 93 m_2 (1,000 SF). CO2 Monitoring locations shall be between 0.9 m (3 ft) and 1.8 m (6 ft) above the floor. For each mechanical ventilation system serving non-densely occupied spaces, provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor airflow rate with an accuracy of plus or minus 15% of the design minimum outdoor air rate, as defined by ASHRAE 62.1-2004.

Daylight & Views – Views for 90% of Spaces

The Tenant shall achieve a direct line of sight to the outdoor environment via vision glazing between 0.76m and 2.3m above finish floor for building occupants in 90% of all regularly occupied areas. Areas directly connected to perimeter windows must have a glazing-to-floor area ratio of at least 0.07. Determine the area with direct line of sight by totalling the regularly occupied square footage that meet the following criteria:

- In plan view, the area is within sight lines drawn from perimeter vision glazing.
- In section view, a direct sight line can be drawn from the area to perimeter vision glazing at a recommended height of 1.1 m, representing the average seated height, or at an otherwise appropriate height as determined by the design team.

Line of sight may be drawn through interior glazing. For private offices, the entire square footage of the office can be counted if 75% or more of the area has direct line of sight to perimeter vision glazing. In all other cases, if the view area of any applicable room exceeds 90%, the entire square footage of the room can be counted.

Lighting Controls

In all perimeter non-lab areas (offices, meeting rooms, support areas, etc.) provide continuous dimming daylight sensors to control the lighting fixtures within an area 15' from the windows. In all perimeter lab areas provide occupancy sensors. In all core areas (defined as more than 15' from the windows), provide occupancy sensors.

Fume Hood Controls – Lab Tenant Only

Provide fume hoods capable of varying the exhaust rate. The base building ventilation and exhaust systems are variable airflow systems. Tenant ventilation and exhaust airflow must be controlled to minimize ventilation use. Tenant pressure independent variable airflow control devices are required to:

a) regulate ventilation air to office occupancies to meet ASHRAE 62.1. (CO2 controlled demand based ventilation).
b) regulate ventilation air to laboratories to maintain minimum air change rates.
c) regulate ventilation air to laboratories to maintain fume hood face velocity.
d) regulate ventilation air to laboratories to maintain space temperature control.
e) Fume hoods are to be provided with variable air flow control based upon sash position.
f) Ventilation rates are required to be controlled to different criteria depending upon occupied and unoccupied modes of operation.
g) Measurement and verification communication capability with the BAS is required as outlined within the TLIM.
Air distribution static pressures and ventilation air flow rates are required to be communicated to the BAS for all zones.
h) Tenant controls systems are required to be integrated with the BAS. The use of BACnet IP or Ethernet protocol is required. BACnet MS-TP systems will be considered as long as all points are mapped to the BAS. The tenant is responsible for the cost of using the base building controls vendor for all controls integration.

Heating and Cooling utility costs will be paid for by the tenant. It is in the best interest of the tenant to minimize the use of ventilation air. The tenant is encouraged to implement additional strategies such as fume hood occupancy sensors or other technologies to minimize energy use.

Office Ventilation Controls

For non-lab systems, for each compartment unit or for each fan coil provide a constant volume box and associated controls capable of limiting the outdoor air rate to the minimum required by ASHRAE 62.1-2004 as calculated by the ventilation rate procedure. For each VAV terminal box (in the case of compartment units) or for each fan coil unit, provide a CO2 sensor and associated controls to implement demand control ventilation.

Office HVAC Systems

For non-lab compartment unit systems, provide NEMA premium efficiency fan motors and limit the compartment unit static pressure to 3". For non-lab fan coil systems provide ECM ("brushless") motors.

Lighting Density Allowance

The building and its systems have been designed to perform efficiently and to reduce environmental and economic impact associated with excessive energy use. The Tenant must provide lighting with a maximum lighting power density of 1.2 W/sf in lab and office spaces.

Appendix D. Total Project Cost Estimate

(available upon request to limited distribution)

Appendix E. Principal Investigator Profile

An alphabetical listing of the Principal Investigators that are scheduled to operate out of TBEL once it is completed in 2015 is provided below.

Peter Backx	Professor, Department of Physiology, Faculty of Medicine
Steffen Sebastian-Bolz	Professor, Department of Physiology, Faculty of Medicine
Anthony Gramolini	Professor, Department of Physiology, Faculty of Medicine
Rodrigo Fernandez-Gonzalez	Assistant Professor, Institute of Biomaterials & Biomedical Engineering
Scott Heximer	Professor, Department of Physiology, Faculty of Medicine
Milica Radisic	Associate Professor, IBBME and Department Chemical Engineering & Applied Chemistry, Faculty of Applied Science & Engineering
Paul Santerre	Professor, IBBME, Faculty of Dentistry
Craig Simmons	Professor and Associate Director, Research, IBBME, Faculty of Dentistry and Department of Mechanical & Industrial Engineering, Faculty of Applied Science & Engineering
TBA	Endowed Chair: Immuno-Bioengineering
TBA	Endowed Chair: Cardiac Tissue & Cellular Systems Modelling

Appendix F. Room Specification Sheets and Master Equipment List (to date)

(available upon request)

Appendix G. Links

U of T Standards and Policies
www.fs.utoronto.ca/standards_and_policies/design.htm

Institute of Biomaterials and Biomedical Engineering (IBBME)
www.ibbme.utoronto.ca

U of T Environmental Health and Safety
www.ehs.utoronto.ca