



**FOR ENDORSEMENT  
AND FORWARDING**

**PUBLIC**

**CLOSED SESSION**

**TO:** Executive Committee

**SPONSOR:** Professor Scott Mabury, Vice President, University Operations

**CONTACT INFO:** 416-978-2031, scott.mabury@utoronto.ca

**PRESENTER:** See sponsor

**CONTACT INFO:**

**DATE:** November 20 for December 1, 2014

**AGENDA ITEM:** 3(a.)

**ITEM IDENTIFICATION:**

Capital Project: Ramsay Wright Building Teaching Laboratories Upgrades – Revisions to the 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] (October 29, 2014)
2. Academic Board [for recommendation] (November 13, 2014)
3. Business Board [(financing) for recommendation] (November 3, 2014)
4. **Executive Committee [for endorsement and forwarding] (December 1, 2014)**
5. Governing Council [for approval] (December 11, 2014)

**B. Execution of the Project**

1. Business Board [for execution of the project] (November 3, 2014)

## **PREVIOUS ACTION TAKEN:**

In June 2013, Governing Council approved in principle the Project Planning Report for the Ramsay Wright Building Teaching Laboratories Upgrade and in addition, approved in principle a project scope totalling approximately 3,846 net assignable square metres, to be funded by the Faculty of Arts and Science, Graduate Expansion Funds and borrowing.

Given the fact that the TPC increased significantly, the project was taken to the CaPS Executive Committee for approval to continue the design process before bringing it forward in Cycle 2 of the 2014-2015 calendar for Governance approval. CaPS Executive approval was granted on June 24, 2014 to continue working with the existing consultants on the design process.

## **HIGHLIGHTS:**

Providing the highest quality educational experience is at the core of the University of Toronto's academic mission. And access to modern laboratory space and equipment is a key contributor to the overall university experience for students in the rapidly developing field of life sciences.

While the current accommodations for teaching in the life sciences on the St. George Campus are in many ways exemplary, there remain some facilities that are technologically outdated relative to current standards. In particular, the laboratory teaching facilities in the Ramsay Wright Building are in need of upgraded services in order for them to continue to fulfill their academic mission.

A significant portion of teaching laboratories used by the Departments of Cell & Systems Biology (CSB) and Ecology & Evolutionary Biology (EEB) are currently located in the Ramsay Wright Building. Approximately 30% of all first year students who enter the Faculty of Arts and Science each year are enrolled in courses taught in Ramsay Wright laboratories. These labs have not been upgraded since the building was built in the late 1960s

One of the major technological limitations of the Ramsay Wright teaching labs is their lack of fume hoods which has constrained the teaching aspirations of two life sciences departments with very high undergraduate enrolments.

This project calls for Ramsay Wright's undergraduate teaching labs to receive a reconfiguration to facilitate future planning through the use of the "lab module". This work will effectively increase available undergraduate teaching space (currently under-utilized due to infrastructure deficiencies) in Ramsay Wright.

To better understand how science teaching is evolving, the design team has provided the following key elements of the "Shifting Pedagogy of Science". These elements include designs that promote collaboration and collaborative learning and that enhance the learning experience; putting "Science on Display". Other important elements include labs that are expandable and contractible and benches that are reconfigurable, moveable, and re-arrangeable. Finally, layouts that promote interaction, integration, innovation, the sharing of ideas, visual connections, view corridors, access to natural light, transparency etc. All of these elements will inform the design of the teaching labs as the design moves forward.

Solid walls delineating labs into distinct units will be eliminated in several areas to provide both a visual and physical connection; this would allow for flexibility & adaptability. The elimination of the separating wall and the visual connection will also accommodate the expansion of the teaching group size by the inclusion of adjacent pods of benches. This type of open plan has been successful for other science labs at the University of Toronto. However, the opportunity for small groups of students to interact with teaching assistants is important to the overall experience of biology labs and should be maintained within this more open design approach of the lab space.

Currently, courses with laboratory exercises that require fume hoods have been located at the Earth Sciences Centre. CSB and EEB are sharing the use of the Earth Sciences labs (alternating by semester) which requires equipment to be moved between buildings each semester. This project will address the problem of sharing the EEB/CSB labs at the Earth Sciences Centre by moving the majority of teaching lab activity to Ramsay Wright and allowing for the future consolidation of EEB research space in the Earth Sciences Centre. This project will also allow for the consolidation of Psychology research space on the 3<sup>rd</sup> floor of Ramsay Wright in an area close to the Psychology research facilities available in the adjacent Centre for Biological Timing & Cognition (CBTC).

A revision of the space program has also been made in order to intensify utilization. To do so, the Human Biology Program (HBP) labs have been added to the space program. HBP has historically taught one to two courses at Ramsay Wright with the majority of its courses taught at Faculty of Medicine undergraduate teaching labs. In the new space program, all but one HBP undergraduate lab course will be moved to newly renovated, dedicated HBP labs at Ramsay Wright. The HMB320 course has a lab component that utilizes samples only available at Medical Sciences Building and so must remain there.

Seven existing teaching laboratories and sixteen prep rooms, 1,101 nasm in total, will be released and reallocated for other use as follows:

- three teachings labs in RW will be converted to much needed research labs.
- four teaching labs in ESC will be made available. One has already been converted to a research lab for EEB and the three remaining labs will be for future use (these include possible labs for the Department of Earth Sciences that saw an increase of 4 Faculty when it was recently restructured or for upcoming plans to consolidate EEB research in the ESC and CSB research in RW).

Two teaching labs in the ESC will continue to be used for courses that require access to the rooftop greenhouses.

The newly renovated teaching laboratories will be at 54% of the space generated by the COU standard when considering prime teaching labs and prep rooms; if existing specialized support spaces, that were based on previous and less efficient standards, are included then the departments would be at 62% of COU standards. The utilization of these specialized support spaces can be greatly improved and the Faculty has already begun to actively work on improving the utilization of some of these spaces, one of which is field storage that has been reduced and reallocated to other uses.

The proposed upgrading of the Ramsay Wright teaching labs entail a renovation of the relevant areas over three phases and a time period of two and a half years. In order to minimize the disruption of teaching activities for all departments involved, the timeline in this project adheres to semester start and end dates.

The Project Planning Committee was struck in September 2012. The membership included representatives from the Faculty of Arts and Science, including the Department of Cell & Systems Biology, the Department of Ecology & Evolutionary Biology, the Department of Psychology, and the Human Biology Program, University Planning, Design and Construction and Facilities Services, as well as, undergraduate and graduate students. The full Project Planning Committee met on several occasions to inform the direction of the proposed project as detailed in Project Planning Report. In addition, individual meetings with user groups including CSB, EEB and Psychology facilitated by Arts & Science Infrastructure Planning and Campus and Facilities Planning varied from bi-weekly to monthly meetings throughout the planning process.

The project has already been through governance and received Governing Council approval in June 2013. An RFP for a design team was issued in May 2013 with Dialog Architects being awarded the contract in July 2013. A Schematic Design Report was completed in October 2013. The Architect's scope of work included a cost estimate at Schematic Design phase. In addition, University of Toronto's Project Management Department also engaged a Consultant Cost Estimator to prepare a cost estimate based on the Schematic Design. Reconciliation of the two figures took place from November 2013 to January 2014. The two independently prepared but jointly fine-tuned estimates were within 2% of each other; as such, the current TPC is a fairly accurate representation of the defined scope.

It is now necessary to resubmit the project through governance because the revised TPC based on the Schematic Design significantly exceeds the original TPC.

The most significant change to the space program from the end users' perspective is the elimination of all work in the basement level. This decision was made in order to contain costs and offset user added scope. It is important to note that the work in the basement is independent from work on the other floors; as such, it can be undertaken as a separate project in future.

Even with this containment strategy the cost has greatly increased. The increases are due to:

1. significantly more required mechanical and electrical infrastructure work than originally anticipated and inclusion of corridor and adjacent service spaces (non-assignable) spaces to be renovated (75%)
2. design change incorporating the use of a "lab module" commonly used in contemporary lab planning which allows for a more efficient and flexible use of space (17%)
3. user requested changes including additional power, air conditioning and increases in renovated areas (17%)
4. building code requirements including emergency power, fire alarm, fire rating and sprinklers (8%)
5. Environmental Health & Safety requirements including additional emergency showers, sinks etc. (4%)
6. building IT requirements including new network rooms and re-route cabling (3%)

- 7. deletion of basement work which is comprised of the anatomy lab, prep rooms and student lounge (-24%)

A detailed listing of areas which have contributed to the cost increases are attached in Appendix A.

Overall the changes in the program areas are:

	<b>Nasm</b>	<b>Project Total sm</b>
Original Project	3,846	4,249
Revised Project	3,514	4,650

Occupancy for Phase 1 is scheduled for January 2016, Phase 2 for September 2016 and Phase 3 for April 2017.

### **Revised Project Schedule**

#### All Phases

- Governance Approval
- Consultant Selection – July 2013
- Schematic Design – June 2013 – September 2013
- Governance Approval (Project Budget Increases, Changes in Scope) –Dec. 2014
- Design Development & Contract Drawings – August 2014 – December 2014

#### Phase 1

- Tender and Award – January - February 2015
- Mobilization and Construction – March 2015 – December 2015
- Commissioning and Moving – December, 2015

#### Phase 2

- Mobilization and Construction – January 2016 – August 2016
- Commissioning and Moving – August 2016

#### Phase 3

- Mobilization and Construction – September 2016 – April 2017
- Commissioning and Moving – April 2017
- Full Operational Occupancy by division – April 2017

### **FINANCIAL IMPLICATIONS**

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

**RECOMMENDATIONS:**

Be It Resolved

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

1. THAT the Revised Project Planning Committee Report for the Ramsay Wright Building Teaching Laboratories Upgrades, dated October 8, 2014, be approved in principle; and
2. THAT the total project scope of approximately 4,650 gross square metres (gsm) (approximately 3,514 net assignable square metres (nasm)), to be funded by the Faculty of Arts and Science, Graduate Expansion Funds, and Financing, be approved in principle.

**DOCUMENTATION PROVIDED:**

- Revised Report of the Project Planning Committee for the Ramsay Wright Building Teaching Laboratories Upgrades, dated October 8, 2014.

## **APPENDIX A**

### **Program scope additions:**

1. Increased lab utilization with increased scheduling of morning and evening sections by both EEB and CSB along with the addition of the Human Biology Program undergraduate teaching labs. An increase of 7 lab courses will now be taught in the renovated Ramsay Wright teaching labs.
2. A design change was made to build in flexibility for future adaptability. The original estimate was based on working within the footprint of existing teaching labs. It was agreed during the design process that working within a “Lab Module” commonly used in contemporary lab planning would allow for the adaptation of programming over time. Using a modular configuration would ensure a regular and predictable location for services as well as a placement of fitments and equipment that is both practical and safe.
3. Additional air conditioning is to be provided to include four adjacent ACE classrooms on the 1<sup>st</sup> floors that were not in the original scope of work. This would result in the whole floor being air conditioned which allows the mechanical system to be designed more efficiently and was deemed worth the incremental cost.
4. Additional EEB prep rooms (3) are to be renovated. This would result in all of EEB space and a contiguous block of space on the first floor being renovated as a result of this project.
5. Additional floor area is incorporated into the Psychology labs renovation area. This allows the research labs to be planned using a “Lab Module” (item #1) and the provision of an additional shared seminar room. This would result in all of Psychology’s space on the third floor being renovated and a reconfiguration that would group the Psychology space in a contiguous block of space.
6. Additional upgrades to the first and second floor corridors and service spaces.
7. Code Requirements: Upgrades required to meet current building and electrical codes not included in the original cost estimate
  - a. Emergency power upgrade in order to separate equipment from life safety systems
  - b. Fire alarm upgrades
  - c. Additional fire rating requirement in non-renovated areas that are interconnected with the renovated spaces
  - d. Requirement to sprinkler building
8. EHS Standards not included in the original cost estimate:
  - a. Emergency showers and sinks
  - b. Acid drainage system

9. IT Standards not included in the original cost estimate:
  - a. IT infrastructure is in need of improvements. Network rooms and cabling were added as needed over the years without an overall plan for the building. It was not known in planning the teaching lab project that current locations of switches to serve departments, found on the 2nd and 3rd floors, would need rerouting to accommodate new network cabling to the newly renovated areas. A plan was developed during the design phase of this project to better serve all areas of the building
  
10. Unforeseen - Mechanical/Electrical:
  - a. During the preliminary planning phase assumptions were made with respect to the nature and extent of infrastructure required to support the renovated space. Once the team of architects and engineers had been engaged it became apparent, after site investigations and Schematic Design work, that greater repair, replacement and enhancement of infrastructure would be required.

**Program scope deletions:**

11. Deletion of all work in the basement was made in order to offset other user added scope. The basement is comprised of an anatomy teaching lab, prep rooms and a student lounge. The planned renovations did not involve a reconfiguration of the space as such there is no substantive advantage of including it in this project (nor a significant financial disadvantage to undertaking the project separately later). Since there was no planned layout change of the anatomy teaching lab there is no impact on the teaching or functioning of the program. The teaching methodology was to continue as is, albeit in a renovated space. It can be undertaken as a separate project. This reduces the number of renovated teaching labs to 20 from 21.

**Summary of scope area changes:**

12. There is a net increase of 400 sq.m. in the project as follows:
  - 360 nasm were added to the scope of work on the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Floors
  - 610 nasm was removed from the scope of work on the basement floor
  - 650 sq.m. increase in non-assignable work in corridors and adjacent service spaces



**Revised Report of the Project Planning Committee  
for the Ramsay Wright Building  
Teaching Laboratories Upgrades**

October 8, 2014

Department of Ecology & Evolutionary Biology,  
Department of Cell & Systems Biology,  
Human Biology Program,  
Department of Psychology  
&  
Faculty of Arts & Science, Infrastructure Planning,  
Campus & Facilities Planning



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1. Space Utilization and COU Guideline Analysis
2. Functional Plan Space Program (test fit)
3. Weekly Utilization diagrams by Department
4. Asbestos Summary Material (available on request)
5. Room Specification Sheets (available on request)
6. Total Project Cost Estimate (available on request to limited distribution)

**Part A: Executive Summary**

Providing the highest quality educational experience is at the core of the University of Toronto's academic mission. And access to modern laboratory space and equipment is a key contributor to the overall university experience for students in the rapidly developing field of life sciences.

While the current accommodations for teaching in the life sciences on the St. George Campus are in many ways exemplary, there remain some facilities that are technologically outdated relative to current standards. In particular, the laboratory teaching facilities in the Ramsay Wright Building are in need of upgraded services in order for them to continue to fulfill their academic mission.

A significant portion of teaching laboratories used by the Departments of Cell & Systems Biology (CSB), Ecology & Evolutionary Biology (EEB) and the Human Biology Program (HBP) are currently located in the Ramsay Wright Building. Approximately 30% of all first year students who enter the Faculty of Arts and Science each year are enrolled in courses taught in Ramsay Wright laboratories. These labs have not been upgraded since the building was built in the late 1960s and, as a result, are equipped with outdated student benches, improper lighting and lack modern audio visual equipment, as well as unreliable wired or wireless data connections. Most labs are not air conditioned and can be extremely uncomfortable for users during the summer and fall sessions.

One of the major technological limitations of the Ramsay Wright teaching labs is their lack of fume hoods. Fume hoods are critical for most CSB courses and specific lab protocols, and some EEB courses and HBP courses. Their absence severely limits what can be taught in courses held in Ramsay Wright labs. These infrastructure limits have ultimately constrained the teaching aspirations of two life sciences departments with very high undergraduate enrolments.

This project calls for Ramsay Wright's undergraduate teaching labs to receive an overall general upgrading of fixtures and finishes including the addition of fume hoods and air conditioning for two floors of the building. This work will result in each unit having consolidated labs that are under departmental control as opposed to the current situation of sharing the same infrastructure, and will effectively increase available undergraduate teaching space (currently under-utilized) in Ramsay Wright.

Currently, courses with laboratory exercises that require fume hoods have been located at the Earth Sciences Centre (ESC). CSB and EEB are sharing the use of three Earth Sciences labs (alternating by semester) which requires equipment to be moved between buildings each semester. This project will address the problem of sharing the EEB/CSB labs at Earth Sciences by moving the majority of teaching lab activity to Ramsay Wright and allow for the future consolidation of EEB research space in Earth Sciences. This project will also allow for the consolidation of Psychology research space on the 3<sup>rd</sup> floor of Ramsay Wright in an area close to the Psychology research facilities available in the adjacent Centre for Biological Timing & Cognition (CBTC).

Seven existing teaching laboratories and sixteen prep rooms, 1,101 nasm in total, will be released and reallocated for other use as follows:

- three teachings labs in RW will be converted to much needed research labs.
- four teaching labs in ESC will be made available. One has already been converted to a research lab for EEB and the three remaining labs will be for future use (these include possible labs for the Department of Earth Sciences that saw in increase of 4 Faculty when

it was recently restructured or for upcoming plans to consolidate EEB research in the ESC and CSB research in RW).

Two teaching labs in the ESC will continue to be used for courses that cannot be accommodated at Ramsay Wright and those related to the greenhouse facility in that building.

The newly renovated teaching laboratories will be at 54% of the space generated by the COU standard when considering prime teaching labs and prep rooms; if existing specialized support spaces, that were based on previous and less efficient standards, are included then the departments would be at 62% of COU standards. The utilization of these specialized support spaces can be greatly improved and the Faculty has already begun to actively work on improving the utilization of some of these spaces, one of which is field storage that has been reduced and reallocated to other uses.

The project received Governing Council approval in June 2013. An RFP for a design team was issued in May 2013 with Dialog Architects being awarded the contract in July 2013. A Schematic Design Report was completed in October 2013 and the Architect's scope of work included a cost estimate at Schematic Design phase. In addition, University of Toronto's Project Management Department also engaged a Consultant Cost Estimator to prepare a cost estimate based on the Schematic Design. Reconciliation of the two figures took place from November 2013 to January 2014. The result of which, was two independently prepared but jointly fine-tuned estimates that were within 2% difference; as such, the current TPC is a fairly accurate representation of the defined scope at schematic design.

Based on the new estimate, the revised TPC significantly exceeds the original TPC. The most significant change to the scope of work is the elimination of all work in the basement level. This decision was made in order to contain costs and offset user added scope. It is important to note that the work in the basement is independent from work on the other floors; as such, it can be undertaken as a separate project in future.

A revision of the space program has also been made in order to intensify utilization. To do so HBP labs have been added to the space program. HBP has historically taught one to two courses at Ramsay Wright with the majority of its courses taught at Faculty of Medicine undergraduate teaching labs. In the new space program, all but one HBP undergraduate lab course will be moved to newly renovated, dedicated HBP labs at Ramsay Wright. HMB320 has a lab component that utilizes samples only available at Medical Sciences Building and so must remain there.

The increased cost has been summarized below and includes:

1. significantly more required mechanical and electrical infrastructure work than originally anticipated and inclusion of corridor and adjacent service spaces (non-assignable) spaces to be renovated (75%)
2. design change incorporating the use of a "lab module" commonly used in contemporary lab planning which allows for a more efficient and flexible use of space (17%)
3. user requested changes including additional power, air conditioning and increases in renovated areas (17%)
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Overall the changes in the program areas are:

	<b>Nasm</b>	<b>Project Total sm</b>
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The proposed upgrading of the Ramsay Wright teaching labs entail a renovation of the relevant areas over three phases and a time period of up to two and a half years. In order to minimize the disruption of teaching activities for all departments involved, the timelines in this project adhere to academic term start and end dates. Occupancy for Phase 1 is scheduled for January, 2016, Phase 2 for September, 2016, and Phase 3 for April, 2017.

### **Preparation for Phase 1**

The preparatory work for Phase 1 of the project includes the relocation of groups not associated with undergraduate CSB, EEB or HBP teaching away from the 2<sup>nd</sup> floor of Ramsay Wright. This relocation will free up the 2<sup>nd</sup> floor areas for the consolidation of space for the CSB and HBP teaching facilities. Two CHASS computer labs and an EEB research lab have already been relocated to vacate space for the teaching lab renovations.

### **Phase 1**

The bulk of Phase 1 of the project involves the renovation of 1,608 nasm (2,108 sm) of building area in Ramsay Wright. Fume hoods will be added to the 2<sup>nd</sup> floor teaching labs, as well as air conditioning to the 1<sup>st</sup> and 2<sup>nd</sup> floors. Student Activity space will be created on the 2<sup>nd</sup> floor for undergraduate biology students. The construction of Phase 1 is projected to start March, 2015, at the earliest and is to be completed by December, 2015.

### **Phase 2**

Phase 2 of the project involves the renovation of 1,317 nasm (1,760 sm) of building area including renovations to 1<sup>st</sup> floor labs at Ramsay Wright for EEB. Fume hoods will be added to the 1<sup>st</sup> floor teaching labs, Student Activity space will be created on the 1<sup>st</sup> floor for undergraduate biology students. Phase 2 construction is projected for an earliest start date of January, 2016, for a period of 8 months with completion for September, 2016.

### **Phase 3**

Phase 3 of the project involves the renovation of 590 nasm (782 sm) of building area and a construction period of another 8 months, starting September, 2015. This final phase includes the relocation of CSB teaching labs from the east portion of the 3<sup>rd</sup> floor of Ramsay Wright to the newly renovated 2<sup>nd</sup> floor teaching labs. Also included are renovations to vacated space on the 3<sup>rd</sup> floor for Psychology department research labs and a teaching lab. Completion date for this work is targeted for April, 2017.

The total of all areas to be renovated over the three phases is 3,514 nasm (4,650 sm) and will be under construction for a period of approximately 2.5 years.

**Part B: Project Background****B1. Membership**

Jay Pratt, Professor, Vice-Dean Research & Infrastructure, Faculty of Arts & Science  
Lucy Chung, Director of Infrastructure Planning, Faculty of Arts & Science  
Kim McLean, Chief Administrative Officer, Faculty of Arts & Science  
John Coleman, Professor, Department of Cell & Systems Biology  
Don Jackson Professor, Chair, Department of Ecology & Evolutionary Biology  
Susanne Ferber Professor, Chair Department of Psychology  
Vince Tropepe, Professor, Director, Human Biology Program.  
Deirdre Loughnan, undergraduate student, Department of Ecology & Evolutionary  
Erich Damm, graduate student, Department of Cell & Systems Biology  
Tamar Mamourian, Chief Administrative Officer, Department of Cell & Systems Biology  
Danielle Churchill, Facilities Designer, Faculty of Arts & Science  
George Phelps, Director, Project Development, Real Estate Operations  
Bruce Dodds, Director of Utilities & Building Operations, Facilities & Services  
Christine Burke, Director, Campus & Facilities Planning  
Alan Webb, Planner, Campus & Facilities Planning (Secretary)

**Past Members**

Robert Baker, Professor, Vice-Dean Research & Infrastructure, Faculty of Arts & Science  
Locke Rowe, Professor, Chair, Department of Ecology & Evolutionary Biology  
Gail Milgrom, Director, Campus & Facilities Planning

**B2. Terms of Reference**

1. Make recommendations for a detailed space program and functional layout for: a) the teaching laboratories and associated prep rooms for the Department of Cell and Systems Biology, the Department of Ecology and Evolutionary Biology and the Human Biology Program on floors 1 and 2 of the Ramsay Wright Laboratories; and b) the research space for the Department of Psychology on floor 3 of the Ramsay Wright Laboratories.
2. Identify the space program as it is related to the Faculty's existing and approved academic plan, taking into account the impact of approved and proposed program enhancements that are reflected in increasing faculty, student and staff complement.
3. Plan to realize maximum flexibility of space to permit future allocation as program needs change.
4. Demonstrate that the proposed space program will take into account the Council of Ontario Universities' and the University's own space standards.
5. Identify all deferred maintenance and items of infrastructure renewal for the Ramsay Wright Laboratories and their associated costs.
6. Identify a phased approach to the implementation of a comprehensive plan, including any staging that may be required.

7. Identify all secondary effects and impact on the delivery of academic programs during construction and the possible required relocation as required to implement the plan of existing units.
8. Identify equipment and moveable furnishings necessary to the project and their estimated cost.
9. Identify all data, networking and communication requirements and their related costs.
10. Identify all security, occupational health and safety and accessibility requirements and their related costs.
11. Identify all costs associated with transition during construction and secondary effects resulting from the realization of this project.
12. Determine a total project cost estimate (TPC) for the capital project including costs of implementation in phases if required, and also identifying all resource costs, including a projected increase to the annual operating cost.
13. Identify all sources of funding for capital and operating costs.
14. Complete report by August 8, 2014.



### **B3. Background Information**

Providing the highest quality educational experience is at the core of the University of Toronto's academic mission. And access to modern laboratory space and equipment is a key contributor to the overall university experience for students in the rapidly developing field of life sciences.

Thousands of students (~30% of all first year FAS students) are enrolled every year in Departments of Cell & Systems Biology (CSB), Ecology & Evolutionary Biology (EEB) and the Human Biology Program (HBP) courses largely taught in the teaching labs located on the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Floors of the Ramsay Wright Building. The labs were built 50 years ago (only 10 years after the discovery of DNA) and, while some accommodations for teaching in the life sciences on the St. George Campus are appropriate, the life sciences have progressed dramatically over the past decades and many facilities are technologically outdated relative to current standards.

The labs have never been upgraded and, as a result, lack appropriate benching and seating, suitable lighting and, audio visual equipment as well as reliable wired or wireless data connections. Mechanical infrastructure is inadequate, the majority of labs are not air conditioned and can be extremely uncomfortable for users during summer and fall terms.

One of the more extreme technological limitations for Ramsay Wright teaching labs is the lack of fume hoods. Fume hoods are critical for most CSB courses and some EEB and HBP courses and their absence severely limits what can be taught in courses held in Ramsay Wright labs. Courses with laboratory exercises that require fume hoods, where possible, have been located at the Earth Sciences Centre (ESC) but, owing to the need for properly serviced labs, CSB and EEB share the use of Earth Sciences labs (alternating by semester) and therefore have to move all preparatory equipment and material and equipment used in the labs by the students from building to building between semesters. This is a two day process involving movers, additional technical staff, and ultimately, an inordinate draw on staff time. In other instances, when access to the more modern Earth Sciences labs is not possible, the scope of the lab exercises is significantly curtailed, with the resulting diminution of the lab experience for the students. These facilities limits have ultimately constrained the teaching aspirations of two departments with very high undergraduate enrolments.

HBP has historically taught one to two courses at Ramsay Wright with the majority of its courses taught at Faculty of Medicine undergraduate teaching labs. In the new space program, a revision to the April 2013 version, all but one HBP undergraduate lab course will be moved to newly renovated, dedicated HBP labs at Ramsay Wright. HMB320 has a lab component that utilizes samples only available at Medical Sciences Building and so must remain there.

The project's origins stem in part from May 2006, when the Planning and Budget Committee received terms of reference for a Project Planning Committee for Biological Sciences. The purpose of the Committee at that time was to recommend a comprehensive space plan that would accommodate two new departments: Cell and Systems Biology (CSB) and, Ecology and Evolutionary Biology (EEB) created through reorganization of the Departments of Botany and Zoology (located in the Earth Science Centre and the Ramsay Wright building) earlier that year. The Committee concluded that the construction of new facilities together with renovations to existing space was considered the best approach. Funding is now available to upgrade virtually all of the teaching laboratories in the Ramsay Wright Laboratories and to co-locate research laboratories and associated equipment of faculty members from CSB and the Department of Psychology who share common research interests and platforms.

#### **B4. Statement of Academic Plan**

With close to 50,000 students, the University of Toronto's St. George campus is the largest in Ontario. In response to the increased demand for university education, both undergraduate and graduate enrolment has expanded dramatically at the University of Toronto over the past decade. Since 2001, undergraduate enrolment on the St. George campus has expanded by close to 65% while graduate enrolment has grown a further 57%.

Enrolment growth in the University's largest Faculty –Arts and Science– has occurred disproportionately in the sciences. Over the past five years undergraduate enrolment on the St. George campus in life science programs has grown significantly. Growth has been particularly strong in Cell and Systems Biology; for example CSB's second year introductory course has seen a 45% increase in enrolment since 2001. Similarly, enrolment in life and biological sciences has also grown (27%) and graduate enrolment in CSB has more than doubled since 2004.

These increases in enrolment are linked to recent introductions of new programs in CSB and EEB that occurred soon after the 2006 reorganization of the biosciences in the Faculty of Arts and Science. Both units prepared comprehensive academic plans in 2010 and both indicated the pressing need for renewed teaching infrastructure. Following a comprehensive external review the Human Biology Programs have also gone through a period of rapid development and growth.

##### **Cell and Systems Biology**

In order to modernize undergraduate education and enrich the student experience, CSB introduced three new programs in 2007: Cell and Molecular Biology Major and Specialist, and Animal Physiology Major. These programs alone have seen enrolment rise to a combined 1,050 students. Total enrolment in all programs, including those shared with EEB, sits at 2,111 students. In addition, many students from other programs, including HBP in particular, fulfill their program requirements with CSB courses. Total course enrolment as of November, 2012, is 4,133.5 FCE.

As part of the FAS Curriculum Renewal process, CSB redesigned its foundational Cell and Molecular Biology course (formerly BIO250Y/BIO240H/241H) such that half was moved to the first year (BIO130H), while the other half remains at the second year level (BIO230H). The new format was introduced in 2010/11 and allows the unit to build pedagogically integrated approaches to undergraduate instruction in the molecular life sciences that continue from the 1st to the 4th year. Another foundational course, BIO252Y Animal Physiology, was reorganized into two half courses, BIO270H and BIO271H, with modernized labs. All of these foundational courses rely on space and facilities in teaching laboratories.

In addition, several CSB upper level courses routinely have large waiting lists, highlighting the need to increase enrolment capacity through a variety of mechanisms including more appropriate laboratory facilities. Since 2006, CSB has introduced 17 new courses to the undergraduate curriculum, 8 of which require teaching laboratories. This is in addition to the reorganization of pre-existing Zoology/Botany courses that were re-numbered (CSB), and in many instances, revamped with updated laboratory components.

##### **Ecology and Evolutionary Biology**

EEB teaches over 3,100 students enrolled in EEB courses, with approximately 1,900 entering students in its introductory course. EEB courses span a wide range of class sizes and venues; from a 1,900 student 1st year lecture course complete with fortnightly laboratories, to 15 student field courses in the Amazon Rainforest, to single student research experiences. Over half of the EEB courses have hands on laboratory components that involve the use of teaching laboratories.

In 2009 the department carried out a comprehensive review of its undergraduate programs, the review led to a new vision of the unit's role in teaching in the University, a vision that led to a clear set of coherent objectives, a set of actions, and future plans.

Actions included a move toward 'H' courses, ranging from the very large first year course to 4th year seminar courses; which greatly increases flexibility for Specialists and Majors, and gives greater access to students from other programs (e.g. HBP). In cooperation with HBP, EEB introduced two new large courses, designed to bring ecology and evolution to a wider audience (The Ecology of Human Population Growth, and The Evolution of the Human Genome). The unit reinforced its commitment to small class research-based experiences, including use of laboratory sessions in large enrolment courses.

### **Human Biology**

The Human Biology Program (HBP) has undergone significant renewal since 2007 and currently offers multiple Specialist and Major programs of study to over 3,300 students (Appendix 1). A significant priority of the HBP is to provide diverse experiential learning opportunities for its students, which currently includes international placements in global health (e.g., Africa, Central America, and the Caribbean), service learning with various organizations in the Toronto community, undergraduate research in various life science laboratories on campus and affiliated hospital research institutes, and focused biological science instruction in laboratory courses.

The Human Biology Program (HBP) is an undergraduate collaborative program between the Faculty of Arts and Science (including CSB, EEB and Psychology) and the Faculty of Medicine. Undergraduate science students may enroll in an HBP program of study in their 2<sup>nd</sup> year after completing introductory (100-level) courses in biology, chemistry, physics and math.

Currently, all of HBP specialist students are required to complete one laboratory course in 3<sup>rd</sup> year in order to fulfill their program requirements. Since HBP does not have its own laboratory space, this is accomplished by utilizing laboratory space in the Medical Sciences Building, as well as in Ramsay Wright. However, there is significant demand for placements in laboratory courses from HBP Major students that goes unfulfilled every year due to space constraints. HBP students consistently report that their experience in laboratory courses had a significant positive impact on their ability not only to secure undergraduate research placements in some of the top laboratories in the city, but also to participate in their projects more effectively and with greater confidence.

Expanding the capacity by enhancing resources for HBP laboratory courses would have a significant impact since a large proportion of Major students are very interested in gaining lab experience, but they do not currently have priority for these coveted positions. A number of possible programmatic solutions to enhancing the student experience include: teaching grants to support the replacement of aging equipment or to modernize and/or developing new labs; increasing teaching assistant support; implementing team teaching using HBP faculty as well as faculty from participating units taking advantage of the knowledge base and skill sets of our individual faculty members. Nonetheless, the most significant enhancement that is critical for modernizing biological laboratory teaching for a very large number of highly qualified HBP students is an investment in new laboratory infrastructure. This investment would have the added effect of substantially improving HBP laboratory course administration and resource management, as well as easing the path toward future improvements to the curriculum.

## **Psychology**

The Department of Psychology offers research-based BSc programs that focus on the experimental and biological approaches to the discipline rather than on a clinical approach to Psychology.

The behavioural neuroscience group in Psychology also teaches an undergraduate laboratory class in Ramsay Wright. This course, PSY399 (Psychobiology), has been limited to 20 students in the past due to space constraints in the building. As this group grows within the department, expanding the capacity of this course, and adding capacity for additional neuroscience laboratory courses, is a priority for the department.

## **B5. Space Requirements**

As this project is focused on the renovation of teaching laboratories for the Departments of Cell Systems Biology, Ecology and Evolutionary Biology and Human Biology Program, as well as the provision of new research laboratory space for the Department of Psychology, the overview of existing space and analysis of facility requirements that follows will be therefore limited to these space types. However, a full analysis of the departmental space requirements was conducted, using the Council of Ontario Universities (COU) space guidelines, and is included in Appendix 1 for reference.

### **CSB, EEB and HBP Undergraduate Teaching Laboratories**

The following sections are organized to provide information on CSB, EEB, and HBP teaching laboratories:

- i. Existing Facilities**  
Inventory of the existing teaching laboratory facilities
- ii. Demand for Teaching Laboratories - CSB , EEB and HBP**  
Demand for those facilities based on courses with practical sections taught in 2013/14 and projected expansion to 2016/17
- iii. Utilization of Teaching Laboratories - CSB, EEB and HBP**  
Actual Utilization of the CSB, EEB and HBP teaching laboratories for 2013-14 and proposed utilization after renovation (2016/2017)
- iv. COU Guidelines and Analysis**  
Analysis of the requirement for teaching laboratory space

- i. Existing Facilities**

The Departments of Cell Systems Biology and Ecology and Evolutionary Biology teaching laboratories are currently located in two Faculty of Arts & Science buildings on the St. George campus, the Ramsay Wright Laboratories and the Earth Sciences Centre. The units currently share teaching laboratory and support space in both buildings. Human Biology Program does not hold any undergraduate teaching space but book labs through other department, with the majority of labs held at Faculty of Medicine undergraduate teaching labs.

**Table 1.** Existing CSB and EEB Undergraduate Teaching Laboratories and Support Space - COU Category 2 (prorated for shared labs)

	<b>Ramsay Wright</b>	<b>Earth Science</b>	<b>Total</b>
	<b>Nasm</b>	<b>Nasm</b>	<b>Nasm</b>
<b>CSB</b>			
Teaching Labs	864	277	1141
Lab Support	531	267	797
Total	1395	544	1939
<b>EEB</b>			
Teaching Labs	1077	277	1354
Lab Support	491	310	801
Total	1568	587	2156
<b>HBP*</b>			
Teaching Labs	0	0	0
Lab Support	0	0	0
Total	0	0	0
<b>Total</b>	<b>2963</b>	<b>1131</b>	<b>4094</b>

\* HBP currently has no allocated space for undergraduate teaching and books labs in CSB and EEB space at Ramsay Wright and at other labs in Medical Sciences Bldg.

There are currently 6 undergraduate teaching labs in the Earth Sciences Centre and 20 undergraduate teaching labs in the Ramsay Wright Building with a total of 692 student laboratory stations. Two Ramsay Wright undergraduate teaching labs are inactive due to lack of services and therefore scheduling of labs is higher in Earth Sciences. The average teaching laboratory station sizes in the two buildings are similar but vary somewhat from room to room. The average for Earth Sciences is 3.53 nasm/station and the average for Ramsay Wright is 3.87 nasm/station.

Also included in any discussion of teaching laboratories are the associated rooms for preparation and storage, the support spaces related to the labs. There is slightly more of a variance for this category of space; 2.98 nasm of support space for every lab teaching station in the Earth Sciences and 2.36 nasm for those in the Ramsay Wright Building. The combined area per station is on average 6.31 nasm.

In the table that follows, the 7 teaching labs that are to be released as a result of this project have been shaded (ESC 2087/2088 has recently been converted to a research lab).

**Table 2.** CSB and EEB Undergraduate Teaching Laboratories

Room	Capacity	Area (nasm)	Area Per Station (nasm)
<b>Earth Sciences</b>			
ESC 1026	20	73.5	3.68
ESC 1027	30	99.8	3.33
ESC 1032	50	153.0	3.06
ESC 2087	30	116.6	3.89
ESC 3088	30	114.0	3.80
ESC 4076	30	113.7	3.79
<i>Avg Tch Stn</i>			3.53
Lab Support		567	2.98
<b>Subtotal</b>	<b>190</b>	<b>1,237.6</b>	<b>6.51</b>
<b>Ramsay Wright</b>			
RW 013	84	288.2	3.43
RW 102	24	83.0	3.46
RW 104	24	82.4	3.43
RW 122	24	83.0	3.46
RW 124	24	84.4	3.52
RW 125	24	84.4	3.52
RW 127	24	82.5	3.44
RW 128	24	83.0	3.46
RW 130	24	82.4	3.43
RW 131	24	82.4	3.43
RW 133	24	83.0	3.46
RW 203	20	83.0	4.15
RW 205	20	82.4	4.12
RW 208	24	82.5	3.44
RW 214	20	83	4.15
RW 216	20	82.4	4.12
RW 219	20	83	4.15
RW 309	18	134.6	7.48
RW 311	18	95.9	5.33
RW 313	18	95.9	5.33
<i>Avg Tch Stn</i>			3.87
Lab Support		1185	2.36
<b>Subtotal</b>	<b>502</b>	<b>3,126.4</b>	<b>6.23</b>
<b>Total</b>	<b>692</b>	<b>4364</b>	<b>6.31</b>

## ii. Demand for Teaching Laboratories – CSB, EEB, HBP

The total student enrolment for 2013/14, in practical sections of both departments, was 6,100 in the fall term and 5,374 in the winter term. The following tables list the courses with practical sections taught in 2013/14 with enrolment totals. The columns show the total number of weekly student contact hours (# students enrolled times the number of weekly hours of practical instruction), the COU space factor and the theoretical amount of space required to accommodate those courses in labs and all associated support space. The last columns show the projected increase in enrolment after renovation and the amount of additional space generated through the COU calculation.

**Table 3.** EEB, CSB, HBP Fall 2013 Laboratory Courses

Course	Current Location	Weekly Practical hrs	Course Enrolment	Wkly. Student Contact Hours	COU space factor	Generated Area NASM	Increased enrolment (Projected 2016-2017)	Increased Generated Area NASM
<b>EEB Laboratory Course Information - Fall 2013</b>								
BIO120H*	RW102	1.5	1824	2736	0.6	1642		
	RW104	1.5						
	RW125	1.5						
	RW127	1.5						
	RW128	1.5						
	RW130	1.5						
	RW131	1.5						
	RW133	1.5						
EEB263Y	RW13	3.0	80	240	0.6	144		
EEB266H	RW13	1.5	120	180	0.6	108		
EEB268H	ES1027	1.5	90	135	0.6	81		
	ES1032	1.5						
EEB321H	RW107	3.0	60	180	0.3	54		
	RW109	3.0						
EEB323H	ES4076	2.0	50	100	0.6	60		
EEB322H	RW208	3.0	80	240	0.6	144		
EEB331H	ES3088	3.0	30	90	0.6	54		
EEB337H	ES3088	3.0	30	90	0.6	54		
EEB360H	ES3088	3.0	30	90	0.6	54		
EEB382H	RW13	2.0	60	120	0.6	72		
EEB388H	RW13	3.0	50	150	0.6	90		
ENV234H	RW122	1.5	192	288	0.6	173	24	22
			2,696	4,639		2,729		22
<b>CSB Laboratory Course Information - Fall 2013</b>								
BIO 230H	ES1026	1.5	1195	1793	0.6	1076		
	ES1027	1.5						
	ES1032	1.5						
BIO255H	ES1032	3.0	34	102	0.6	61		
BIO270H	RW309	2.0	531	1062	0.6	637		
	RW311	2.0						
	RW313	2.0						
CSB328H	RW203	2.0	83	166	0.6	100		
	RW205	2.0						
	RW219	2.0						
CSB350H	ES3088	5.0	49	245	0.6	147		
	ES4076	5.0						
			1,892	3,368		2,021		
<b>HMB Laboratory Course Information - Fall 2013</b>								
HMB265	MS	1.0	1200	1200	0.6	720	96	58
HMB302	MS	3.0	180	540	0.6	324		
HMB310	MS	3.0	44	132	0.6	79	28	50
HMB314	MS	3.0	88	264	0.6	158	56	101
			1,512	2,136		1,282		209
<i>Total Fall 2013 EEB, CSB, HMB</i>			<i>6,100</i>	<i>10,143</i>		<i>6,032</i>		<i>6,262</i>

Note: Students in BIO120 and BIO230 meet in alternating weeks. EEB221 is held in the computer lab.

**Table 4.** EEB, CSB and HBP Winter 2014 Laboratory Courses

Course	Current Location	Weekly Practical hrs	Course Enrolment	Wkly. Student Contact Hours	COU space factor	Generated Area NASM	Increased enrolment (Projected 2016-2017)	Increased Generated Area NASM
<b>EEB Laboratory Course Information - Winter 2014</b>								
BIO220H	ES1026	1.5	1440	2160	0.6	1296		
	ES1027	1.5						
	ES1032	1.5						
	ES2087	1.5						
BIO251H	ES1027	1.5	180	270	0.6	162		
	ES1032	1.5						
EEB225H	RW107	1.0	120	120	0.3	36		
	RW109	1.0						
EEB263Y	RW013	3.0	80	240	0.6	144		
EEB267H	RW013	1.5	140	210	0.6	126		
ENV319H	RW122	3.0	70	210	0.6	126		
	RW124	3.0						
EEB330H	ES3088	3.0	30	90	0.6	54		
EEB340H	ES2087	3.0	35	105	0.6	63		
EEB356H	ES3088	2.0	30	60	0.6	36		
EEB365H	RW109	2.0	110	220	0.3	66		
EEB384H	RW013	3.0	30	90	0.6	54		
EEB386H	RW013	1.0	80	80	0.6	48		
ENV334H	RW122	3.0	60	180	0.6	108	30	54
			2,405	4,035		2,319		54
<b>CSB Laboratory Course Information - Winter 2014</b>								
BIO130H	RW102	1.5	1703	2555	0.6	1533		
	RW104	1.5						
	RW128	1.5						
	RW130	1.5						
	RW131	1.5						
	RW133	1.5						
BIO271H	RW309	2.0	486	972	0.6	583		
	RW311	2.0						
	RW313	2.0						
CSB330H	RW311	5.0	36	180	0.6	108		
	RW313	5.0						
CSB352H	RW107	2.0	102	204	0.3	61		
	RW109	2.0						
CSB474H	ES4076	4.0	20	80	0.6	48		
			2,347	3,991		2,333		
<b>HMB Laboratory Course Information - Winter 2014</b>								
HMB202	MS	1.0	360	360	0.6	216		
HMB310	MS	3.0	0	0	0.6	0	72	130
HMB311	MS	3.0	44	132	0.6	79	28	50
HMB312	MS	3.0	88	264	0.6	158	56	101
HMB320	MS	2.0	130	260	0.6	156		
			622	1016		610		281
<b>Total Winter 2014 EEB, CSB, HMB</b>			<b>5,374</b>	<b>9,042</b>		<b>5,262</b>		<b>5,597</b>

Note: Students in BIO 130 and BIO 220 meet in alternating weeks. EEB225 and 365, and CSB352 are held in computer labs.

The current demand for teaching laboratories and support space, based on the COU guidelines, suggests that approximately 6,262 nasm are required (2,729 nasm for EEB + 2,021 nasm for CSB and 1,282 nasm for HBP) compared to the 4,165 nasm existing. This will be discussed in more detail in the COU Guidelines and Analysis section.



### iii. Utilization of Teaching Laboratories - CSB, EEB and HBP

#### Current use

Typically the undergraduate teaching activities of the two departments have seen alternating use of the more modern Earth Sciences Centre facilities by term, with CSB using the Earth Sciences labs during the Fall terms and EEB during the Winter terms.

Biology-related courses currently use the 18 functioning teaching labs in Ramsay Wright (out of 20) and the 5 remaining teaching labs in Earth Sciences (out of 6). Two Ramsay Wright undergraduate teaching labs are inactive due to lack of services. Courses that require fume hoods have been located temporarily at Earth Sciences but, owing to the need for properly serviced labs, CSB and EEB share the use of Earth Sciences labs (alternating by semester) and therefore have to move all preparatory equipment and equipment used in the labs by the students from building to building between semesters. The total weekly hours for each existing teaching lab used by CSB and EEB are presented in Table 5.

**Table 5. Current Weekly Teaching Lab Usage in Ramsay Wright and Earth Sciences Centre 2013-2014**

Location	Room	Fall 2013 (hrs.)				Fall Total (hrs.)	Winter 2014(hrs.)		Winter Total (hrs.)
		CSB/EEB		HMB			CSB/EEB		
		Day	Eve	Day	Eve		Day	Eve	
Ramsay Wright	RW 013	11	6	6		23	13	5	18
Ramsay Wright	RW 102	12	3			15	15	6	21
Ramsay Wright	RW 104	12	3			15	15	6	21
Ramsay Wright	RW 122	12		3		15	12	3	15
Ramsay Wright	RW 124					0	3	3	6
Ramsay Wright	RW 125	12	3			15			0
Ramsay Wright	RW 127	12	3			15			0
Ramsay Wright	RW 128	12	3			15	15	6	21
Ramsay Wright	RW 130	12	3			15	15	6	21
Ramsay Wright	RW 131	12	3			15	15	6	21
Ramsay Wright	RW 133	12	3			15	15	6	21
Ramsay Wright	RW 203	6				6	2		2
Ramsay Wright	RW 205	4		3		7	2		2
Ramsay Wright	RW 208	12				12			0
Ramsay Wright	RW 214					0			0
Ramsay Wright	RW 216					0			0
Ramsay Wright	RW 219			9		9			0
Ramsay Wright	RW 309	15				15	15		15
Ramsay Wright	RW 311	15				15	21		21
Ramsay Wright	RW 313	15				15	21		21
<b>Subtotal Ramsay Wright</b>		<b>186</b>	<b>30</b>	<b>21</b>	<b>0</b>	<b>237</b>	<b>179</b>	<b>47</b>	<b>226</b>
Earth Science	ESC 1026	18	6			24	15	3	18
Earth Science	ESC 1027	21	6			27	18	6	24
Earth Science	ESC 1032	24	9			33	18	6	24
Earth Science	ESC 2087					0	21	3	24
Earth Science	ESC 3088	11				11			0
Earth Science	ESC 4076	10	1			11	5		5
<b>Subtotal Earth Sciences</b>		<b>84</b>	<b>22</b>	<b>0</b>	<b>0</b>	<b>106</b>	<b>77</b>	<b>18</b>	<b>95</b>
<b>Total</b>		<b>270</b>	<b>52</b>	<b>21</b>	<b>0</b>	<b>343</b>	<b>256</b>	<b>65</b>	<b>321</b>

The average booking total for Earth Sciences labs, in the fall term, is 21.2 hours per week and for 17 labs Ramsay Wright is 13.2 hours per week, excluding the non-functioning labs. The lack of fume hoods in the Ramsay Wright teaching laboratories have resulted in low utilization. (Refer to Section iv. for details.)

Future use

In the new facilities, first and second year undergraduate teaching activities for EEB and CSB will be held in Ramsay Wright and will no longer alternate use at Earth Sciences Centre facilities by term. Biology-related courses will use the 21 teaching labs in Ramsay Wright and the 2 remaining teaching labs in Earth Sciences. Labs in Earth Sciences Centre will be 3<sup>rd</sup> and 4<sup>th</sup> level courses that cannot be accommodated at Ramsay Wright and those related to the greenhouse facility in that building.

**Table 6. Weekly Teaching Lab Usage in Ramsay Wright and Earth Sciences Centre Fall 2016**

Location	Room	CSB (hrs.)	EEB (hrs.)	HMB (hrs.)	Weekly Prep	Weekly Drop-In	Expansion (incl.)	Fall Booked Total (hrs.)	Fall Total Occupied hrs.
Ramsay Wright	RW 013		22		17			22	39
Ramsay Wright	RW 102		18		16			18	34
Ramsay Wright	RW 104		18		14			18	32
Ramsay Wright	RW 124		24		16		3	24	40
Ramsay Wright	RW 125		12		9	12	3	12	33
Ramsay Wright	RW 127		18		14			18	32
Ramsay Wright	RW 128		18		14			18	32
Ramsay Wright	RW 130		18		14			18	32
Ramsay Wright	RW 131		21		16			21	37
Ramsay Wright	RW 133		21		15			21	36
Ramsay Wright	RW 203	27			28			27	55
Ramsay Wright	RW 205	27			28			27	55
Ramsay Wright	RW 208	25			23			25	48
Ramsay Wright	RW 210	25			23			25	48
Ramsay Wright	RW 211	14			13		14	14	27
Ramsay Wright	RW 213	27			28			27	55
Ramsay Wright	RW 214	27			28			27	55
Ramsay Wright	RW 216	24			12		15	24	36
Ramsay Wright	RW 225			28	14		9	28	42
Ramsay Wright	RW 226			28	14		9	28	42
Ramsay Wright	RW 227			28	14	9	9	28	51
<b>Subtotal Ramsay Wright</b>		<b>196</b>	<b>190</b>	<b>84</b>	<b>370</b>	<b>21</b>	<b>62</b>	<b>470</b>	<b>861</b>
Earth Science	ESC 3088	10	12		15		8	22	37
Earth Science	ESC 4076	15			14			15	29
<b>Subtotal Earth Sciences</b>		<b>25</b>	<b>12</b>	<b>0</b>	<b>29</b>	<b>0</b>	<b>8</b>	<b>37</b>	<b>66</b>
<b>Total</b>		<b>221</b>	<b>202</b>	<b>84</b>	<b>399</b>	<b>21</b>	<b>70</b>	<b>507</b>	<b>927</b>

**Table 7. Weekly Teaching Lab Usage in Ramsay Wright and Earth Sciences Centre Winter 2017**

Location	Room	CSB (hrs.)	EEB (hrs.)	HMB (hrs.)	Weekly Prep	Weekly Drop-In	Expansion (incl.)	Winter Booked Total (hrs.)	Winter Total Occupied hrs.
Ramsay Wright	RW 013		23		9			23	32
Ramsay Wright	RW 102		18		13			18	31
Ramsay Wright	RW 104		18		11			18	29
Ramsay Wright	RW 124		18		14		3	18	32
Ramsay Wright	RW 125		18		10			18	28
Ramsay Wright	RW 127		18		11			18	29
Ramsay Wright	RW 128		21		12		6	21	33
Ramsay Wright	RW 130		20		13		6	20	33
Ramsay Wright	RW 131		18		11			18	29
Ramsay Wright	RW 133		18		11			18	29
Ramsay Wright	RW 203	21			23			21	44
Ramsay Wright	RW 205	21			23			21	44
Ramsay Wright	RW 208	21			18			21	39
Ramsay Wright	RW 210	21			18			21	39
Ramsay Wright	RW 211	21			23			21	44
Ramsay Wright	RW 213	21			23			21	44
Ramsay Wright	RW 214	21			23			21	44
Ramsay Wright	RW 216	21			23			21	44
Ramsay Wright	RW 225			23	10		9	23	33
Ramsay Wright	RW 226			23	10		9	23	33
Ramsay Wright	RW 227			23	10		9	23	33
<b>Subtotal Ramsay Wright</b>		<b>168</b>	<b>190</b>	<b>69</b>	<b>319</b>	<b>0</b>	<b>42</b>	<b>427</b>	<b>746</b>
Earth Science	ESC 3088	13	6		12	10		19	31
Earth Science	ESC 4076	22			12	10		22	34
<b>Subtotal Earth Sciences</b>		<b>35</b>	<b>6</b>	<b>0</b>	<b>24</b>	<b>20</b>	<b>0</b>	<b>41</b>	<b>65</b>
<b>Total</b>		<b>203</b>	<b>196</b>	<b>69</b>	<b>343</b>	<b>20</b>	<b>42</b>	<b>468</b>	<b>811</b>

The average weekly booking total for Ramsay Wright labs, in the Fall term of 2016 (when the project is completed), will be 22.4 hours per week (compared to 13.2 hours per week for Fall, 2013). The average weekly booking total for the Winter term 2017 will be 20.3 and an average over both academic terms of 21.4. An overall average weekly booked hours, including Earth Sciences labs, is 21.2. Taking into account preparation time for lab set-up and drop in times for student projects, the average weekly number of hours that the Ramsay Wright labs will be occupied will be 41.0 in the Fall and 35.5 in the Winter.

#### iv. COU Guidelines and Analysis

The use of the Ontario Council of Universities guidelines for determining the amount of teaching laboratory and support space required has, recently, been under scrutiny by the University. There are various opinions that would place the standards as too rich or as not flexible enough.

The space standard is based on a number of assumptions – that on average, disciplines like biology, chemistry, zoology have similar overall laboratory space requirements, and that the “standard” is meant to encompass activity of first and second year students as well as upper year students, and to provide for scheduled and unscheduled activity, i.e. supervised instruction and the time necessary for independent practice and set up and take down activities. The standard addresses both the “teaching labs” themselves and all the support spaces required to service those

labs. The “driver” or input measure for determining the overall space requirement for a department or faculty’s teaching laboratories is the number of weekly student lab contact hours which is the sum of the product of the number of students enrolled in every course by the number of hours a week they receive regularly scheduled instruction.

The components of the COU standard are for Biology type laboratories are:

- 8.1 nasm allowance per teaching station for both within the lab and in related support space
- 18 hour per week minimum for scheduled instructional use which allows the remaining hours to be used for set up and changeover of experiments and for individual student practice and experimentation
- 75% of the stations being occupied when the room is in use

Using the data presented previously, and comparing the assumptions underlying the COU space standard and the current practices for CSB, EEB and HBP resulted in the following:

- The existing area of teaching laboratory per station space, including support space, for CSB and EEB is 6.6 nasm, considerably less than the COU of 8.1 nasm.
- The proposed area of teaching laboratory per station space in the new plan, including support space for the 3 departments (CSB, EEB and HBP) is 5.0.
- The utilization of the existing array of teaching labs (5 functioning lab only) is 21.2 hours per week for Earth Sciences while labs in Ramsay Wright are at 13.2 hours per week. 13 labs in the winter met or exceeded the benchmark of 18 hours per week and 4 in the fall. 7 labs in the winter term and 4 labs in the fall were not in service at all.
- The projected utilization for the 21 new labs at Ramsay Wright is 21.4 hours per week. 21 of 23 teaching labs in Ramsay Wright and Earth Sciences meet or exceed COU utilization standards of 18 hours booked time per week. The two remaining labs do not exceed the 18 hours per week because they are equipped for specialized courses that rely on special equipment such as a fish tank at each station, which precludes other course use. Using scheduled time, lab preparation time and drop in time, the average time that teaching labs in both Ramsay Wright and Earth Sciences are occupied is 37.8 hours per week.
- Depending on the term, 97% or 80% of the stations are being occupied when the room is in use, well over the 75% COU standard.
- EEB, CSB and HBP generate 6,262 nasm using the COU formula for undergraduate teaching labs versus their current 4,165 nasm, a difference of 2,097 nasm.

#### The New Labs

A modeling exercise was undertaken to determine the impact of the new updated properly outfitted laboratories with sufficient fume hoods and how they would allow for increased utilization and a reduction in space allocated for teaching laboratories.

The renovation of the teaching laboratories in Ramsay Wright and relocation of labs from Earth Sciences will enable approximately 1,101 nasm, including 769 nasm of teaching laboratory space (3 labs in Ramsay Wright and 4 labs in Earth Sciences) and 332 nasm in associate prep rooms, to be reallocated for other purposes. As part of this project, the vacated space on the third floor of Ramsay Wright will be allocated for Psychology research activities (approximately 400 nasm). The additional areas identified for reallocation, the Earth Sciences Centre teaching labs, will be repurposed as part of a separate project. The future plan for these Earth Sciences Centre labs is not addressed in this report.

CSB and EEB hold unique space requirements for the delivery of their programs, beyond standard lab support space, and these are included in the table below. These unique facilities include greenhouse space in both Ramsay Wright and Earth Sciences. Wood and metal shops as well as supply stores are found in Ramsay Wright that support both undergraduate teaching and research for CSB. EEB is required to have space for large field equipment storage for undergraduate courses and it is located in Ramsay Wright.

**Table 8.** CSB & EEB - Comparison of Existing, COU and Proposed Teaching Lab Space (nasm)

		Existing Nasm			COU	Proposed Nasm		
		RW	ESC	Total		RW	ESC	Total
CSB	Teaching Labs	864	277	1141		691	114	805
	Lab Support	358	130	488		480	34	515
	<i>Subtotal</i>	<i>1222</i>	<i>407</i>	<i>1629</i>	<i>2333</i>	<i>1171</i>	<i>148</i>	<i>1320</i>
	Greenhouses		137	137			137	137
	Stores, Wood /Metal Shops	173		173		173		173
	<b>CSB Total</b>	<b>1395</b>	<b>544</b>	<b>1939</b>		<b>1344</b>	<b>285</b>	<b>1629</b>
EEB	Teaching Labs	1077	277	1354		1147	114	1261
	Lab Support	401	174	574		466	34	500
	<i>Subtotal</i>	<i>1478</i>	<i>451</i>	<i>1929</i>	<i>2729</i>	<i>1613</i>	<i>148</i>	<i>1761</i>
	Greenhouses		137	137			137	137
	Field Storage	90		90		90		90
	<b>EEB Total</b>	<b>1568</b>	<b>587</b>	<b>2156</b>		<b>1703</b>	<b>285</b>	<b>1988</b>
HMB	Teaching Labs	0	0	0		278		
	Lab Support	0	0	0		44		
	<b>HMBTotal</b>			<i>0</i>	<i>1282</i>	<i>322</i>		<i>322</i>
	<b>Total</b>	<b>2963</b>	<b>1131</b>	<b>4094</b>	<b>6344</b>	<b>3369</b>	<b>570</b>	<b>3939</b>

\*Note: Totals include departmental space in Ramsay Wright & Earth Sciences  
 Proposed Post-Renovation totals include Test Fit renovated areas and existing, unrenovated departmental areas that are to remain active following project renovations  
 Some CSB lab support space to be shared with HBP.

Overall the newly renovated teaching laboratories for the three disciplines will be at 54% of the space generated by the COU standard when considering prime teaching lab and support space. If the specialized greenhouse, aquatic facility, metal shops and field storage are included in the total inventory then the departments will be at 62% of COU post renovation. As a result of this project, the overall number of teaching labs and instructional stations will be reduced and the lab utilization and efficiency increased.

The following considerations will have an impact on the utilization of the new teaching laboratories:

Concurrent Sessions

First-year BIO course sections are currently taught in 6-8 labs at one time to accommodate the high number of students enrolled (up to 1,824 enrolled in one course). The new labs will use 5-6 labs at one time for first year courses, as utilization has increased by adding sections per lab.

### Wait Lists

Courses such as BIO 270H and BIO271H; CSB 330H and CSB 350H have extensive wait lists which could be met in part by additional lab space. There are also planned additions to the curriculum including a new 300H level Animal Physiology course (to complement the heavily subscribed BIO 270H and BIO 271H offerings) and an expansion of an existing upper year (400 level) team research project course (CSB 491H) which requires significant access to a high level teaching lab. The new labs will allow for scheduling of labs and enrolment to increase slightly in order to accommodate more students.

Many HBP courses have wait lists, for example HMB 310 Lab in Neuroscience, in the proposed plan will have the opportunity to increase enrolment and run the course in both the fall and winter terms.

### Conflicting Schedules

Popular first-year courses taken by Life Science students (BIO120H, BIO130H, CHM138H, CHM139H, MAT135H, MAT136H, PHY131H, PHY132H, and PSY100H) all have day sections, and in most cases with lectures between 9 AM and 1 PM. Thus daytime laboratories in these science courses are offered in the afternoon, to avoid conflicts. As such, it is not always possible to schedule labs at these times due to student timetable conflicts.

### Third and Fourth Level Courses

Third and fourth level students in CSB/EEB are enrolled in lab courses that require unscheduled drop in time to work on individual experiments/projects. The equipment used for these higher level courses is specialized and therefore there is a requirement for specialized labs as in ESC, separate from the general first and second year labs.

Examples of these courses include CSB 330H (Techniques in Cell and Molecular Biology), CSB 350H (Laboratory in Molecular Plant Biology), CSB 491H (Team-based research- Research in Cell and Molecular Biology), EEB 322H (Behaviour and Behaviour Ecology), EEB331H (Intro to the Fungi), and EEB356H (Biology of Insects) as well as, HMB 302 (Vertebrate Histology & Histopathology). These labs do not all use the typical 3 hour block of laboratory time, and in many instances, require the students to return to the lab to continue or complete work outside of the scheduled 4 or 5 hour block. Or if they do have 3 hour labs, students are also required to come into the lab space to work on independent projects and experiments.

### Lab Turnover

Lab set up and take down by technicians can take a number of hours, particularly in very large courses such as the first and second year BIO courses, and this must be factored into the designated hours of lab use. In addition, it is not often practical (nor efficient use of technician time) to remove the set-up for a specific lab running multiple, simultaneous sections over several consecutive days over a two-week period, setup a new lab for another course on a single available time slot, and then re-establish the earlier lab set-up (although on rare occasions this is necessary to accommodate another course that requires specialized space or equipment). This means that there are significant limitations on running different courses within the same lab over a consecutive set of days.

Lab prep time for BIO 120 and BIO 130 (enrolments up to 1824 students) requires set up of 72 shared stations; 6 concurrent lab sections, 24 stations, 1 per set up per 2 students. Prep for the 72 stations require different equipment set up for each lab at the beginning of a lab. Each lab period runs for two weeks with refresh between each lab section (6-7 times a week for 72 stations). It is

calculated that at 10 minutes per station, the initial two-week lab set-up can take a minimum of 12 person hours.

Evening Labs

Students clearly prefer laboratories during the day as many commute and, owing to reduced TTC and Go Train service in the evening, those in evening sessions may not arrive home until well after 10:00 PM. New scheduling will reflect this preference.

**Summary of Space Requirements – Psychology**

Having recently vacated space in the One Spadina building, Psychology is currently accommodated in approximately 4,726 nasm across two buildings, Sidney Smith Hall and Ramsay Wright (which includes Psychology’s CBTC facility). There is 1,992 nasm of research laboratory and support space in Sidney Smith and 1,307 nasm in Ramsay Wright for a total of 3,299 nasm.

The Department of Psychology is a life-science based research and teaching with broad strengths in cognition and neuroscience. The department essentially contains three research groups: (a) social cognition, (b) cognitive neuroscience, and (b) behavioural neuroscience. The former two groups are contained in Sidney Smith Hall, while the behavioural neuroscience group has both research and teaching laboratory space in Ramsay Wright. The neuroscientists in this group use both behavioural (e.g., electrophysiology) and genetic approaches to examine the relationship between minds and brains. Research topics included determining the neuronal circuits that modulate anxiety, how long-term memories exist in networks of neurons, and the neurochemistry that underlies cognitive functions such as attention and learning.

Students in the department are encouraged to combine classroom instruction with laboratory experience, and improving the very limited departmental teaching laboratory space in Ramsay Wright is a priority for the department.

**Table 9.** Psychology Existing Research and Teaching Lab Space to COU Allocation

	<b>Current Space Inventory</b>	<b>COU Analysis</b>
<b>Use (COU Category)</b>	<b>NASMS</b>	<b>NASMS</b>
Research Labs & Support Space (3.0)	3299	3435
Teaching Labs & Support Space (2.0)	41	30

There are 6 of the 28 research Faculty in wet labs (Neurobiology Research) which are comparable in area requirements to Biology research labs (with a COU space factor of 45 nasm/FTE). The remainder of the research faculty space is generated at the customary 30 nasm/FTE.

See Appendix 1 for a detailed COU analysis.

## **Part C: Project Description**

### **C1. Vision Statement**

The Faculty of Arts and Science envisions educating students to be strong analytical, critical and creative thinkers who are well prepared for immediate careers in the workforce, or for additional accreditation through graduate and professional studies. We are very proud of our success in these areas. Nevertheless, we are aware of some issues related to the student experience, in particular, the 2008 NSSE survey revealed that we lag behind our Canadian G13 peers in areas such as ‘active and collaborative learning’, and in ‘enriching educational experiences’, areas that are linked to the quality and availability of laboratory teaching in the life sciences.

Demographic forecasts and our own data indicate that demand for undergraduate spaces in the life sciences in the Faculty of Arts & Science will remain high for some years to come and we are convinced that improving the student experience in our teaching labs in the life sciences is critical to maintaining our ability to attract top students and provide them with appropriate experiential platforms for their development. Renovations to our teaching laboratories will not only provide access to modern techniques, the laboratory sessions provide an ideal opportunity for high quality, small class experience for even the largest first year courses. Improved laboratories should help enhance the level of student engagement and sense of community, especially for the very large proportion of our students who commute to campus.

In order for the Faculty to best serve our students in the life sciences, and to best train the biologists of the future at the level of rigor and involvement associated with the University of Toronto, we must provide access to safe, welcoming and efficient laboratories equipped with the most recent scientific equipment and instrumentation and designed for the most appropriate pedagogy.

Our vision includes:

- Dedicated, contiguous space reserved for undergraduate teaching laboratories and their associated support areas. The experience of entry-level undergraduates will be enhanced by having centralized, readily recognizable teaching laboratories. Centralization will provide for efficiencies in use of equipment and technical help, and improve staff comfort and allow them to provide a higher level of service.
- Laboratories and support areas that are safe, welcoming areas designed so that each individual teaching laboratory can host at a minimum two (and where required three) laboratory sessions on any given 9AM-9PM time slot.
- Laboratories located as close as possible to the ground floor, and away from lecture halls and research laboratories, to ease the movement of many hundreds of students and minimize the disruption on lectures and research.
- An arrangement of benching and infrastructure that, wherever possible, is flexible and allows for engagement of the instructor with the entire class as well as for small group, collaborative interactions and solitary work.
- Access to the internet at each workstation that will allow for submission of in class work; access to protocols, background searches, instruction through digital technologies, etc.
- Provision of some specialized laboratory space and infrastructure for upper level classes.
- Creation of a home for CSB,EEB and HBP students by providing access to safe, welcoming and effective student study and activity space.



## **C2. Space Program and Functional Plan**

The proposed renovations to the Ramsay Wright Building will allow for a number of functional improvements to the respective departments' pedagogical missions and create efficiencies of operations through consolidation of program.

The project will renovate 11 teaching labs on the 2<sup>nd</sup> floor of Ramsay Wright and equip the labs with fume hoods. Additionally, 9 labs will be renovated on the 1<sup>st</sup> floor for a total of 20 newly renovated labs at Ramsay Wright. The majority of teaching can then be done in Ramsay Wright once improvements have been made.

Three existing teaching labs in Ramsay Wright will be released on the 3<sup>rd</sup> floor for use by the Department of Psychology. Four of the six labs that are now heavily used in Earth Sciences will be repurposed (one has already been done) as part of a separate project. The future plan for Earth Sciences teaching labs is not addressed in this report. The two labs to remain in Earth Sciences will be 3<sup>rd</sup> and 4<sup>th</sup> level courses that cannot be accommodated at Ramsay Wright and those related to the greenhouse facility in that building.

This project will allow an opportunity to provide much needed student amenity space within the Ramsay Wright building. Areas on the first and second floors will be designed for a student study and activity areas to accommodate some of the high volume of EEB, CSB and HBP students using the building's teaching labs on a daily basis.

A related benefit to the rationalized redistribution of program in Ramsay Wright is the relocation of CSB teaching space from the third floor, allowing for a fit out specific to Psychology research needs.

Where the second floor of Ramsay Wright currently accommodates shared teaching labs, research space and vacant areas (former departmental library), the renovation will create a floor of contiguous CSB teaching facilities and HBP teaching facilities. Likewise the renovation to the first floor of Ramsay Wright will allow for consolidation of EEB departmental space with upgraded teaching laboratory facilities. The two teaching lab floors will be properly equipped to the specific needs of the courses taught and lab support spaces will be shared between the departments wherever possible.

### **Proposed Test Fit and Schematic Design**

The test fit and schematic design drawings are included in Appendix 2. The test fit drawings show the general outline of the location of the labs, prep areas, office locations and student areas. The schematic design drawings show the concepts for the design including the:

- Services zone and technician corridor
- Media zone and teaching corridor
- Visual connections and transparency zone
- Fume hood locations

To better understand how science teaching is evolving, the design team has provided the following key elements of the "Shifting Pedagogy of Science". These elements include designs that promote collaboration and collaborative learning and that enhance the learning experience; putting "Science on Display". Other important elements include labs that are expandable and contractible and benches that are reconfigurable and moveable. Finally, layouts that promote interaction, integration, innovation, the sharing of ideas, visual connections, view corridors,

access to natural light, transparency etc. All of these elements will inform the design of the teaching labs as the design moves forward.

Solid walls delineating labs into distinct units will be eliminated in several areas to provide both a visual and physical connection; this would allow for flexibility and adaptability. The elimination of the separating wall and the visual connection will also accommodate the expansion of the teaching group size by the inclusion of adjacent pods of benches. This type of open plan has been successful for other science labs at the University of Toronto. However, the opportunity for small groups of students to interact with teaching assistants is important to the overall experience of biology labs and should be maintained within this more open design approach of the lab space.

A lab module will be adopted to ensure regular and predictable locations of lab services on the floor plate. The lab layout will work on a grid and allow proper clearances around fume hoods and biosafety cabinets. The lab module will allow for future flexibility and make future changes to the labs, such as increasing and decreasing the size of labs or running new services, more cost effective when needed.

### **Phasing**

The Ramsay Wright teaching laboratories renovations will be phased over 2.5 years. The various stages of renovation will be scheduled where possible to take advantage of semester start and end dates in order to minimize disruption to teaching.

The preparatory work for Phase 1 of the project includes a renovation and the relocation of groups not associated with undergraduate CSB, EEB or HBP teaching away from the 2<sup>nd</sup> floor of Ramsay Wright. This relocation will free up the 2<sup>nd</sup> floor areas for the consolidation of space for the CSB and HBP teaching facilities.

Preparation work in advance of the renovations includes the relocation of EEB research labs and a Psychology Teaching/Research lab. EEB research lab has already been relocated, as well as, CHASS labs from the 2nd floor. All preparatory work must be completed by January, 2015.

Phase 1 of the project involves the renovation of 1,608 nasm (2,108 sm) of building area. Fume hoods will be added to the 2nd floor teaching labs, as well as air conditioning to the 1st and 2nd floors. Student Activity space will be created on the 2nd floor for undergraduate biology students.

Teaching labs that are normally held on the 2nd floor of Ramsay Wright will be temporarily relocated to the 1st floor with some activities going to Earth Sciences. Other possibilities of temporary teaching will also be explored.

The construction of Phase 1 is projected for March, 2015, at the earliest running until December, 2015.

Phase 2 of the project involves the renovation of 1,317 nasm (1,760 sm) of building area. Work includes the temporary relocation of teaching labs normally scheduled on the 1st floor of Ramsay Wright to newly renovated teaching labs on the 2nd floor as well as Earth Sciences teaching labs. This phase includes renovations to 1st floor labs at Ramsay Wright for EEB. Phase 2 construction is projected for January, 2016, at the earliest running until August, 2016.

Phase 3 of the project will renovate of 590 nasm (782 sm) of building area on the 3rd floor. This final phase includes the relocation of CSB teaching labs from the east portion of the 3rd floor of Ramsay Wright to the newly renovated 2nd floor teaching labs. Also included are renovations to

vacated space on the 3rd floor for Psychology department research. Phase 3 will begin at the earliest September, 2016, and run for 8 months.

The total of all areas to be renovated over the three phases is 3,514 nasm (4,650 sm) and will be under construction for a period of approximately 2 to 2.5 years. Table 9 below, shows the breakdown of Net Assignable and Non Assignable (including corridors, walls and service shafts) space for renovation.

**Table 10.** Total areas of renovated space for 3 phases

	Nasm	Project Total sm
Revised Project	3,514	4,650

**Design Improvements**

CSB/EEB/HBP Teaching Labs and Support

The renovation of Ramsay Wright teaching labs will provide modern teaching facilities for CSB, EEB and HBP. The upgrades will include updated finishes, new furniture (benching), new mechanical and lab services and modern audiovisual equipment. Each of the departments has specific requirements for teaching.

The addition of fume hoods will be the major upgrade for Ramsay Wright. One fume hood will be available per lab and found on the perimeter of the room where students can access it during the lab sessions. Fume hoods will also be necessary in prep areas.

The labs will have new perimeter fixed benches with sinks and services, as necessary for the types of labs taught. The typical layout of labs will be groups of four students working together.

Updated audiovisual equipment will be an important part of the design including ceiling mounted projectors, projection screens and whiteboards will be incorporated into the design. Opportunities for integration of computers for student work during the lab will also be explored.

Psychology Research Labs

The Psychology department will inhabit the 3<sup>rd</sup> floor area previously occupied by CSB teaching labs. This will allow the 3<sup>rd</sup> floor of Ramsay Wright to be almost fully occupied with research activities in both Psychology and CSB that are heavily dependent on facilities in the adjacent CBTC. Six neurobiology wet labs, a teaching lab and a small seminar room will be created for Psychology faculty that are currently occupying limited facilities in the basement floor. One Psychology teaching lab will be relocated to the same area on the 3<sup>rd</sup> floor. The labs will be fitted with new benches and lab services.

Student Activity Areas

One space on each floor will be converted to student study and activity space. These spaces will be fitted with flexible furniture for student meeting and gathering, as well as some designated quiet study space. It will provide a much needed area to accommodate some of the thousands of students that attend undergraduate labs.

In addition to the dedicated student study and activity space, fixed corridor seating will be explored to accommodate students waiting for lab times.

**Table 11.** Ramsay Wright 1<sup>st</sup> Floor Proposed Space Program (based on Test Fit)

Usage	Phase	Location	Capacity	Area (nasm)	Quantity	Total (nasm)
<b>Undergrad Teaching Labs</b>						
EEB Laboratory 30 seat	2	1st Floor	24	92	8	736
EEB Laboratory 24 Seat	2	1st Floor	24	81	1	81
<b>Sub-total</b>			<b>216</b>			<b>817</b>
<b>Laboratory Support</b>						
EEB Teaching Lab Refresh	2	1st Floor		20	1	20
EEB Teaching Laboratory Prep	2	1st Floor		210	1	210
EEB Lab Technicians Offices/ Work Area	2	1st Floor	5	70	1	70
<b>Sub-total</b>						<b>300</b>
<b>Lecturer's Offices</b>						
EEB Lecturers Offices	2	1st Floor		11	6	66
Waiting Area	2	1st Floor		23	1	23
<b>Sub-total</b>						<b>89</b>
<b>Student Activity Space*</b>						
Lounge/Study area	1	2nd Floor		81	1	81
<b>Total</b>						<b>1,287</b>

\*Student Activity Space shared 50% by CSB and EEB

**Table 12.** Ramsay Wright 2<sup>nd</sup> Floor Program Space Program (based on Test Fit)

Usage	Phase	Location	Capacity	Area (nasm)	Quantity	Total (nasm)
<b>Undergrad Teaching Labs</b>						
CSB Laboratory 24 seat	1	2nd Floor	24	92	8	736
HMB Laboratory 24 seat	1	2nd Floor	24	92	3	276
<b>Sub-total</b>			<b>264</b>			<b>1,012</b>
<b>Laboratory Support</b>						
CSB Physiology Teaching Lab Prep	1	2nd Floor		44	1	44
CSB Teaching Lab Prep	1	2nd Floor		92	2	184
CSB & HMB Teaching Lab Prep	1	2nd Floor		93	1	93
CSB & HMB Storage / Equipment	1	2nd Floor		30	1	30
<b>Sub-total</b>						<b>351</b>
<b>Lab Technician Offices &amp; Support</b>						
CSB & HMB Lab Technician Offices/Work area	1	2nd Floor	5	69	1	69
<b>Lecturers' Offices</b>						
CSB Lecturers' Offices	1	2nd Floor		11	6	66
Waiting Area	1	2nd Floor		23	1	23
<b>Sub-total</b>						<b>89</b>
<b>Student Activity Space*</b>						
Lounge/Study area	1	2nd Floor		102	1	102
<b>Total</b>						<b>1,623</b>

\*Student Activity Space shared 50% by CSB and EEB

**Table 13.** Ramsay Wright 3<sup>rd</sup> Floor Space Program (based on Test Fit)

Usage	Phase	Location	Capacity	Area (nasm)	Quantity	Total (nasm)
<b>Research Laboratory</b>						
Psychology Laboratory	3	3rd Floor		75	6	450
<b>Sub-total</b>						<b>450</b>
<b>Undergrad Teaching Labs</b>						
Psychology Laboratory (Shared use)	3	3rd Floor	20	75	1	75
<b>Support Space</b>						
Psychology Seminar Room / Kitchenette	3	3rd Floor	10	75	1	75
<b>Total</b>						<b>600</b>

### **C3. Building Considerations**

#### **Accessibility**

The University of Toronto is committed to ensuring that its buildings and services are accessible to persons with disabilities. Compliance with the University's Barrier Free Accessibility Design Standards is required for all new construction and renovation projects at the St. George campus. Design teams are required to submit the checklist to the University at 75% completion of the Design Development.

The new Accessible Built Environment Standard (Ontario Building Code elements) will take effect January 1, 2015. The standard will apply to new projects, major retrofits, common space and circulation areas, and change in use. The amended requirements are intended to substantially enhance accessibility in newly constructed buildings and existing buildings that are to be extensively renovated.

For renovation projects, particularly of older buildings, there may be some recommendations that are very difficult or impossible to implement. However, design teams must provide written explanation in the event of non-compliance.

The requirements for this project include push-button activated door openers on laboratory corridor access doors and at least one barrier-free student station per teaching lab.

#### **Safety and Security**

An access control system will be required to control entry to teaching labs and prep rooms.

#### **Sustainability – Construction/Renovation**

Design and construction must be carried out in accordance with all applicable environmental, health and safety legislation and University of Toronto policies and standards.

The upgraded Mechanical HVAC infrastructure of the affected floors of Ramsay Wright will allow the use of low-velocity, variable-flow fume hoods and generally improved efficiency of mechanical ventilation.

#### **Sustainability – Laboratory Operation**

The proposed renovation must address the sustainability objectives outlined in the University of Toronto Environmental Protection Policy:

##### **Fundamental Principles**

- Meet and where possible exceed environmental standards, regulation, and guidelines.
- Meet and, where reasonably possible, exceed compliance with applicable federal, provincial and local environmental regulations and other requirements to which the University subscribes.
- Operate so as to minimize negative impacts on the environment.
- Adopt practices that reflect the conservation and wise use of natural resources.
- Respect biodiversity.

##### **Specific Objectives**

- Minimize the use of energy, water and other resources, through efficient design, management and practice.
- Minimize waste generation and actively manage the impact of waste, emissions, & effluents generated by University activities.
- Minimize noise and odour pollution from University activities.
- Manage the use of chemicals or toxic substances in accordance with regulatory requirements and established environmental practices, including scientific research practices. This will include local acid drainage systems to minimize acids from entering the city's water system. A detailed review of chemical use by occupants will be completed to confirm that acid drainage systems will only be needed in prep areas and research labs.
- Include biodiversity and environmental concerns in planning and landscape decisions and minimize negative impacts of University activities on biodiversity and natural spaces.

### **Background - Existing Building Condition**

The general scope of the project is that most of the first and second floors will be renovated to upgrade undergraduate teaching labs, including the addition of fume hoods. A smaller area on the third floor will become research labs for psychology. Current HVAC systems in these areas will not be adequate either in function or reliability – neither of the first and second floors is air conditioned for example – so it is assumed that a major retrofit of the mechanical systems is anticipated.

The significance of the condition of the existing building depends on the purposes to be made of them and the extent to which the spaces will be renovated and systems retrofitted. Usually the deficiencies noted by F&S are those which are considered necessary to treat for the success of the anticipated renovations and/or are recommended at this time because the renovation offers an opportunity for the work which might otherwise not be available in the future. However, the dynamic nature of a research building makes it likely that sometime in the near future, the remaining floors will also be renovated or repurposed. It is essential that the design team for this project remember this fact and design so that pathways for future ducts to the penthouse are not blocked and required capacity for power or other services is not underestimated. Moreover, it is important to understand the challenges inherent in this building – even those that do not directly affect the floors being renovated – so that all plans that follow from this project, will take these into considerations. It is highly recommended that an overall schematic plan for the building be developed now so that this and each subsequent renovation adhere to that schematic plan.

It should also be remembered that Ramsay Wright is in the second highest tier of energy usage per unit area and Ramsay Wright is tied as the largest user of water per unit area of all the buildings on campus. Any changes planned for this building should make as a priority reduction of these expensive resources.

### **Designated Substances in Building Materials**

Asbestos-containing sprayed fireproofing is present in areas [Room 1003 & 108K] that are adjacent to the current project locations. Other asbestos-containing materials within the project area include vinyl floor tiles, insulation on mechanical systems, acoustic transite panels, transite fumehood panels and drywall joint compounds.

Please see the attached high-level summary (in Appendix) based on a more detailed survey that will be available to the team planning the renovation work. Prior to planning any renovation or demolition project a pre-construction survey must be carried out.



A major mold remediation took place in 2005, when there was considerable leakage of condensation from the chilled water lines onto the ceiling tiles. It appears that there have been further instances of sporadic leakage and discolouration of tiles since then, which have been dealt with on a one-off basis. Depending on the scope of the planned renovations, there may be an opportunity to remove the ceiling and effect a more thorough treatment.

Laboratory decontamination, mercury assessment etc. will be required prior to work.

### **Heating, Ventilation and Air Conditioning Systems**

When the building was constructed in the mid-1960s, it was not an uncommon practice to air condition research areas which operated year-round, but not air condition teaching or administrative areas. The major lecture rooms have been retrofitted with air conditioning but neither the fan that serves the corridors on the first and second floors (AHU#6) and the fan that supplies the northwest common area in the basement (AHU#10) have provision for air conditioning. New rooftop units could be located on the low roof above the loading dock on the south side of the building and ducted into the building above a dropped ceiling. Once the new units and distribution system are in place, the old units and ducts serving the area can be removed, providing routing space for new fume hood system to get to the high roof.

AHU #8 has been identified for replacement since it has reached the end of its useful life. Replacement of this unit will be part of the renewal of mechanical HVAC that will be ongoing as opportunities for upgrades become available.

The project will include extending new HVAC to non-renovated area on renovation floors where needed. This will be done to avoid small pockets of space adjacent to the renovation that are running on older systems and/or not air conditioned and to upgrade the entire of floor 1 and 2 with HVAC system improvements.

The perimeter heating units are connected to the heating water system using dielectric couplings to prevent corrosion from galvanic action. These couplings are in poor condition and in danger of failing one at a time. Failures in the past have resulted in floods and water damage. (Pre-existing galvanized plugs on copper piping have since been removed.)

The valves and controls that regulate the heating system temperature for the building are old. New pneumatic actuators cannot fit on the old valves, requiring replacement of the valves as well.

The disconnects and switchgear for the motor control centres that operate the pumps and fans are old and in poor condition. They should be replaced to ensure reliability of the systems they serve.

Dampers and damper controls that regulate the air flow in the building are old, and frequently unreliable, resulting in air quality complaints.

The condition of the building envelope prevents any mechanical humidification of the ventilation air in the winter.

The building's HVAC system is controlled locally, using an obsolete pneumatic system. It is not controlled by the University's Central Control and Monitoring System, nor any other proprietary remote system. A direct digital control system in accordance with F&S Design Standards should be installed for this renovation which can then be expanded to the rest of the building as more areas are renewed.

**Fume Hood Systems**

Nuisance vibrations have been experienced by sensitive equipment on the 6th floor, likely because the 7th floor holds 50 fans for the building's fume hoods. At present, tests are being conducted to ascertain whether this is indeed the source, and to indicate possible corrective measures that could be taken.

A further 22 fans are located on the roof where they are exposed to the elements and as a result, are in very poor condition.

Existing fume hood systems are not variable volume-type, meaning they throw out the same volume of expensive conditioned air whether they are open or closed. This uses a lot of energy.

New fume hoods added in this project will be designed for a variable air volume system and ducting will be grouped together to extend to a new central fume hood exhaust unit. Fume hood design shall meet or exceed industry best practices for containment and high efficiency.

**Water Systems**

The water system feeding the aquatic area is filtered using activated charcoal. The units are grossly oversized, requiring large amounts of water for backwashing. Avoiding the cost of periodic change outs of the charcoal and Anthrifilt would more than compensate for the cost of replacement with new units sized properly. Also, the valves and controls associated with this process are old and leaking and require replacement. Alternatively, a water recycling system similar to the one used by the University of Ottawa (which uses 88% less water) could be considered for a retrofit of the Ramsay Wright. This will be addressed in a separate project.

Despite the fact that the reverse osmosis water system has been recently upgraded, if it is estimated that the load will increase then the system must be checked for its ability to meet the new load.

**Main Electrical Supply**

The normal power supply is fed from the Central Station at Russell and Huron via the University's 4,160 volt Loop #7, which also feeds Sidney Smith hall. Although the loop feeders were upgraded, the new estimated loads from the CBTC building have used up the spare capacity, although because the building is not yet running at full capacity, there is no empirical data to substantiate this.

If renovations to the Ramsay Wright building result in substantial increases to the current loads there are two options available to provide more capacity:

Option 1 – Disconnect the building from the University's 4,160 volt Loop 7 and connect it directly to the Toronto Hydro infrastructure running up St. George Street. This will require a new 13,800 volt substation and replacement of the existing transformers with ones having a 13,800 volt primary.

Option 2 – Disconnect Sidney Smith Hall from the University's 4,160 volt Loop 7 and connect directly to Toronto Hydro's 13,800 volt grid. This will release the capacity for the Ramsay Wright. However, a new 13,800 volt substation for Sidney Smith will be required. The main Sidney Smith transformers are already being replaced with equipment having dual 4,160 and

13,800 volt primaries as part of a PCB removal project. However, a separate transformer to serve the chillers which operate at 4,160 volts will be required.

In addition to the issue of feeder capacity, transformer T3 which supplies 600V power, is running with a peak close to its capacity. An upgrade of this transformer will be needed if more power is taken from the supply.

### **Emergency Power**

Emergency power is provided to Ramsay Wright, Sidney Smith and the CBTC by a single 450kW diesel generator operating at 600 volts. The generator has been sized to supply only enough power for life safety equipment (such as emergency lighting, EXIT signs, the fire alarm panel, sprinklers and fire pumps) and equipment required to prevent damage to the building from a prolonged power failure (such as sump pumps). In addition, the city water booster pump is on emergency power, and so water will be available throughout the building at normal pressures. The de-chlorinator for the aquatic area, as well as the pumps and bubblers and the bilge pump that handles the overflow are all on emergency power. The heating pumps for the greenhouse are also supplied. There is no spare capacity available for any other research equipment.

As a recent requirement of the Ontario Building Code (OBC), the emergency power transfer switch must be separated to isolate life safety from non-life safety loads. This work will be undertaken in this project.

### **Building Electrical Distribution**

Ground fault protection is inadequate in the animal facilities. The wiring should be replaced in any area where wash down procedures or aquatics research occurs. As well, the electrical supply to rooms containing a large concentration of laboratory equipment should be reviewed.

### **IT Infrastructure**

The project will include upgrades to network cabling in renovation areas to meet University of Toronto standards. A new network room will be created to on the 3<sup>rd</sup> floor as a connection point from the University backbone (via fibre connection), to house switches for the building departments and University groups, and as a central service point for new network cabling to renovated areas. The location of the new network room will be based on an overall plan for upgrade of IT infrastructure in the building. Wireless routers will be installed as per U of T, Information Technology Services standards to meet the needs of teaching lab and student areas.

### **Fire Alarm System**

The fire alarm system for this building was upgraded circa 1998. As such, it is a currently supported model (Chubb/Edwards EST-3) that is capable of expansion or addition of devices. As a building code requirement, fire alarm upgrades will be made to renovated and non-renovated floors and the building extension, CBTC, to have one fire alarm system consistent throughout the whole building.

### **Fire Suppression (Sprinkler System)**

The building is presently only equipped with sprinklers below grade. The Ontario Building Code now requires sprinklers in this type of occupancy (major renovation or new construction). The initial “main” sprinkler riser and system (including fire pump) should be sized to cover all areas, so that subsequent planned renovations can be sprinklered and connected to the main riser in accordance with the overall building plan.

### **Fire Code Requirements for Laboratories**

Teaching labs should be designed to meet the requirements of Part 4 of the Ontario Fire Code, with particular attention being given to fire separations and ventilation. Specifically, fire rating will be applied to the shaft access doors on all floors of the building to meeting the Ontario Building Code. Since lab use often changes from its originally intended function, it is recommended that all potential lab spaces are designed to meet requirements of OFC Part 4 for labs.

### **Environmental Health and Safety Laboratory Standards**

EHS planning will be aimed at recognizing, assessing, controlling, and evaluating hazards as they relate to the building, work areas and environment. EHS involves the identification, evaluation, and control of hazards in the workplace in order to prevent illness and injuries of staff, faculty, students and visitors. Types of hazard can include biological, chemical, physical (including safety hazards from equipment) and ergonomic.

Wet laboratories are laboratories where chemicals, drugs, or other material or biological matter are handled in liquid solutions or volatile phases, requiring direct ventilation, and specialized piped utilities (typically water and various gasses). Containment level 1 (standard chemical 'wet lab' and biological agents) teaching labs and containment level 2 research labs in this project will include the minimum physical containment and operational practice requirements for handling infectious material or toxins safely in laboratory and animal work environments.

EHS is guided by U of T's Biosafety policies and procedures manual, Laboratory Safety Program and Design Standard, the Ontario Occupational Health & Safety Act, associated regulations, relevant standards, Public Health Agency of Canada (PHAC), Canadian Food Inspection Agency (CFIA), Canadian Nuclear Safety Commission (CNSC) and Environment Canada.

### **Building Envelope**

Exterior cladding should be checked for soundness.

Single glazed windows are beyond useful life. Replacement with double glazed units would improve occupant comfort and help save energy cost for the building. This will not be addressed in this project.

Significant sections of the roof are beyond useful life. Replacement is scheduled within the next couple of years. Some of the roof areas were replacement in 2001. This will not be addressed in this project.

### **Laboratories - Plumbing/ Furniture/Lighting**

Existing lab sinks are polypropylene. They are in bad shape and require replacement. Gooseneck faucets and the fixture backflow preventers should also be replaced if the sinks are changed. Reverse osmosis water dispensers also require replacement.

Lighting will be designed in accordance with F&S Design Standard.

### **Elevators**

There are one freight and two passenger elevators in the building. They are original equipment with virtually no upgrades; however, they are all in good condition and parts are readily available. Longer term plans for the building should include upgrades of the cars and controls for accessibility as per applicable building code requirements and University design standards.

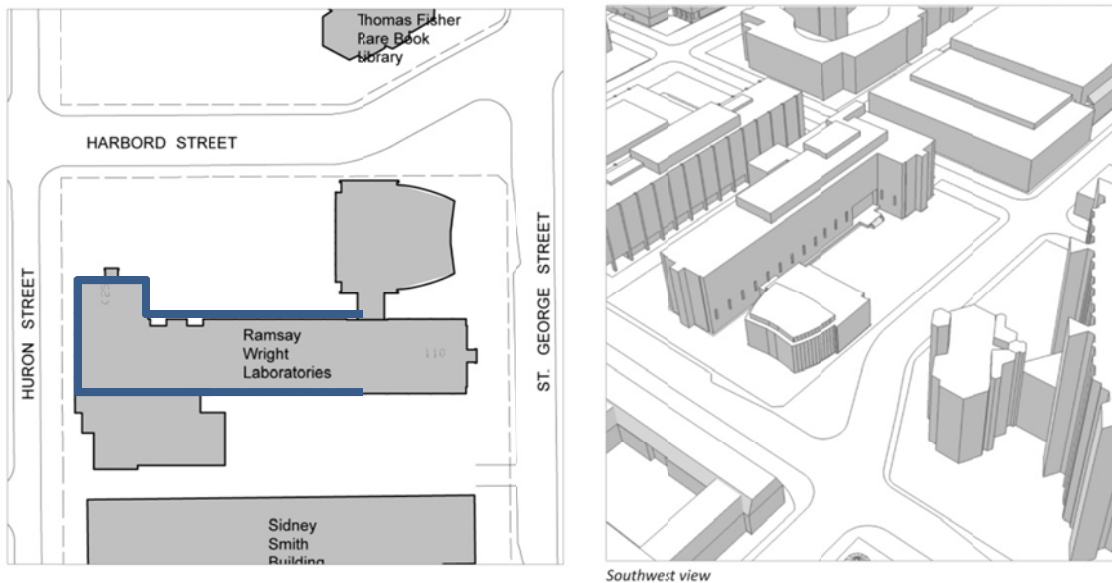
#### C4. Site Considerations

The University of Toronto's St. George Campus Master Plan (June, 2011) includes a proposed development envelope (Site D) as an addition to the Ramsay Wright Building. This development would require the demolition of the existing lecture theatre pavilion at the northeast corner of the site.

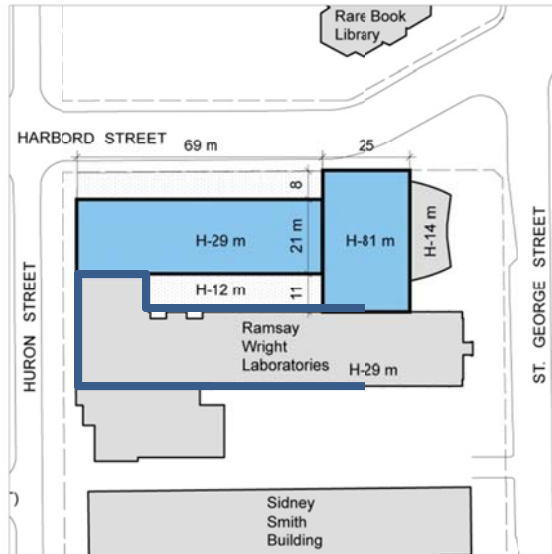
The proposed Ramsay Wright Teaching Laboratories Upgrades will not adversely affect the development potential of this site.

#### Site Context

Site D is located directly north of the Ramsay Wright Laboratories building on Harbord Street in the block bounded by St. George Street and Huron Street. Recognizing the prominence of the site at the centre of campus, and its adjacency to the most robust of campus buildings (Robarts Library), a significant envelope has been proposed in this location.



A 7-storey development envelope allows for the continuation of existing program matching the existing Ramsay Wright Laboratories building in height and floor level. The envelope extends north to bring the main address and building entry to the street, and provides an opportunity to enliven the streetscape with programming at ground level. The envelope anticipates an atrium/winter garden connection between the new structure and the existing Ramsay Wright building.



A tower is proposed at the eastern edge of the site. The tower is situated such that it minimizes shadowing to the green space immediately north along Harbord Street, while providing a structure of landmark significance at this important location on campus. The existing single level lecture theatre pavilion located at the intersection of St. George and Harbord Streets could be demolished to accomplish this envelope, or maintained as a podium.

#### Secondary Effects of Site Development

- disruption to existing occupants during construction and tie-in of structure
- demolition of pavilion will require relocation of classroom facilities

#### Servicing

- to be expanded in existing location

#### Height and Massing

- proposed base matches existing building height
- site proposes a landmark tower visible from Harbord, and St. George Streets
- development envelope massing minimizes shadow impacts on open space surrounding Roberts Library north of Harbord Street.

**C5. Secondary Effects**

Two computer labs on the 2<sup>nd</sup> floor are being decommissioned and replaced by a new computer lab, based on a more interactive pedagogy model, in the basement of Sidney Smith Hall. This new computer lab is part of a larger development that centralizes and consolidates the Faculty's Office of Information & Instructional Technology (IIT). This consolidation will release and/or reallocate space in several buildings including University College and Robarts. The space being redeveloped was largely used for storage.

Several research labs that are located in the project area will be relocated to storage space in Ramsay Wright. This has been, and continues to be, a good opportunity for occupants of the building to purge, clean and consolidate areas that may not be well and fully utilized.

ACE rooms 142, 143, 229 will be out of commission for a period of time during construction.

Teaching lab scheduling will be affected by construction. Teaching labs that are normally held on the 2<sup>nd</sup> floor of Ramsay Wright will be temporarily relocated to the 1<sup>st</sup> floor of Ramsay Wright with some activities going to Earth Sciences. Other possibilities of temporary teaching will also be explored.

**C6. Staging**

- Psychology teaching lab will move to the 3<sup>rd</sup> floor proposed Psychology space but will be staged on 1<sup>st</sup> floor of Ramsay Wright during renovations.

**C7. Schedule**

## All Phases

- Governance Approval
- Consultant Selection – May 2013
- Schematic Design – June 2013 – September 2013
- Governance Approval (Project Budget Increases, Changes in Scope) – Oct. 2014
- Design Development & Contract Drawings – August 2014 – December 2014

## Phase 1

- Tender and Award – January - February 2015
- Mobilization and Construction – March 2015 – December, 2015
- Commissioning and Moving – December 1, 2015

## Phase 2

- Mobilization and Construction – January 2016 – August, 2016
- Commissioning and Moving – August 1, 2016

## Phase 3

- Mobilization and Construction – September, 2016 – April, 2017
- Commissioning and Moving – April, 2017
- Full Operational Occupancy by division – April 2017

**Part D: Recommendations**

Be It Recommended to the Academic Board:

1. THAT the Revised Project Planning Committee Report for the Ramsay Wright Building Teaching Laboratories Upgrades, dated October 8, 2014, be approved in principle; and
2. THAT the total project scope of approximately 4,650 gross square metres (gsm) (approximately 3,514 net assignable square metres (nasm)), to be funded by the Faculty of Arts and Science, Graduate Expansion Funds and financing, be approved in principle.



**APPENDICES:**

- 1. Space Utilization and COU Guideline Analysis**
- 2. Functional Plan Space Program (Test Fit)**
- 3. Weekly Utilization diagrams by Department**
- 4. Asbestos Summary Material** (available on request)
- 5. Room Specification Sheets** (available on request)
- 6. Total Project Cost Estimate** (available on request to limited distribution)

**Appendix 1: Space Utilization and COU Guideline Analysis****CSB, EEB, HBP Current Space by Building**

<b>Department of Cell Systems Biology (CSB)</b>	
<b>Building Location</b>	<b>nasm</b>
Ramsay Wright Laboratories	5923
Earth Sciences	3427
<b>Grand Total</b>	<b>9350</b>

<b>Department of Ecology and Evolutionary Biology (EEB)</b>	
<b>Building Location</b>	<b>nasm</b>
Ramsay Wright Laboratories	4397
Earth Sciences	3630
<b>Grand Total</b>	<b>8027</b>

<b>Human Biology Program (HBP)</b>	
<b>Building Location</b>	<b>nasm</b>
Wetmore Hall	134
<b>Grand Total</b>	<b>134</b>

**Summary of Space Requirements – Cell & Systems Biology**Occupant Profile

The Department of Cell and Systems Biology (CSB) is a large and diverse department that provides a wide variety of offerings in cell biology, genomics, molecular biology and bioinformatics, animal and plant developmental biology, and physiology.

CSB offers over 50 courses covering topics such as genetics, neurophysiology, introductory virology, eukaryotic gene expression, computational genomics and bioinformatics and plant-microorganism interactions. The Department's foundation courses in cell, molecular and developmental biology, and physiology provide fundamental concepts in each area along with essential skills in modern laboratory techniques. As students move into upper-level courses, they encounter courses that are more specialized and provide training in advanced concepts and state-of-the-art techniques in research, including specific lab-based techniques courses in molecular and cell biology. The 400-level courses often have small enrolments allowing for a more personal experience. Many of these courses are seminar based which allows students to present research data, actively participate in discussions that are fundamental to their studies and evaluate the strengths and weaknesses of different experimental approaches. Students are also encouraged to conduct their own research through CSB independent project courses where they work one-on-one in a professor's laboratory. These courses develop students' abilities in evaluating data and critical thinking.

Departmental courses are arranged into a number of academic programs: Animal Physiology, Cell and Molecular Biology, and Developmental Biology. These programs provide students with a comprehensive education in these areas of specialization. In addition, the Department contributes to the interdepartmental specialist program in Bioinformatics and Computational Biology. CSB also offer programs in Biology jointly with the Department of Ecology and

Evolutionary Biology and Genome Biology jointly with EEB, the Department of Biochemistry, and the Department of Computer Science.

### CSB – Comparison of Current, COU Allocated and Proposed Space

	Current Space Inventory	COU Analysis	Proposed Space
Use (COU Category)	NASMS	NASMS	NASMS
Teaching Labs & Support Space (2.0)	1939	2301	1628
Research Labs & Support Space (3.0)	5501	5760	5501
Academic Offices (4.1)	458	449	480
Research Office/Project Space (4.2)	26	189	26
Graduate Student Space (4.3)	332	708	332
Departmental Admin & Support Staff (4.4)	259	559	249
Office Support Space (4.5)	508	476	493
<b>SUBTOTAL</b>	<b>9023</b>	<b>10441</b>	<b>8709</b>
Classroom Facilities (1.0)	151		88
Library Facilities & Campus Study (5.0)	0		0
Common Use & Student Activity (14.0)	122		285
Assembly & Exhibition (15.0)	0		0
Inactive Space (19.0)	54		54
<b>TOTAL</b>	<b>9350</b>	<b>10441</b>	<b>9137</b>

**Cell and Systems Biology – COU Input Analysis (includes projected increases 2016-17)**

**A Academic Offices**

4.1 (FTE Faculty + 15%) x 13 NASMs

FTE Faculty	30	1.15	13	Quotient equals	449	A
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**B Research Offices/Project Space**

4.2 (FTE PDFs + FTE Research Associates + FTE Non-Academic Staff, requiring offices, paid from research funding) x 13 nasms  
(students are counted below)

FTE PDFs	17
FTE Research Associates	6
FTE Non- Academic Staff (research)	6
Sum	29

Sum	29	6.5	13	Quotient equals	189	B
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**C Graduate Student Space**

4.3 FTE Grads x 4 NASMs (A & S 75% only)

FTE Grads (based on f/t grad students)	177	4	13	Quotient equals	708	
					708	C

**D Departmental Administrative and Support Staff Offices**

4.4 FTE Non-Academic (requiring office space) x 13 NASMs

FTE Non-Academic	43	13	Quotient equals	559	D
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**E Office Support Space**

4.5 (A + B + C + D) \* 25%

	1904	
	0	
	476	E

**F Research Laboratories and Support Space**

3.0 (FTE Faculty + (0.5 FTE Grads + 0.5 PDFs + 0.5 FTE Research Associates)) x Space Factor for Group

FTE Faculty	28
FTE Grads	88.5
FTE PDFs	8.5
FTE Research Associates	3
sum	128

sum	128	45	Space Factor* equals	5760	F
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**G Teaching Laboratories and Support Space**

2.0 # Scheduled Laboratory Weekly Student Contact Hours x Space Factor for Group

# hours	3887	0.6	Space Factor* equals	2301	G
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0.3 for computer labs

**TOTAL AGGREGATE SPACE GENERATED**      10441

**Summary of Space Requirements – Ecology & Evolutionary Biology**

Occupant Profile

The Department of Ecology & Evolutionary Biology (EEB) is one of the largest departments of its kind in North America, with internationally renowned and award-winning faculty. EEB is engaged in research and scholarship in diverse sub-disciplines within ecology and evolutionary biology. The Department offers several undergraduate programs and over 55 courses, including independent projects, fourth-year seminars, and field courses. Graduate students may enroll in both MSc and PhD programs and study with graduate program faculty on the St. George, Mississauga and Scarborough campuses of the University, and at the Royal Ontario Museum.

Successful science combines both “curiosity-driven” and “solution-driven” research, and EEB has practitioners of both. The Department has four strategic research foci: evolutionary genetics and genomics, quantitative ecology, and reproductive systems biology, and a fourth in systematics, centered on EEB faculty at the Royal Ontario Museum.

Ecologists and evolutionists address the central questions of the origin, maintenance and organization of biodiversity. The Department’s faculty members teach, study and consult on all aspects of earth’s organismal diversity, from genome to ecosystem, encompassing the range of plant, animal and microbial species.

The faculty members’ goal is to continue building on their excellence in teaching, discovery and innovation in the basic sciences of ecology and evolution, developing the new Department of Ecology and Evolutionary Biology as the top research and training program in Canada, indeed among the best in the world, and to take advantage of opportunities for interdisciplinary synergies within and outside the University.

**EEB – Comparison of Current, COU Allocated and Proposed Space**

	<b>Current Space Inventory</b>	<b>COU Analysis</b>	<b>Proposed Space</b>
<b>Use (COU Category)</b>	<b>NASMS</b>	<b>NASMS</b>	<b>NASMS</b>
Teaching Labs & Support Space (2.0)	2156	2729	1988
Research Labs & Support Space (3.0)	4046	4410	3837
Academic Offices (4.1)	447	344	536
Research Office/Project Space (4.2)	35	137	35
Graduate Student Space (4.3)	455	532	455
Departmental Admin & Support Staff (4.4)	255	247	217
Office Support Space (4.5)	239	315	206
<b>SUBTOTAL</b>	<b>7633</b>	<b>8714</b>	<b>7273</b>
Classroom Facilities (1.0)	88		88
Library Facilities & Campus Study (5.0)	81		81
Common Use & Student Activity (14.0)	115		115
Assembly & Exhibition (15.0)			
Inactive Space (19.0)	109		109
<b>TOTAL</b>	<b>8027</b>	<b>8714</b>	<b>7667</b>

**Ecology & Evolutionary Biology – COU Input Analysis (includes projected increases 2016-17)**

**A Academic Offices**

4.1 (FTE Faculty + 15%) x 13 NASMs

Faculty	23	1.15	13	Quotient equals	344	A
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**B Research Offices/Project Space**

4.2 (FTE PDFs + FTE Research Associates + FTE Non-Academic Staff, requiring offices, paid from research funding) x 13 nasm  
(students are counted below)

FTE PDFs	19					
FTE Research Associates	2					
FTE Non- Academic Staff (research)						
Sum	21		6.5	Quotient equals	137	B

**C Graduate Student Space**

4.3 FTE Grads x 4 NASMs (A & S 75% only)

FTE Grads (based on f/t grad students)	133		4	Quotient equals	532	
					532	C

**D Departmental Administrative and Support Staff Offices**

4.4 FTE Non-Academic (requiring office space) x 13 NASMs

FTE Non-Academic	19		13	Quotient equals	247	D
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**E Office Support Space**

4.5 (A + B + C + D) \* 25%

	1259					
	0					
	315					E

**F Research Laboratories and Support Space**

3.0 (FTE Faculty + (0.5 FTE Grads + 0.5 PDFs + 0.5 FTE Research Associates)) x Space Factor for Group

FTE Faculty	21					
FTE Grads	66.5					
FTE PDFs	9.5					
FTE Research Associates	1					
sum	98		45	Space Factor* equals	4410	F

**G Teaching Laboratories and Support Space**

2.0 # Scheduled Laboratory Weekly Student Contact Hours x Space Factor for Group

# hours	4,639		0.6	Space Factor* equals	2729	G
				.3 for computer labs		

**TOTAL AGGREGATE SPACE GENERATED** 8714

## Summary of Space Requirements – Human Biology Program

### Occupant Profile

The Human Biology Program (HBP) is an undergraduate collaborative program between the Faculty of Arts and Science (including CSB, EEB and Psychology) and the Faculty of Medicine. HBP is designed to examine the biology of our species through an interdisciplinary lens by integrating topics from the medical sciences, biological and social sciences, as well as the humanities. The program currently offers Specialist and Major programs in Environment and Health, Genes Genetics and Biotechnology, Global Health, Health and Disease, and Neuroscience, as well as a Major in Human Biology. Undergraduate science students may enroll in an HBP program of study in their 2<sup>nd</sup> year after completing introductory (100-level) courses in biology, chemistry, physics and math.

Students are introduced to their program of study in 2<sup>nd</sup> year with foundational courses designed to provide a broad overview of the subject area. Other introductory courses revolve around subject areas that are integral to all of our programs and that require some additional detailed instruction, such as genetics and statistics. As students progress through their programs to 3<sup>rd</sup> year, they become increasingly exposed to smaller, specialized courses in their fields. Generally, these courses are designed to focus on specific topics in more detail and to encourage more self-directed learning. By building on their fundamental knowledge, these courses examine ways of applying it to different domains of our everyday lives. They are designed to be rigorous with respect to the level of detail and challenging with respect to how student learning is evaluated, whether through writing assignments, oral presentations, or short-answer based examinations. A hallmark of the 3<sup>rd</sup> year in most of our programs of study is the opportunity to enroll in laboratory courses, which perpetually in very high demand. Finally, in 4<sup>th</sup> year students are further engaged to practice their critical thinking by taking specialized seminar-based courses in each of their respective fields. These courses are designed so that students analyze and critically evaluate cutting-edge primary research and present this information in scholarly formats (e.g. formal seminars, grant proposals, literature review articles, etc.). Assignments of this nature give students the opportunity for extensive self-directed learning, sharpening their analytical reasoning and practicing effective communication.

A central objective of the program is to facilitate the development of core competencies in our students, which includes: critical and creative thinking, self-directed learning, quantitative and analytical reasoning, effective communication, scholarship and research. As a result, we aim to prepare our students for future careers where an interdisciplinary education would be an asset, such as academic research and teaching, health professions, and public policy on research, health, education, and the environment.

**HBP – Comparison of Current, COU Allocated and Proposed Space**

	<b>Current Space Inventory</b>	<b>COU Analysis</b>	<b>Proposed Space</b>
<b>Use (COU Category)</b>	<b>NASMS</b>	<b>NASMS</b>	<b>NASMS</b>
Teaching Labs & Support Space (2.0)	0	1282	322
Research Labs & Support Space (3.0)	0	0	0
Academic Offices (4.1)	63	90	43
Research Office/Project Space (4.2)	0	0	0
Graduate Student Space (4.3)	0	0	0
Departmental Admin & Support Staff (4.4)	28	39	28
Office Support Space (4.5)	43	32	43
<b>SUBTOTAL</b>	<b>134</b>	<b>1443</b>	<b>436</b>
Classroom Facilities (1.0)	0		0
Library Facilities & Campus Study (5.0)	0		0
Common Use & Student Activity (14.0)	0		0
Assembly & Exhibition (15.0)	0		0
Inactive Space (19.0)	0		0
<b>TOTAL</b>	<b>134</b>	<b>1443</b>	<b>436</b>



**Human Biology Program – COU Input Analysis (includes projected increases 2016-17)**

**A Academic Offices**

4.1 (FTE Faculty + 15%) x 13 NASMs

Faculty			Quotient	
FTE Faculty	6	1.15	13 equals	90 A

**B Research Offices/Project Space**

4.2 (FTE PDFs + FTE Research Associates + \*TE Non-Academic Staff, requiring offices, paid from research funding) x 13 nasm  
(students are counted below)

FTE PDFs	0			
FTE Research Associates	0			
FTE Non- Academic Staff (research)	0		Quotient	
Sum	0		6.5 equals	0 B

**C Graduate Student Space**

4.3 FTE Grads x 4 NASMs (A & S 75% only)

FTE Grads (based on f/t grad students)	0		Quotient	4 equals	0
					1
					0 C

**D Departmental Administrative and Support Staff Offices**

4.4 FTE Non-Academic (requiring office space) x 13 NASMs

FTE Non-Academic	3		Quotient	13 equals	39 D
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**E Office Support Space**

4.5 (A + B + C + D) \* 25%

	129
	0
	32 E

**F Research Laboratories and Support Space**

3.0 (FTE Faculty + (0.5 FTE Grads + 0.5 PDFs + 0.5 FTE Research Associates)) x Space Factor for Group

FTE Faculty	0			
FTE Grads	0			
FTE PDFs	0			
FTE Research Associates	0		Space Factor*	
sum	0		1 equals	0 F

**G Teaching Laboratories and Support Space**

2.0 # Scheduled Laboratory Weekly Student Contact Hours x Space Factor for Group

# hours	2,136		Space Factor*	0.6 equals	1282 G
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**TOTAL AGGREGATE SPACE GENERATED** 1442

**Summary of Space Requirements – Psychology**

**Psychology – Comparison of Current, COU Allocated and Proposed Space**

	<b>Current Space Inventory</b>	<b>COU Analysis</b>	<b>Proposed Space</b>
<b>Use (COU Category)</b>	<b>nasm</b>	<b>nasm</b>	<b>nasm</b>
Teaching Labs & Support Space (2.0)	41	30	41
Research Labs & Support Space (3.0)	3,299	3,435	3,699
Academic Offices (4.1)	638	419	638
Research Office/Project Space (4.2)	27	111	27
Graduate Student Space (4.3)	64	572	64
Departmental Admin & Support Staff(4.4)	125	143	125
Office Support Space (4.5)	123	311	123
<b>SUBTOTAL</b>	<b>4,317</b>	<b>5,020</b>	<b>4,717</b>
Classroom Facilities (1.0)	188		188
Library Facilities & Campus Study 5.0)			
Common Use & Student Activity (14.0)	43		43
Assembly & Exhibition (15.0)			
Inactive (19.5)	178		89
<b>TOTAL</b>	<b>4,726</b>	<b>5,020</b>	<b>5,037</b>

\*Note: Graduate student space is comparatively low and research space high due to Psychology’s method of accommodating grad students within research lab space.

**Psychology – Teaching Laboratories Usage and Space Summary**

<b>Course</b>	<b>Current Location</b>	<b>Weekly Practical hrs</b>	<b>Course Enrolment</b>	<b>Wkly. Student Contact Hours</b>	<b>COU space factor</b>	<b>Generated Area NASM</b>
<b>EEB Laboratory Course Information - Fall 2011</b>						
PSY399H	217	3.0	20	60	0.5	30

**Psychology – COU Input Analysis**

**A Academic Offices**  
 4.1 (FTE Faculty + 15%) x 13 NASMs

Faculty	28	1.15	13	Quotient equals	418	<b>A</b>
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**B Research Offices/Project Space**  
 4.2 (FTE PDFs + FTE Research Associates + FTE Non-Academic Staff, requiring offices, paid from research funding) x 13 nasms  
 (students are counted below)

FTE PDFs	9	Sum	6.5	59		
FTE Research Associates		Sum	13			
FTE Non- Academic Staff (research)	4	Sum	13	52		
				equals	111	<b>B</b>

**C Graduate Student Space**  
 4.3 FTE Grads x 4 NASMs (A & S 75% only)

FTE Grads (based on f/t grad students)	143	Quotient	4	equals	572	
					572	<b>C</b>

**D Departmental Administrative and Support Staff Offices**  
 4.4 FTE Non-Academic (requiring office space) x 13 NASMs

FTE Non-Academic	11	Quotient	13	equals	143	<b>D</b>
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**E Office Support Space**  
 4.5 (A + B + C + D) \* 25%

	1,244
	C
	311
	<b>E</b>

**F Research Laboratories and Support Space**  
 3.0 (FTE Faculty + (0.5 FTE Grads + 0.5 PDFs + 0.5 FTE Research Associates)) x Space Factor for Group

FTE Faculty	22			
FTE Grads	56.5			
FTE PDFs	4.5			
FTE Research Associates	0	Space Factor*		
sum	83	30	equals 2,490	
				<b>F</b>

**Research Laboratories and Support Space (Neurobiology Faculty)**  
 (FTE Faculty + (0.5 FTE Grads + 0.5 PDFs + 0.5 FTE Research Associates)) x Space Factor for Group

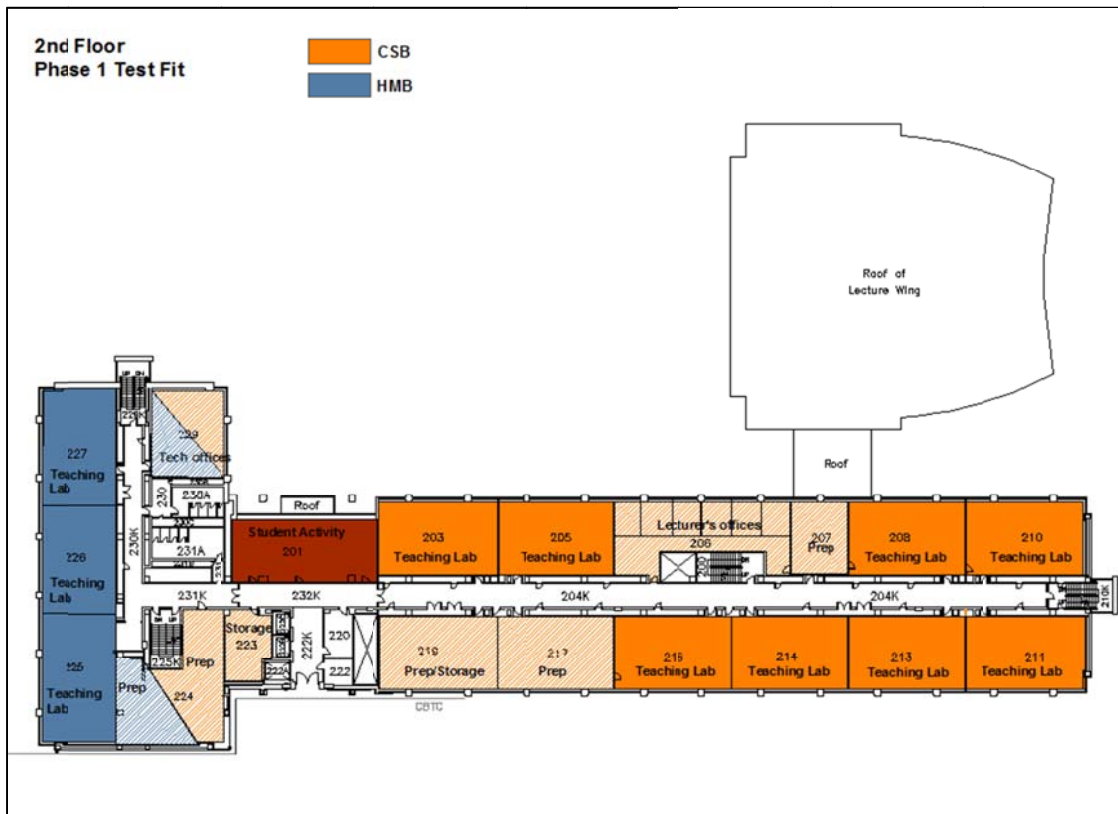
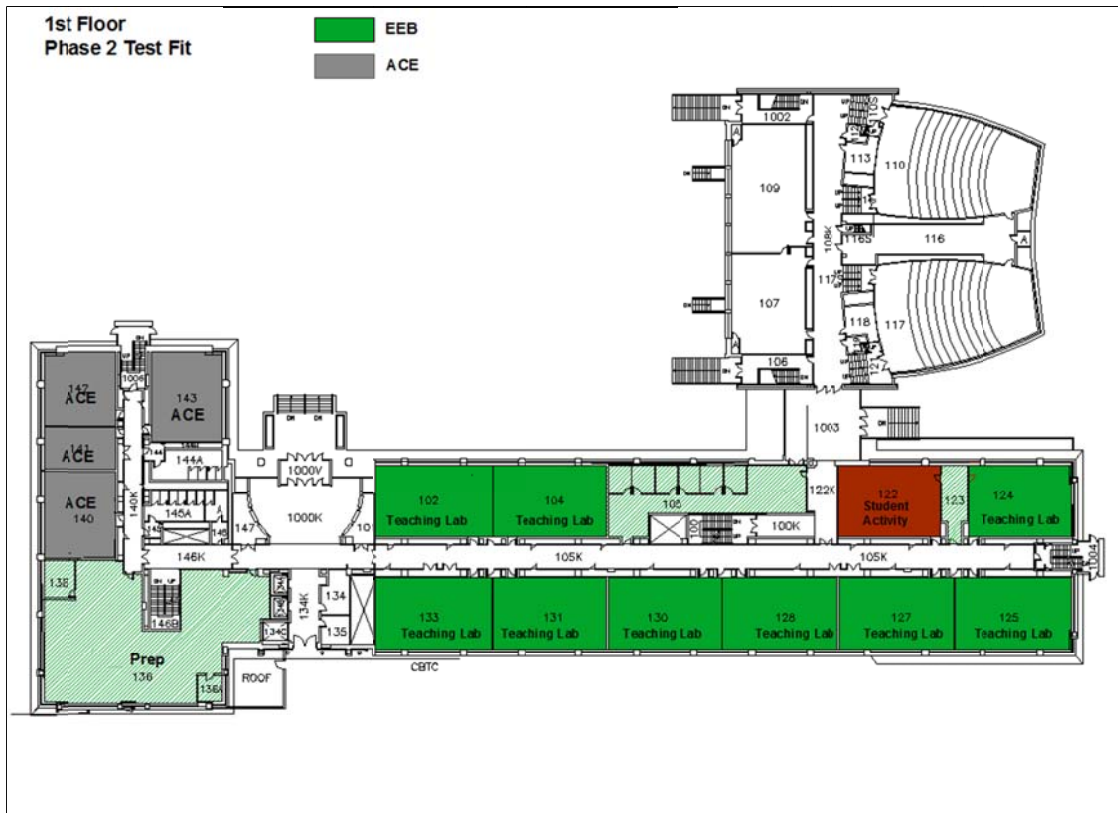
FTE Faculty	6			
FTE Grads	15			
FTE PDFs	0			
FTE Research Associates	0	Space Factor*		
sum	21	45	equals 945	
				<b>F</b>

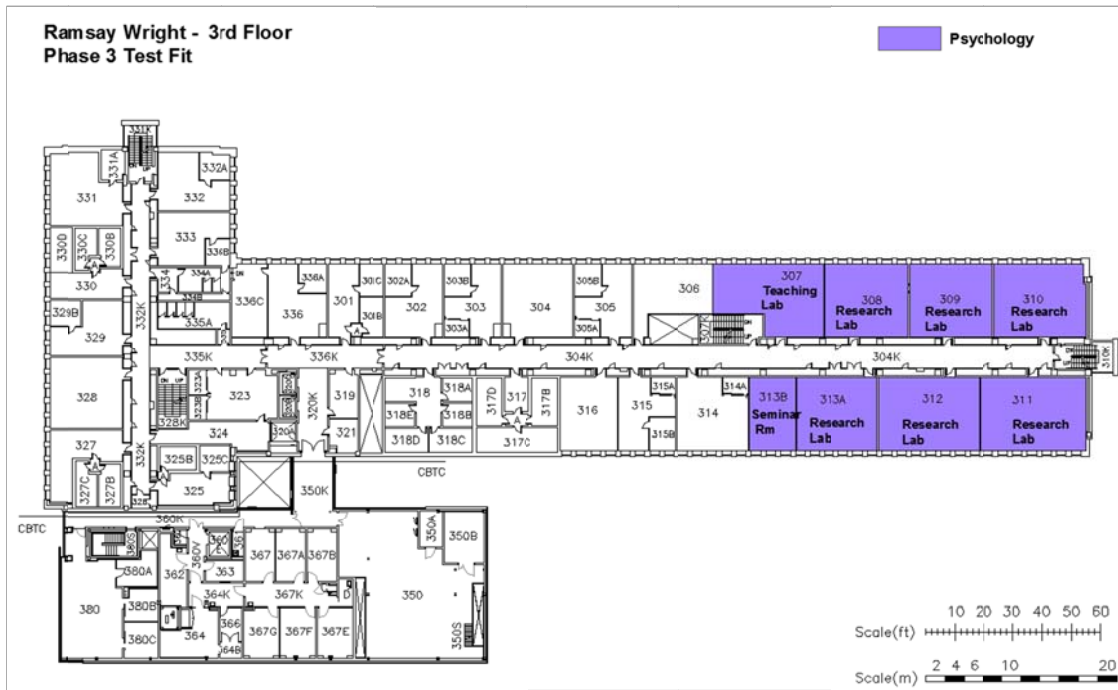
**G Teaching Laboratories and Support Space**  
 2.0 # Scheduled Laboratory Weekly Student Contact Hours x Space Factor for Group

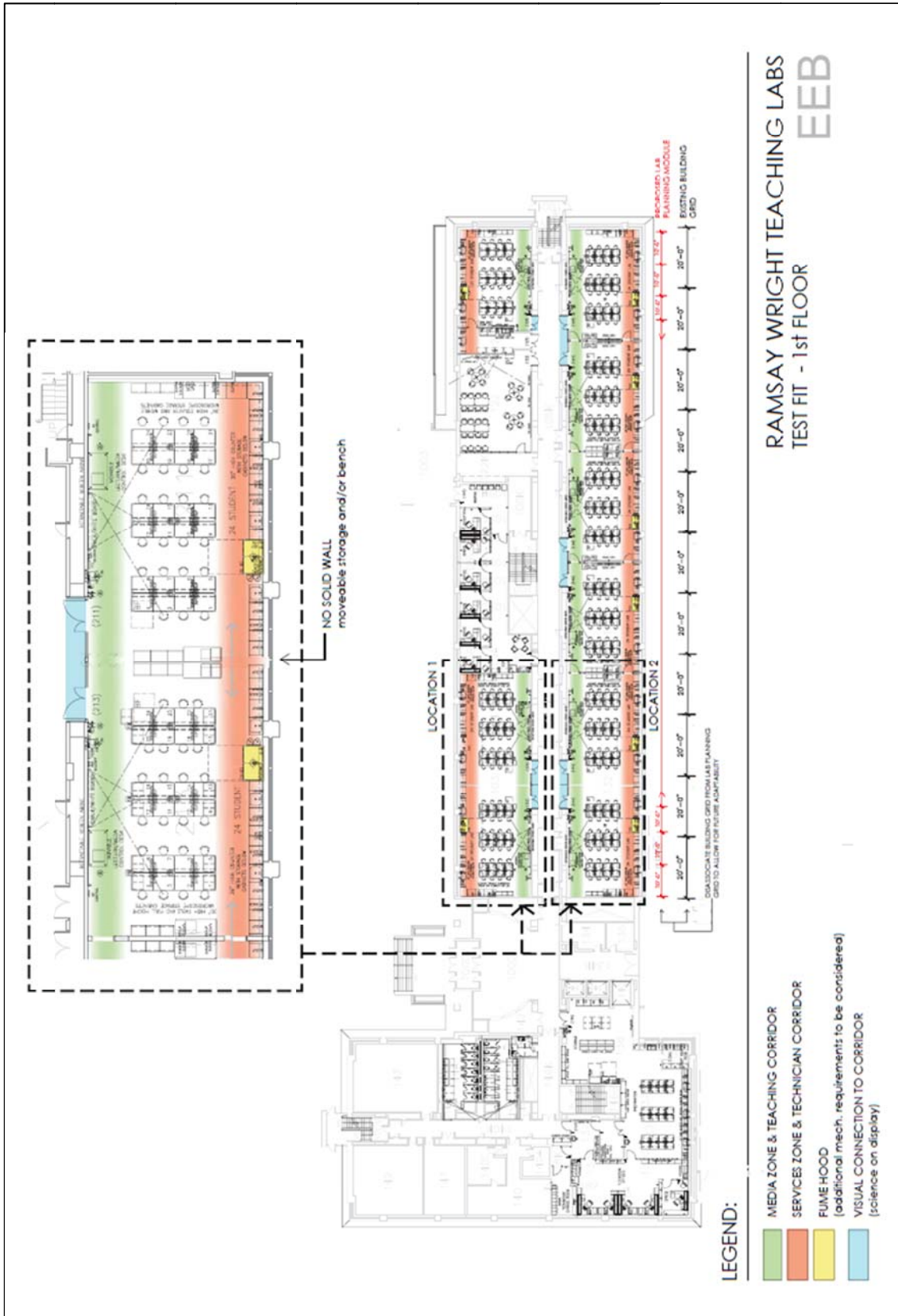
# hours	60	Space Factor*	0.5	equals	30	<b>G</b>
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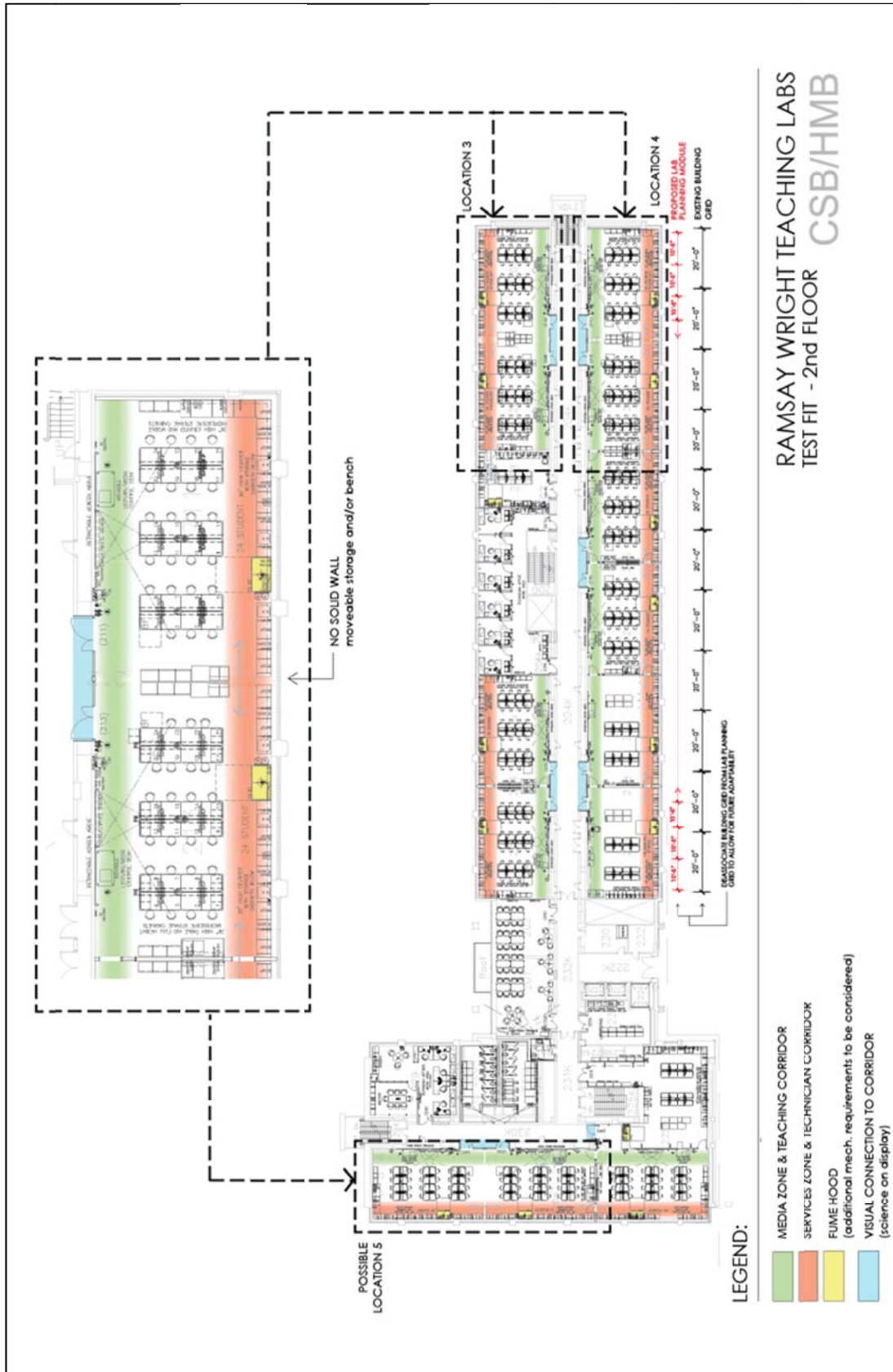
**TOTAL AGGREGATE SPACE GENERATED** 5,020

Appendix 2: Functional Plan Space Program (test fit)



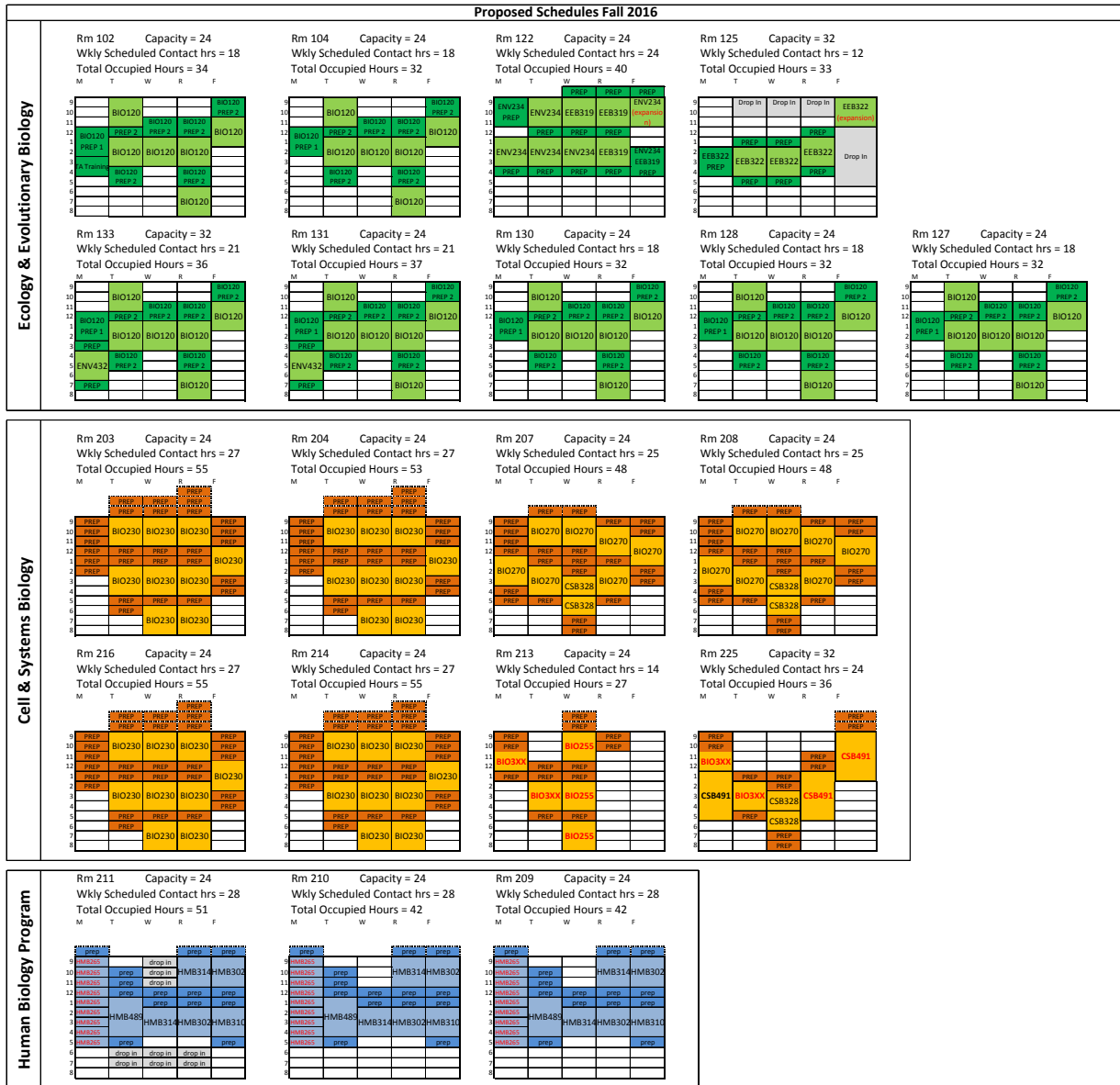






Appendix 3 - Weekly Utilization diagrams by Department

Proposed Schedules for EEB, CSB and HBP - Fall 2016





Proposed Schedules for EEB, CSB and HBP - Winter 2017

		Proposed Schedules Winter 2017												
Ecology & Evolutionary Biology	<p>Rm 102 Capacity = 24 Total Scheduled Weekly hrs = 18 Total Occupied Hours = 31</p>	<p>Rm 104 Capacity = 24 Total Scheduled Weekly hrs = 18 Total Occupied Hours = 29</p>	<p>Rm 122 Capacity = 32 Total Scheduled Weekly hrs = 18 Total Occupied Hours = 32</p>	<p>Rm 125 Capacity = 32 Total Scheduled Weekly hrs = 18 Total Occupied Hours = 29</p>	<p>Rm 133 Capacity = 32 Total Scheduled Weekly hrs = 18 Total Occupied Hours = 29</p>	<p>Rm 131 Capacity = 24 Total Scheduled Weekly hrs = 18 Total Occupied Hours = 29</p>	<p>Rm 130 Capacity = 24 Total Scheduled Weekly hrs = 20 Total Occupied Hours = 33</p>	<p>Rm 128 Capacity = 24 Total Scheduled Weekly hrs = 21 Total Occupied Hours = 33</p>	<p>Rm 127 Capacity = 24 Total Scheduled Weekly hrs = 18 Total Occupied Hours = 29</p>					
	Cell & Systems Biology	<p>Rm 203 Capacity = 24 Total Scheduled Weekly hrs = 21 Total Occupied Hours = 44</p>	<p>Rm 204 Capacity = 24 Total Scheduled Weekly hrs = 21 Total Occupied Hours = 44</p>	<p>Rm 207 Capacity = 24 Total Scheduled Weekly hrs = 21 Total Occupied Hours = 39</p>	<p>Rm 208 Capacity = 24 Total Scheduled Weekly hrs = 21 Total Occupied Hours = 39</p>	<p>Rm 216 Capacity = 24 Total Scheduled Weekly hrs = 21 Total Occupied Hours = 44</p>	<p>Rm 214 Capacity = 24 Total Scheduled Weekly hrs = 21 Total Occupied Hours = 44</p>	<p>Rm 213 Capacity = 24 Total Scheduled Weekly hrs = 21 Total Occupied Hours = 44</p>	<p>Rm 225 Capacity = 32 Total Scheduled Weekly hrs = 21 Total Occupied Hours = 44</p>					
		Human Biology Program	<p>Rm 211 Capacity = 24 Total Scheduled Weekly hrs = 23 Total Occupied Hours = 33</p>	<p>Rm 210 Capacity = 24 Total Scheduled Weekly hrs = 23 Total Occupied Hours = 33</p>	<p>Rm 209 Capacity = 24 Total Scheduled Weekly hrs = 23 Total Occupied Hours = 33</p>									