New Laboratory Design Guidelines and Standards

DESIGN SERVICES
OFFICE OF SUSTAINABILITY
ENVIRONMENT, HEALTH AND SAFETY

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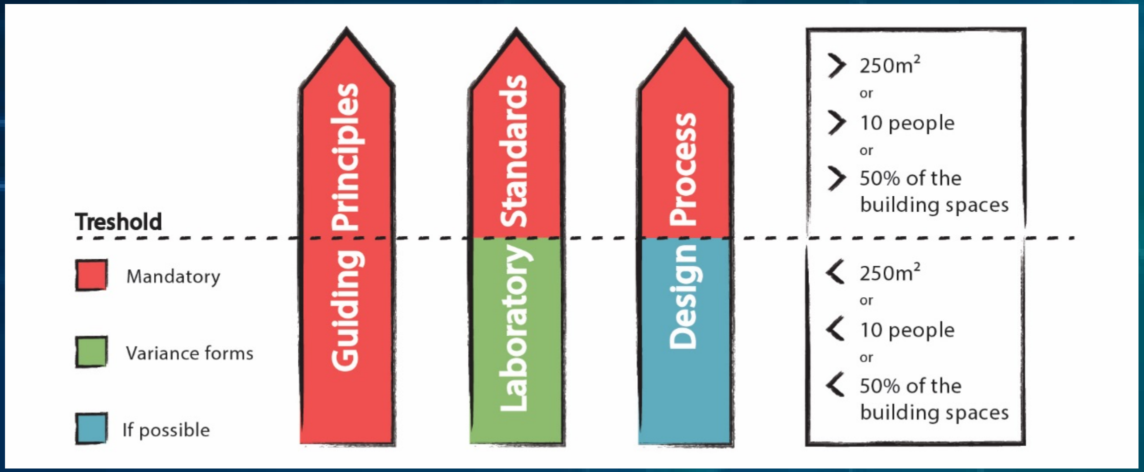
1. Vision

“THE UNIVERSITY RESEARCH SPACES WILL SUPPORT COLLABORATION, INNOVATION AND FOSTER CREATIVITY WITH CUTTING-EDGE DESIGN THAT IS ADAPTABLE, SAFE AND SUSTAINABLE, THUS STRENGTHENING MCGILL’S ROLE AS A WORLD LEADING INSTITUTION”

Objectives

1. Provide design guidance for future research spaces
2. Adopt the best practices



2. Guiding Principles

I. Creativity, Innovation & Technology
II. Planning & Design
III. Interaction
IV. Health & Safety
V. Adaptability
VI. Sustainability
VII. Ownership & Governance

I. Creativity, Innovation & Technology

DESCRIPTION

The primary goal of the laboratory remains the same: Experimentation. However, the path to discovery, and the way scientists work and interact, are being revolutionized by **emergent technologies** including smaller, more powerful instruments, robotics/automation, computer analysis and advanced communication systems. In a recent Laboratory Equipment reader survey, 48 percent of respondents said instrumentation improvements will expand their research capabilities in the next 10 years. The most significant changes in technologies expected are likely to be **automation systems**, **data acquisition systems**, **detectors**, and **sensors**.

ASPIRATION

Emergent technologies will reduce the physical footprint of laboratories and free up time for scientists to engage in more collaborative and idea-based endeavours. The future laboratory will need to reflect this change, with a choice of **working environments** replacing the space that was previously dedicated to traditional laboratories. The future laboratory will also provide **flexibility** in the **physical** and **operational aspects** of the laboratory to allow for **emergent technologies**. Additionally, it will provide collaborative **hi-tech tools** such as video and virtual conferences to accommodate a more mobile workforce and supporting **mobility**, at some level, for all employees.

KEY WORDS

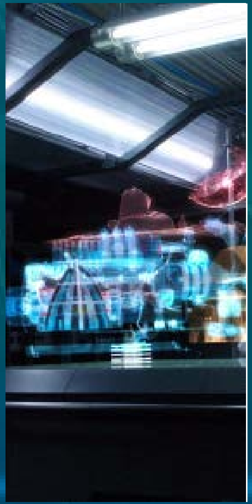
Synergy, Interdisciplinary, Collaboration, New collaborative technology, Virtual analysis
Big Data

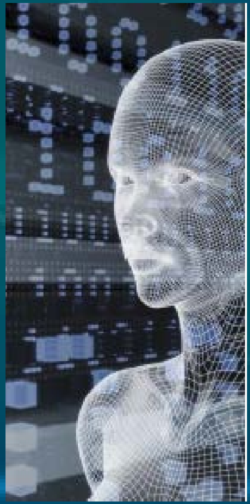
AREAS INVOLVED

Flexible design,
Shared spaces,
Shared equipment

I. Creativity, Innovation & Technology

EXAMPLES





2. Planning & Design

DESCRIPTION

The ultimate goal of laboratory design is to foster innovation, support science and keep scientists safe.
Traditional laboratories are designed as units, compartmentalized, self contained and not collective.
Scientists are separated from each other in formally arranged and **rigid layouts**, reflecting **linear processes** and **static functionality**.

ASPIRATION

The nature of laboratory work requires **distinct** workspaces, and a defined, but permeable barrier between them. Scientists working in these spaces need an area that allows for both **focused concentration** and **easy engagement** with colleagues. Design should use acoustic technologies and visual cues to bring these different spaces as close together as possible. **Adjacencies** and **visual connections** should be created to allow for spontaneous interaction and collaboration between disciplines. Design should focus on workplaces that promote innovation, the transfer of knowledge, collaboration and effectiveness while still providing a beautiful environment which is desirable to occupy. Another consideration to take into account is the integration of **flexible laboratories** that would allow **rapid reconfiguration** based on scientific needs.

KEY WORDS

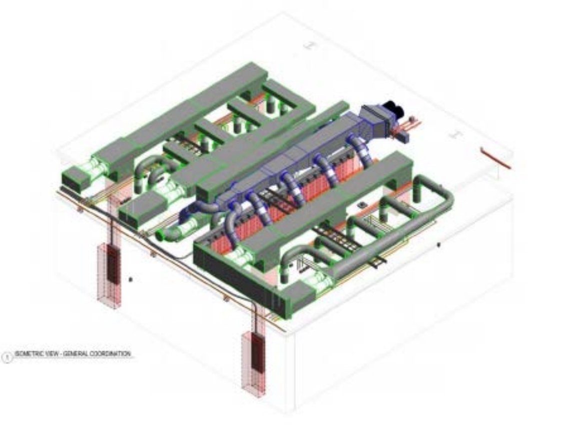
Ergonomic
Adaptability
Flexibility
Decentralized spaces
Collaboration settings
Interdisciplinary
Right location

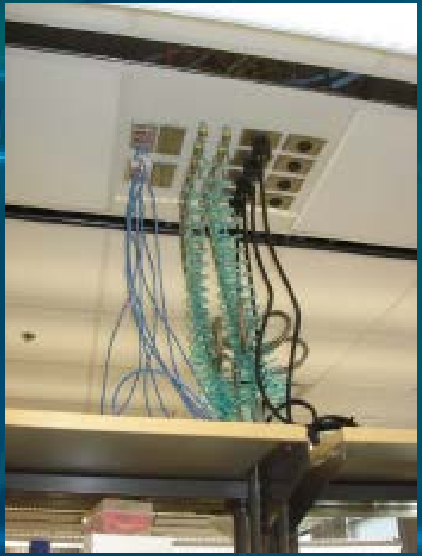
AREAS INVOLVED

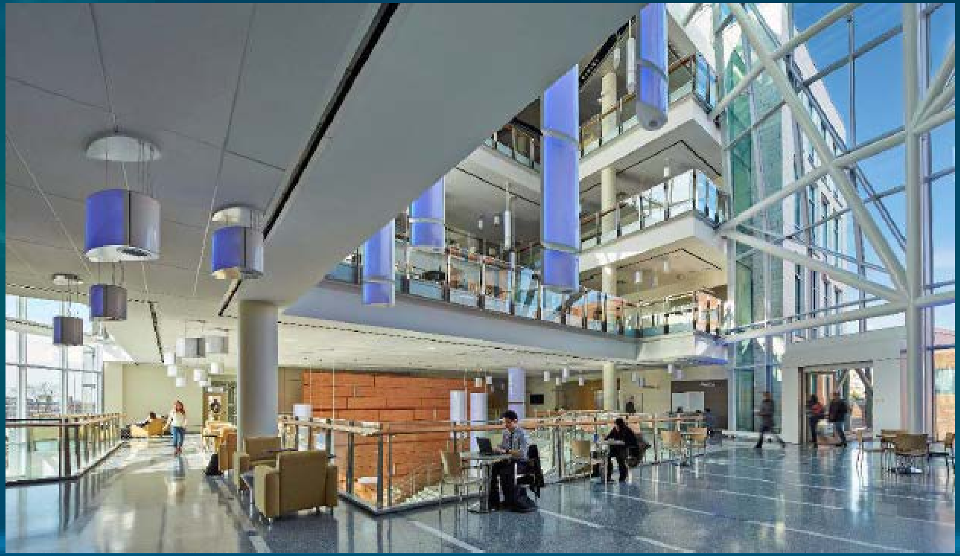
High Performance Design
Aesthetic spaces
Sustainability
Energy conservation
Renewable energy
Water conservation

2. Planning & Design

EXAMPLES







3. Interaction

DESCRIPTION

Challenging researchers to **collaborate across disciplines**, despite their initial reluctance, has led to the creation of new fields of study not defined 20 years ago.
Interdisciplinary collaboration has become paramount to academic and corporate-based research. Fixed benches and utilities limit scientists to their individual workstation and hinder them from working in teams.
A study done in 2014 by CBRE, demonstrated that a “typical” laboratory in life science industry devotes only 7% of its square footage for collaboration.
The **sharing** of personnel (and equipment) may prove to be a highly effective measure to counter realities such as budget restrictions.

ASPIRATION

Collaboration spaces, venues and pathways for chance meetings are seen as critically important means to foster an innovative culture. A **variety** of meeting rooms with video conferencing, informal social/working areas with a place for laptops, whiteboards on every surface and glass walls are the norm. Design efforts will look to the creation of **spaces that promote collaboration** across more disciplines and further **multidisciplinary** and transdisciplinary research. Design will also promote **core facilities** that create the opportunity to allow mixing of users from multiple locations based on synergies between groups around an area of study, as opposed to within a specific discipline. Other design considerations include the possibility to provide open spaces creating more **visual connections**, the use of technology to untether and connect people and the integration of virtual communication.

KEY WORDS

Interdisciplinary
Interactive
Build around community
Social Spaces
Communication
Shared resources
Visibility

AREAS INVOLVED

High Performance Design
Aesthetic spaces
Sustainability
Energy conservation
Renewable energy
Water conservation

3. Interaction

EXAMPLES

4. Health & Safety

DESCRIPTION

Health and safety means, first and foremost, **protecting** the health and safety of our community and guests and fostering an environment that is conducive to a **productive learning environment**. It also encompasses protection from material losses or evets that can negatively impact on the continued operation of the institution. Compliance with health and safety legislation is a **complex challenge**, with **jurisdictions** at the municipal, provincial, national and international levels. Research granting agencies also impose health and safety conditions as a part of the research granting process. Health and safety is a moving target, with **new hazards** emerging from new research, coupled with a steady stream of new regulatory requirements.

ASPIRATION

Meeting the compliance requirements of health and safety in the research lab is commonly viewed as an obstacle to progress, however the ultimate goal is not to put up obstacles, rather it is to **effectively manage risks** and avert situations which can impede progress. The aim in the lab design process is to make sure the safety components are **"right-sized"** i.e., able to meet the demands of the present and flexible enough to also do so in the future. On one hand, an under-designed lab can result in retrofits that usually cost more than they would have if included in the original design, while on the other hand, and an over-designed lab can include expensive safety features that are never used, thereby diverting valuable financial resources that could have been used on more important items.

KEY WORDS

Hazardous agents
Ergonomics
Personal Safety
Safe Spaces
Emergency Management
Commissioning and decommissioning
Compliance
Safety Committees
Best practices

AREAS INVOLVED

EHS
Hazardous Waste Management
Principal Investigators, Lab Managers, Lab Users
Public Safety
Safety Committees
Regulatory agencies
Granting agencies
Research Ethics
Operations and Building Services

4. Health & Safety

EXAMPLES

5. Adaptability

DESCRIPTION

Science and technology changes rapidly, and the facilities used for them do too. Therefore, new laboratory must be **flexible**, **adaptable**.

Maximizing adaptability has always been a key concern in designing or renovating a laboratory building. Adaptability can mean several things, including the **ability to expand easily**, to **readily accommodate reconfigurations** and other changes, and to **permit a variety of uses**. Adaptable labs allow universities to meet changing needs in the future while reducing renovation costs and lab downtime.

ASPIRATION

Core facilities and campus amenities are resources which enable flexibility and adaptability in general research space. They strengthen the campus community and **foster the exchange** of ideas by serving different departments, which may not have otherwise interacted. Adaptability features allow lab space to be **leaner** and **increase efficiencies** in layout.

AREAS INVOLVED

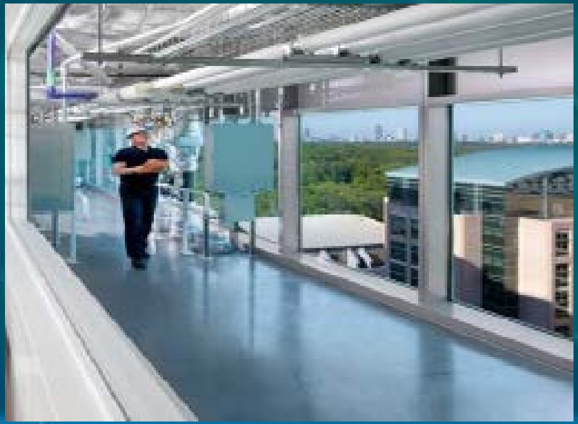
Lab module
Mobile casework
Laboratory bench
Outlets and fixtures
Future equipment

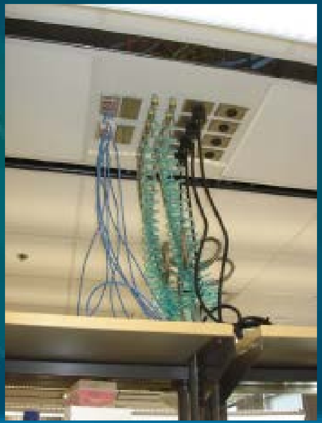
KEY WORDS

Flexible
Transformative
Accessibility
Inclusive
Evolving
Mobile

5. Adaptability

DESCRIPTION





6. Sustainability

DESCRIPTION

Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs. In addition to natural resources, we also need social and economic resources. Sustainability is not just environmentalism. Embedded in most definitions of sustainability we also find concerns for social equity and economic development. In the context of a lab, it means developing **new approaches** (technical, operational and behavioral) to enhance the **environmental performance** of a space that feels **safe**, **inclusive** and **connected**, with a sounds economic approach.

ASPIRATION

Laboratories are places of discovery and scientific progress, housing both the research that matters and the researchers and equipment responsible for it. All that science, though, takes **energy**, and many facilities—especially those with significant ventilation needs—utilize it in **high volumes**. To combat this issue, it is important to implement strategies in the workplace that will **minimize the environmental footprint** of our labs and make them environmentally friendly homes for the science of tomorrow.

In a lab that embodies the principle of sustainability, people collaborate across disciplines to inform and advance solutions to contemporary problems. They are aware of and responsible for the **environmental**, **economic** and **social implications** of their research.

KEY WORDS

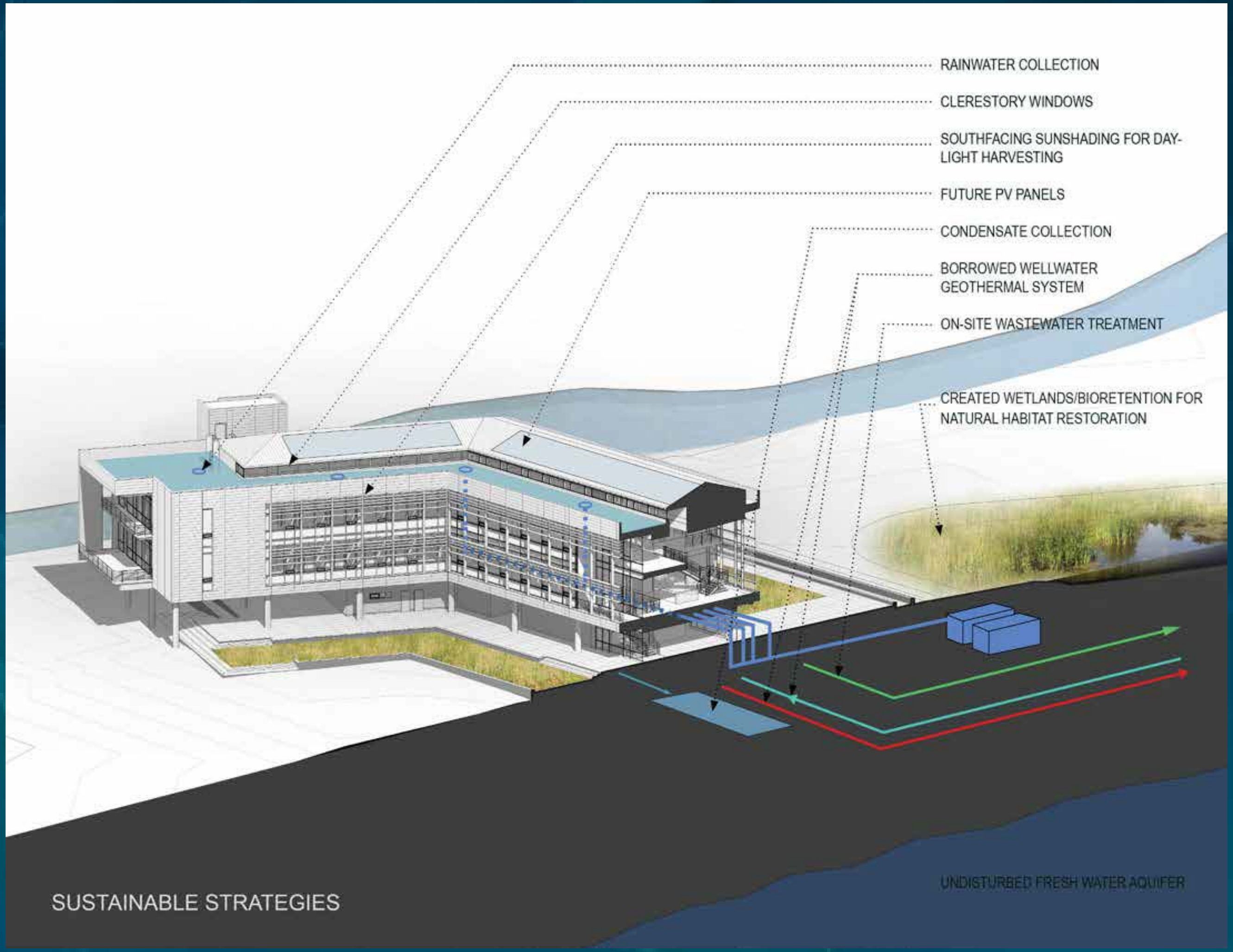
Net-Zero Energy Use
Net-Zero Water Use
Net-Zero Carbon Footprint
Net-Zero During Construction and Operation

AREAS INVOLVED

Waste management (non-hazardous)
Low carbon design
Sustainable materials
Life cycle analysis

6. Sustainability

EXAMPLES



7. Ownership & Governance

DESCRIPTION

In a large institution where responsibilities are widely dispersed the question of ownership is a subject of ongoing debate. Who actually **owns a lab**? The PI, the department, the faculty, and central administration can all lay claim to ownership in some respects, but who is responsible for the space allocation, the design, construction, and choice of materials; the operation of the lab and its maintenance. What about safety surveillance, emergency preparedness, and the responsibility for reporting and correcting problems? When does a deficiency become an extra? Who pays?

ASPIRATION

Ownership of laboratories, responsibility for **maintaining** them **and accountability** for what goes on inside the laboratory should be clearly defined and well understood by all stakeholders. New laboratories do not always require new space if existing spaces are optimized. To achieve this, laboratory spaces should be allocated on the basis of the **needs of the University**, **irrespective of inter-departmental or inter-faculty** differences over ownership. This will also go a long way towards accommodating inter-disciplinary research.

KEY WORDS

Internal Responsibility
Enforcement
Accountability
Financial responsibility
Ownership
Access to Information
Service Level Agreement
Key controls
Space allocation

AREAS INVOLVED

Legal
Faculty Deans
PI's, Lab managers and other "owners".
FMAS

2. Design Standards

I. Architectural design
   I. Flexible furniture and casework
   II. Modular wall systems
   III. Acoustics
II. Electrical design
   I. Natural lighting
   II. Overhead service carriers
   III. Communication and network
III. Mechanical design
   I. HVAC systems
   II. Ultra low flow variable air volume fume hoods

Questions?