MCW Consultants
mechanical & electrical engineers

A huge laboratory building at the University of British Columbia has achieved Gold status with LEED.

UBC Life Sciences Centre

By 2001, more than 20 years had passed in British Columbia without any notable investment in training more doctors. The population of the province had increased by 50% during the same time, leading to a shortage of physicians and other medical experts.

Faced with this shortage, in March 2002, the B.C. government allotted $110 million for a Life Sciences Centre at the University of B.C. in Vancouver to help train new doctors. The complex, completed in 2004 at the corner of Wesbrook Mall and Agronomy Road, is the largest at the university. Accommodating 2,600 people in total, it has a floor area of over 52,000 square metres.

MCW Consultants was selected through an open engineering competition to do the mechanical and electrical design. The project had a demanding schedule — 29 months from the time the design team was selected to building occupancy.

The university also set ambitious sustainability goals. As a result, the Life Sciences Centre successfully achieved Gold level certification with the U.S. Green Building Council, making it the largest LEED Gold laboratory in the world. At the same time, the centre was built for about 60% of the average cost of a comparative building.

The centre consists of three five-storey towers separated by two large atria. There are also two full basement levels. The three towers each contain eight biosafety level 2 laboratories, consisting of core support service areas and laboratory bays measuring 45 metres long, 6 metres wide and 3.6 metres high. The lower levels contain a gross anatomy laboratory, morgue, biosafety level 2 and 3 laboratories, and an animal facility. They also contain administration, food services and material handling. Late in the project, an animal MRI suite, prion laboratory and human pathology laboratory were added to the building.

Other important components are two 350-seat lecture theatres and a multi-purpose laboratory that accommodates 250 students. The lab provides one computer for every two students, for viewing colour images to assist with wet lab work. These audio-visual teaching programs can be viewed interactively in real time at medical schools at the University of Victoria and the University of Northern B.C. as part of their distance learning programs.

Elizabeth Gyde, Diamond-Schmitt (DSAI)

Above: building exterior. Right: one of the two large atriums between the laboratory blocks; these spaces have no air-conditioning, only "free" cooling.

Eliminates 500 tonnes of greenhouse gases a year

The total building uses 26 ekwhrs (equivalent kilowatt hours) per square foot per year, 28% less than the LEED energy compliance standard. The savings are equivalent to the energy used by over 100 B.C. homes, cutting greenhouse gas emissions of carbon dioxide by 500 tonnes a year.

Each energy conservation measure was considered individually based on a 10-year payback benchmark.

The key mechanical design features to achieve this performance were:

- heat recovery glycol runaround coils for all 11,100% fresh air systems
- building process cooling water interconnected to the heat recovery system, providing additional "free" low temperature reheat
- three 400-ton high pressure centrifugal chillers piped in series, using one for heat recovery
- low temperature chilled water system with variable pumping to reduce pump energy and pipe sizes
- variable speed drives (VSDs) for all variable air volume (VAV) fan systems
- two large atria without air conditioning, only free cooling.

Displacement air

The two atria are fitted with Hi-Lo exhaust/return air systems to recover high-level heat in winter and remove excess heat in summer. The ventilation systems are integrated with the atria smoke exhaust fans, to provide a relief air function.

In the main lecture theatres, displacement air is delivered through the stair risers from pressurized drywall plenums under the seating. The air is delivered at 9 m/min velocity and 17-20°C. Using plenums instead of ductwork saved approximately $50,000.

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To avoid the cost of 50 downdraft cadaver tables in gross anatomy, a high volume laminar flow overhead air distribution system with low level return was designed using computational fluid dynamic modeling.

A 3,000-m² mechanical room

One of the biggest challenges for MCW was allocating the mechanical spaces, shaft sizes and service routings long before the technical requirements for all areas of the building were defined. The absolute minimum size for the basement main mechanical room was an enormous 3,000 m² in order to house $15 million worth of mechanical equipment (the total mechanical construction cost was $40 million).

An additional 6,000-m² interstitial floor space on the lower levels is dedicated to all the mechanical, electrical and plumbing systems for the critical containment laboratories and the animal care vivarium. The interstitial space allows for the systems to be serviced and maintained without disrupting or possibly contaminating the laboratory and vivarium environments. All the critical air handling units and the Tri-Stack exhaust fans for the vivarium and biosafety laboratories are designed for N+1 redundancy and are on emergency power.

The laboratories take up approximately 75% of the net building area and are all supplied by 100% fresh air, which is preheated and maintained at 50% relative humidity. Elsewhere, all the recirculation air systems have CO_2-controlled fresh air intakes. The laboratory ventilation systems are pressure cascaded to prevent air migration from these rooms.

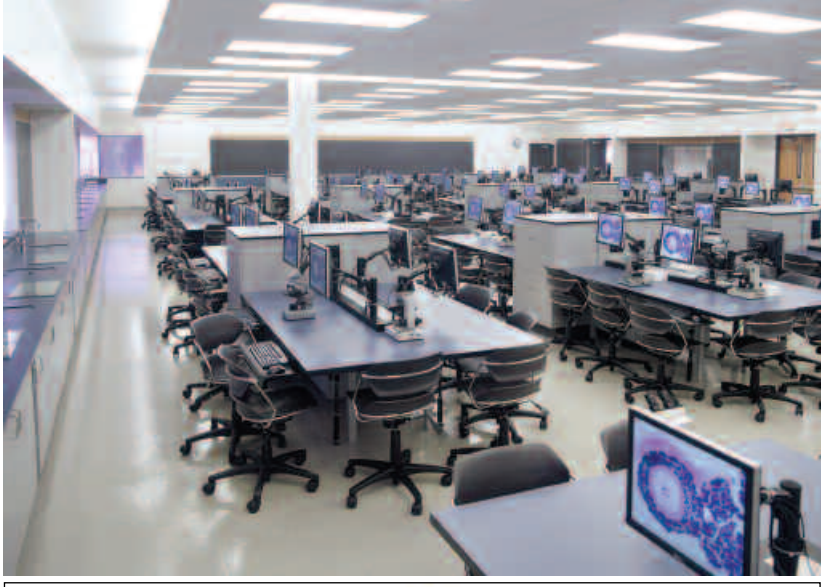
Big power, daylight, and 500 kilometres of cable

The facility has a main hydro service with three 3,000 kVA power transformers in a 340-m² main electrical room. For reliability, the building has dual-radial incoming feeds from the campus utility, with a 2,250 kVA standby emergency diesel generator. All areas have harmonic mitigating K13 transformers and surge suppression devices to ensure the power quality.

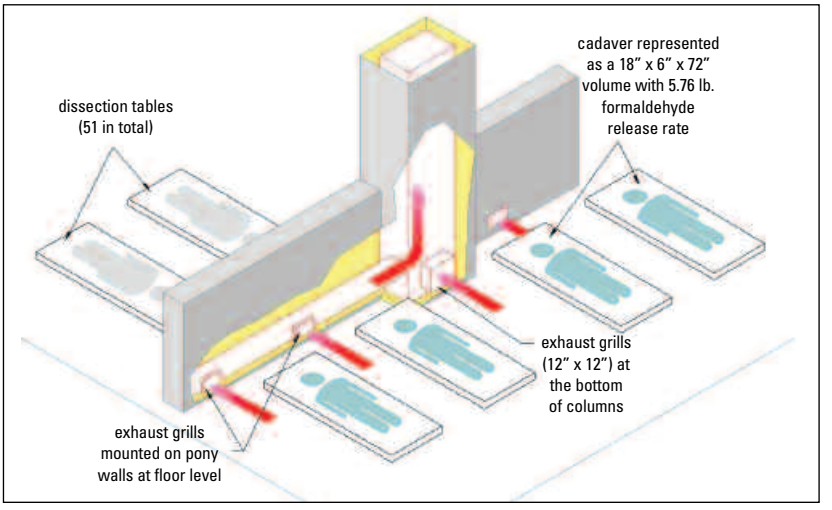
Natural light is exploited as much as possible, using the atria to bring daylight into the upper floors. The building has 8,800 light fixtures that include high efficiency lamps which, that are also lead free, low-mercury and with low-embodied-energy materials. The savings in lighting energy are enough to light 600 homes.

The telephone and data system has 7,000 cable drops, and 500 kilometres of Category 6 cable to 12 data rooms. In addition, WiFi access for mobile devices is provided throughout.

The Life Sciences Centre project has achieved great success on each goal that was set: function, budget, schedule and sustainability. The energy-efficient systems will save the university approximately $1 million every five years. Further, thanks to the new facilities, the province has doubled the number of medical students graduating every year, meaning there will be health benefits for future generations of British Columbians. CCE



Howard Waisman



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Top: multi-purpose laboratory with computers. Above: cadavar table air system in gross anatomy laboratory; general supply air in this laboratory is high-volume and low return.

Client: *University of B.C.*
Mechanical & electrical: *MCW Consultants (Michael Boyle, P.Eng., Sam Louie, P.Eng., Bob Deagle, P.Eng., Erik Mak, P.Eng.)*
Architects: *Bunting Coady, Diamond + Schmitt*
Structural & building envelope: *Read Jones Christoffersen*
Energy: *G.F. Shymko & Associates*
LEED consultants: *Build Green Developments*
Audio visual: *MC2 Systems*
Construction manager: *Ledcor*
Suppliers: *Guardian Equipment (emergency protective equipment); Siemens (building controls, security systems); Victaulic (hydronic piping)*

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