Form Meets Function

The Donnelly Centre for Cellular and Biomolecular Research provides an open, flexible and collegial environment for some of the world's best scientists

By Shibu Thomas

PHOTOGRAPH: TOM ARBAN

The building that houses the Donnelly Centre for Cellular and Biomolecular Research can be described as transparent, open and flexible. Those words would also describe the research approaches of the 32 principal investigators and the more than 400 research staff members that call the Centre home.

But was this the original objective of the team that envisioned the Donnelly Centre earlier in the decade? "Absolutely," says Dr. James Friesen, Professor Emeritus and former Chair of the Banting and Best Department of Medical Research, who is regarded, along with the late Dr. Cecil Yip, as the research visionary who helped conceptualize the Donnelly Centre and make it a reality.

"We envisaged interdisciplinary teams coming together to collaborate in an open, flexible and collegial environment," reminisces Dr. Friesen. "We heard the call of scientists who all wanted windows with natural light." The all-glass structure bears testimony to those needs.

The mandate of the Donnelly Centre is to stimulate new interactions at the interface of biology, chemistry, engineering and computer science in order to develop and apply new technologies for approaching the most challenging biological problems in the post-genomic era.

The Centre opened its doors in 2005 as a unique institute in which investigators from the Faculties of Medicine, Pharmacy, Applied Sciences & Engineering, and Arts & Science are brought together in an open, think-tank environment.

The Donnelly Centre's scientific community interacts in spectacular open-concept laboratories and meeting spaces distributed over 10 floors in a research tower that is said to symbolize the amazing potential of the post-genomic era. The laboratory floors total approximately 200,000 square feet. Each floor can accommodate three to five investigators and their teams, which include several large support rooms for shared equipment and informal meeting rooms. Laboratory benches are modular and flexible and can be readily adapted to the needs of engineers as well as computational or molecular biologists.

Today, the Donnelly Centre has rapidly become recognized as a premier international centre for post-genome biology and has solidified Canada's reputation as a leader in genomic research. The success of the Centre is evident through its ability to compete on the international scene for top researchers in high throughput mammalian cell genetics, proteomics, computational biology and functional genomics.

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Prof. Brenda Andrews, the Donnelly Centre's Director, has been successful in not only attracting top international researchers but also in joint recruitment initiatives between departments in the University that have never before been involved in co-recruitment of new faculty. Each of the new recruits, along with other researchers in the building, have started new collaborative research projects enabled in large part by the Centre's open environment.

Prof. Igor Stagljar, who has his office on the 12th floor, is one of the early recruits to the Centre. Emphasis on technology development as well as the collaborative and collegial atmosphere is what attracted him. He motions towards the glass wall of the building to the expansive and unobstructed view of the skyline and the city. "I feel one with nature," he says. "It is a combination of freedom, free form thinking and of no boundaries that has such a positive impact on my work and life."

An Associate Professor in the Department of Biochemistry and the Department of Molecular Genetics, Stagljar studies how proteins interact in human cells, to understand how impaired protein-protein interactions lead to numerous human diseases such as cancer, schizophrenia, cystic fibrosis, arthritis and Parkinson's disease. Stagljar's lab has also developed a unique and internationally known test that can monitor interactions between membrane proteins, the so-called membrane yeast two-hybrid system (MYTH). The system has great potential in proteomics research.

Aaron Wheeler, Assistant Professor, Department of Chemistry, also joined the Donnelly Centre in the initial stages. When interviewing for jobs in 2005, Wheeler discovered that "interdisciplinary research" was the buzzword among many universities in North America, but he noticed that "only the University of Toronto, with its $100 million investment towards the Donnelly Centre was doing anything concrete about it." He is excited about the dynamic and informal atmosphere with the free flow of information. "It is the way of the future in research," he adds.

Wheeler is one of the developers of a technique that evaluates tiny fluid samples, sometimes referred to a "lab-on-a-chip" technology that significantly reduces the invasiveness of conventional methods for breast cancer detection. His research team was successful in analyzing hormones in blood, serum and breast tissue samples

PHOTOGRAPH: MARGARET MULLIGAN

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over a two-year study period. The clinical implications could be significant and investigators are developing methods to apply this technique for early detection with the hope of preventing breast cancer in individuals at higher risk.

Collaboration is a cornerstone of research at the Donnelly Centre. One example of this approach is the GenNet laboratory for automated genetics analysis. This collaborative platform combines functional genomics (the field of molecular biology that studies the vast data derived from gene projects to describe the functions and interactions of genes and proteins) and systems biology (which uses a holistic, all-inclusive and inter-disciplinary approach) to open the door to large-scale genetic network studies and network studies involving heterologous genes (in which a protein is experimentally put into a cell that normally does not make that protein, for example, human disease genes expressed in yeast). In addition to determining the roles of individual genes, genetic network analysis enables the study of cells as a complex network of biochemical factors. Understanding genetic networks will also provide researchers with novel drug targets, sensitive diagnostics for individualized therapy, and early indicators of toxic drug effects.

Another collaborative Donnelly Centre project is the establishment of the Toronto Centre for Phenogenomics. This state-of-the-art research facility is a collaboration between Mount Sinai Hospital, The Hospital for Sick Children, Saint Michael's Hospital and the University Health Network. The centre combines phenotypic profiling (based on any observable characteristic or trait of an organism) and chemical genomics (the study of genomic responses to chemical compounds). High-throughput phenotypic profiling is a high-content screening platform that allows a researcher to quickly conduct millions of biochemical, genetic or pharmacological tests. Through this process, one can rapidly identify active compounds, antibodies or genes which modulate a particular bimolecular pathway. The results of these experiments provide starting points for drug design and for understanding the interaction or role of a particular biochemical process in biology.

Dr. Friesen looks forward to seeing more results from this method of organizing research. But he has no doubts about the value of bringing people together in a collaborative, interdisciplinary environment. It allows people to "discuss, disseminate … stir things up a bit!"

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