



**CHILD
& FAMILY
RESEARCH
INSTITUTE**

Science Making **Miracles**

2008/09 Annual Report



Smarter technology
for **safer operating rooms**



Tackling high rates of
Type 2 diabetes in
remote B.C. communities

Taking aim at cancer: research identifies
possible drug target



How **genetic testing** can
improve drug safety



The Child & Family Research Institute (CFRI) conducts discovery, clinical and applied research to benefit the health of children and families. It is the largest institute of its kind in Western Canada. There are 200 investigators affiliated with CFRI. More than 200 trainees, including graduate students and postdoctoral fellows, work at the institute.

CFRI works in close partnership with the University of British Columbia (UBC); BC Children's Hospital and Sunny Hill Health Centre for Children, BC Women's Hospital & Health Centre and BC Mental Health & Addiction Services, agencies of the Provincial Health Services Authority; and BC Children's Hospital Foundation.

CFRI has additional important relationships with British Columbia's five regional health authorities and with B.C. academic institutions Simon Fraser University, the University of Victoria, the University of Northern British Columbia and the British Columbia Institute of Technology.

Our Vision

Science Making Miracles

We passionately pursue discovery, knowing our achievements have the capacity to transform lives.

Our Mission

CFRI conducts discovery research to benefit the health of children and families.

Our Values

We work in an environment that values:

- Integrity
- Excellence
- Transformation
- Interaction
- Openness

Our Research Clusters

- Childhood Cancer
- Diabetes, Nutrition & Metabolism
- Developmental Neurosciences & Child Health
- Genetics & Health
- Immunity in Health & Disease
- Innovations in Acute Care & Technology
- Reproduction & Healthy Pregnancy

The BC Mental Health & Addiction Research Institute, CFRI, the Women's Health Research Institute and the Provincial Health Services Authority are developing a new program to further research in key areas related to health and society, including health policy, health services delivery, health technology assessment and health informatics.

The Centre for Molecular Medicine and Therapeutics (CMMT)

CMMT is a synergistic group of scientists and researchers who share a strong sense of commitment to solve the many genetic questions surrounding human illness and well-being. Affiliated with UBC and CFRI, CMMT conducts discovery research and translates that research into effective clinical and therapeutic strategies to promote health.

\$20.1-million national research network to improve drug safety

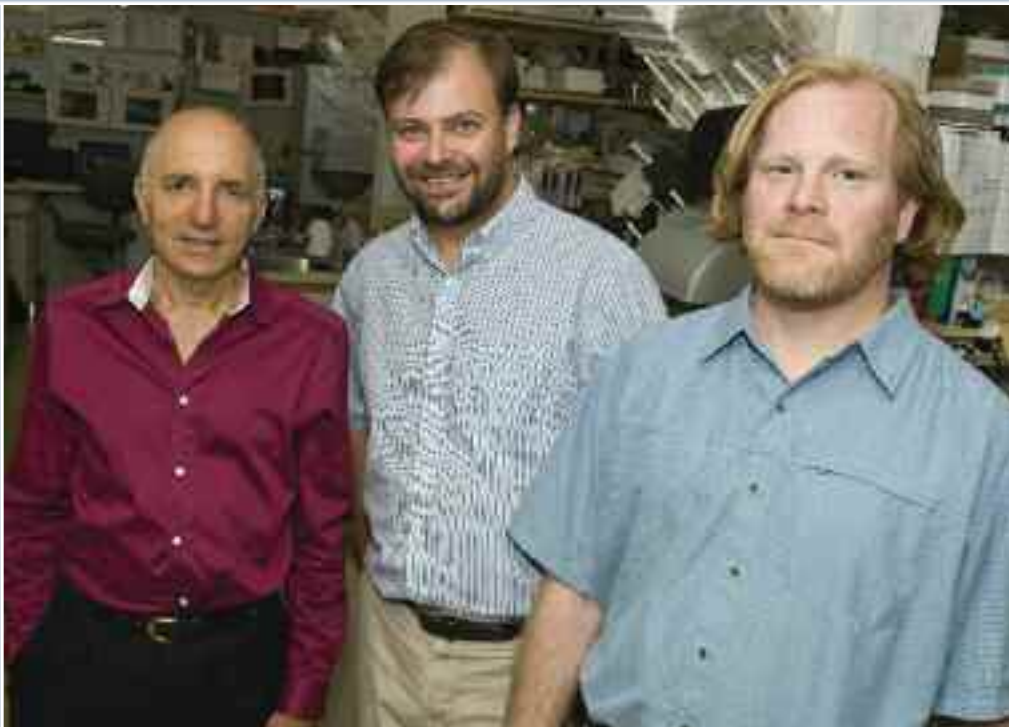
Research aims to develop genetic tests indicating which patients are vulnerable to serious adverse drug reactions

British Columbian researchers are leading a \$20.1-million national research network to reduce the risk of serious adverse drug reactions by developing genetic tests that will allow doctors to prescribe drugs based on a patient's genetic profile. Genes determine how drugs are metabolized and whether a drug accumulates in the body in toxic amounts. Researchers with the network, called the Canadian Pharmacogenomics Network for Drug Safety, are based in all the major children's hospitals across Canada. They're collecting patient DNA samples and comparing the reactions to various medications.

The network's initial priority is to find the genes behind reactions to three widely used drugs: the analgesic codeine and the lifesaving anticancer drugs cisplatin and anthracyclines. Codeine can be life-threatening to some infants when secreted as its morphine metabolite in the mother's breast milk, while cisplatin is associated with hearing loss and anthracyclines with heart failure.

"Serious adverse drug reactions are under-reported and yet are a major cause of death in North America," says Dr. Bruce Carleton of the Child & Family Research Institute (CFRI) at BC Children's Hospital, an agency of the Provincial Health Services Authority, and the network's chief operating officer. "The network is set up to help drug experts solve the drug safety problem by finding the right drug at the right dose for each child."

"The time is right for these studies because advances in genetics are allowing us to identify clinically relevant DNA markers that predict the risk of adverse events," says Dr. Michael Hayden, Director of the University



of British Columbia's (UBC's) Centre for Molecular Medicine and Therapeutics (CMMT) at CFRI and the network's chief executive officer. "In the future, this is likely to become a standard of clinical practice."

Historically, there has been little research on drug response in children, who are often at risk of toxicity because they metabolize drugs differently than adults. Network researchers are also beginning to work on adult psychiatric and cardiac medications.

The Canadian Institutes of Health Research and the Canada Foundation for Innovation through the Research Hospital Fund recently awarded a \$14-million grant to the network. An additional \$6.1 million in matching funds came from BC Children's Hospital Foundation, CFRI, CMMT, BC Mental Health & Addictions Research Institute, Pfizer Canada and the Lawson Health Research Institute in London, Ontario.

Left to right: Dr. Michael Hayden, Dr. Colin Ross and Dr. Bruce Carleton. Drs. Hayden and Carleton are co-leading the Canadian Pharmacogenomics Network for Drug Safety. Dr. Ross is a Research Associate who coordinates the network's genetic analyses.



Above, left to right: Dr. Henk Visscher and Catherine Carter. Part of a national research team, Dr. Visscher and Catherine scan and analyze DNA samples to identify the genetic mutations behind adverse drug reactions. Dr. Visscher is a UBC Postdoctoral Fellow at CMMT/CFRI. Catherine is a Research Technician at CMMT.

Below, left to right: Tina Wong and Claudette Hildebrand. Tina and Claudette coordinate the surveillance and reporting of adverse drug reactions at hospitals across Canada. Claudette is the National Coordinator for the Canadian Pharmacogenomics Network for Drug Safety and is responsible for surveillance of children. Tina is the network's Adult Coordinator.

The funding supports technology, operations and training for the next generation of drug safety experts including 10 graduate students, eight postdoctoral fellows and four junior researchers.

The network's research hub is situated in more than 750 square metres of lab space in the BC Mental Health & Addiction Research Institute co-located with CFRI.

In January 2009, Genome British Columbia announced a further \$1.3-million grant to Dr. Hayden and Dr. Carleton to accelerate the transfer of these genetic discoveries into the realm of clinical practice. The grant is matched by additional funds for a total project value of \$3.9 million.

Dr. Michael Hayden is University Killam Professor, Department of Medical Genetics at UBC. He is Director and Senior Scientist at CMMT and Scientist at CFRI. He holds a Canada Research Chair in Human Genetics and Molecular Medicine.

Dr. Bruce Carleton is Senior Clinician Scientist at CFRI, Director of the Pharmaceutical Outcomes Programme at BC Children's, Professor in the Department of Pediatrics at UBC and Associate Professor in the Department of Pharmaceutical Sciences at UBC.



Protecting the brain development of premature infants

Study shows that low blood pressure after birth is a risk factor for brain injury



Left to right: Neurologists Dr. Steven Miller and Dr. Vann Chau stand with a specially adapted incubator that's MRI compatible and allows imaging of critically ill babies.

New facility to transform research

In June 2009, CFRI and the University of British Columbia were awarded \$4.9 million from the Canada Foundation for Innovation under the New Initiative Fund for the development of a Child & Family Research Imaging Facility. An application has been made to the British Columbia Knowledge Development Fund for matching funds. The total project cost will be approximately \$12.12 million.

This new core facility is designed to address the requirements of any research study on the Oak Street campus. Expected to be built by 2011, it will house a 3-Tesla MRI scanner and an imaging analysis and neuro-informatics lab. The successful grant application builds on years of collaboration among researchers on-site, at UBC and elsewhere in Vancouver.

"The 3T MRI will give us a new window into the brain," says Dr. Steven Miller, the grant's principal investigator and CFRI Senior Clinician Scientist. "This will transform how we do research."

New parents of preterm babies can now be reassured that placental infection isn't likely to impair their baby's brain development.

A new study led by neurologists Dr. Steven Miller and Dr. Vann Chau has challenged conventional medical thinking, which led physicians to worry about the neurological outcome of premature infants who were exposed to chorioamnionitis before birth.

Instead, Drs. Miller and Chau found that preterm babies with hypotension – low blood pressure – after birth are at higher risk of injury to the brain's white matter.

"This is important because hypotension is treatable and now we know we should monitor the babies more closely after they are born," says Dr. Chau, the study's lead author. He completed the research while a postdoctoral fellow in neonatal neurology at the Child & Family Research Institute (CFRI) and BC Children's Hospital, an agency of the

Provincial Health Services Authority (PHSA), where he recently accepted a position as a neurologist.

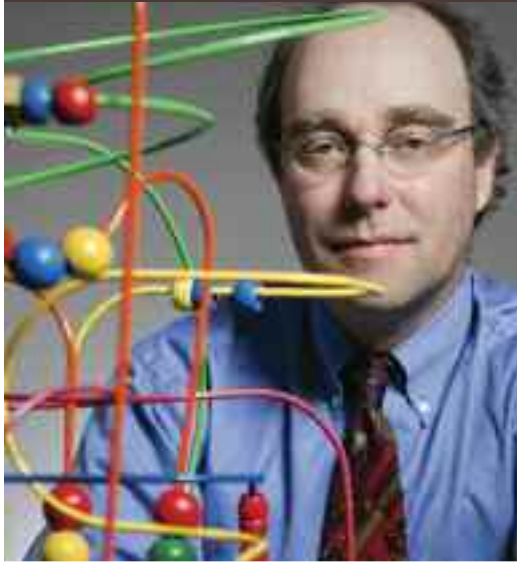
"Being exposed to chorioamnionitis in the womb does not mean that premature babies will have brain injury or abnormal brain development. But as chorioamnionitis is a risk factor for being born prematurely, it still needs to be treated," says Dr. Chau.

The finding was published in the April 2009 issue of *Annals of Neurology*, which commissioned an editorial on the study.

The research team did MRI (magnetic resonance imaging) scans of 92 premature babies, who were placed inside a special, non-magnetic incubator and wore protective earmuffs. They scanned the babies soon after birth at an average gestational age of 32 weeks and when the babies reached full-term at 40 weeks. Of the babies, over 28 per cent had white matter brain injury, without any significant difference in their exposure to chorioamnionitis. In contrast, the newborns with postnatal hypotension were more than twice as likely to have white matter injury.

The researchers will continue following the babies' neurodevelopment for three years at the Neonatal Follow-up Clinic at BC Women's Hospital & Health Centre, a PHSA agency. With Dr. Chau's recruitment, the team hopes to obtain additional research funding to follow the children until early adulthood.

In British Columbia, over five per cent of all infants were born prematurely in 2003. These children risk developmental delays caused by brain injuries: between five and 10 per cent of low birth weight children have difficulties with motor skills and 25 to 50 per cent have developmental and visual difficulties.



Mom's mood matters:

Both depression and antidepressant drugs during pregnancy affect infant brain development

CFRI Clinician Scientist Dr. Tim Oberlander studies the effect of mother's mood and antidepressant medications on her baby's brain development.
(Photo: Faculty of Medicine, UBC)

How a pregnant mother's mental health shapes her baby's brain development is not a simple story," says Dr. Tim Oberlander, Clinician Scientist at the Child & Family Research Institute (CFRI). "While under-treated depression is unsafe for both mother and baby, the antidepressant medications used to treat it may also present risks. Depression during pregnancy is a huge public health issue and there are no easy answers."

Both depression and a class of antidepressants called SSRIs (selective serotonin reuptake inhibitors) affect the brain's levels of serotonin, a brain chemical that plays a critical role in the body's stress response system. Serotonin helps nerve cells communicate and is involved in many functions such as regulating sleep, appetite, pain and thinking. Changes in brain serotonin have been linked to short attention spans, memory and learning difficulties, autism, depression and suicide.

Dr. Oberlander and colleagues found that babies exposed to SSRIs during pregnancy were less responsive to stress. As newborns and at two months of age, they had a lower heart rate and less facial action after a typical painful event – a small incision on the heel to collect blood for routine metabolic disease screening.

In a separate study published in *Early Human Development* in 2008, Dr. Oberlander's team

reported that three-month-old babies who'd been exposed to SSRIs during pregnancy had lower nighttime levels of the stress hormone cortisol.

"With the cortisol findings, we began to wonder if there was something linking the mothers' depression with the way their babies responded to stress," says Dr. Oberlander. "So we turned our attention to looking at how mother's depression might control the way the baby's genes are expressed and how that affects stress responses."

To do this, his team looked at whether a mother's depression changes the molecules that coat a very specific region of a gene called *NR3C1* that controls stress response. The presence of these molecules affects the gene's activation.

Dr. Oberlander's team did genetic analysis on cord blood samples from newborns. They found that mothers who'd had prenatal depression had infants with more molecules coating a specific control region of the *NR3C1* gene. Regardless of whether SSRIs were used during pregnancy, babies of depressed mothers were less able to regulate their response to stress at three months of age.

These findings, Dr. Oberlander says, suggest that mother's mood affects her infant in ways that go beyond inherited genes or exposure to

medication during pregnancy. The journal *Epigenetics* published these results in 2008.

"If you change serotonin levels during fetal development – whether because of mother's mood or her antidepressant treatment – this might influence a child's behaviour later on," says Dr. Oberlander.

For a 2006 paper published in *Archives of General Psychiatry*, Dr. Oberlander's team reviewed prescriptions and health records for mothers of approximately 120,000 infants born in British Columbia over a 39-month period from 1998-2001. They found that 15 per cent of mothers were diagnosed with depression during their pregnancy in 2001 and five per cent of all infants were exposed to SSRIs during pregnancy.

"I'm hopeful our research about early brain development can help families understand critical issues that influence a child's happiness and success later in school," says Dr. Oberlander.

Dr. Oberlander is a Developmental Pediatrician and Attending Physician with the Complex Pain Service at BC Children's Hospital and Sunny Hill Health Centre for Children, and BC Women's Hospital & Health Centre, agencies of the Provincial Health Services Authority. He is a Professor of Pediatrics at the University of British Columbia.

First Nations youth in three remote B.C. communities at higher risk of Type 2 diabetes and cardiovascular disease

Childhood overweight and obesity almost double the national rate

After learning that First Nations children with diabetes are likely to go undiagnosed because they often don't show telltale symptoms, the community of Hartley Bay decided to test each child for the disease.

"All of our kids have at least two risk factors," says David Benton, former Health Director of the Hartley Bay Nursing Station. "They are First Nations, and every child in Hartley Bay has a relative with Type 1 or Type 2 diabetes."

The hallmark symptoms of Type 2 diabetes in children are increased urination, thirst and tiredness; nausea; blurred vision; frequent infections and slow-healing wounds; and weight loss.

The community invited Dr. Dina Panagiotopoulos of BC Children's Hospital, an agency of the Provincial Health Services Authority, and the Child & Family Research Institute (CFRI) to set up a diabetes screening program.

Dr. Panagiotopoulos assembled a small medical team who used a float plane to bring medical supplies to the community and return frozen blood samples to the lab for analysis.

Her team screened 192 youth between ages six and 18, which comprised 85 per cent of the Tsimshian Cultural Group youth in the First Nations communities of Hartley Bay (Gitga'at), Kitkatla (Gitxaala) and Port Simpson (Lax Kw'alaams) on the Pacific coast of British Columbia, all located within 160 km of Prince Rupert.

The screening revealed that over 19 per cent of the youth had impaired glucose tolerance, a precursor for Type 2 diabetes. There was nearly double the national rates for childhood overweight and obesity, as 19 per cent of the youth were overweight, 26 per cent were obese and 36 per cent had central adiposity.



The medical team screened 192 youth for Type 2 diabetes in the First Nations communities of Hartley Bay (Gitga'at), Kitkatla (Gitxaala) and Port Simpson (Lax Kw'alaams). *Shown above: Kitkatla.*

Historically, Type 2 diabetes was an adult disease but today it is increasing in children alongside the rising rates of childhood overweight and obesity, which are known risk factors for the disease.

"I was shocked but gratified we had done the testing," says David. "It revealed we had kids who were at risk for developing diabetes. These kids have to be monitored, because tomorrow they could be diabetic and could suffer serious consequences if left untreated."

Children identified by the screening as having active health issues received appropriate treatment and follow-up and continue to be monitored.

The screening also showed that over eight per cent of the youth had components of metabolic syndrome, which includes a combination of high blood sugar, high blood pressure and cholesterol problems such as high triglycerides or low HDL cholesterol.

This group of symptoms precedes the development of Type 2 diabetes and cardiovascular disease.

“It’s frightening to see the risk factors in these young kids,” says Dr. Panagiotopoulos. “Hardening and thickening of the arteries can begin in childhood, and these changes don’t go away as the kids grow up. In fact, these are the beginning stages of cardiovascular disease and will get worse over time if changes aren’t made. With Type 2 diabetes, they’re in danger of complications such as blindness, nerve damage and amputations by their early 20s.”

“It was a bit of a shocker when they presented the results to the community,” says Ernie Hill, Principal of the Hartley Bay Elementary Junior Secondary School.

Both Ernie and David point to the community’s rapid change in diet over the last 100 years – from the traditional high-protein, high-fat, fish-based diet towards today’s fast foods and carbohydrates – accompanied by a decrease in physical activity.

“The whole community has gotten behind the need to increase activity of our kids both in and out of school and to improve their nutrition,” says David. “The school was the kingpin of helping the kids onto a healthier lifestyle.”



The medical team included (left to right): Agnieszka Klimek, UBC PhD candidate at CFRI; Dr. Dina Panagiotopoulos, CFRI Clinician Scientist; Fran Power, RN; Faith Gagnon, Research Associate; Dr. Gita Wahi, Pediatric Resident at UBC and BC Children’s Hospital.

The school implemented the Action Schools! BC program to promote physical activity, and is now working with Dr. Panagiotopoulos’ team to set up the Healthy Buddies program, which promotes physical activity, nutrition and mental health. The school established a “no junk food” policy and is one of 11 schools in Canada to pilot the breakfast program.

“In the school, we show how to harvest, prepare and cook our traditional food from the sea,” says Ernie. “We’re concerned with

ensuring the availability of our traditional food sources and protecting the environment on which it depends.”

The screening results are published in the spring 2009 issue of the Canadian Medical Association’s *Canadian Journal of Rural Medicine*. It is the first data on obesity, abnormal metabolism and metabolic syndrome among First Nations children in British Columbia.

The team also published an article in the July/August 2008 issue of *Air Medical Journal* about the logistics of transporting medical equipment to the remote communities that are home to 1,000 to 1,400 people, and accessible only by boat or float plane.

Dr. Panagiotopoulos is Clinician Scientist at CFRI, Pediatric Endocrinologist at BC Children’s Hospital and Assistant Professor in the Department of Pediatrics at the University of British Columbia. In April 2009, she received the Regional Outstanding Health Professional Award from the Canadian Diabetes Association.

The medical team used a float plane to bring medical supplies to the community and return frozen blood samples to the lab for analysis.



Smarter technology for safer operating rooms

New intelligent monitoring technology supports clinician decision-making

In the operating room, anesthetists are surrounded by competing noises, alarms, signals and displays. They must carefully watch the patient and monitor a number of sensors measuring vital signs such as blood pressure, heartbeat and the brain's electrical activity.

"Anesthesia today is very safe," says Dr. Mark Ansermino, Associate Clinician Scientist with the Child & Family Research Institute (CFRI) and Director of Research for Pediatric Anesthesia at BC Children's Hospital, an agency of the Provincial Health Services Authority. "But that doesn't mean we can't make it safer. We need intelligent monitoring technology that can improve the way anesthetists work."

Dr. Ansermino and his colleagues are currently developing software and technology that will inform the development of intelligent

monitoring. This system analyzes, interprets and communicates data from the sensors attached to the patient in a way that helps clinicians make informed decisions.

One example is a project titled *eVENT: an expert system for detecting ventilatory events during anesthesia*. eVENT is advanced software that will interpret sensor data and integrate existing alarms to improve recognition of dangerous anesthesia-related complications such as leaks in the equipment that administers anesthesia, changes in the lung due to surgery or the effect of surgery and unintentional anesthesia overdose. Researchers have created the first eVENT prototype and are recruiting clinicians to test the system on electronic dummies that simulate human vital signs. Expected to be completed in 2012, this project is a collaboration with Dr. Guy Dumont, a Professor of Electrical and Computer

Engineering at the University of British Columbia (UBC). The project is funded by a Canadian Institutes of Health Research Operating Grant.

The research team has also published a study in *Anesthesia and Analgesia* that explored the use of a vibrotactile display in the operating room. The study found that, in simulator testing, clinicians wearing the vibrating belt responded faster to the early signs of a life-threatening allergic reaction. The belts vibrate to signal important changes in a patient's vital signs.

According to Dr. Ansermino, the development of intelligent monitoring has the potential to improve safety beyond the operating room. It could improve monitoring in the intensive care unit, contribute to the development of patient-monitoring systems for use at home and provide developing countries with technology that will make anesthesia safer.

Dr. Ansermino is Assistant Professor in the Department of Anesthesia at UBC.

CFRI Associate Clinician Scientist Dr. Mark Ansermino and colleagues created a vibrating belt that notifies anesthetists of continuous or sudden changes in a patient's vital signs, such as decreasing blood pressure or slowed breathing. A research study showed that clinicians wearing the belts responded faster to early signs of a life-threatening allergic reaction.



Research identifies cancer cell protein as possible new drug target

Potential biomarker that could guide treatment of aggressive tumours

Cancer patients with high levels of a protein called YB-1 may need more aggressive treatment to increase their chance of survival and prevent relapse, shows laboratory work by Dr. Sandra Dunn that was published in the journal *Cancer Research*. This finding has broad implications as YB-1 is a key protein found in leukemia, brain tumours, and bone, breast, prostate and colon cancers.

“We’re uncovering how the YB-1 protein promotes the growth of tumour cells,” says Dr. Dunn, Scientist with the Child & Family Research Institute (CFRI) and Associate Professor of Pediatrics at the University of British Columbia (UBC). “Ultimately, our goal is to prevent the recurrence of cancer by using new drug molecules to inhibit YB-1.”

This past year, Dr. Dunn published another paper in *Cancer Research* suggesting that the YB-1 protein is a more powerful predictor of poor patient survival and increased rates of cancer relapse than the biomarkers that doctors presently use to guide treatment of breast cancer. Her team is investigating whether YB-1 could be used clinically as a biomarker to diagnose the more aggressive subtypes of leukemia, brain and breast cancers and indicate which patients could benefit from more intensive treatment.

“It could help select patients who need more care from those who could be spared the effects of radiation and chemotherapy,” says Dr. Dunn.

In another study, Dr. Dunn’s team tested YB-1 as a potential drug target. Looking at breast cancer cells in the lab and at tumours in mice, they injected genetic material called RNA that turned off the YB-1 gene and prevented development of the YB-1 protein. They found that turning off YB-1 prevented some breast cancer cells from growing



In May 2008, Premier Gordon Campbell announced \$2 million in one-time funding to the Michael Cuccione Foundation to support research into new treatments for childhood cancer. The announcement took place at CFRI and included a tour of Dr. Sandra Dunn’s laboratory. The Michael Cuccione Foundation supports research at CFRI through BC Children’s Hospital Foundation.

into tumours and might have encouraged these cells to die off. The journal *Cancer Research* published the results as a Priority Report.

Dr. Dunn’s laboratory demonstrated the same result with cells from childhood and adult brain tumours. They found that turning off the YB-1 gene made cancer cells more sensitive to

chemotherapy. This finding is an important step in understanding how genes influence the effectiveness of chemotherapy and the recurrence of cancer.

“This is particularly important in brain tumours where the cure rates are still very, very low,” says Dr. Dunn.

Protein plays a key role in cancer relapse

Dr. Poul Sorensen reported in the journal *Cancer Cell* that while the YB-1 protein slows or stops the growth of cancer cells at the primary tumour site, it can simultaneously enable these cells to invade a new site and potentially cause a recurrence of the cancer when the cells become reactivated. This may occur five to 10 years after the patient’s initial diagnosis and treatment. The finding explains why conventional cancer treatments might not work well in the presence of over-expressed YB-1.

Four years ago, Dr. Sorensen relocated from CFRI to BC Cancer Agency (BCCA), an agency of the Provincial Health Services Authority, to build stronger links between childhood and adult cancer research.

Dr. Sorensen is the Johal Chair for CFRI’s Childhood Cancer Research Program, Senior Scientist at BCCA and Professor in the Departments of Pathology and Pediatrics at UBC.

Exploring the potential of rare diseases to yield common insight

Dr. Cornelius Boerkoel's research doesn't start with a question: It starts with a person.



CFRI Senior Clinician Scientist Dr. Cornelius Boerkoel investigates the genetics behind rare diseases. He is an international expert on Schimke immuno-osseous dysplasia, a rare and fatal form of dwarfism.

may also influence brain development and function.

As the complications of SIOD are similar to conditions seen in the general population, such as stroke, kidney failure and immunodeficiency, his research is relevant to a better understanding of the genetic pathways that underlie these common health problems.

Another example of rare disease research with broader application is a Genome BC-funded study that builds on Dr. Boerkoel's previous research linking spinocerebellar ataxia with neuropathy (also called SCAN1) – a rare disorder that leads to muscle weakness and difficulties with coordination and speech – with an enzyme known to play a role in making cells resistant to a common chemotherapy drug. This research is an early-stage examination of the potential use of drugs that inhibit this enzyme as a treatment for some pediatric and adult cancers and is conducted in collaboration with researchers at BC Cancer Agency, an agency of PHSA, and the Childhood Cancer research program at BC Children's and CFRI.

Dr. Boerkoel is Associate Professor, Department of Medical Genetics, University of British Columbia. His research is supported in part by the newly established Rare Disease Foundation. The Rare Disease Foundation works in partnership with BC Children's Hospital Foundation to support research at BC Children's and BC Women's.

Dr. Cornelius Boerkoel sees the province's pediatric medical mysteries – children with rare or unknown medical conditions. A disease is considered rare if it affects fewer than one in 2,000 people. Most rare diseases are even rarer; they affect only a handful of people worldwide and are unnamed and poorly understood.

“My research goes from the patient to the lab to the patient,” says Dr. Boerkoel, a medical geneticist at BC Children's Hospital and BC Women's Hospital & Health Centre, agencies of the Provincial Health Services Authority (PHSA), and Senior Clinician Scientist at the Child & Family Research Institute (CFRI). “I research the genetic causes of these rare diseases to help the patient in front of me.”

His research, Dr. Boerkoel explains, also has the potential for wider impact.

“Rare disease research can reveal previously unknown biologic pathways or help us understand a known pathway and, in doing so, help us gain insight into the mechanism of human health,” says Dr. Boerkoel.

One example of this is Dr. Boerkoel's research into Schimke immuno-osseous dysplasia (SIOD). Children with this rare and fatal form of dwarfism are extremely small and often described as doll-like. They have kidney problems, weak immune systems, abnormal bone growth and thickening of the arteries.

His early research identified the cause of SIOD, mutations in both copies of a specific gene named *SMARCAL1*, and showed that SIOD is characterized by abnormal activity across most genes. In a recent publication in the *Journal of Neuropathology and Experimental Neurology*, Dr. Boerkoel and his colleagues found that *SMARCAL1* deficiency, known to influence circulation in the brain,

Moving beyond the autism diagnosis

Understanding the genetic causes of autism may lead to individualized care



Dr. Suzanne Lewis, CFRI Senior Clinician Scientist, is co-director of a \$4.27-million project to explore the genetic causes of autism spectrum disorders.

New screening guidelines for genetic blood disorders

The best time to find out if your baby is at risk of a life-threatening blood disorder is before conception, say new national recommendations in the *Journal of Obstetrics and Gynaecology Canada*.

“Early screening gives couples at risk options for prenatal or early postnatal diagnosis,” says Dr. Sylvie Langlois, a principal author of the guidelines; Clinical Investigator, Child & Family Research Institute; Director of the BC Prenatal Genetic Screening Program; a medical geneticist, BC Children’s Hospital and BC Women’s Hospital & Health Centre, agencies of the Provincial Health Services Authority. “With early diagnosis, we don’t have to wait until an infant becomes profoundly sick to begin treatment.”

There are 3.7 million Canadians with an ethnic background known to be associated with increased risk for the blood disorders thalassemia or hemoglobinopathies, which result from a deficiency in the amount and quality of hemoglobin (oxygen-carrying molecules in red blood cells). These disorders range from mild to severe and can cause organ damage or circulatory problems. In some cases, they can cause death before birth or in the first few years of life if left untreated.

The guidelines recommend screening for people of African, Asian (except Japanese and Korean), Caribbean, Mediterranean, Middle Eastern and South American descent.

Dr. Langlois is Professor, Department of Medical Genetics, University of British Columbia.

Every child with autism is unique,” says Dr. Suzanne Lewis, Senior Clinician Scientist at the Child & Family Research Institute (CFRI) a medical geneticist at BC Children’s Hospital and BC Women’s Hospital & Health Centre, agencies of the Provincial Health Services Authority.

Characterized by impairments in communication, behaviour and social interactions, autism spectrum disorders (ASDs) have a range of symptoms and genetic influences.

Dr. Lewis uses assessments of physical, biochemical and neuropsychological traits to understand gene structure, regulation, expression and function in ASDs.

“We use genetic investigation to explore unique characteristics of a child’s autism and predict long-term medical complications or developmental issues that affect health,” says Dr. Lewis.

Dr. Lewis is a member of the national Autism Spectrum Interdisciplinary Research (ASPIRE)

team, which received a \$1.7-million grant from the Canada Foundation for Innovation, to be matched by additional funds for a \$4.27-million total project cost.

Awarded to Queen’s University, in partnership with the University of British Columbia (UBC) and CFRI, the grant will fund sophisticated equipment for studying the genetic causes of autism. Dr. Lewis is the British Columbia lead and Co-Director of ASPIREdb, which will allow researchers to integrate research findings with public databases and predict the best candidate genes for study.

In related work, Dr. Dan Goldowitz (Canada Research Chair and Scientist with the Centre for Molecular Medicine and Therapeutics at CFRI) was selected to submit NeuroDevNet NCE, a Canadian research network focusing on brain development that includes a major autism project, to the 2009 Networks of Centres of Excellence competition.

Dr. Lewis is Clinical Professor, Department of Medical Genetics, UBC.

Uncovering the causes of disease at the molecular level

Dr. Elizabeth Conibear sums up her research in two words: protein movement

This simple description belies the complexity of her research. A Scientist with the Centre for Molecular Medicine and Therapeutics (CMMT) at the Child & Family Research Institute (CFRI), Dr. Conibear combines the study of yeast with tailored genomics and bioinformatics to provide insight into the causes of disease.

Known for making bread rise, yeast is a useful model for health research. In yeast and human cells, the basic mechanics of replication, recombination, cell division and metabolism are very similar.

In a recent study published in the *Journal of Cell Biology*, Dr. Conibear and her colleagues examined endocytosis – how proteins and molecules enter through the cell membrane.

Dr. Conibear describes proteins as “little machines” that work together to do something specific and use a complex transportation system to move within cells. A breakdown of one or more of those “little machines” can cause disease.

Using genome-wide analysis, the researchers described the proteins responsible for endocytosis in yeast cells. In doing so, they identified several genes that were not previously known to contribute to the process, and whose human counterparts are not well understood.

“This research has given us a deeper understanding of endocytosis and suggests that continued analysis will provide further insight into the specific roles that proteins play in health and disease,” says Dr. Conibear.

Dr. Conibear’s lab is currently researching the molecular cause of diseases like cystic fibro-



Dr. Elizabeth Conibear, Scientist with CMMT at CFRI, uses sophisticated robotics to conduct quick and thorough studies to identify all of the proteins within a cell. This advanced genomic research provides insight into the causes of disease at the molecular level.

sis, where cells fail to transport proteins to the cell surface because the proteins are not folded properly. She is also collaborating with Dr. Michael Hayden, CMMT’s Director, to investigate the function of the gene known to cause Huntington’s disease.

Dr. Conibear says she hopes her research will further understanding and help advance the development of drugs that treat disease by regulating the movement of proteins.

“In this day and age, you need a target to make an effective drug,” says Dr. Conibear. “Our research could identify those targets and contribute to the development of

transformative treatments.”

Since her lab was established in 2004, Dr. Conibear and her team have received salary and trainee awards from the Michael Smith Foundation for Health Research, in addition to grants and awards from the Canada Foundation for Innovation, the British Columbia Knowledge Development Fund, the Canadian Institutes of Health Research and the Natural Sciences and Engineering Research Council of Canada.

Dr. Conibear is Associate Professor, Department of Medical Genetics, University of British Columbia.

Identifying the genetic influences in bipolar disorder

Pinpointing genetic variants creates potential for developing new treatments

Scientists studying a specific brain gene have found genetic variations linked to bipolar disorder, a mental illness marked by severe mood swings that affects one per cent of Canadians during their lifetime.

“Mental illness is complex and it involves environment and genetics,” says Dr. Elizabeth M. Simpson, who led the research. “In my laboratory, we are striving to reveal the unknown genetic causes and create opportunities for developing new treatments.”

Dr. Simpson and colleagues analyzed DNA samples from 394 patients with bipolar disorder, 396 patients with schizophrenia and 479 healthy individuals. In addition, they did detailed studies on the genes of 126 people with bipolar disorder, schizophrenia or aggressive behaviours and 325 healthy controls. They found that people with a subtle variant form of a gene called nuclear receptor 2E1 (*NR2E1*) were 1.3 per cent more likely to be diagnosed with bipolar disorder. The results are published in the *American Journal of Medical Genetics*.



Dr. Elizabeth M. Simpson is a Senior Scientist with CMMT at CFRI. She leads the Pleiades Promoter Project, a \$10.2-million, four-year Genome Canada project to advance research and gene-driven therapies for brain and eye disorders. Dr. Simpson also partners with the School of Journalism at UBC to develop new ways to better communicate science to the public.

“Mental illness is complex and it involves environment and genetics,” says Dr. Elizabeth M. Simpson.

This research builds on Dr. Simpson’s earlier work with “fierce mice,” which lack the entire mouse form of the *NR2E1* gene. The animals are violent, attacking and sometimes killing each other and often abandoning their pups.

The mice also have abnormalities in the cortical and limbic areas of the brain, which in humans govern memory, attention, perceptual awareness, thought, language, consciousness, emotion and behaviour. Dr. Simpson found that inserting the human *NR2E1* gene into “fierce” embryonic mice corrected the aggression, produced docile mice and promoted normal brain development.

Dr. Simpson is Senior Scientist with the Centre for Molecular Medicine and Therapeutics (CMMT) at the Child & Family Research Institute (CFRI), Canada Research Chair in Genetics & Behaviour and Professor of Medical Genetics at the University of British Columbia (UBC).

New Recruits

In 2008/09 the Child & Family Research Institute (CFRI) was delighted to welcome the following new recruits:



Dr. Shazhan Amed, Associate Clinician Scientist, Diabetes, Nutrition & Metabolism, and Innovations in Acute Care & Technology

Dr. Amed studies the epidemiology of Type 2 diabetes and the prevention of childhood obesity. She also conducts health services research into innovative ways to provide health care to children with diabetes and other chronic diseases. She is Clinical Assistant Professor in the Department of Pediatrics at the University of British Columbia.



Dr. Brad Hoffman, Scientist Level 1, Diabetes, Nutrition & Metabolism

Dr. Hoffman's research explores the genetic and epigenetic mechanisms controlling beta cell development and function (beta cells are the insulin-secreting cells in the pancreas). He is Assistant Professor in the Department of Surgery at the University of British Columbia.



Dr. Pascal Lavoie, Clinician Scientist, Immunity in Health & Disease

Dr. Lavoie studies the immune system of newborns. His research focuses on fundamental aspects of neonatal immunity and mechanisms of inflammatory-related complication, including the development of chronic lung disease common in premature infants. Dr. Lavoie is a neonatologist at BC Women's Hospital & Health Centre, an agency of the Provincial Health Services Authority, and Assistant Professor in the Department of Pediatrics at the University of British Columbia.

To learn more about the research of CFRI's new recruits or any of our 200 investigators, please visit www.cfri.ca and click "Find a Researcher."



Dr. C. James Lim, Scientist Level 1, Childhood Cancer, and Immunity in Health & Disease

Dr. Lim's research focuses on understanding differences in cell adhesion signaling – communications that govern cell activity – between healthy and diseased cells in order to explore and evaluate novel targets for therapeutic intervention in blood diseases. He is Assistant Professor in the Department of Pediatrics at the University of British Columbia.



Dr. Francis Lynn, Scientist Level 1, Diabetes, Nutrition & Metabolism

Dr. Lynn's research aims to improve understanding of the genetic mechanisms and pathways that regulate the formation of pancreatic insulin-secreting beta cells during solid organ formation. He is Assistant Professor in the Departments of Surgery, and Cellular and Physiological Sciences at the University of British Columbia.



Dr. Stefan Taubert, Scientist, Centre for Molecular Medicine and Therapeutics

Dr. Taubert's research examines how molecules, cells and tissues operate to regulate dietary metabolism. His lab aims to identify novel genes and pathways that contribute to metabolic diseases such as diabetes and obesity. He is Assistant Professor in the Department of Medical Genetics at the University of British Columbia and Scientist Level 1 at the Child & Family Research Institute.

Major awards held by principal investigators at the Child & Family Research Institute



INFRASTRUCTURE AWARDS

Research Hospital Fund: Clinical Research Initiatives from the Canada Foundation for Innovation and the Canadian Institutes of Health Research:

Dr. Bruce Carleton and Dr. Michael Hayden, Genotype-Specific Approaches to Therapy in Children: Canadian Pharmacogenomics Network for Drug Safety

New Initiatives Fund of the Canada Foundation for Innovation and BC Knowledge Development Fund:

Dr. Steven Miller, Child & Family Research Imaging Facility

Dr. David Speert, Centre for Understanding and Preventing Infection in Children

Dr. Bruce Verchere, Centre for Research on Childhood Diabetes

National Platforms Fund of the Canada Foundation for Innovation and BC Knowledge Development Fund:

Dr. Jan Friedman, Canadian Molecular Cytogenetics Platform

Recent Awards from the Leaders Opportunity Fund of the Canada Foundation for Innovation and the BC Knowledge Development Fund:

Dr. Thomas Boyce, Social Disparities in Neurological and Epigenetic Vulnerability among British Columbia Children

Left to right: Dr. Jan Friedman, Dr. Louise Mâsse, Dr. Urs Ribary, Dr. Jan Dutz, Dr. Laura Sly, Dr. Wyeth Wasserman and Dr. Bill Gibson.



To learn more about the research of CFRI's 200 investigators, please visit www.cfri.ca and click on "Find a Researcher."

Dr. William Gibson, Laboratory for Obesity Genetics and Indirect Calorimetry

Dr. Michael Kobor, Chromatin Biology Laboratory

Dr. Tobias Kollmann, VIVArc: Vancouver Immunity and Vaccine Analysis Research Centre

Dr. Louise Mâsse, Childhood Obesity – Prevention Unit – Population Health and Policy Research

Recent Canada Research Chairs Infrastructure Awards of the Canada Foundation for Innovation and the BC Knowledge Development Fund:

Dr. Daniel Goldowitz, Neurodevelopmental Imaging Facility

Dr. Stefan Taubert, Laboratory for Transcriptional Regulatory Networks

EXTERNAL SALARY AWARDS

National Research Chairs:

Dr. Ronald Barr, Canada Research Chair in Community Child Health Research

Dr. Adele Diamond, Canada Research Chair in Developmental Cognitive Neuroscience

Dr. Daniel Goldowitz, Canada Research Chair in Developmental Neurogenetics

Dr. Geoffrey Hammond, Canada Research Chair in Reproductive Health

Dr. Michael Hayden, Canada Research Chair in Human Genetics and Molecular Medicine

Dr. Elizabeth Saewyc, Canadian Institutes of Health Research/Public Health Agency of Canada Chair in Applied Public Health Research

Dr. David Scheifele, Canadian Institutes of Health Research/Wyeth Chair in Clinical Vaccine Research

Dr. Elizabeth Simpson, Canada Research Chair in Genetics and Behaviour

Dr. Stefan Taubert, Canada Research Chair in Transcriptional Regulatory Networks

Dr. Glen Tibbits, Canada Research Chair in Molecular Cardiac Physiology (Simon Fraser University)

Dr. Bruce Vallance, Canada Research Chair in Pediatric Gastroenterology

B.C. Leadership Research Chairs of the

B.C. Leading Edge Endowment Fund:

Dr. Thomas Boyce, Sunny Hill Health Centre B.C. Leadership Chair in Early Childhood Development

Dr. Urs Ribary, B.C. Leadership Chair in Cognitive Neuroscience (Simon Fraser University)

Michael Smith Foundation for Health Research

Dr. J. Mark Ansermino, Scholar – Clinical

Dr. Cornelius Boerkoel, Scholar – Biomedical

Dr. Mariana Brussoni, Scholar – Health Services

Dr. Elizabeth Conibear, Scholar – Biomedical

Dr. Jan Dutz, Senior Scholar – Clinical

Dr. Michael Kobor, Scholar – Biomedical

Dr. Blair Leavitt, Scholar – Biomedical

Dr. Suzanne Lewis, Scholar – Clinical

Dr. Louise Mâsse, Senior Scholar – Population Health

Dr. Steven Miller, Scholar – Clinical

Dr. Evica Rajcan-Separovic, Scholar – Clinical

Dr. Elizabeth Saewyc, Scholar – Population Health

Dr. Rusung Tan, Senior Scholar – Clinical

Dr. Peter van den Elzen, Scholar – Biomedical

Dr. Bruce Verchere, Senior Scholar – Biomedical

Dr. Peter von Dadelszen, Senior Scholar – Clinical

Dr. Fay Warnock, Scholar – Population Health

Dr. Wyeth Wasserman, Scholar – Biomedical

Canadian Institutes of Health Research

Dr. Elizabeth Conibear, New Investigator

Dr. William Gibson, Clinician Scientist

Dr. Liisa Holsti, Canadian Child Health Clinician Scientist Program

Dr. Tobias Kollmann, Canadian Child Health Clinician Scientist Program

Dr. Blair Leavitt, Clinician Scientist

Dr. Ying MacNab, New Investigator

Dr. Steven Miller, Clinician Scientist

Dr. Stuart Turvey, Canadian Child Health Clinician Scientist Program

Dr. Wyeth Wasserman, New Investigator

Dr. Cheryl Wellington, New Investigator

Canadian Association of Gastroenterology/ Crohn's and Colitis Foundation of Canada/ Canadian Institutes of Health Research (Rx&D)

Dr. Laura Sly, New Investigator Award

Canadian Diabetes Association

Dr. Constadina Panagiotopoulos, Clinician Scientist Award

Heart and Stroke Foundation of Canada

Dr. Angela Devlin, Heart and Stroke Foundation of Canada, New Investigator and recipient, McDonald Scholarship Award

Multiple Sclerosis Society of Canada

Dr. Peter van den Elzen, Career Development Award

HIGHLIGHTS OF RECENT HONOURS

Dr. Ronald Barr was elected to the Fellowship of the Canadian Academy of Health Sciences.

Dr. Barr is a Scientist at the Child & Family Research Institute (CFRI) where he co-leads the Developmental Neurosciences & Child Health research cluster. He is a Professor in the Department of Pediatrics at the University of British Columbia (UBC) and a Fellow of Experienced-based Brain and Biological Development Program, Canadian Institute of Advanced Research.

The Canadian Institutes of Health Research named **Dr. Michael Hayden** as Canada's Health Researcher of the Year 2008 in the

field of biomedical and clinical research.

Dr. Hayden is a University Killam Professor in the Department of Medical Genetics at UBC and Director of the Centre for Molecular Medicine and Therapeutics at CFRI.

The University of Alberta awarded **Dr. Hayden** an honorary Doctor of Science Degree.

The Canadian Child & Youth Health Coalition designated CFRI as the new host institution for the *Maternal, Infant, Child and Youth Research Network (MICYRN)*. **Dr. Anne Junker**, CFRI's Director of Clinical and Population Health Studies, is the new Director of MICYRN.

Dr. Aubrey Tingle, Past President of the Michael Smith Foundation for Health Research and founding Executive Director of CFRI, is the new Associate Director of MICYRN.

UBC appointed **Dr. Peter Leung** as the Associate Dean, Graduate and Postdoctoral Education, Faculty of Medicine. Dr. Leung is Scientist at CFRI and Professor, Department of Obstetrics & Gynecology at UBC.

Dr. Kishore Mulpuri received the 2008 Angela S.M. Kuo Memorial Award from the Pediatric Orthopedic Society of North America.

Dr. Mulpuri is Associate Clinician Scientist at CFRI, Orthopedic Surgeon at BC Children's Hospital, an agency of the Provincial Health Services Authority, and Clinical Instructor in the Department of Orthopedics at UBC.

Dr. Ross Petty was named to the Order of Canada. Dr. Petty is Professor Emeritus in the Division of Rheumatology at UBC, former head of Rheumatology at BC Children's and a founding researcher on the Oak Street campus. He has improved the lives of countless children with rheumatic disease through his service to patients and his commitment to furthering academic development and research.

Board Chair Comment



Mr. Maurice Mourton, Chair, CFRI Board of Directors

As my term concludes and I reflect upon my six-year tenure as Board Chair of the Child & Family Research Institute (CFRI), I am privileged to have witnessed the impressive growth of CFRI under the leadership of Dr. Stuart MacLeod, Dr. Geoffrey Hammond and Dr. Anne Junker.

Since its founding in 1995, CFRI has rapidly expanded to become the largest institute of its kind in Western Canada. From 2003/04 to 2008/09, CFRI's external funding increased from \$29.9 million to \$41.5 million.

CFRI's growth has directly resulted from the success of our investigators in major funding competitions. On their merit, our investigators have attracted federal funds and international awards into British Columbia.

The expertise of CFRI's in-house Research and Technology Development Office has been pivotal to this success. The office opened in 2003/04 supported by a grant from the Michael Smith Foundation for Health Research. Dr. Dawn McArthur, Joel Livingston and colleagues facilitate strategic research planning, research design, and grants crafting. With their contributions, CFRI's overall success rate in funding competitions

of the Canadian Institutes of Health Research (CIHR) and other similar funding agencies is close to 50 per cent – double CIHR's national average. CFRI has received major federal and provincial infrastructure grants for projects such as the Centre for Understanding and Preventing Infection in Children, the Canadian Pharmacogenomics Network for Drug Safety (CPNDS), and the Child & Family Research Imaging Facility, as well as major research chairs, salary awards and other grants.

BC Children's Hospital and BC Women's Hospital & Health Centre recognized Dr. McArthur last year with an "Excellence in Education Award" noting that she "has been instrumental in steering the path of future research. Clinical and basic science researchers, graduate students and postdoctoral fellows have all benefited."

This past year, Dr. Michael Hayden, head of the Centre for Molecular Medicine and Therapeutics (CMMT), received the 2008 CIHR Health Researcher of the Year Award, and the Order of British Columbia in September 2009, which speaks well for the excellence of CFRI and CMMT.

With our growth, it wasn't long before CFRI was bursting at the seams. Success needed space: for new infrastructure, equipment, technology and the world-class scientists being recruited to British Columbia to join CFRI.

Following years of planning and construction, we were delighted to formally open the new Translational Research Building in fall 2008. BC Mental Health & Addiction Research Institute has joined CFRI investigators on the building's third floor in facilities that include new lab space for CPNDS.

The new building also houses CFRI's major supporter, BC Children's Hospital Foundation. The Foundation's support has been – and

continues to be – fundamental to the success of CFRI. Activities such as the annual Miracle Weekend, hosted by Global BC, continue to sustain CFRI's viability. Without the Foundation and its community of donors, volunteers, and staff, CFRI would be a much smaller enterprise.

In 2009/10, CFRI is facing significant leadership changes in both the executive, with Dr. MacLeod's retirement, and the Board, with the completion of my term at the 2009 Annual General Meeting. I would like to especially thank Dr. MacLeod for his outstanding contribution to research in not only CFRI but also British Columbia as a whole.

CFRI is a relatively young organization and in a short time, it has made notable contributions to British Columbia. I've been privileged to be involved with the history of BC Children's Hospital for over 25 years in various roles – as Foundation Vice-Chair, Hospital Chair, CFRI Board Chair, and now as a Governor of BC Children's Hospital Foundation. It has given me great satisfaction to participate in creating a better future for B.C.'s children and youth. I am confident that CFRI will continue to shine as one of B.C.'s greatest success stories in research and innovation.

BC Children's patient Cambie pushes a button to officially open the new Translational Research Building in November 2008.



Executive Comment



Dr. Geoffrey Hammond,
Scientific Director, CFRI



Dr. Stuart MacLeod,
Executive Director, CFRI



Dr. Anne Junker, Clinical and
Population Health Studies
Director, CFRI

This past year, despite challenging economic conditions, the Child & Family Research Institute (CFRI) continued to experience a steady upward trajectory in success with grant funding, development of new research teams and expansion of existing programs. In November 2008, we opened the administration and wet lab areas of the new Translational Research Building, followed by the dry lab offices and the research clinic in September 2009.

CFRI is in the midst of several transitions and there are days when it seems like “change is the only constant.” It is increasingly important to see the CFRI research programs and strategic direction in harmony with those of BC Children’s Hospital, and to see CFRI as an integrated part of the Provincial Health Services Authority and its related agencies on the Oak Street campus.

After discussions that began with planning for a national grant application in 2006, CFRI has settled on a new scientific structure featuring seven “research clusters.” In addition to the **Childhood Cancer** and the **Reproduction & Healthy Pregnancy** research clusters, we have created five new research clusters by bringing together areas of research excellence to promote greater interactions and sense of community.

These include:

- The new **Developmental Neurosciences & Child Health** research cluster, which encompasses the former Centre for Community Child Health and Neurosciences research program. Investigators in the new research cluster collaborate on the child neuro-developmental themes that are so important to our overall activity.
- A new research cluster, **Innovations in Acute Care & Technology (iACT)**, was created in recognition of the considerable number of clinical investigators and research activity in BC Children’s acute and critical care areas. It also addresses the growing need to develop and evaluate new technologies including imaging and clinical information systems.
- The new **Immunity in Health & Disease** research cluster brings together investigators in infectious diseases and immunology.
- The new **Diabetes, Nutrition & Metabolism** research cluster builds our growing interest in both Type 1 and Type 2 diabetes and includes investigators with a focus on optimal nutrition, healthy eating and obesity.
- The position of the **Centre for Molecular Medicine and Therapeutics (CMMT)** has been better delineated as a University of British Columbia (UBC) Senate-approved research centre that operates in an

interdependent fashion with CFRI. CMMT is differentiated from CFRI’s **Genetics & Health** cluster, which embraces a broader spectrum of medical genetics research.

Underpinning CFRI’s research clusters is a broad commitment to population health research that will assist the decision-making needs of government and health care providers. Development of a research stream in “Health and Society” is a priority for CFRI over the next 12 months. This stream will reach out to our partners in public and population health at UBC and Simon Fraser University. It will blend theoretical and methodological research and innovation with applied health research, health policy research and health technology assessment.

There will be transition in CFRI’s leadership: the completion of Maurice Mourtou’s term as Board Chair in September 2009 and Dr. Stuart MacLeod’s retirement from his role as Executive Director in June 2010. An external review of CFRI was completed in July 2009 and the Board, in collaboration with UBC and PHSA, will identify a new leader over the year ahead.

While final government approval has not yet been received, we hope the next milestone will be construction of the population health facility needed to complement the Translational Research Building. That essential project is scheduled to begin within the next 12 months. The new building will better position CFRI to be a leader in child health research, not just for British Columbia, but for Canada and internationally.

CFRI is already a complex organization but it must continue to evolve in order to meet the ongoing challenges of improving health outcomes for infants, children and youth while contributing to a national effort to make optimal health care sustainable.

Interview with Dr. Gavin Stuart and Dr. Alison Buchan

Dr. Stuart is the Dean, Faculty of Medicine at the University of British Columbia (UBC) and a Board Member of the Child & Family Research Institute (CFRI). He is represented on CFRI's Board by Dr. Alison Buchan, Executive Associate Dean of Research in the Faculty of Medicine at UBC.

What is an academic health sciences centre?

An academic health sciences centre is above all a partnership between one or more universities, health authorities and health care providers focusing on world-class research, delivery of clinical services, and the education and training of health care professionals.

What is the importance of the Child & Family Research Institute to the research enterprise of the University of British Columbia?

CFRI is a valued partner of the UBC Faculty of Medicine. With its 200 investigators and more than 200 trainees, CFRI obtains approximately 20 per cent of the Faculty's health research funding annually and is a major contributor to both the Faculty's education and research mandates. CFRI is uniquely placed to translate new research discoveries immediately into new treatments and prevention strategies focused on some of our most vulnerable populations: infants, children and youth.

What do you think the future of the research environment will look like in British Columbia?

Over the past 10 years, the climate for life sciences in the province has become increasingly positive with the creation of several successful biotech companies and major investments

in health research. These investments have provided essential funding to assemble the critical mass of outstanding researchers (greatly facilitated by the partnerships between BC Children's Hospital Foundation, the Michael Smith Foundation for Health Research and UBC's Faculty of Medicine) and to provide the infrastructure to support their research. The challenge before us all is to sustain and enable the research community to realize its full potential by turning discoveries into improved health for British Columbians.

How can we improve the integration of research activities across the UBC academic system?

We have been moving towards greater integration of core administrative research functions for some time. This includes harmonized research ethics reviews and grants administration. Greater integration of core research infrastructure and effective partnerships among research groups will be the next phase of the alignment process. Integrating units and support functions provides both the opportunity to enhance research productivity through increased collaboration and to realize cost savings due to economies of scale.



Left: Now in his second term as Dean, Faculty of Medicine, UBC, Dr. Gavin Stuart continues to practice as a gynecological oncologist at Vancouver General Hospital and BC Cancer Agency, an agency of the Provincial Health Services Authority.

Right: Dr. Alison Buchan is Executive Associate Dean of Research, Faculty of Medicine, UBC. She is a widely published Professor in the Department of Cellular and Physiological Sciences, UBC and a Fellow of the Canadian Academy of Health Sciences.



Financials

The 2008/09 total revenue of the Child & Family Research Institute (CFRI) was approximately \$55.3 million, of which \$41.5 million was external funding including grants, contracts and agreements received from foundations, granting agencies and organizations, government contracts, hospitals, universities, Canada Foundation for Innovation and British Columbia Knowledge Development Fund. Approximately \$13.8 million in internal funding was received from BC Children's Hospital Foundation, University of British Columbia (UBC), Sunny Hill Foundation for Children and the Children's & Women's Health Centre of British Columbia, an agency of the Provincial Health Services Authority. An additional \$5.4 million was provided by UBC for CFRI investigator salaries.

Fast Facts 2008/09

- CFRI's overall success rate in funding competitions of the Canadian Institutes of Health Research and other similar health funding agencies is close to 50 per cent – twice the national average.
- In 2008/09, CFRI faculty produced 539 publications, including 35 book chapters.

Commercialization metrics:

- Invention disclosures involving CFRI faculty: 13
- Patent applications filed by CFRI investigators: 13
- Patents issued to CFRI faculty: 2
- Licence/option agreements to industry for CFRI-developed technologies: 2
- Licence agreements to government, non-profits and academic centres for CFRI-developed technologies: 9

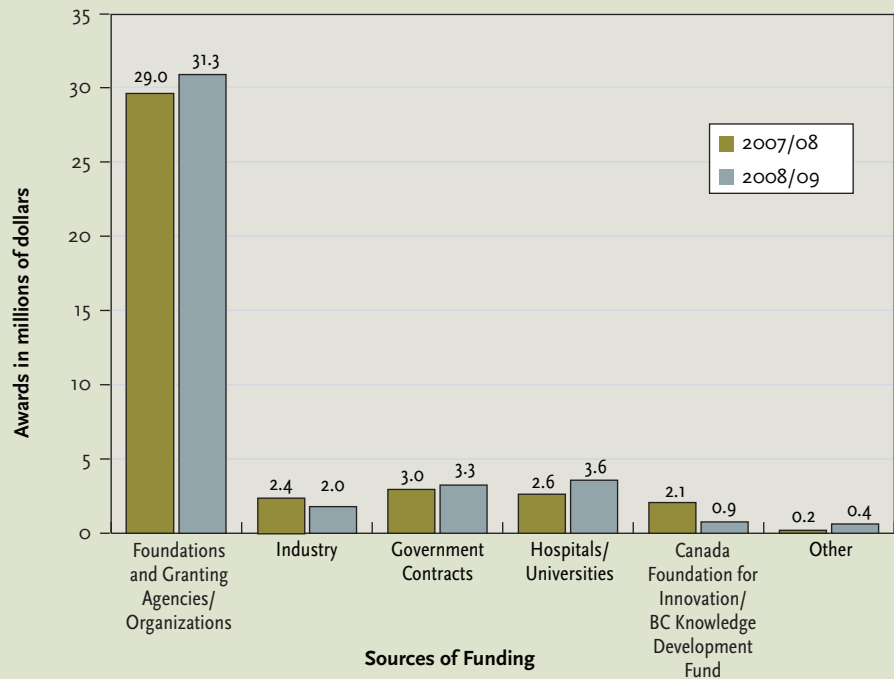
CFRI's 2008/09 total revenue was approximately \$55.3 million, of which \$41.5 million was external funding and approximately \$13.8 million was internal funding. An additional \$5.4 million was provided by the University of British Columbia for CFRI investigator salaries.

Over 160 agencies contributed to CFRI's external funding.

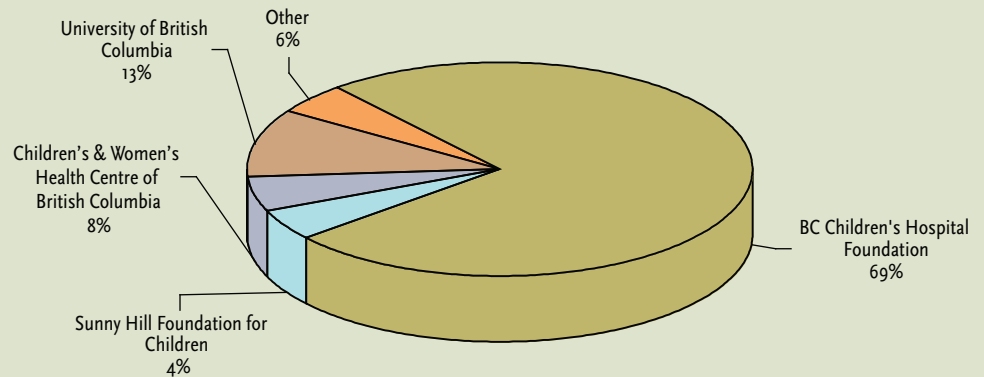
CFRI people:

- 200 investigators
- 204 trainees (including graduate students and postdoctoral fellows)
- 40 summer students
- 311 research staff
- 28 administration staff

Comparison of External Funding Sources 2007/08 and 2008/09



2008/09 Internal Revenue (\$13.8 million)



The University of British Columbia provided an additional \$5.4 million for CFRI investigator salaries.

Research Funding

More than 160 agencies contributed to the Child & Family Research Institute's external funding of \$41.5 million in 2008/09. These agencies are recognized below.

FOUNDATIONS AND GRANTING AGENCIES/ ORGANIZATIONS

AllerGen NCE Inc. - Allergy, Genes and Environment Network
Alzheimer Society of Canada
Alzheimer's Drug Discovery Foundation
American Heart Association
Arthritis Society
Autism Speaks
BC Academic Health Council
BC Children's Hospital Foundation
BC Medical Services Foundation
BC Transplant Research Foundation
Bill & Melinda Gates Foundation
Brain Tumour Foundation of Canada
British Columbia Injury Research and Prevention Unit
British Columbia Lung Association
Burroughs Wellcome Fund
C17 Research Network
Canada Foundation for Innovation
Canada Research Chairs
Canadian Anesthesiologists' Society
Canadian Association of Gastroenterology
Canadian Breast Cancer Research Alliance
Canadian Child Health Clinician Scientist Program
Canadian Cystic Fibrosis Foundation
Canadian Dermatology Foundation
Canadian Diabetes Association
Canadian Hemophilia Society
Canadian Institute for Advanced Research
Canadian Institutes of Health Research
Canadian Liver Foundation
Canadian Paediatric Society
Centre de santé et de services sociaux de Rimouski-Neigette
CHDI Foundation, Inc.
Children's Tumor Foundation (U.S.)
Crohn's and Colitis Foundation of Canada
Cystic Fibrosis Foundation (U.S.)
Cystic Fibrosis Foundation Therapeutics, Inc.
Fanconi Canada
Genome British Columbia
Heart and Stroke Foundation of BC & Yukon
Heart and Stroke Foundation of Canada
High Q Foundation
HP Therapeutics Foundation
Huntington's Disease Society of America
International Human Frontier Science Program Organization
International Pediatric Association
Jack and Doris Brown Foundation
Juvenile Diabetes Research Foundation International
Kidney Foundation of Canada
Lawson Foundation
Lloyd Jones Collins Foundation
Lotte & John Hecht Memorial Foundation
Massage Therapy Foundation
Michael Smith Foundation for Health Research
Multiple Sclerosis Scientific Research Foundation
Multiple Sclerosis Society of Canada
National Alliance for Autism Research
National Cancer Institute of Canada
National Childhood Cancer Foundation (U.S.)

National Institutes of Health
National Marrow Donor Program
National Multiple Sclerosis Society (U.S.)
Natural Sciences and Engineering Research Council of Canada
North American Pediatric Renal Trials and Collaborative Studies
Ontario Genomics Institute
Pacific Alzheimer Research Foundation
Q'wemtsin Health Society
Rethink Breast Cancer
Rx&D Health Research Foundation
Safe Kids Canada
Scottish Rite Charitable Foundation of Canada
SickKids Foundation
SmartRisk
Social Sciences and Humanities Research Council of Canada
Stem Cell Network (SCN) - Networks of Centres of Excellence (NCE)
The Blue Sky Foundation
The Community Against Preventable Injuries Association
The Consortium for Applied Research and Evaluation in Mental Health
The Gerber Foundation
The Leukemia and Lymphoma Society of Canada
United Way of the Lower Mainland
Vancouver Foundation
Victoria Foundation

GOVERNMENT

Alberta Health Services
BC Ministry of Children and Family Development
BC Ministry of Health Services
British Columbia Knowledge Development Fund
British Columbia Ministry of Public Safety and Solicitor General
Calgary Regional Health Authority
Centre for Drug Research and Development
Flax Council of Canada
Government of Canada
Health Canada
Insurance Corporation of British Columbia
Manitoba Falls Prevention
Nova Scotia Department of Health
Providence Health Care
Public Health Agency of Canada
Regie de l'Assurance Maladie du Quebec
The Government of Manitoba
United States Army
U.S. Department of Defense
U.S. Food and Drug Administration
Vancouver Coastal Health Authority
World Health Organization

HOSPITALS/UNIVERSITIES

BC Children's Hospital and Sunny Hill Health Centre for Children
Centre hospitalier de l'Université de Montréal
Dalhousie University
Hamilton Health Sciences
Hôpital Saint-Luc du CHUM

IWK Health Centre
Kingston General Hospital Clinical Evaluation Research Unit
McGill University
St. Michael's Hospital
Sudbury Regional Hospital
Sunnybrook Health Sciences Centre
The Hospital for Sick Children
The Hospital for Sick Children Research Institute
UBC Centre for Molecular Medicine and Therapeutics
UBC Department of Pediatrics
UBC Department of Surgery
UBC Faculty of Medicine
UBC Peter Wall Institute for Advanced Studies
UBC School of Nursing
University of Alberta
University of California, San Francisco

INDUSTRY

Abbott Laboratories
AMGEN Canada Inc.
AstraZeneca Canada Inc.
Bristol-Myers Squibb Medical Imaging
Bristol-Myers Squibb
Canucks for Kids Fund
Centocor Inc.
CJM (Singapore) Pte Ltd
Dragerwerk AG
Eli Lilly Canada Inc.
EMD Serono Canada Inc.
Genzyme Canada Inc.
GlaxoSmithKline Inc. (Canada)
GTC Biotherapeutics Inc.
Hoffmann-La Roche Limited
Hollis and Wright P.G.
Innovacon Inc.
Inspire Pharmaceuticals Inc.
Islington Business Centre
Janssen-Ortho Inc.
Livatrol, LLC
Medbuy Corporation
Medtronic USA
Novartis Pharmaceuticals Canada Inc.
Novo-Nordisk
Ortho Biotech
Ortho Clinical Diagnostics
Pfizer Canada Inc.
Pneuma Pharmaceuticals, Inc.,
PTC Therapeutics Inc
Quintiles Canada
Sanofi Pasteur Limited
Sanofi-Aventis Canada Inc.
UCB Bioproducts S.A.
Various Sources
Wyeth-Ayerst Canada Inc.
Wyeth-Ayerst Research
Xenon Pharmaceuticals Inc.

Our People

The outstanding success of the Child & Family Research Institute (CFRI) is possible because of its community of committed investigators, trainees, support staff and administration. Every effort has been made to be accurate; please accept our apologies for any errors or omissions.

FACULTY					
Kouros Afshar	Leigh Field	Robert Liston	Evan Shereck	Arezoo Astanehe	Abbas Fotovati
Christine Alvarez	John Forbes	Jeffrey Ludemann	Harold Siden	Alireza Baradaran Heravi	Sonia Franciosi
Shazhan Amed	Helen Foster	Judith Lynam	Elizabeth Simpson	Kristina Becanovic	Debra Fulton
Mark Ansermino	Roger Freeman	Francis Lynn	Erik Skarsgard	Samantha Benton	Alex Goldman
Linlea Armstrong	Jan Friedman	Sai Ma	Peter Skippen	Kirk Bergstrom	Mehran Ghoreishi
Robert Armstrong	Christopher J. Fryer	Colin MacCalman	Amanda Skoll	Darrell Bessette	Sanjoy Ghosh
Jehannine Austin	E. Jane Garland	Ross T.A. MacGillivray	Laura Sly	Rossi Billie	Deanna Gibson
Shelina Babul	Anne George	Stuart MacLeod	Poul Sorensen	Loraine Bischoff	Rona Graham
Collin Barker	Deborah Giaschi	Andrew Macnab	David Speert	Christoph Blohmke	Jatinder Grewal
Ronald Barr	William Gibson	Ying MacNab	Rose Steele	Adrienne Borrie	Jian Guo
Julie Bettinger	Hillel Goelman	Andrew MacNeily	Paul Steinbok	Danielle Bourque	Hazel Gutierrez
Laird Birmingham	Ran Goldman	Laura Magee	Sylvia Stockler-Ipsiroglu	Helen Burston	Thomas Ha
Geoffrey Blair	Daniel Goldowitz	Peter Malleson	Richard Stokes	Michael Butt	Meredith Hamilton
Cornelius F. Boerkoel	Tim Green	Ruth Martin	Lynn Straatman	Pat Camp	Courtney Hanna
Mason Bond	Ruth Eckstein Grunau	Lucy Marzban	Caron Strahlendorf	Kristine Carino	Tyler Hickey
Thomas Boyce	Stefan Grzybowski	Louise Mâsse	Anne Synnes	Prescilla Carrion	Cindy Ho
Rollin Brant	Judith Hall	Douglas Matsell	Joseph Y.C. Tai	Jeffrey Carroll	Greenly Ho
Carolyn Brown	Geoffrey Hammond	Deborah McFadden	Rusung Tan	Lucila Castro-Pastrana	Katrin Hoefl
David Brown	Rosamund Harrison	Daniel Metzger	Stefan Taubert	Nicole Catherine	Eui Ju Hong
John Brunstein	Michael Hayden	John Millar	Glen Tibbits	David Chai	In Sun Hong
Mariana Brussoni	Alan Hill	Anton Miller	Lori Tucker	Edgar Chan Wong	Gabriela Horvath
Helene Bruyere	Bradford Hoffman	Steven Miller	Stuart Turvey	Herbert Chan	Kun Huang
David Burdge	Liisa Holsti	Deborah Money	Bruce Vallance	Stephanie Chan	Yu-Hsuan Huang
Sonia Butterworth	Jill Hoube	Kishore Mulpuri	Hilary Vallance	John Chandler	Rebecca Hunt Newbury
David Cabral	Kristin Houghton	James Murphy	Margot Van Allen	Hsun Ming Chang	Angela Inglis
Susan Cadell	Timothy Huerta	John O'Kusky	Casey Van Breemen	Vann Chau	Agatha Jassem
Andrew Campbell	Juliette Hukin	Tim Oberlander	Peter van den Elzen	Junling Chen	Martin Kang
Bruce Carleton	Derek Human	Catherine Pallen	Bruce Verchere	Jung-Chien (Jordan) Cheng	Gordon Kirkpatrick
Jean-Pierre Chanoine	Sheila Innis	Constadina Panagiotopoulos	Peter von Dadelszen	Suzanne Cheng	Agnieszka Klimek
Janet Chantler	Kevan Jacobson	Millan Patel	Faye Warnock	Wing-Ki (Vicky) Cheng	Joanna Karasinska
Phillippe Chessex	James Jan	Robert Peterson	Garth Warnock	Warren Cheung	Mohammed Khan
Lorne Clarke	Patricia Janssen	Ian Pike	Wyeth Wasserman	Alice Chou	Janine Kruit
Sterling Clarren	Anne Junker	Jerilynn Prior	Paula Waters	Brian Chung	Andrew Kwon
David D. Cochrane	Diana Juriloff	Jerilynn Prior	Joanne Weinberg	Brian Chung	Karen Lam
Jean-Paul Collet	Janusz Kaczorowski	Sheila Pritchard	Margaret Weiss	Velapatino Cochachi	Matt Larouche
Elizabeth Conibear	Bernd Keller	Evica Rajcan-Separovic	Cheryl Wellington	Victoria Conlin	Fiona Lau
Mary Connolly	Niranjan Kissoon	Shahrad Rassekh	Stephen Wellington	Lauren Currie	Andrew Lee
Marion Coulter-Mackie	Michael Klein	Pratibha Reebey	Janet Werker	Chuanbin Dai	Cathy Lee
Leanne Dahlgren	Michael Kobor	Christopher Reilly	Colin White	Pauline Dan	Erica (I-Fang) Lee
Betty Davies	Tobias Kollmann	Birgit Reime	Sandy Whitehouse	Jeremy Daniels	Hwa-Yong Lee
Jeffrey Davis	Fred Kozak	Urs Ribary	Michael Whitfield	Alastair Davies	Linda Lee
Marie-France Delisle	Sylvie Langlois	Wendy Robinson	Simon Whyte	Charles de Leeuw	Grace Leung
Angela Devlin	Bruce Lanphear	Brian Rodrigues	John Wu	Sarah Desmarais	Nancy Levesque
Adele Diamond	Charles Larson	Paul Rogers		Jaspreet (Jessie) Dhillon	Wangyang Li
Janis Dionne	Gillian Lauder	Dan Rurak		Domenico Di Curzio	Yvonne Li
David Dix	Pascal Lavoie	Elizabeth Saewyc	TRAINEES	Dan Diego Alvarez	Yi Lin
Walter Duncan	Scott Lear	Shubhayan Sanatani	Mohammad Abdullah	Sam Doesburg	Sarka Lisonkova
Sandra Dunn	Blair Leavitt	George Sandor	Elysia Adams	James Donkin	Daniella Loeffler
Jan Dutz	Jacques LeBlanc	Bonita Sawatzky	Mai Al-Khatib	Genevieve Eastabrook	Ya Ting (Phoebe) Lu
Mary Ensom	Peter Leung	David Scheifele	Salman Ali	Dagmar Ehrnhoefer	Kelly Lynn MacDonald
Kevin Farrell	Suzanne Lewis	Richard Schreiber	Lenka Allan	Mitra Esfandiarei	Marcia MacDonald
Alexander Ferguson	Chinten James Lim	Kirk Schultz	Sura Alwan	Jianjia Fan	Saadet Mahmutoglu
	Ken Lim	Victoria Scott	Urui Anjum	Adam Fleming	Cherry Mammen
			Maria Aristizabal		

Our People

Lisa Mansson	Marita Partanen	Shaun Sanders	Karen To	Tingting Zhang	Linda Ip
Claudia Marano	Bo Peng	Karen Sauve	Eva Yap-Todos	Xin Zhang	Todd Jacques
Ashish Marwaha	Karen Petersen	Jean-Francois Schmouth	Peter Trnka	Ilsa J. Zou	Rita Jekabsons
Kiran Massey	Terri Petkau (Sosa)	Julia Schulze	Tracy Tucker	James Zlosnik	Husein Kaba
Kathleen Mayberry	Anna Poon	Peter Schutz	Kristin Turner		Jennifer Kohm
Gelareh Mazarei	Song Ling Poon	John Secen	Audra Vair	ADMINISTRATION	Annie Lam
Theresa McElroy	Elodie Portales-Casamar	Alicia Semaka	Henk Visscher	Lori Alfano	Virginia Lew
Keith McLarren	Katherine Potter	Andy Sham	Alice (Yijun) Wang	Nelly Amenyogbe	Stuart MacLeod
Martina Metzler	Mahmoud Pouladi	Fengtao Shi	Bin Wang	Lainie Burgess	Farin Meralli
Shelley Miller	Tim Prestidge	Prasad Shrawane	Pei-shan Wang	Anita Chiu	Nathalie Pilkington
Agata Minor	Ying Qiao	Roshni Singaraja	Simon Warby	Gurm Dhugga	Allison Rintoul
Valancy Miranda	Nicole Quenneville	Ashley Smith	Whitney Weikum	Stephanie Dunn	Dan Rurak
Joel Montane	Dexin Qiu	Kinga Smolen	Jiadi Wen	Sandra Elias	Angela Seldner
Marinieve Montero	Brian Reikie	Wai-Kin So	Bibiana Wong	Steffany Ellingham	Nick Steel
Dhananjay Namjoshi	Kristen Reipas	Andrew Steer	Tsung-Sheng Wu	Mickey Frenklach	Jordan Trask
Francisco Ng	Noemie Riendeau	Rochelle Stokes	Fang Xie	Tracie Galbraith	Grace Valente
York Ng	Tammy Romanuik	Anna Stratford	Huei-Hsin Clarice Yang	Sheril Gelmon	RESEARCH & TECHNOLOGY DEVELOPMENT OFFICE
Hehong Ni	Colin Ross	Guobin Sun	Ping Yang	Maryam Ghafouri	Joel Livingston
Allison Nicholls	Natasha Ryz	Douglas Swanson	Sahar Abdoli Yazdi	Reena Gill	Dawn McArthur
Elizabeth Novak	Jana Sabo	Harley Syyong	Fiona Young	Mike Gottenbos	
Hajime Oishi	Sina Sakian	Chris Taplin	Ryan Yuen	Geoff Hammond	
Kevin Park	Lionel Samayawardhena	Jenny Thiele	Farah Zahir	Joanna Ho	

Board of Directors & Board Committees 2008/09

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Ms. Nicola Sutton (Vice Chair)
Ms. Patricia Hanbury (Secretary-Treasurer)
Dr. Don Brooks
Ms. Sue Carruthers
Mr. Chris Carty (BCCHF representative)
Dr. Diane Finegood
Mr. Larry Gold
Dr. David Hardwick
Ms. Lynne Kent
Mr. Michael Marchbank
Dr. Gavin Stuart (Alternate: Dr. Alison Buchan)
Dr. Stuart MacLeod (ex officio)

Board Executive Committee:

Mr. Maurice Mourton (Chair)
Ms. Nicola Sutton (Vice Chair)
Mr. Michael Marchbank
Dr. Stuart MacLeod (ex officio)
Dr. Geoff Hammond (by invitation)

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Ms. Lynne Kent
Dr. Stuart MacLeod (ex officio)
Mr. Maurice Mourton (ex officio)
Ms. Nicola Sutton (ex officio)
Mr. Thomas Chan (by invitation)
Ms. Anita Chiu (non-voting member)

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Dr. David Hardwick
Mr. Michael Marchbank
Dr. Stuart MacLeod (ex officio)

External Relations Committee:

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Dr. Alison Buchan
Ms. Sue Carruthers
Mr. Larry Gold
Dr. Stuart MacLeod (ex officio)
Dr. Geoff Hammond (by invitation)
Ms. Jennifer Kohm (non-voting member)

The CFRI Board of Directors would like to acknowledge the contributions of Dr. Donald Rix, who resigned from the Board in March 2009, and welcome Dr. Jane Ingman-Baker, who joined the Board in May 2009.

CFRI Research Cluster Leadership

Childhood Cancer

Dr. Kirk Schultz

Diabetes, Nutrition & Metabolism

Dr. Sheila Innis (Nutrition & Metabolism)
Dr. Bruce Verchere (Diabetes)

Developmental Neurosciences & Child Health

Dr. Ron Barr
Dr. Bruce Bjornson

Genetics & Health

Dr. Jan Friedman

Immunity in Health & Disease

Dr. Rusung Tan
Dr. Stuart Turvey

Innovations in Acute Care & Technology

Dr. Erik Skarsgard

Reproduction & Healthy Pregnancy

Dr. Geoff Hammond
Dr. Peter von Dadelszen

A UBC partner organization of CFRI: The Centre for Molecular Medicine and Therapeutics (CMMT)

Dr. Michael Hayden

Our Partners

The Child & Family Research Institute (CFRI) conducts discovery research, clinical investigation and applied health research to benefit the health of children and families. CFRI works in close partnership with the University of British Columbia; BC Children's Hospital and Sunny Hill Health Centre for Children, BC Women's Hospital & Health Centre and BC Mental Health & Addiction Services, agencies of the Provincial Health Services Authority; and BC Children's Hospital Foundation. CFRI has additional important relationships with British Columbia's five regional health authorities and with B.C. academic institutions Simon Fraser University, the University of Victoria, the University of Northern British Columbia and the British Columbia Institute of Technology.



BC Children's Hospital Foundation

BC Children's Hospital Foundation raises money to support excellence and innovation in care, treatment and research at BC Children's Hospital, Sunny Hill Health Centre for Children and the Child & Family Research Institute (CFRI). The Foundation's activities include major gift fundraising, planned giving and a wide variety of annual programs. As steward of philanthropic donations to BC Children's, Sunny Hill and CFRI, the Foundation issues charitable receipts and ensures donations are allocated to the areas to which donors have designated their support. The Foundation is currently engaged in the \$200-million *Campaign for BC Children* to build a new children's hospital and ensure all BC children have access to a consistent standard of pediatric care.

University of British Columbia

The University of British Columbia (UBC) is one of Canada's largest and most prestigious public research and teaching institutions and consistently ranks among the top 40 universities in the world. It offers a range of innovative undergraduate, graduate and professional programs in the arts, sciences, medicine, law, commerce and other faculties. UBC has particular strengths in biotechnology, ranks in the top 10 universities in North America and number one in Canada for commercializing research and for its patent activity in the life sciences.

Provincial Health Services Authority

The first authority of its kind in Canada, the Provincial Health Services Authority (PHSA) plans, manages and evaluates selected specialty and province-wide health care services across B.C., working with the five geographic health authorities to deliver province-wide solutions that improve the health of British Columbians. With more than 11,000 employees and an annual budget of over \$1.5 billion, the PHSA operates provincial agencies like BC Children's Hospital, plans and in some instances funds specialized health care services like trauma, critical care and thoracic surgery, and delivers a variety of specialized programs and services throughout the province. PHSA is one of the largest academic health organizations in Canada, with about 2,000 people involved in research activities supported by \$150 million in research funding each year.

BC Children's Hospital and Sunny Hill Health Centre for Children

BC Children's is B.C.'s only pediatric hospital and home to many specialized pediatric services available nowhere else in the province, including BC's trauma centre for children, pediatric intensive care, kidney and bone marrow transplants, open heart surgery, neurosurgery and cancer treatment. Sunny Hill is the provincial facility that offers specialized child development and rehabilitation services to children and youth.



BC Women's Hospital & Health Centre

BC Women's is the province's only facility devoted exclusively to the health of women, newborns and families. It is one of the country's busiest maternity centres, delivering more than 7,000 babies annually. It has the largest neonatal intensive care unit in B.C. BC Women's supports women through all the phases of their lives – more than 20,000 women are seen annually through its specialized women's health programs, which include world-class services in breast health, substance dependency, osteoporosis, HIV/AIDS and reproductive health.

BC Mental Health & Addiction Services

BC Mental Health & Addiction Services (BCMHAS) provides unique and specialized mental health services to the citizens of British Columbia. The assessment and treatment of addictions is an integral part of our programs, which include: Adult Tertiary Psychiatry and Geriatric Psychiatry Services, Forensic Psychiatric Services, Child and Adolescent Mental Health & Addiction Services located at BC Children's Hospital and the Provincial Specialized Eating Disorders Program for youth and adults. The agency also makes significant contributions in the areas of research and knowledge exchange in the field of mental health.

Centre for Molecular Medicine and Therapeutics

The Centre for Molecular Medicine and Therapeutics (CMMT) is a synergistic group of scientists and researchers who share a strong sense of commitment to solve the many genetic questions surrounding human illness and well-being. Affiliated with the University of British Columbia and the Child & Family Research Institute, CMMT conducts discovery research and translates that research into effective clinical and therapeutic strategies to promote health. For more information, visit www.cmmt.ubc.ca.



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950 West 28th Avenue, Vancouver, BC Canada V5Z 4H4
Phone: 604.875.3194 | Fax: 604.875.2496 www.cfri.ca