



# *imagine 10-11*

The Annual Scientific Report of  
The Arthur and Sonia Labatt Brain Tumour Research Centre  
at The Hospital for Sick Children



Dr. James Rutka, Director

## MESSAGE FROM DR. JAMES RUTKA

I am pleased and proud to provide you with this introduction to this year's Annual Scientific Report of the Labatt Brain Tumour Research Centre (BTRC). We have had, once again, an incredible year characterized by numerous successes, honours and awards. All principal investigators have garnered numerous multi-year grant awards, and have published their work in the best scientific journals. Students and researchers, from all corners of the world including Italy, Portugal, Korea, Japan, India, and the United States, continue to join us for advanced training in the lab. We continue to be recognized as an Institute of the Pediatric Brain Tumor Foundation along with Duke University and the University of California San Francisco. This past year, Michael Taylor published a seminal article in the *Journal of Clinical Oncology* on the subcategorization of medulloblastoma into four distinct and separate diseases. This article has the prospects of changing our current paradigm for treating children with this malignant brain tumour, and offering new hope for the future. Since 1998, the investigators and researchers within the Labatt BTRC have been dedicated and devoted to determining the molecular underpinnings of the genetically most complex and devastating brain tumours in hopes of arriving at new treatment options. Now, 13 years later, we are very close to achieving this goal.

I am pleased to provide this summary of the progress made within the BTRC for 2010-11. We hope you will appreciate our enthusiasm for and dedication to the field of brain tumour research as you read through the pages of this year's scientific report.

As many of you may know, a new research tower for SickKids is being constructed on the corner of Elm and Bay streets with a scheduled opening date for 2013. In that year, the Labatt BTRC will be moving along with other SickKids research groups to the new research building. We will be pleased to provide you with an update on the progress of the new research tower, and our move to the new space and facilities in upcoming issues of *Imagine*.



## 19TH INTERNATIONAL CONFERENCE ON BRAIN TUMOUR RESEARCH AND THERAPY

From June 21-24, 2012, investigators from the Labatt BTRC will host the 19th International Conference on Brain Tumour Research and Therapy. Known also as the "Asilomar" meeting for its origins in Asilomar near Monterey, California, in the 1970s, this conference will bring together over 200 world leaders in brain tumour research. The meeting will be held at the Marriott Niagara Falls Hotel Fallsview & Spa in Niagara Falls. We are indeed honoured and pleased that a Canadian site has been selected for this prestigious meeting, and that our Labatt BTRC team will be actively involved in planning and conducting the meeting next year. This is the first time that the Asilomar meeting will be held in Canada. Other countries which have hosted the meeting in the past have included Japan, the United States, England, Italy, Germany, and Norway, to name a few.



### ON THE FRONT COVER...

#### PRINCIPAL INVESTIGATORS OF THE LABS AT BTRC

(top to bottom and left to right) Dr. James Rutka, Dr. Jane McGlade, Dr. Peter Dirks, Dr. Annie Huang, Dr. Michael D. Taylor, Dr. Cynthia Hawkins, Dr. Uri Tabori, Dr. Gelareh Zadeh, Dr. Todd Mainprize, Dr. Sidney Croul, and Dr. Sunit Das.

## DR. ABHIJIT GUHA, 1957-2011, IN MEMORIAM



It is with great sadness that I inform you that Dr. Abhijit (Ab) Guha passed away peacefully in the early morning hours on November 8th, 2011.

For the past 3 years, Ab has been courageously fighting his diagnosis of acute myelocytic leukemia (AML). He was 54 years old.

Ab graduated with a degree in Medicine from the University of Toronto in 1982. He then entered the neurosurgery residency training program at the University of Toronto under Dr. Alan Hudson. In 1985, he received a Masters degree from the Institute of Medical Sciences under the tutelage of Dr. Charles Tator.

He completed his neurosurgical residency training in 1989, and passed his Royal College specialty examination in neurosurgery that same year. Ab then traveled to Boston with his family to work as post-doctoral fellow with Dr. Charles Stiles at Harvard where he began his career long interest in neuro-oncology research. After his research fellowship at Harvard, Ab returned to the University of Toronto in 1993 to begin his faculty appointment as an Assistant Professor, and to conduct research in signal transduction mechanisms under the supervision of Dr. Tony Pawson at the Lunenfeld Research Institute.

Ab was promoted to Associate Professor in 1997, and to Full Professor in 2001. In 1997, he received the Gold Medal Award from the Royal College of Physicians and Surgeons of Canada. In 1998, he was the recipient of the George Armstrong Peters Prize in the Department of Surgery. In 2000, he was appointed as the co-director of the Arthur and Sonia Labatt Brain Tumour Research Centre (BTRC). In 2001, he was given the Farber Award for excellence in neuro-oncology research by the Society for Neuro-Oncology (SNO) and the AANS/CNS. In 2002, he was installed as the inaugural Alan and Susan Hudson Chair in Neuro-Oncology at the University Health Network. In 2005, he received the Humanitarian Award from the Indo-Canadian Chamber of Commerce. That same year, he began a two year term as President of the Society for Neuro-Oncology. In 2009, he was awarded the Lister Prize in the Department of Surgery at the University of Toronto.

Ab served on numerous editorial boards, grants panels, and boards of private philanthropic foundations. His research focus was on the molecular biology of human brain tumours, in particular, human astrocytoma. For this tumour, he developed some of the most promising model systems, and discovered new genes that are associated with astrocytoma formation. His lab has been well funded over many years by numerous peer-reviewed granting agencies. He published his work in top tier neuro-oncology journals. He was an invited speaker around the world for his outstanding research work in human brain tumours.

Born in Kolkata, India, Ab devoted himself in recent years to the establishment of a Neuroscience Institute in Kolkata where he frequently traveled to teach, operate on patients with neurosurgical diseases, and educate the faculty there about research.

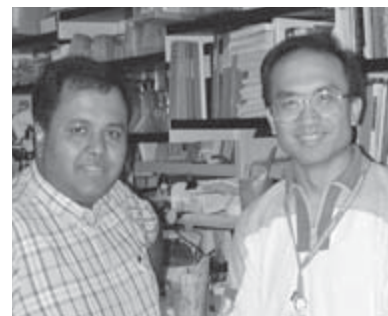
Ab was married to Soma, and had two children, Daipayan (Deep) a medical student at the University of Toronto, and Tia, an undergraduate student at the University of Toronto. The Labatt Brain Tumour Research Centre extends its most sincere and heartfelt condolences to the Guha family at this difficult time.

### **James T. Rutka MD, PhD**

Director, Labatt BTRC



Annual Labatt Academic Lectureship 2007 with (left to right) Drs. Dirks, Gutmann, Guha and Rutka



Dr. Guha shown with his first research technician, Nelson Lau, in the Labatt BTRC in the McMaster Building June 2002



Annual Labatt Academic Lectureship 2004 with (left to right) Drs. Guha, Holland, and Rutka



Dr. Sunit Das with Dr. Guha, July 2011, Toronto



## DR. JAMES T. RUTKA

*Director, The Arthur and Sonia Labatt Brain Tumour Research Centre, Principal Investigator*

Dr. Rutka's laboratory has been studying the cytoskeleton as a means to increase our understanding of the mechanisms by which astrocytoma cells grow, adhere to surrounding substrates and invade normal brain tissue. Current studies are aimed at investigating how cytoskeletal matrix interactions lead to the profound cellular changes we have observed through a detailed analysis of cell cycle gene alterations, metalloproteinase and inhibitor secretion and ultrastructural cytoskeletal relationships. Recent emphasis has been placed on the small Rho-GTPases as potential targets for inhibiting astrocytoma invasiveness.

In a second project, Dr. Rutka's lab has focused additional research interest on the childhood brain tumour known as medulloblastoma. His lab personnel are studying the contributions of the hepatocyte growth factor (HGF)/cMET pathway in the pathogenesis of this malignant brain tumour. The Rutka lab has recently shown that HGF/cMET elements are epigenetically regulated in medulloblastoma leading to increased tumour cell growth and invasion. In addition, through a comprehensive mutational analysis, the Rutka lab has now shown that members of the HGF/cMET pathway are mutated leading to a possible mechanism of tumour cell proliferation. More importantly, Dr. Rutka's lab has shown that the HGF/cMET pathway is a target for inhibition using well characterized small molecule inhibitors in vitro, and in vivo.

### RESEARCH SUPPORT

Canadian Institutes of Health Research, National Cancer Institute of Canada, Pediatric Brain Tumor Foundation of the United States, Brain Tumour Foundation of Canada, b.r.a.i.n.child

## THE GUHA LAB

Dr. Guha and his colleagues have shown that activated Ras is functionally relevant in human astrocytomas. Blockade of Ras signalling leads to decreased glioma growth. This activation is not only found within human gliomas, but also peripheral nerve tumours. Ras and other signalling pathways are activated by aberrant growth factor receptors in gliomas, such as the epidermal growth factor receptor (EGFR). Using state-of-the-art technologies, in collaboration with MDSProteomics, Dr. Guha's lab is investigating Ras and other signalling pathways utilized by these receptors to promote growth of gliomas. It is hoped that drugs being investigated in the Guha lab to inhibit these receptors or their signalling pathways, will be ultimately efficacious in the clinic.

Another area of interest for the laboratory is the study of angiogenic factors. Brain tumours remain among the most angiogenic tumours known to man. In particular, vascular endothelial growth factor (VEGF) and angiopoietins and their receptors are angiogenic specific and aberrant in human gliomas and peripheral nerve tumours. Dr. Guha's laboratory is studying how VEGF and angiopoietins stimulate and interact to promote angiogenesis, how they are regulated in normoxia and hypoxic conditions, as well as pharmaceutical inhibition in pre-clinical models to determine if they are relevant clinical therapeutic targets.

### RESEARCH SUPPORT

Canadian Institutes of Health Research, National Cancer Institute of Canada, b.r.a.i.n.child, Ontario Institute of Cancer Research, Cancer Research Society, Brain Tumour Foundation of Canada

### LABORATORY PERSONNEL

Christian Smith, *BTRC Operations Manager*  
Brian Golburn, *Research Technician*  
Claudia Faria, *Graduate Student*  
Roberto Diaz, *Graduate Student*  
Adrienne Weeks, *Graduate Student*  
Arnold Etame, *Graduate Student*  
Sara Onvani, *Graduate Student*  
Yuzo Terakawa, *Visiting Fellow*  
Jong Hee Change, *Visiting Fellow*  
James Loukides, *Technician*

### THE GUHA LAB

#### LABORATORY PERSONNEL

Nesrin Sabha, *Laboratory Manager*  
Vedant Arun, *Graduate Student*  
Alenoosh Albertvartanian, *Graduate Student*  
Elena Bogdanovic, *Postdoctoral Fellow*  
Sameer Agnihotri, *Graduate Student*  
Aaron Gajadhar, *Graduate Student*  
Diana Munos, *Graduate Student*  
Karolyn Au, *Graduate Student*  
Amparo Wolfe, *Graduate Student*  
Suhail Arar, *Postdoctoral Student*  
Johann Micallef, *Graduate Student*

## DR. JANE MCGLADE

*Senior Scientist, Principal Investigator*

Dr. McGlade's research is directed towards understanding the molecular changes which occur during the process of malignant cell transformation. Work in the lab involves several aspects of signal transduction and the identification and characterization of novel signalling molecules.

Recently, Dr. McGlade has focused specifically on one class of cytoplasmic adapter molecules and the role they play in the localization, integration and co-ordination of signalling cascade components within two distinct signalling paradigms. It is hoped that this work will have broad implications in terms of understanding temporal and spatial organization of mitogenic signal transduction pathways, as well as the process of asymmetric cell division and epithelial cell polarity in mammals.

The long-term goal of this work is to define the molecular processes which regulate the formation and activation of signalling complexes and how disruption of this regulation can lead to cell dysfunction and malignant disease.

### RESEARCH SUPPORT

Canadian Institutes of Health Research, National Cancer Institute of Canada, The Leukemia and Lymphoma Society of Canada, The Foundation Fighting Blindness – Canada, b.r.a.i.n.child

## DR. PETER DIRKS

*Scientist, Principal Investigator*

Dr. Peter Dirks' research program's long-term goal is to determine if a normal neural stem cell or progenitor cell is transformed into a brain tumour. Two approaches are being used to study this question. One approach involves a study of primary human brain tumours to determine if stem cell populations exist in brain tumours. The Dirks lab is answering the question: is there a small population of cancer cells in a brain tumour that uniquely has the ability to maintain the tumour? Dr. Dirks' lab has recently isolated and characterized a repopulating cell from human brain tumours of different phenotypes that expresses neural stem cell markers and has stem cell-like behaviour in vitro. This subpopulation of tumour cells could be considered as cancer stem cells, because they share properties with normal stem cells and because they are necessary for maintaining tumour growth in vitro.

The second approach involves a study of the key determinants of proliferation and self-renewal in normal neural stem cells. The focus is on the sonic hedgehog signalling pathway, as it is perturbed in primary human brain tumours (medulloblastomas), and because it has been shown to be critically important for normal brain development. Preliminary studies suggest that different Shh pathway members play important and distinct roles in neural stem cell proliferation and self-renewal. A better understanding of how this pathway functions in normal neural stem cells may help us to better understand brain tumour proliferation and self-renewal.

### RESEARCH SUPPORT

Canadian Institutes of Health Research, National Cancer Institute of Canada, Ontario Institute of Cancer Research



### LABORATORY PERSONNEL

Donna Berry, *Research Associate*,  
Sascha Dho, *Research Associate*  
Renu Sarao, *Project Manager*  
Nancy Silva, *Postdoctoral Fellow*  
Emily Griffiths, *Postdoctoral Fellow*  
Jon Krieger, *Graduate Student*  
Christopher Smith, *Graduate Student*  
Fabio Morgese, *Postdoctoral Fellow*  
Leanne Wybenga-Groot, *Postdoctoral Fellow*  
Brittany Prevost, *Graduate Student*  
Sarah Di Clemente, *Graduate Student*  
Dushyandi Rajendran, *Student*  
Amanda Luck, *Research Technician*  
Junior West, *Student*  
Cheryl Wolting, *Graduate Student*  
Larissa Lontos, *Graduate Student*  
Kimberly Lau, *Graduate Student*



### LABORATORY PERSONNEL

Tzvi Aviv, *Postdoctoral Fellow*  
Fiona Coutinho, *Graduate Student*  
Phedias Diamandis, *Graduate Student*  
Julia DiLabio, *Graduate Student*  
Sonam Dolma, *Graduate Student*  
Marco Gallo, *Postdoctoral Fellow*  
Jeremy Graham, *Research Technician*  
Renee Head, *Research Technician*  
Michelle Kushida, *Research Technician*  
Lillian Lee, *Research Technician*  
Erick Ling, *Graduate Student*  
Mona Meyer, *Postdoctoral Fellow*  
Kathleen Nethery-Broxx, *Research Technician*  
Milly So, *Research Technician*  
Robert Vanner, *Graduate Student*  
Ryan Ward, *Graduate Student*  
Xueming Zhu, *Research Technician*



## DR. ANNIE HUANG

*Scientist, Principal Investigator*

Brain tumours, the most common solid malignancies of childhood, differ from other solid malignancies in that brain tumours rarely metastasize outside of the central nervous system. Despite this relatively “restricted” pattern of progression, metastatic brain tumours are therapy resistant. Due to the devastating growth and neurocognitive consequences of the best current treatment which includes radiation, there is much interest in identifying molecular pathways that specify metastatic behaviour in malignant paediatric brain tumours, in order to ultimately develop more effective and less toxic tumour therapy.

Dr. Huang’s lab is interested in cellular and molecular mechanisms that underlie tumour progression in central nervous system primitive neuro-ectodermal tumours (PNET), the most frequent group of paediatric malignant brain tumours. Current projects involve use of high resolution genomic tools such as SNP microarrays and ChiP-on-chip technology to define novel genes and pathways associated with aggressive PNET phenotypes.

A major interest in the lab is to determine how c-Myc, a potent oncoprotein, specifies aggressive phenotypes in cerebellar PNET/medulloblastoma. To investigate the molecular basis of this association the lab has focused on identifying Myc protein interactors and target genes with key contributions to Myc-mediated transformation in medulloblastoma cells. Recently, a novel family of Myc interacting and co-transforming proteins, the JPO proteins, which are overexpressed in metastatic medulloblastoma was identified. Characterization of the role of JPO proteins and other novel Myc partners/targets in medulloblastoma/PNET pathogenesis is the focus of ongoing work.

### LABORATORY PERSONNEL

Daniel Picard, *Laboratory Technician*  
Limei Zhou, *Research Associate*  
Tiffany Chan, *Graduate Student*  
David Shih, *Graduate Student*  
Tara Spence, *Graduate Student*  
Mei Lu, *Research Associate*  
Patrick Sin-Chan, *Graduate Student*  
Eva Lee, *Research Fellow*  
King Ching Ho, *Research Technician*

### RESEARCH SUPPORT

Canadian Institutes of Health Research,  
Canadian Cancer Society Research Institute,  
Childhood Cancer and Blood Disorders,  
Research Network, Genome Canada/  
National Brain Tumor Society



## DR. MICHAEL D. TAYLOR

*Scientist, Principal Investigator*

Dr. Taylor’s laboratory hopes to use the tools of forward and reverse genetics to better understand the underlying biology of medulloblastoma and ependymoma, two of the most common malignant paediatric brain tumours.

In forward genetic approaches, the normal cells that are thought to give rise to a cancer are perturbed in a systemic fashion in an attempt to determine which genes or signalling pathways promote malignant transformation. By randomly over-expressing genes in the cellular precursor of medulloblastoma, the lab hopes to determine which genes are important to the initiation, maintenance and progression of medulloblastoma. This sort of functional genomic approach has recently been made feasible by the completion of the mouse genome project.

In reverse genetics, primary human tumours are studied in an attempt to determine the genetic events that lead to transformation. The Taylor lab is using a number of genome-wide techniques to identify novel tumour suppressor genes and oncogenes important in the pathogenesis of medulloblastoma and ependymoma.

Through an understanding of the genetic basis of brain tumours, it is hoped that novel, rational therapeutics may be developed that are more effective and less toxic than existing therapies. It is hoped that synergism between forward and reverse genetic approaches will allow for key genes important in brain tumour biology to be identified.

### LABORATORY PERSONNEL

Adrian Dubuc, *Graduate Student*  
Xin Wang, *Graduate Student*  
Stephen Mack, *Graduate Student*  
Paul Northcott, *Graduate Student*  
Yuan Yao, *Graduate Student*  
John Peacock, *Technician*  
Xiaochong Wu, *Postdoctoral Fellow*  
Livia Garzia, *Postdoctoral Fellow*  
Xueyuan Shang, *Technician*  
Jessica Liu, *Technician*  
Alexander Unterberger, *Postdoctoral Fellow*  
David Shih, *Graduate Student*  
Adi Rolider, *Postdoctoral Fellow*

### RESEARCH SUPPORT

Canadian Institutes of Health Research,  
National Cancer Institute of Canada,  
Genome Canada, National Institutes of Health,  
McLaughlin Center for Molecular Medicine,  
b.r.a.i.n.child

## DR. CYNTHIA HAWKINS

*Scientist, Principal Investigator*

Dr. Hawkins' laboratory focuses on genetic and proteomic markers for prognostication and therapy guidance in paediatric brain tumours including medulloblastoma, astrocytoma and ependymoma. Traditionally, medulloblastomas have been classified on the basis of their appearance into different pathological types, but with poor correlation between these categories and outcome.

Dr. Hawkins' laboratory developed a clinical-biologic model to predict survival in medulloblastoma. Although this goes beyond previous studies in differentiating those children with a good versus a poor prognosis, Dr. Hawkins' laboratory aims to acquire more detailed knowledge of the biology of medulloblastomas in order to tailor therapy to the particular biology and predicted behaviour of an individual patient's tumour. Genome-wide approaches are being used to better understand the genes important for development of paediatric astrocytoma. Potential targets are then verified at the RNA and then protein level using tissue microarrays. In ependymoma, Dr. Hawkins' laboratory has found that expression of telomerase, a protein important for continued cell division, can predict outcome in paediatric ependymoma more effectively than clinical prognostic factors and is investigating its potential as a therapeutic target for these tumours.

## DR. URI TABORI

*Scientist, Principal Investigator*

Dr. Tabori studies mechanisms that control brain tumour progression and survival. One of his main research interests is paediatric low-grade astrocytoma, a tumour that has unique growth characteristics when compared to other paediatric or adult brain tumours. For paediatric low-grade astrocytoma, Dr. Tabori is studying replicative and oncogene induced senescence – factors which may be for prognosis in these tumours.

In addition, Dr. Tabori will extend his studies to develop novel therapies for high-grade paediatric gliomas such as ependymomas and glioblastomas. Finally, Dr. Tabori's laboratory will investigate the genetic alterations that determine the clinical course of patients with neurofibromatosis type 1, the most common cancer predisposition syndrome, in which low-grade and high-grade neuroglial tumours predominate.



### LABORATORY PERSONNEL

Andrew Morrison, *Research Technician*  
Pawel Buczkwicz, *Graduate Student*  
Mark Barszczyk, *Student*  
Nequesha Mohamed, *Student*

### RESEARCH SUPPORT

National Brain Tumor Society,  
Canadian Institutes of Health Research,  
b.r.a.i.n.child



### LABORATORY PERSONNEL

Cindy Zhang, *Lab Manager*  
Pedro Castelo-Branco, *Postdoctoral Fellow*  
Cynthia Elisabeth, *Research Technician*  
Tatiana Lipman, *Graduate Student*  
Dianna Martin, *Postdoctoral Fellow*  
Nataliya Zhukova, *Graduate Student*  
Wesley Wilson, *Student*  
Erin Walker, *Postdoctoral Fellow*

### RESEARCH SUPPORT

Canadian Institutes of Health Research, Terry  
Fox Foundation, Comprehensive Cancer Centre,  
Ontario Institute of Cancer Research, Pediatric  
Brain Tumor Foundation of the United States,  
b.r.a.i.n.child



### **DR. GELAREH ZADEH**

*Scientist, Principal Investigator*

Dr. Zadeh's overall research goal is to gain a better understanding of the molecular regulators of tumour angiogenesis in response to ionizing radiation (IR) in order to improve the therapeutic benefit of radiation therapy (RT) for brain tumours. She has two inter-related research aims to investigate her hypothesis. Her first aim focuses on understanding the molecular mechanisms that regulate bone marrow progenitor cells (BMPCs) and in specific endothelial progenitor cells (EPCs) contribution in response to IR in both normal and tumour-related vasculature. Her second aim is to identify the mechanisms and sequence of therapeutics targeting tumour angiogenesis concurrent with IR in order to identify the most efficacious therapeutic combination for treatment of malignant astrocytomas. She uses three principal anti-angiogenic strategies: VEGF-TRAP, pharmaceutical inhibitors of angiogenesis and, lastly, a novel strategy using radiation-activated angiogenic and anti-angiogenic genes of interest in collaboration with Dr. Susan Scott, UK. In order to carry out these experiments, she takes advantage of a wide range of molecular biology, molecular imaging, molecular physics and angiogenesis techniques in collaboration with other groups.

#### **LABORATORY PERSONNEL**

Shahrzad Jalali, *Postdoctoral Fellow*

Kelly Burrell, *Research Technician*

Boris Krischek, *Postdoctoral Fellow*

#### **RESEARCH SUPPORT**

Canadian Institutes of Health Research,

b.r.a.i.n.child



### **DR. TODD MAINPRIZE**

*Scientist, Principal Investigator*

Dr. Mainprize has two main areas of research interest. In his first area of interest, Dr. Mainprize is collaborating with scientists at Sunnybrook Health Science Centre to investigate the utility of MR-guided focused ultrasound in the treatment of primary and metastatic brain tumours. This novel modality can be used to safely and reversibly disrupt the blood-brain barrier allowing for better delivery of chemotherapeutic agents to a tumour. Focused ultrasound can target and destroy tumour cells with millimetre accuracy and may be a radiation-free alternative to radiosurgery. In his second area of interest, he is investigating the various pathway dysregulations in meningiomas with the hopes of developing more effective treatments for recurrent and higher-grade tumours.

#### **RESEARCH SUPPORT**

Canadian Institutes of Health Research



### **DR. SIDNEY E. CROUL**

*Scientist, Principal Investigator*

Dr. Croul's primary research interest is the role that cell surface adhesive molecules play in the tendency of certain central nervous system tumours, particularly medulloblastoma, to undergo leptomeningeal dissemination. This spread across the surface of the brain and spinal cord is associated with significant morbidity and mortality. The identification of these molecules may help to predict which patients are at risk for leptomeningeal dissemination at an earlier and more treatable stage than is presently possible. Recognition of cellular pathways which are activated by this spread may also help to design more effective and less toxic therapies than are currently available.

#### **LABORATORY PERSONNEL**

Donya Aref, *Masters Student*

Conner Moffat, *Technician*

#### **RESEARCH SUPPORT**

The Grant Miller Foundation, b.r.a.i.n.child

## DR. SUNIT DAS

*Scientist, Principal Investigator*

Dr. Das was educated at the University of Michigan and Harvard University before attending medical school at Northwestern University in Chicago. During medical school, he performed studies at the NINDS/NIH leading up to his PhD in Neurobiology. Dr. Sunit completed neurosurgical training at Northwestern University in 2010. He was recruited to the Division of Neurosurgery at St. Michael's Hospital, the University of Toronto in 2010. Over the years, he has received numerous honours and awards. He has published his research findings in excellent scientific journals including *J Biol Chem*, *Mol Cell*, *JAMA*, and *PLoS One*. His main areas of research interest are in glioblastoma stem cells and epithelial-mesenchymal transitions in these cells. We welcome Sunit to the Labatt Brain Tumour Research Centre as our newest Principal Investigator!



### LABORATORY PERSONNEL

Megan Wu, *Lab Manager*

Nestor Fernandez, *Research Student*

### RESEARCH SUPPORT

b.r.a.i.n.child

## 2010-2011 LABATT BTRC GUEST LECTURERS

**June 23, 2011** *Circulating tumor DNA as blood based biomarkers in patients with solid tumors*

Dr. Chetan Bettegowda, Johns Hopkins

**June 9, 2011** *Heterogeneity in Glioblastoma: a driver of tumor growth and therapeutic resistance*

Dr. Frank Furnari, Ludwig Institute for Cancer Research

**May 26, 2011** *Laboratory-based neuro-oncology research in the UK; my part in the jigsaw*

Dr. Geoffrey J. Pilkington, University of Portsmouth

**April 28, 2011** *Roles for the hedgehog and hippo pathway target YAP in normal brain development and medulloblastoma*

Dr. Anna Kenney, Vanderbilt University Medical Center

**March 17, 2011** *Embracing nervous system heterogeneity in brain cancer research*

Dr. David H. Gutmann, Washington University School of Medicine

**December 9, 2010** *Advancing a tumor-specific vaccine to the holy grail of big pharma*

Dr. John Sampson, The Preston Robert Tisch Brain Tumor Center at Duke

**November 17, 2010** *Trying to decipher the Li-Fraumeni Genome – what can we learn from this*

Dr. Stefan Pfister, German Cancer Research Center

**November 2, 2010** *Integrative genomic profiling of Posterior Fossa Ependymoma delineate*

*two molecularly and clinically distinct subgroups*

Dr. Hendrik Witt, German Cancer Research Center

**September 30, 2010** *Regulating the mammalian circadian clock*

Dr. Mary Cheng, Ottawa University





Dr. Kenneth Aldape



## 13TH ANNUAL LABATT BTRC LECTURESHIP 2011

The 13th annual Arthur and Sonia Labatt Brain Tumour Research Centre academic lecture took place on January 20, 2011. Our guest speaker was Dr. Kenneth Aldape, MD, Professor, Department of Pathology, University of Texas, Anderson Cancer Center, Houston Texas. The topic of his lecture was *Molecular diagnostics of gliomas*.

## VISITING LECTURESHIP

### PREVIOUS BTRC ACADEMIC GUEST LECTURERS

- 1999 Dr. Robert Martuza *Georgetown University*
- 2000 Dr. Gregory Cairncross *University of Western Ontario*
- 2001 Dr. David Kaplan *McGill University*
- 2002 Dr. Charles Stiles *The Dana-Farber Cancer Institute*
- 2003 Dr. Luis Parada *University of Texas Southwestern Medical Center*
- 2004 Dr. Eric Holland *Memorial Sloan-Kettering Cancer Center*
- 2005 Dr. Darell Bigner *Pediatric Brain Tumor Foundation Institute at Duke*
- 2006 Dr. Webster Cavenee *University of California at San Diego*
- 2007 Dr. David H. Gutmann *Washington University School of Medicine*
- 2008 Dr. Henry Brem *Johns Hopkins University*
- 2009 Dr. Joe Costello *University of California at San Diego*
- 2010 Dr. Waldemar Debinski *Wake Forest University*



## AFFILIATED SCIENTISTS

- Cameron Ackerley *PhD*
- Mark Bernstein *MD*
- Eric Bouffet *MD*
- David Kaplan *PhD*
- Normand Laperrière *MD*
- Donald Mabbott *PhD*
- Warren Mason *MD*
- James Perry *MD*

## ADVISORY BOARD OF THE ARTHUR AND SONIA LABATT BRAIN TUMOUR RESEARCH CENTRE

Sonia and Arthur Labatt *Benefactors*

- Dr. Robert S. Bell *CEO, University Health Network*
- Dr. David Berman *Scientific Advisor*
- Helen Berman *Benefactor*
- Ted Garrard *CEO and President, SickKids Foundation*
- Mary Jo Haddad *CEO and President, The Hospital for Sick Children*
- Dr. Ben Neel *Director of Research at PMH/OCI*
- Dr. Christopher Paige *VP of Research, UHN*
- Dr. Janet Rossant *Chief of Research, SickKids Research Institute*
- Dr. Catharine Whiteside *Dean, Faculty of Medicine, University of Toronto*
- Dr. Jim Wright *Surgeon-in-Chief, The Hospital for Sick Children*

## THE YEAR IN REVIEW

### Dr. James Rutka

*Molecular targeting of the Rho-GTPase pathway in human astrocytomas* **Canadian Institutes of Health Research**

*The role of aberrant HGF/c-Met signaling in medulloblastoma* **Canadian Cancer Society Research Institute**

*An analysis of isochromosome 17q in pediatric medulloblastoma* **Pediatric Brain Tumor Foundation of the United States (PBTfUS)**

*Characterization of nanoparticle delivery across the blood brain barrier* **Brain Tumour Foundation of Canada**

### Dr. Ab Guha

*Tissue factor in tumor progression, angiogenesis* **National Cancer Institutes of Canada** Co-applicant

*Microenvironment induced molecular heterogeneity in glioblastoma multiforme (GBM)* **Canadian Institutes of Health Research**

*The role of oncogene-containing microvesicles in tumor* **National Cancer Institutes of Canada** Co-applicant

*Glioblastoma multiforme biomarkers: 1 yr bridge funding* **Canadian Institutes of Health Research** Co-applicant

*From tumors to blood: biomarker-based diagnostics, and implications in prognostics and therapeutics of glioblastoma multiforme* **Canadian Institutes of Health Research** Co-applicant

*Role of a novel NF1 – LRPPRC interaction in RNA granule transport* **b.r.a.i.n.child**

*Tissue factor in tumour progression and angiogenesis* **Canadian Institutes of Health Research** Co-applicant

*GATA4 and GATA6 transcription factors in gliomagenesis* **Canadian Institutes of Health Research**

*Nilotinib in growing vestibular schwannomas* **Ontario Institute of Cancer Research**

*Aberrations in EGFR in human GBMs: novel diagnostic and biomarker strategies* **Cancer Research Society**

*Receptor tyrosine kinase expression, activations and inhibition in high grade pediatric gliomas* **b.r.a.i.n.child**

*Oncogene-containing microvesicles as mediators and messengers of tumour progression* **Canadian Institutes of Health Research** Co-applicant

*Role of peroxisomes in gliomas;* **Brain Tumour Foundation of Canada**

### Dr. Jane McGlade

*Role of the endocytic adaptor protein Numb in normal development and cancer* **National Cancer Institute of Canada**

*Role of mammalian CRB1 in retinal morphogenesis and degeneration* **The Foundation Fighting Blindness, Canada**

*Role of the GADS adaptor protein in BCR-Abl induced leukemogenesis* **The Leukemia and Lymphoma Society of Canada**

*Role of the SLAP adaptor proteins in ubiquitin dependent regulation of receptor tyrosine kinases* **Canadian Institutes of Health Research**

*Role of the E3 ligase LNX2 in Wnt signaling, cell polarity and cancer* **Canadian Institutes of Health Research**

*Alternative splicing of Numb in medulloblastoma* **b.r.a.i.n.child**

*Role of the CRB1-EPB41L5 complex in retinal degeneration* **The Foundation Fighting Blindness, Canada**

*Function and regulation of Numb isoform expression in cancer* **The Foundation Fighting Blindness, Canada**

### Dr. Peter Dirks

*Therapeutic opportunities to target tumor initiating cells in solid tumors* **Canadian Institutes of Health Research** Co-applicant

*Defining cancer stem cell and clonal heterogeneity in mouse brain tumors* **National Cancer Institute of Canada**

*Asymmetrical self renewal in normal and cancer stem cells of the human brain* **Canadian Institutes of Health Research**

## DISTINCTIONS

**2011** James Rutka appointed as the RS McLaughlin Chair in the Department of Surgery at the University of Toronto

**2011** James Rutka is made a Fellow of the Royal Society of Canada

**2011** Uri Tabori is the recipient of the Junior Physician Research Award from the University of Toronto

**2010** Sunit Das recruited from Northwestern University, Chicago

**2010** James Rutka named President of the American Association of Neurological Surgeons

**2010** Todd Mainprize named Fellowship Director for the Division of Neurosurgery

**2010** Peter Dirks appointed Division of Neurosurgery Research Director

**2010** Annie Huang promoted to Associate Professor

**2010** Ab Guha receives Victor Levin Award Society for Neuro-Oncology

**2009** Arthur and Sonia Labatt Brain Tumour Research Centre designated an Institute of the Pediatric Brain Tumor Foundation of the United States

**2009** Michael Taylor receives the Canadian Cancer Society Award for Excellence in Cancer Research

**2009** Todd Mainprize joins the BTRC's research staff

**2009** Ab Guha receives Lister Prize in Surgery University of Toronto

## STUDENT AWARDS

### Vedant Arun

University of Toronto  
Medical Biophysics Fellowship  
Crother's Fellowship in  
Peripheral Nerve Research  
Princess Margaret Hospital Fellowship  
Restracomp  
Garron Family Cancer Centre Grant  
Ontario Graduate Scholarship  
CIHR Vanier Graduate Scholarship  
McMurrich award

### Pawel Buczkowicz

b.r.a.i.n.child

### Roberto Diaz

University of Toronto Fellowship Award  
CIHR Vanier Scholarship

### Adrian Dubuc

CIHR Vanier Scholarship  
Pediatric Brain Tumor Foundation  
Award for Pediatric Basic Science

### Leanne Wybenga-Groot

American Brain Tumor Association  
Basic Research Fellowship

### Tatiana Lipman

Restracomp

### Stephen Mack

CIHR Vanier Scholarship

### Yuzo Terakawa

Uehara Memorial Foundation  
Research Fellowship  
Government of Canada Awards –  
Post-Doctoral Research Fellowship

### Xin (Kevin) Wang

CIHR MD/PhD Studentship  
McLaughlin Centre for Molecular  
Medicine MD/PhD Scholarship  
Canadian Institutes of Health  
Research Health Professional Student  
Research Award

## THE YEAR IN REVIEW

### Dr. Peter Dirks (continued)

*Screening brain cancer stem cells* **Ontario Institute for Cancer Research** Co-applicant  
*Characterization of brain cancer stem cells* **Ontario Institute for Cancer Research** Co-applicant  
*Understanding the human brain tumorigenic process: focus on cancer stem cells* **National Cancer Institute of Canada**

### Dr. Annie Huang

*Discovery and characterization of C19MC a novel oncogenic miRNA locus in malignant brain tumours* **Canadian Institutes of Health Research**  
*Genetic alterations converge on cell adhesion pathways in childhood sPNET* **National Brain Tumor Society**  
*Biochemical and genetic analyses of JPO2, a novel of c-Myc interacting protein* **Canadian Cancer Society Research Institute**  
*Identification of prognostic factors and therapeutic targets in childhood CNS atypical teratoid rhabdoid tumours (ATRT)* **C17 Childhood Cancer and Blood Disorders Research Network** Co-applicant  
*Translating next-generation sequencing technologies into improved therapies for high-risk childhood cancer* **Genome Canada/CIHR Advancing Technology** Co-applicant

### Dr. Michael D. Taylor

*The role of aberrant HGF/cMET signaling in medulloblastoma* **National Cancer Institute of Canada** Co-applicant  
*Role of histone lysine methylation in medulloblastoma and cerebellar development* **Canadian Institutes of Health Research**  
*Medulloblastoma and metastases* **National Institute of Health, United States**  
*Zebrafish as a novel, tractable model of metastatic medulloblastoma* **New Ideas' Cancer Research Fund, The Hospital for Sick Children**  
*Translating next-generation sequencing technologies into improved therapies for high-risk childhood cancer* **Genome Canada/Canadian Institutes of Health Research** Co-applicant  
*Stratifying and targeting medulloblastoma through genomics* **Genome Canada**  
*Cellular and genetic basis of anaplastic medulloblastoma* **National Institutes of Health, United States**  
*Co-operating events and drug response in sonic hedgehog driven medulloblastoma* **McLaughlin Center for Molecular Medicine**  
*Creation of a tractable preclinical model of metastatic medulloblastoma in zebrafish* **b.r.a.i.n.child**  
*Identification and validation of the first Group D medulloblastoma oncogene* **b.r.a.i.n.child**

### Dr. Cynthia Hawkins

*Targeting paediatric brainstem glioma using integrated whole genome analysis* **Canadian Institutes of Health Research**  
*Prediction and Prevention of glioma recurrence by targeting telomere dependent self-renewal capacity of tumor initiating cells* **Canadian Institutes of Health Research** Co-applicant  
*The Canadian Pediatric Cancer Genomic Consortium: unravelling the genetic basis of childhood cancer through next-generation sequencing* **Canadian Institutes of Health Research**  
*Detailed expression analysis of paediatric brainstem gliomas* **b.r.a.i.n.child**  
*GATA4 and GATA6 transcription factors in gliomagenesis* **Canadian Institutes of Health Research** Co-applicant  
*Genome-wide profiling of pediatric diffuse intrinsic pontine glioma* **National Brain Tumor Society**

## THE YEAR IN REVIEW

### Dr. Uri Tabori

*Prediction and prevention of glioma recurrence by targeting telomere dependent self-renewal capacity of tumor initiating cells* **Canadian Institutes of Health Research**

*Exhaustion of tumor initiating cells by targeting their self-renewal capacity with telomerase inhibition* **The Terry Fox Foundation**

*Examining the relationship between white matter integrity and the speed of neural processing in healthy children and children with brain tumours* **Comprehensive Cancer Centre** Co-applicant

*The neuro-protective effects of exercise in children treated with cranial radiation for brain tumours* **Canadian Institutes of Health Research** Co-applicant

*Combined telomerase inhibition and drug screen as novel therapies for tumor initiating cells in pediatric nervous system tumours* **Canadian Institutes of Health Research – New Investigator Award**

*A novel classification for childhood low grade gliomas* **b.r.a.i.n.child**

*Prediction of tumor resistance and normal brain sensitivity to cranial irradiation in pediatric brain tumours* **b.r.a.i.n.child**

*Combined telomerase inhibition and drug screen as novel therapies for tumor initiating cells in pediatric nervous system tumors* **Ontario Institute for Cancer Research**

*Predictors of functional and neuro-cognitive outcomes in long term survivors of pediatric low grade gliomas* **Pediatric Brain Tumor Foundation of the United States (PBTfUS)**

*Prognostic and therapeutic implications for telomere maintenance and telomerase inhibition in pediatric high grade gliomas* **Canadian Institutes of Health Research**

*Genetic determinants of predisposition to childhood brain tumor initiation and progression* **b.r.a.i.n.child**

*Establishment of a comprehensive genetic bank for children with brain tumors* **b.r.a.i.n.child**

### Dr. Sidney Croul

*Signaling from IGF1 to Beta 1 integrin in medulloblastoma* **b.r.a.i.n.child**

*Metastatic medulloblastoma: whole genome expression* **b.r.a.i.n.child**

*The role of Beta 1 and Beta 8 integrins in medulloblastoma metastasis* **Grant Miller Foundation**

*Beta integrins as adhesive molecules in leptomeningeal medulloblastoma* **b.r.a.i.n.child**

### Dr. Gelareh Zadeh

*Radiation response of normal brain to ionizing radiation* **b.r.a.i.n.child**

*Molecular mechanisms of anti-angiogenesis and radiation therapy in brain tumors* **Canadian Institutes of Health Research**

*Identifying molecular therapeutic targets for bone invasive meningiomas* **Brain Tumour Foundation of Canada**

### Dr. Sunit Das

*The role of prostacyclins in the survival of glioblastoma brain tumor stem cells* **b.r.a.i.n.child**

*Treatment of brain tumor stem cells using a self-assembling gel* **Northwestern Memorial Hospital Auxillary Board Award**

*Self-assembling peptide amphiphiles in the treatment of brain tumours* **Northwestern Memorial Hospital Dixon Award** Co-applicant

### Dr. Todd Mainprize

*Molecular targeting of the Rho-GTPase pathway in human astrocytomas* **Canadian Institutes of Health Research** Co-applicant

## STUDENT AWARDS

### Xiaochong Wu

American Association for Cancer Research Scholar-in-Training Award

American Brain Tumor Association Fellowship Award

AACR–Bristol-Myers Squibb Oncology Scholar-in-Training Award

### Yuan Yao

Restracomp

### MAJOR GRANT AWARD FROM GENOME CANADA

Michael Taylor and David Malkin from SickKids Haematology/Oncology, and Marco Marra from the Department of Medical Genetics at the University of British Columbia have been awarded a multi-year, multi-million dollar grant award from Genome Canada for their proposal on the *Genetics of Paediatric Medulloblastoma*. This proposal focuses on the recently identified sub-classification of medulloblastoma into four distinct subgroups of tumours. Through further genetic analyses, Taylor and colleagues will study additional tumours to identify novel targets within subgroups that can be used to help stratify children with medulloblastoma into more appropriate treatment groups.

Congratulations to Dr. Taylor and his collaborators for this very significant award!



## MAJOR DONORS

### JACK MICHAEL BAKER FUND

Brian and Erin Baker have established a fund to further research on cancer stem cells in brain tumours. This donation is in honour of their son, Jack Michael Baker.

### LAURIE BERMAN FUND FOR BRAIN TUMOUR RESEARCH

Established in 2002 by Helen and Joe Berman in memory of their son, Laurie, this fund provides ongoing support for graduate students, postdoctoral research fellows, lab equipment and supplies. The fund also enables neurosurgical nurses to attend the annual Canadian Neurological Sciences Federation meeting.



### NATHALIE CROSBIE ENDOWMENT FUND

The Nathalie Crosbie Endowment Fund was created in 1998 by Jolie Lin and Ian Crosbie to support paediatric brain tumour research at SickKids. The fund is now fully endowed and enables scientists at the BTRC to perform research on medulloblastoma, the most common malignant brain tumour in children.

### JONATHAN HILL FUND

In 1997, Jonathan Hill, a vivacious, charismatic boy with an infectious smile, an irresistible charm, a beloved son and nephew, lost his courageous battle to a brain tumour at the age of eight. At the same time, two of his cousins were fighting their own battles and both are survivors. Why? Mostly because of the tireless efforts of doctors and researchers who were able to develop life-saving treatments for their particular cancers. Paediatric cancer research has come a long way, and has resulted in treatments that improve the quality of life for children with cancer, and even produced higher cure rates. The Jonathan Hill Fund will specifically assist research in the areas of brain tumours and leukemia, two of the most common childhood cancers. This fund will help future children afflicted with cancer beat the odds and help keep Jonathan's memory alive.



### ROCHELLE SHERWOOD FUND FOR BRAIN TUMOUR RESEARCH

Judy Stein-Korte and Carl Korte have given generously to establish a fund to support research in the BTRC in honour of Judy's sister, Rochelle, who was diagnosed with a brain tumour. This endowment fund will be used to support ongoing research projects on esthesioneuroblastoma, medulloblastoma and primitive neuro-ectodermal tumours.



### THE WILEY FUND IN BRAIN TUMOUR RESEARCH

Established in 2001 by Averil and Joe Wiley in honour of their son, Andrew, who was cared for by Dr. Rutka. This fund supports the ongoing research projects of two PhD students and two postdoctoral research fellows.

### BEQUEST FROM THE ESTATE OF ERIC YOLLES

A bequest has been received from the estate of Eric Yolles to be used for furthering research in the BTRC.



### CHARITABLE DONATION FROM SOLMON ROTHBART GOODMAN LLP

For the past several years the Labatt BTRC has received an annual donation from Solmon Rothbart Goodman LLP. Randall Rothbart and Dr. Rutka have been friends since elementary school.

## ANNUAL FUNDRAISING EVENTS

**Amy's Shining Star** is a dinner dance that is held biennially by family and friends in memory of Amy Beacock. This event continues to raise necessary funding for brain tumour research.

**B-Strong Bash** is an annual cocktail party that raises funds for brain tumour research at various institutions. In 2010 the B-Strong Bash raised \$30,000 for the Brain Tumour Research Centre at SickKids, bringing the four-year total to \$100,000.

**Bunzl Canada** continues its strong commitment to b.r.a.i.n.child through its annual "Ripple of Hope Golf Tournament." Bunzl Canada believes it is important to participate in the communities in which it exists and it continues to make a vital impact in the lives of children and families afflicted by brain tumours.

**Care for Kids** is a long standing SickKids donor who supports b.r.a.i.n.child through its annual golf tournament. Care for Kids is pleased to support The Arthur & Sonia Labatt Brain Tumour Research Centre because it is one of the best centres in the world.

**E1 Entertainment** supports b.r.a.i.n.child through its annual charity golf tournament. E1 Entertainment is committed to making a difference in the lives of children and their families afflicted with brain tumours through its generous support.

**Jessica's Footprint** is a five-kilometre, family-oriented walk held in her hometown of Guelph. This past June, the Durigon's, as well as over 2,000 members of the Guelph community celebrated the Jessica's Footprint Walks 6th anniversary! To date, over \$1 million has been raised to support the BTRC. Funds raised will be used to create an endowment at SickKids, which will ensure that Jessica's legacy will continue to fund world leading paediatric brain tumour research at SickKids and help change the lives of patients and their families.

**Larry and Gloria Sdao** hosted annual fundraisers for b.r.a.i.n.child and helped to change the lives of children diagnosed with brain tumours.

**Laughing with the Ladybugs** is the fifth annual event in support of b.r.a.i.n.child was held on September 17. Featuring live and silent auctions, raffle, dinner and comedic entertainment. The event was started to mark Kathryn Peeters 10th anniversary of diagnosis with a massive brain tumour at age four. Her family is thankful that Kathryn is a survivor and wants to help other families.

**Meagan's Walk: Creating a Circle of Hope** celebrated its 10th annual walk in May. It has raised over \$2 million in support of b.r.a.i.n.child and the Meagan Bebenek Endowment Fund at SickKids. The walk spread awareness about brain tumours as the leading cause of cancer related deaths in young people and engages the community to participate in fundraising events to make a difference. Meagan's legacy continues to change the lives of children and their families in Canada and around the world.

**Rigatoni for Research** is a fundraising dinner created in memory of Christopher Douthart. Christopher's family created a legacy to honour his short yet powerful life and raised over \$1.6 million in its 10-year history in support of b.r.a.i.n.child and The Arthur & Sonia Labatt Brain Tumour Research Centre.

**Skate With Daniel** is a fundraising event held by family and friends to promote awareness and support brain tumour research and carry on Daniel Michael Bertoia's wish of one day finding a cure. This annual skate honours Daniel's love of hockey and brings together his friends, family and community to raise funds for an endowment created in his name and support of b.r.a.i.n.child.





## ANNUAL FUNDRAISING EVENTS

**Suri's Smile** is a gala organized by Jarrod and Lisa Boon to celebrate their daughter Suri's birthday in an effort to create a legacy in her memory and raise much-needed funds and awareness about paediatric brain tumours.

**Tali's Fund** raises money for various research projects, some of which study in Atypical Teratoid/Rhabdoid (ATRT) tumours. Dr. Huang was the recipient in 2008 of these funds to help her research in ATRT. Since 2008 this group has raised over \$60,000.



**Team Brother Bear** continues its fight against brain tumours in memory of Austin Brasil by supporting b.r.a.i.n.child. Through its fundraising efforts and dedication the team supports brain tumour research and families in need.

**Walk for Grace** 6th Annual fundraiser to support paediatric brain tumour research at The Hospital For Sick Children. It consists of a 31 km road and trail walk/run representing 1 km for every month of Grace's life. The Grace Compagnon Stanley Tribute Fund passionately supports b.r.a.i.n.child and all research at SickKids. Ian Stanley and Leslie Compagnon began this walk for their daughter Grace, with the goal of helping to reach a greater understanding of brain tumours by supporting research.



## BTRC DONOR WALL



## PUBLICATIONS

### 2010

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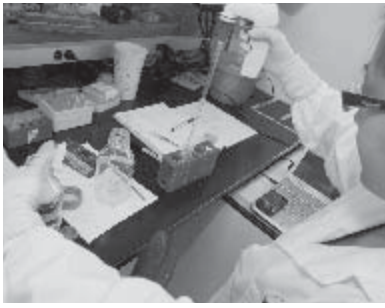
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**The BTRC would like to thank and acknowledge the volunteer and professional photographers who have contributed to the year's Report.**

Elizabeth London is the photographer from the Bunzl Golf Tournament.

Mallory Hawkins is the photographer from Ladybugs.

Nancy Howson is the photographer from Meagan's Walk.

SickKids Creative Services has been involved in all the BTRC personnel and on-site photographs.



#### **Acknowledgement**

We would like to acknowledge the generous support of the research institutes and Foundations of The Hospital for Sick Children and the University Health Network in the establishment of The Arthur and Sonia Labatt Brain Tumour Research Centre. Special thanks to b.r.a.i.n.child for generously supporting ongoing research projects.

To learn more about The Arthur and Sonia Labatt Brain Tumour Research Centre, visit [www.sickkids.ca/research/BTRC](http://www.sickkids.ca/research/BTRC).

**SickKids®**

THE HOSPITAL FOR  
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*The Arthur and Sonia Labatt*  
**Brain Tumour Research Centre**

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Toronto General Hospital Toronto Western Hospital Princess Margaret Hospital