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extending our reach

Annual Report 2011 2012

working together for healthy brains

NeuroDevNet, a Canada Network of Centres of Excellence (NCE), is dedicated to helping children and their families overcome neurodevelopmental disorders

Vision

To improve the lives of children with neurodevelopmental disorders and their families by accelerating and integrating the discovery and utilization of knowledge about disorders of the brain, their early diagnosis, prevention and therapy.

Mission

NeuroDevNet is a national trans-disciplinary network dedicated to bringing hope to children with ASD, CP, FASD and related neurodevelopmental disorders, as well as to their families and caregivers. NeuroDevNet funds integrated team-based research initiatives related to cause, early diagnosis, and interventions. Engaging families, stakeholders and partners both nationally and internationally, NeuroDevNet leverages and enhances the talents of new and seasoned researchers to translate research findings into effective therapies and ethically-guided policy and practice.

Objectives

Capacity Building

Train the next generation of experts in brain development disorders.

Research

Support and conduct multidisciplinary research excellence.

Knowledge Transfer

Raise awareness of brain development disorder and disseminate research findings to help with care delivery and policy decisions.

Business Development

Support

Translate research findings into diagnostic, preventative, and therapeutic applications.

NeuroDevNet's spiral logo

communicates change, progression, and evolution. Its bright multi-colour palette emphasizes the network's focus on children. Starting from a smaller yellow neuron, denoting hope, the neurons rise to a crescendo, ending in a green neuron, signifying health. The third annual report aligns with the purple neurons in our spiral, conveying the theme of wisdom.

NeuroDevNet is made possible by the Networks of Centres of Excellence, a program of the federal

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government to advance science and technology.







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making connections

NeuroDevNet

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Design

Photos

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comment from the Scientific Director and **Executive Director**

WITH INCREASING MOMENTUM, NeuroDevNet is bringing together researchers, policymakers, parents and children, health professionals and an ever-extending range of partners with a common passion for understanding the developing brain, and helping families and individuals faced with neurodevelopmental challenges.

Our advancement during the second year as a Network encompasses more than the amount and diversity of research we fund in autism, cerebral palsy and fetal alcohol spectrum disorder (FASD). It includes the increasing number trainees and young professionals brought into NeuroDevNet through fellowships, workshops and internships with our researchers and industry partners, and our growing impact through collaborations across Canada and alliances around the world.

That NeuroDevNet is becoming a trusted ally in supporting brain research and brain development initiatives is evident in the expanding range of stakeholders seeking our involvement, and our ability as a Network to leverage our resources by attracting substantial external funding for our endeavours. Partnerships fostered by the network have increased from 18 organizations in year one, to 70 in year two. These include new relationships with government ministries, industry, highly regarded research organizations, and non-profit organizations active in our fields of interest.



A highlight of working with like-minded organizations over the past year was Health Minister Leona Agulukkaq's March 27 announcement of the launch of competition for a new chair focused on bringing innovative approaches to the treatment and/or care of autism spectrum disorders. NeuroDevNet partnered in this initiative, contributing \$150,000 of the \$1 million of the funds needed by Canadian Institutes for Health Research to finance the Chair.

We have made a concerted effort to catalyze research in all aspects of developmental neurosciences. Our researchers have shaped this process, sharing their diverse interests and expertise throughout our trans-Canadian network. This is an inherent strength of the NCE program, and a hallmark of the uniqueness of NeuroDevNet.

We are hitting our stride within NeuroDevNet, and are proud of the results we are sharing with you through this annual report. Our researchers are making world-class genetic discoveries in autism, establishing a trans-Canada registry for improving care for children with CP, understanding the underlying brain issues in fetal alcohol spectrum disorder, researching basic mechanisms of brain development, and developing computer gaming technology to establish effective and evidence-based interventions in all three disorders.

These initiatives are sustained by research and crucial data infrastructure research and design executed by our Neuroinformatics group, whose Neurocarta Database and associated tool, Gemma, enable comparisons of vast amounts of genomics data among neurodevelopmental disorders. Our Neuroethics group has analyzed treatment information produced by advocacy organizations, and the challenges posed to parents and policymakers in healthcare decision-making informed by resources on the Web.

NeuroDevNet's translation and exploitation of our research outputs has flourished in year two. Our combined efforts, aided by our dedicated knowledge translation group, have placed useful, actionable information in the hands of partners and stakeholders alike, with a particular focus on families affected by neurodevelopmental disorders. Our annual brain development conference continues to grow and attract stellar presenters and attendees.

Key to our success has been the selfless giving of time and energy by the members of Board and our Research Management Committee, and the Research Training Committee, who help us keep our sights on excellence. We will be re-engaging our Scientific Advisory Board, whom we also thank for steering us in the right direction from the start, to position us for renewal in two years' time.

There is more potential, excitement and hope to anticipate as we join forces in helping children and families overcome neurodevelopmental disorders. We are closer to that goal with your help.

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Daniel Goldowitz Scientific Director, NeuroDevNet

Nicola Lewis Executive Director, NeuroDevNet

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over the past year, one of remarkable achievement and progress. During this second year of activity,

ON BEHALF OF MY COLLEAGUES on the Board of

Directors of NeuroDevNet, I am proud to present

this Annual Report which highlights our activities

NeuroDevNet, a truly unique research network, has begun to deliver on the promise on which we base our existence: through novel approaches to collaborative research and, as importantly, through the corresponding dissemination of the results to clinicians and families, we are helping children and families overcome the challenges they face in dealing with neurodevelopmental disorders. Launched in December 2009, with funding from the Government of Canada's Networks of Centers of Excellence Program (NCE) of \$19 million over five years, the NeuroDevNet network has already accomplished significant achievements in its short life.

In this 2011|2012 annual report, you will read about how our researchers are narrowing in on the genetic roots of autism, cerebral palsy, and fetal alcohol spectrum disorder, and how NeuroDevNet's support for the development of therapeutic interventions is already providing meaningful, measurable outcomes for children and parents for whom encouraging news has been only too scarce in previous years.

By strategically allocating the financial resources entrusted in our care, we have focused on the support of multi-disciplinary research aimed at identifying the causes of neurodevelopmental disorders and improving early diagnosis; on broadening our training programs that are nurturing the next generation of Canadian neuroscientists to include preparation for careers outside academic settings; and on translating our findings into commercially viable products with the potential to influence clinical practice or into influencing health care policy in order to improve both the quality of health care delivery and its economics. This report provides examples of these important areas of NeuroDevNet activities. In the years ahead, we plan to continue and, in some cases, extend these efforts.

A strong feature of the overall NCE program is collaboration, and a great strength of NeuroDevNet is its partnerships. Our network's reach is increasingly global, engaging researchers and institutions at the leading edge in neurodevelopmental work in the United States, France, Israel and Australia as well as exchanging knowledge, and fostering capacity building alongside like-minded colleagues in the key emerging economies of India and China.

NeuroDevNet's Board of Directors has been crucial in guiding the network toward these partnerships and accomplishments, as well as the specific success stories recounted in this report. Over the past year, the Board was comprised of fourteen members who represent different levels of experience and expertise, and a diversity of backgrounds from the private, university and public sectors. Our directors' wealth of skills and attributes has served NeuroDevNet well, providing important oversight in the governance, strategy and the management of the network. We are very fortunate to have an engaged group of individuals who

execute their duties and stewardship with the utmost care and due diligence. This is particularly true of the work over this past year particularly in determining the strategic direction of NeuroDevNet as it moves forward in the next two years and into the renewal phase.

Three of our number stepped down in 2012 at the end of their terms of service. I would like to acknowledge the contributions of Dr. Aubrey Tingle, Dr. Franz Hefti, and Dr. Irene Bridger as Directors of NeuroDevNet. For an NCE with a mandate to ensure generated knowledge is translated into tangible diagnostic, preventative, therapeutic, social, economic and health benefits, the extensive talents of our departing Board members have been essential in helping ensure the success of the network. I thank each one of them for their support and service to NeuroDevNet.

At our 2012 Annual General Meeting, NeuroDevNet welcomed several new Directors of the Board. Dr. Glenis Godlovitch, Mr. Patrick Lafferty, Dr. John O'Neil, Dr. David Phipps, and Dr. James Reynolds. Collectively they bring skills in the areas of industry, private sector partnerships and commercialization, knowledge translation, ethics, law, executive leadership, finance and research in aboriginal health and fetal alcohol spectrum disorder. Each also has an understanding of the mandate and uniqueness of the Centres of Excellence Program. I know they will bring wise counsel and innovative ideas to NeuroDevNet.

Together with our Board and the scientists, trainee researchers, partners and staff who are NeuroDevNet we are working to overcome neurodevelopmental disorders— both raising awareness of their existence, and mitigating their impacts. We encourage you to learn more about NeuroDevNet, and to join us in helping children with neurodevelopmental disorders live healthier lives.

Henri Rothschild Chair of the Board of Directors. NeuroDevNet

comment from the Chair of the Board of Directors



Jem Roveld



NeuroDevNet's Board of Directors New Member Profiles

IN 2012. NEURODEVNET WELCOMED FOUR DISTINGUISHED NEW MEMBERS TO ITS BOARD OF DIRECTORS. We are honoured by the participation and guidance of Ms. Glenys Godlovitch, Mr. Patrick Lafferty, Dr. John O'Neil, Dr. David Phipps and Dr. James Reynolds, whose contributions will guide NeuroDevNet through a period of critical growth and development as the network prepares for renewal in 2014.

Glenys Godlovitch

A philosopher and lawyer, Glenys Godlovitch came to health law and ethics through a happy coincidence when she moved for family reasons to Christchurch, New Zealand in 1994. Until then Glenys practised law in Alberta and taught occasional university courses in philosophy, jurisprudence and criminal law. In New Zealand, Glenys's first job was as a lawyer with the regional health authority. In 1996 she took an academic position in law and philosophy at Lincoln University, teaching commercial and real estate law as well as an introduction to philosophy and moral philosophy. She joined the Canterbury Ethics Committee as ethicist in 1996 and began to focus on and publish in bioethics, medical law and property law. Glenys and family returned to Canada in 2002 specifically for her to take up a position at the University of Calgary where she chaired the University's Conjoint Health Research Ethics Board, taught and supervised students in health law and ethics and served on a number of national and provincial committees to help harmonize research ethics review. She retired from her position as Associate Professor in the Faculty of Medicine at the University of Calgary in September 2012 and now chairs the Alberta Cancer Research Ethics Committee, as well as serving on the steering committee for MICYRN (Mother, Infant, Child and Youth Research Network). Her special interests are health research and bio-banking. registries and secondary use of health information. She continues to maintain her involvement with New Zealand.



Patrick Lafferty

Patrick D. Lafferty retired in 2002 after more than 38 years serving PricewaterhouseCoopers LLP in Toronto, London (U.K.), Montreal, New York, and Ottawa. He provided auditing, business valuation, financial management, and strategic planning services to the private sector, regulated industries, three levels of government, Crown corporations, and the United Nations. This included terms as: Assistant Auditor General of Canada: member of the Public Sector Accounting and Auditing Standards Committee of the Canadian Institute of Chartered Accountants; co-author of a governance study entitled Effectiveness Reporting and Auditing in the Public Sector: and national leader of government, telecom industry and postal services. He also served on the Boards of Opera Lyra, The Rideau Club, and The Country Club. Through the 1990s he provided strategic planning support to: the Medical Research Council, The Canadian Medical Discovery Fund, the Canadian Institutes of Health Research, most branches of Health Canada, the Ontario Cancer Research Network, Rick Hansen Foundation, the Canada West Health Innovation Council, and several universities and research institutes. In retirement he served as a member of the Ontario Cancer Working Group, and provided strategic planning services to St. Boniface Hospital Research Institute, Genome Canada, Ontario Photonics Institute, and the Alberta Heritage Foundation for Medical Research. He recently completed terms on the board of Friends of Canadian Institutes of Health Research, and the Henry G. Friesen International Prize for Health Research. He continues on the boards of the University of Ottawa Institute for Mental Health Research and the Canadian Orthopaedic Foundation.



NeuroDevNet's Board of Directors - New Member Profiles

Dr. John O'Neil

Dr. John O'Neil is Professor and Dean of the Faculty of Health Sciences at Simon Fraser University. Previously. he was Director of the Manitoba First Nations Centre for Aboriginal Health Research, and Professor and Head of the Department of Community Health Sciences in the Faculty of Medicine at the University of Manitoba. He is currently on the Science Advisory Board of Health Canada; the Advisory Board of the National Collaborating Centre for Aboriginal Health; and the Board of Directors of Michael Smith Foundation for Health Research. He was the founding Chair of the Advisory Board for CIHR's Institute for Aboriginal People's Health from 2000 to 2006. Dr. O'Neil's work has been primarily in the area of Aboriginal health. He has published more than 120 papers and reports on a variety of aboriginal health issues, including self-government and health system development, cultural understandings of environmental health

risks, and social determinants of health disparities. Dr. O'Neil's work in this area was recognized by his appointment as a CIHR Senior Investigator in 2000. More recently Dr. O'Neil has become involved in HIV/AIDS prevention in low- and middle-income countries. He has held grants from the Bill and Melinda Gates Foundation, CIHR and CIDA designed to build local public health capacity in China and India in the area of HIV/AIDS prevention. He has published on the cultural context of HIV/AIDS prevention in India. Dr. O'Neil holds a doctorate in medical anthropology from the University of California (San Francisco/ Berkeley).



Dr. David Phipps

Dr. Phipps received his Ph.D. in Immunology from Queen's University (Kingston, Ontario) and undertook post-doctoral studies in HIV research at the University Health Network (Toronto). After leaving the lab he built a career managing academic research holding successively senior positions at the University of Toronto Innovations Foundation (Manager of Biotechnology and Life Sciences), Canadian Arthritis Network (Director of Business Development) and Canadian Institutes of Health Research (Director of Partnerships). In 2001 Dr. Phipps completed his MBA from the Rotman School of Management (University of Toronto). Dr. Phipps is the Director, Research Services & Knowledge Exchange at York University where he manages all research grants and contracts including knowledge and technology transfer. Dr. Phipps authored the first grant offered by the tri-council Intellectual Property Mobilization program funding knowledge mobilization (KMb) in partnership with the University of Victoria to build the infrastructure for a KMb network that has grown to include Memorial University of Newfoundland and Labrador, Université du Québec à Montréal, University of Guelph and University of Saskatchewan. Dr. Phipps is leading York's KMb Unit that provides services to researchers, community organizations and government agencies who wish to use policy and practice related research to inform public policy and professional practice. In 2012 York University's KMb Unit was awarded a best practice award from the Europeanbased Knowledge Economy Network.



Dr. James Revnolds

Dr. James Reynolds is a graduate of Queen's University (B.Sc., 1982, Ph.D, 1987). His thesis research investigated the neurochemical mechanisms underlying heavy metal toxicity. Subsequently, he completed postdoctoral training at the Addiction Research Foundation and the University of Toronto. Dr. Reynolds' first faculty position was at Memorial University in St. John's, Newfoundland. He returned to Queen's in 1995, where his research program has grown to encompass both basic and clinical investigations. Dr. Revnolds is a Full Professor in the Department of Biomedical and Molecular Sciences, and the Centre for Neuroscience Studies, at Queen's University. His research interests over the past 20 years have centred around studies on the effects of alcohol on brain function. In particular, his current research program is focused on understanding the mechanisms of brain injury, and the resulting behavioural and cognitive deficits. that are induced by prenatal exposure to alcohol. The long term goal is to understand how prenatal exposure to alcohol alters brain neurochemistry and structure, and thus brain function, in offspring. Dr. Reynolds has been funded by CIHR for interdisciplinary basic and clinical investigations into the cellular mechanisms and neurobehavioural consequences of Fetal Alcohol Spectrum Disorder (FASD). He led a 7-member CIHR-funded New Emerging Team in FASD research, and is the Project Lead for the FASD Demonstration Project in NeuroDevNet.



NeuroDevNet by the Numbers

Key Developments 2010-2012

Internships 2010/11 2011/12 **Member Institutions** 25 2011/12 83 24 2010/11 **Collaborators - Publications* 42 Articles in Refereed** 3 **Publications** 2010/11 2011/12 *Collaborators - Publications represents the number of non-network researchers involved in significant collaboration

with network researchers on publications.

NeuroDevNet by the Numbers - Key Developments 2010-2012



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Genetic discoveries... will pave the way for more targeted and individualized therapies.

Autism Research Group

NeuroDevNet's Autism research group made a number of significant discoveries in the past year that improved understanding of the genetics of autism and other neurodevelopmental disorders. The group also spearheaded an international effort to establish a biorepository aimed at supporting research into genetic influences on outcomes of infants at increased risk of autism spectrum disorder (ASD).

NeuroDevNet's Autism Research Group at the Leading Edge of Identifying Potential Genetic and Environmental Interactions in ASD

The group's most notable achievements this year included identifying new and rare inherited variations in genes associated with Autism Spectrum Disorder, as well as ADHD and other neurodevelopmental conditions. Copy number variation (CNV), a phenomenon where genes in the human genome —the body's instruction manual— are missing or duplicated, is known to influence many body functions, including brain development. Dr. Stephen Scherer, co-principal investigator on NeuroDevNet's ASD project, and a senior author has been a pioneer in identifying CNVs related to autism.

The new findings were published in *Science Translational Medicine* and received national media attention as well as coverage from prestigious science news organizations in the United States. A second publication in the American Journal of Human Genetics identified new and rare inherited deletions of genetic coding on NRXN3, a member of a gene family already implicated in ASD.

"Identifying these genes will allow for better diagnostic testing in the future," says Dr. Stephen Scherer, co-principal investigator on NeuroDevNet's autism project. "Genetic discoveries are also helping us understand the specific mechanisms underlying abnormal brain development in ASD, which will pave the way for more targeted and individualized therapies".

Leveraging NeuroDevNet's Resources to establish an International Biorepository for Autism Research

Drs. Zwaigenbaum and Scherer were awarded a \$1.3 million grant from the Simons Foundation for Autism Research Initiative (SFARI) and Autism Speaks US to lead an international group in the establishment of a new biorepository.

The biorepository, a collection of DNA samples and other biological specimens, will be aimed at supporting research into genetic influences on outcomes in infants at increased risk of ASD. The new BSRC biorepository will link biological samples with observational data for individuals with ASD across several sites, including the Canadian Infant Sibling Study group (Drs. Zwaigenbaum, Susan Bryson, Wendy Roberts, Jessica Brian, Isabel Smith and Peter Szatmari) and five other sites of the international Baby Siblings Research Consortium (BSRC).

"The award complements and leverages NeuroDevNet funding, by adding resources for blood collection and additional phenotype data— information about behaviour and personality style in parents and other family members, the home environment and pregnancy exposures" says Dr. Zwaigenbaum. The Autism Speaks grant will support microarray analysis, a technology used to study the expression of many genes at once, he adds.

"Support from NeuroDevNet provided the foundation for both the Canadian effort and the international collaboration," says Zwaigenbaum, "which promises to lead to new insights into genetic contributions to development and outcomes in highrisk infants, as well as provide an international resource to other scientists for years to come."

Autism Research Group

A substantial portion of adults with ASD remain un- or under-employed.

NeuroDevNet Supports Vocational Opportunities Conference for People with ASD

One of the greatest concerns for adults on the autism spectrum and their parents is the lack of opportunities for meaningful work or other vocational activity.

NeuroDevNet acknowledged the importance of this issue by supporting "On the Job: Advancing Vocational Opportunities for Persons with Autism Spectrum Disorders (ASD)", a conference held in February 2012 in Toronto. The gathering drew 260 people from across Canada and the United States, and included people with ASD, families, service providers, employers and HR personnel, researchers, policymakers, elected officials and other stakeholders.

"This is an important area, as vocational opportunities are noted as critical to a living wage, self-esteem and quality of life for adults," says Dr. David Nicholas, who oversees knowledge exchange for NeuroDevNet's autism research group, and played a key role in organizing the conference, along with Dr. Wendy Roberts.

"A key concern here," continues Nicholas, "is that while vocational opportunity emerges as so important for adults with ASD, a substantial proportion of this population remain un- or under-employed."

While there are examples of successful and supportive programs for adults with ASD, substantial gaps in knowledge and practice remain. Researchers are increasingly interested in evidence-informed models, and demonstrating outcomes in this arena, says Nicholas.

Presentations at the conference included a plenary session by Thorkil Sonne, who spoke about Specialisterne, a Danish company that is successfully providing information technology jobs to people with ASD. "Sonne addressed components of his initiative's success," says Nicholas, "including extensive assessment, support and training for employees. He presented his inspiring goal of enabling one million jobs worldwide for adults with ASD." Other presenters included Randy Lewis from US-based Walgreens and Susan Bryson, a researcher and advocate for opportunities for adults with ASD.

Next steps in the developing field of vocational research and services in ASD include developing a strong theoretical and evidence base guiding vocational practice in ASD, developing best approaches relative to the diversity across the

autism spectrum, and moving from evidence to action at regional, provincial and national levels, according to Nicholas. Plans are underway for a second vocational conference to be held in June 2013 in Calgary, co-chaired by Drs. Margaret Clarke, David Nicholas and a national conference committee.

Other supporters of the 2012 ASD vocational conference were: the Hospital for Sick Children's (SickKids) Autism Research Unit, SickKids Foundation, Sinneave Family Foundation, New Haven Learning Centre, Autism Speaks Canada, the Faculty of Social Work at the University of Calgary, and KRG.



Cerebral Palsy Research Group

Cerebral palsy (CP) is one of the most common causes of physical impairment in children. NeuroDevNet's cerebral palsy research group is making strides in identifying the profile and risk factors of CP in the Canadian population, and advancing understanding of the causes of CP, as well as prevention and treatment of the disorder.

Growing the First National CP Registry in North America

The 2011 launch and expansion of the Canadian Cerebral Palsy Registry into multiple regions across the country brings us closer to identifying potential risk factors in pregnancy and the interactions of genetics and the environment on the disorder. Now operational in Quebec, the Greater Toronto Area, Northern and Southern Alberta, Newfoundland, Nova Scotia and British Columbia, the registry is a secure, de-identified database compiling information about children with CP born on or after January 1st, 1999.

"We want to understand the prevalence and spectrum of CP in Canada", says Dr. Michael Shevell, principal investigator of NeuroDevNet's CP group, and co-lead on the CP registry team. "This means the type, severity, the suspected cause, and conditions associated with cerebral palsy. We also want to know the geographic distribution of children in Canada who have a CP diagnosis."

A total of 690 children have been enrolled in the registry since early spring, 2012. The registry team is interested in studying pre-natal, birth, and post-natal factors linked with a CP diagnosis in this population, as well as fetal, maternal and environmental factors associated with CP type or severity.

Shevell and colleagues have studied registry data on children with CP and have generated a number of publications in high-profile journals. Registry researchers are also interested in the use of health care services among families with children with CP, and want to gain insight into parent's perspectives on their child's care.

Future plans for the registry include exploration of associations between family income, education levels and the severity of CP and other, related conditions often seen in children with the disorder.

We want to understand the prevalence and spectrum of CP in Canada... 77





Cerebral Palsy Research Group

We are very excited that this kind of functional and anatomical repair and regeneration of white matter is possible in the brain.

Stem Cell Breakthrough Shows Promise for CP and other Neurological Disorders

Demyelination —the loss of the fatty white matter (myelin) that normally surrounds neurons— is a major feature of cerebral palsy (CP). Myelin increases the speed of nerve impulses transmitted by individual neurons, and is necessary for the proper functioning of the nervous system.

Dr. Michael Fehlings, associate scientific director of NeuroDevNet and a member of the CP research group, showed that transplanted stem cells will migrate to certain areas of the brain where they become cells capable of creating myelin.

The group also found that when brains with transplanted stem cells were imaged using MRI, increased signals indicating the presence of white matter. These findings, indicating the physical presence of myelin were reinforced by studies examining the function of the neurons following stem cell transplantation. Electrophysiological experiments showed that the neurons with stem-cell generated white matter were functioning as a myelinated neuron should.

"We are very excited that this kind of functional and anatomical repair and regeneration of white matter is possible in the brain," says Fehlings. "Further studies confirming this could have immense potential to be translated into the clinic for CP —and other conditions where demyelination is found— such as spinal cord injury and multiple sclerosis."



Cerebral Palsy Research Group



Timing of Intervention and Prenatal Diet Show Potential Benefits in CP

Dr. Jerome Yager's group has made discoveries that reflect the importance of early intervention in cerebral palsy and explored a dietary strategy that may prevent the condition. The group studied inflammation changes in fetal rats exposed to placental insufficiency, a complication of pregnancy in which the placenta cannot bring enough oxygen and nutrients to the developing fetus. Placental insufficiency is known as one of the most common underlying causes of CP.

"We found, surprisingly, that the inflammatory response in newborn rats, which are developmentally similar to the premature newborn human, is muted," says Yager. "The findings are important, as they may help us direct the timing of certain therapies for CP, especially stem cell placement.

"Most current studies are looking at interventions late in childhood," he adds. "Our findings suggest that stem cell therapies can be used at a much earlier stage, post-injury in the newborn, when they will have a greater potential impact."

Yager's group has also explored preventive strategies for brain injury and CP in the newborn. "We've previously shown that eating broccoli sprouts, which act as phase-II enzyme inducers, prevents the white matter injury to the brain that is typical in cerebral palsy. Even more importantly, the sprouts prevent the developmental disability in these animals from occurring."

Phase-II enzyme inducers increase the body's ability to fight oxidation —free radical damage to cells— and inflammation, explains Yager. "Typically," he adds, "because the fetus and newborn are still immature, they have limited capacity to withstand the additional stress of placental insufficiency. Phase-II enzyme inducers help with that."

In preparation for the first steps of a human clinical trial, looking at broccoli sprout consumption as a CP prevention strategy, Yager's group has conducted a systematic review summarizing research evidence on the safety of medicinal use of cruciferous plants, which include broccoli, brussels sprouts and cabbage.

They have also conducted focus groups, to study the willingness of pregnant women to add broccoli sprouts to their diets in conditions where they may be of benefit to their fetus. "Both have had very promising results," says Yager.





The Fetal Alcohol Spectrum Disorder (FASD) Research Group

Prenatal alcohol exposure can lead to a wide range of developmental issues in children, and is the leading cause of mental disability in Canada. NeuroDevNet's FASD investigators are using neuroimaging to improve understanding of early physical signs of the disorder, as well as predictors of outcomes in children with FASD. They are also engaging in and evaluating efforts to share evidence-based information with parents, health professionals and other stakeholders to help discourage pregnant women from consuming alcohol, and assist families in handling FASD-related behavioural challenges.

Creating a Comprehensive Picture of FASD's Impacts on the Young Brain

Led by Dr. Christian Beaulieu, NeuroDevNet's FASD group has been conducting a multi-site brain imaging study. They have generated what may be the largest FASD database in the world, bringing together both MRI brain scans and a wealth of information on behavioural and cognitive functioning. Using different brands of MRI scanners in Edmonton, Winnipeg, Vancouver, and Kingston, the team scanned eight "phantom" controls at each study site to ensure comparable results. Their efforts will be an important contribution to imaging methods in research.

"In our study, we are using what is called Diffusion Tensor Imaging," says Beaulieu. "This gives us a very sensitive way to identify and measure white matter tracts in the brain, which is not possible with any other imaging method.

"Three main brain differences seen in FASD are a small head and brain relative to body size, a thin corpus collosum, and an underdeveloped cerebellum," adds Beaulieu. "Given the variety of neurological and cognitive deficits we see in FASD, other brain regions are likely to be affected— and should be explored. In addition to the white matter 'wiring', our scans will allow us to measure brain volumes and the thickness of the cortex throughout the brain, as well as deep gray matter structures such as the hippocampus, and the amygdala that are important for various cognitive and motor skills."

Beaulieu and his team will compare the brain imaging to eye tracking, cognitive, behavioral, and genetic results for each child in their study to generate an understanding of how the connectivity in the brain as a whole is related to function. A larger imaging study of children with FASD like this is needed, he adds, in order to establish these relationships and to better understand this common neurological disorder.



Raising FASD Awareness and Promoting Education and Prevention

FASD has been shown to negatively impact all facets of society, and is a leading cause of behavioural and cognitive disorders in children. According to Health Canada, it's estimated that 9 out of every 1,000 babies are born with the disorder, though the true prevalence of FASD is probably greater.

In November 2011, NeuroDevNet's FASD and Knowledge Translation groups joined forces to present a Café Scientifique— an informal discussion of the challenges posed by binge drinking and contrasting advice from health professionals offered through the lens of FASD researchers, clinicians, advocacy organizations, public health officers and families affected by FASD.

"How Much is Too Much? Understanding pre-natal alcohol exposure and its impact on individuals, families and society," took place in Kingston, Ontario, drawing an audience of 70 people. "The Café was an opportunity for raising awareness of FASD, and public education," says Dr. James Reynolds, co-principal investigator of NeuroDevNet's FASD group. "We discussed current FASD research and how the new knowledge being generated offers hope to families living with FASD, but also looked at the problem from a public health perspective— including the heavy economic costs and challenges we face as a society managing individuals with FASD in the justice system. We explored how inconsistent advice and the increase in heavy drinking among young women, affect the rate of pre-natal alcohol exposure. Perhaps most important, families raising children with FASD were there to share their stories and experience."

Many families and community workers in the audience had been unaware of NeuroDevNet before the event, which galvanized local interest, and continues to elicit interest across the country. Many attendees have since signed up as potential participants in the NeuroDevNet FASD study being conducted at Queen's University in Kingston. Compliments continue to flow in from across Canada from a variety of people at the front line of engaging with FASD and its social consequences in response to the two widely disseminated videos that documented the event and discussion. The Café received funding from the Canadian Institutes for Health Research and NeuroDevNet's Knowledge Translation group.

> **C** The Café Scientifique was an opportunity for raising awareness of FASD and that no amount of alcohol during pregnancy is safe for a healthy pregnancy.

The Fetal Alcohol Spectrum Disorder (FASD) Research Group

Knowledge Translation Group

STEED!

Knowledge Translation (KT) is an integral aspect of NeuroDevNet, rooted within individual research groups investigating our three target disorders and standing as a research and practice group in its own right. Our knowledge translation investigators, staff and trainees develop capacity, and support and create opportunities and vehicles for the sharing and exchange of evidence-based information targeted toward the end user.

A Place to Turn – Strengthening Families Facing Behavioural Challenges with Distance Education

A parent training program for families impacted by FASD is being developed through a partnership between NeuroDevNet, the Izaak Walton Killam Health Centre in Nova Scotia and the Public Health Agency of Canada.

NeuroDevNet's knowledge translation and FASD group collaborated with Dr. Patrick McGrath of the IWK Health Centre, to submit a proposal to CIHR to research and develop a distance training program aimed specifically at improving behavioural challenges identified in children with FASD.

"Although a variety of cognitive and behavioural approaches have been developed to treat neurologically based behavioural disorders, relatively little research has been conducted that is specifically aimed at FASD," says Dr. James Reynolds co-principal investigator of NeuroDevNet's FASD group. "We know that there are significant problems with lack of communication between families affected by FASD, service delivery providers and policy makers. This means appropriate and timely treatment programs don't get put in place. In addition, families with children affected by FASD often live in remote or small communities and don't have access to services."



In 2005, the Public Health Agency of Canada released a document entitled "FASD - a framework for action." One of the key recommendations in the document specifically identified the need to determine the types of supports children with FASD and their families require, and to develop appropriate ways to provide these services at the community, provincial and territorial and federal levels.

"This identified need is the basis for the current proposal," says Reynolds. "We believe that an internet-based, FASD-specific parent training program can be developed, using input from major stakeholders to address the current obstacles to access and eligibility for families seeking services and supports."

The research team will develop an internet based program based on the Strongest Families initiative overseen by McGrath and his team at IWK that helps families deal with common childhood problems, as well as the results of a survey of major stakeholders. The NeuroDevNet collaboration proposes to target parents and caregivers of children with FASD between the ages of 5-12 years, to evaluate the feasibility and usability of the program.

Reynolds and colleagues anticipate partnerships across the country will evolve as an additional benefit of the research. "We hope to create a platform for sharing resources and ideas with parents, guardians, clinicians, researchers and other knowledge-users," says Reynolds. "Our ultimate goal is to influence policy change and improve the quality of life for those affected by FASD."

iKT Toolbox - A Knowledge Translation Toolkit for NeuroDevNet

A gap persists between published evidence and practice in clinical settings where children with neurodevelopmental disorders are seen and treated.

The Knowledge Translation group proposes to bridge this gap by promoting an integrated knowledge translation iKT approach within NeuroDevNet and studying its effectiveness.

"Several KT strategies are being developed and piloted to support the engagement of knowledge users within the network," says Dr. Mayada Elsabbagh, who manages the KT portfolio for NeuroDevNet.

"Four pilot applications of the iKT toolbox are being pursued in partnership with NeuroDevNet researchers and community stakeholders including the Canadian Association of Paediatric Health Centres, the CanChild Centre for Childhood Disability Research and the International Society for Autism Research (INSAR).

"First, we've been engaging families affected by autism in dialogue about research on biomarkers, and how the current evidence can be effectively translated into clinical settings. "We are trying to help families who are touched ASD. They are asking important questions, and we need to be able to provide the best solutions to them.

"Second," adds Elsabbagh, "we're exploring perspectives of families affected by CP regarding stem cell therapy. We want to learn what potential benefits they expect from this therapy.

Next, the KT group and its partners will explore the extent to which evidence is being used optimally in clinical practice. "We'll do that by engaging health professionals involved in early identification and intervention with children with neurodevelopmental disorders," says Elsabbagh.

Our ultimate intention is to support knowledge access and build global capacity in early identification and intervention, she adds. "In this part of the initiative, we'll engage international researchers and clinicians in sharing successful experiences and identifying barriers."

Information obtained from the iKT project will be used to develop resources for families seeking biomarker testing and stem cell therapies, and will help build KT infrastructure nationally in the area of early identification and intervention for neurodevelopmental disorders.





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Knowledge Translation Group

This year, many activities were aimed at children, to teach them how the brain works and how to protect it

KT Group facilitates Brain Awareness Activities Across Canada

Brain Awareness Week (BAW), the inspiration of the US-based Dana Alliance for Brain Initiatives promotes events around the world during a dedicated seven-day period in March. Individual Canadian efforts received a particular boost from NeuroDevNet's KT group in 2012.

Promoting NeuroDevNet at Saskatoon's Annual Brain Blast

The group sponsored advertising and supported a booth promoting NeuroDevNet at the annual Brain Blast, a free, interactive public event held at City Hospital in Saskatoon. Several hundred people engaged in an all-ages educational activity journeyed through various pavilions focusing on different aspects of the brain including neuroimaging, brain injury, brain tumors and Alzheimer's disease.

"Brain Blast has been running for a number of years, and is well publicized in Saskatoon," says KT group consultant Fleur Macqueen Smith. "This year, many activities were aimed at children, to teach them how the brain works and how to protect it."

Next year, the group plans a more active, educational booth, in partnership with one of the other regular presenters.

Helping Engage High School Students in Neuroscience through Vancouver's Brain Bee

Vancouver lived up to its reputation as a robust hub for neuroscience with multiple events, including the annual Brain Bee, part of an international competition on brain knowledge for high school students. Competitors are tested on their knowledge of the brain and nervous system, with the winner participating in the Canadian national competition. The KT group provided funding for the 2012 Vancouver event, attended by 35 students in grades 10-12. CIHR Canadian National Brain Bee: http://brainbee.ca

Promoting Education about the Interaction between the Environment, Brain Development and Health

Dr. Bryan Kolb from the Canadian Center for Behavioural Neuroscience at the University of Lethbridge and a member of NeuroDevNet's Research Management Committee, presented to a capacity crowd of 500 at an event sponsored by the KT Group. The free public lecture was one of six events celebrating Brain Awareness Week in Lethbridge.

Debunking and Discussing Myths about the Brain

Leading neuroscientists gathered in Montreal during BAW to explore brain myths and realities with the public at a Café Scientique. Dr. Michael G. Fehlings, NeuroDevNet's associate scientific director attended as a presenter with the support of the KT group. The March 14 event drew 120 people who joined in discussion of topics ranging from computer-human interface to memory to stem cell regeneration.

Knowledge Translation Group

... and Pollinating Neurodevelopmental Knowledge Translation in Face-to-Face meetings with Researchers

The NeuroDevNet Dialogue in Knowledge Translation Series began in November 2011. Members of the KT team have rolled out the program with the intent of improving understanding of each group's specific research context, and de-mystifying integrated KT principles, where knowledge translation is interwoven with a research project as a first consideration. Dialogue series activities were hosted with research groups specializing in autism, cerebral palsy and FASD in Montreal, Toronto, Kingston, and Vancouver.

Participants have provided useful feedback that will help shape future exchanges. "The workshop was very useful and helped me to adopt a broader concept of KT and its administration," wrote one. "I had difficulty imagining KT in relation to animal models, but now view it as a conceivable and valuable exercise," wrote a second. "I would like to continue to work on developing a KT plan of sorts and would certainly use [NeuroDevNet's KT Group] consulting services to this end," wrote another.

"We want to encourage reflection on integrated KT opportunities and challenges, and identify commonalities and differences in KT across various research groups," says Dr. Muhajarine, lead of NeuroDevNet's KT group. "Our goal is to create capacity, and to facilitate KT hubs across the country."





Knowledge Translation Group

KT Group to Promote use of Magnesium Sulphate to Prevent CP

Solid evidence stands behind the important role a form of magnesium plays in protecting pre-term babies at risk of cerebral palsy.

Translating these research findings into clinical practice and evaluating the effectiveness of this translation poses obstacles and challenges being explored in a national research study funded by the Canadian Institutes of Health Research.

Members of the KT team have already provided consultation on the scope of knowledge sharing activities planned by the study collaborators and the group is slated to help design promotional and other educational items for use by researchers at more than ten study sites across Canada.

"The KT team will also help design an evaluation of the magnesium intervention," explains Dr. Nazeem Muhajarine, lead of NeuroDevNet's Knowledge Translation group, "so that we can learn which KT practices work most effectively in clinical settings."

"Use of magnesium sulphate to help protect premature infants from developing CP is a new and a very promising application for this medication," says Dr. Laura Magee, a senior physician scientist at the Child and Family Research Centre in British Columbia, and co-principal investigator on the project. "There are ongoing debates about many issues, including when to administer magnesium sulphate, in terms of the gestational age of the infant, dosage level, side effects, and other considerations."

Dr. Steven Miller, a NeuroDevNet network investigator, is using advanced MRI techniques to better understand brain development and injury in pre-term babies. He plans to image 175 of the newborns among the infants in the study to examine the physical effects of magnesium sulphate on the newborns' brains.

"We plan to carefully monitor the safety and effectiveness of magnesium sulphate in clinical practice," adds Magee. "We are pursuing this research because we believe the evidence for the medication shows such strong promise as a preventive measure."

"An objective of the proposed study is to see if an active KT program can help push the use of magnesium sulphate in clinical settings up to 80 percent over four years," adds Magee. "We also hope to see overuse of magnesium sulphate in less than 10 percent of cases when it is used to treat babies before birth that is only likely to be premature, rather than birth that is certain to be premature. Of course, we also hope to prove that meeting these objectives is associated with the anticipated decrease in rates of childhood CP."

Results from the study are expected in about four years' time.



Neuroethics Group

Anticipating and addressing the ethical issues arising in the course of NeuroDevNet's research, the Neuroethics group explores the perspectives and values of investigators, patients and families working and living with neurodevelopmental disorders (NDDs). The evidence base established by their findings informs ethical guidelines on pediatric research and NDDs and helps build neuroethics considerations into all NeuroDevNet-funded research. The Neuroethics group's recent work has examined issues such as neuroimaging imaging biomarkers, the services available to youth with neurodevelopmental disorders and their experiences in care settings, and explored how NeuroDevNet can work together with Aboriginal communities to address gaps in health research involving vulnerable populations.

Exploring the Ethical Challenges of Neuroimaging as a Predictor of Neurodevelopmental Disorders in Newborns

The ability to predict future outcomes is vital in the care of severely ill newborns with neurological injuries. At the same time, physicians and other health care professionals who work in neonatal intensive care settings may encounter many technical and medical challenges that make providing accurate predictions difficult— even in the case of infants with only moderate injury from lack of oxygen or blood flow.

Co-led by Éric Racine, co-lead of NeuroDevNet's Neuroethics group, and Director of Montreal's Neuroethics Research Unit and Dr. Michael Shevell, leader of NeuroDevNet's CP group, Canadian neonatologists and pediatric neurologists are being interviewed about how neuroimaging is being used to predict outcomes in newborns and infants. "We're also exploring knowledge translation aspects with relation to how these technologies are taken up into clinical practice and integrated into clinical care," says Racine.

"Many investigators and clinicians indicate that accurate prediction depends on the development of tools that improve our ability to identify, predict and prevent brain injury in the neonate," adds Racine.

What began as an exploration with Dr. Jerome Yager, co-lead of NeuroDevNet's Cerebral Palsy group into the ethical challenges in end of life decision-making and the use of MRI neuroimaging in neonatal intensive care settings has evolved into a wider collaboration. NeuroDevNet's Neuroethics, Cerebral Palsy and Knowledge Translation research groups have joined forces to develop a protocol for exploring patterns of prediction in neonatal settings, with the goal of improving clinical decision-making and communication about outcomes in newborn infants with brain injury.

Current medical training and practice does not place much emphasis on prediction as a skill, thus lack of experience is a challenge for clinicians. Extensive research also documents that, independent of the condition of the patient, physician characteristics such as training, age, experience, religious beliefs and practice setting influence end-of-life care in pediatric and neonatal intensive care units.

"We believe this work can identify and help understand issues related to ethical challenges that arise from the use of MRI for predicting outcomes in neonates born with severe brain injury," says Racine. "The results of our study could help assess existing challenges, and provide ways of improving ethical decision-making," adds Dr. Emily Bell, co-investigator on this project and a NeuroDevNet researcher.



critically ill neonatal patients."

Involving NeuroDevNet's Knowledge Translation group with the specialty physicians in the field should ensure rapid and effective uptake of findings, according to Bell. "Depending on the outcomes of this study," she adds, "we plan to extend our examination of professional differences to other providers involved in the care of

Neuroethics Group

G Recent research by NeuroDevNet's Neuroethics group has found Aboriginal children are underrepresented in health research

Exploring NeuroDevelopmental Disorders in a Canadian Aboriginal Context

Indigenous children in Canada have been found to be less healthy than their non-Aboriginal counterparts in almost all measures of child health. Lower birth weight, poor nutrition, and a greater likelihood of experiencing disease and death have all been documented, yet recent research by NeuroDevNet's Neuroethics group has found Aboriginal children are underrepresented in health research.

To address this gap, the Neuroethics group conducted a review of the research literature to determine the level of engagement between researchers and Aboriginal communities within NeuroDevNet's three areas of focus—fetal alcohol spectrum disorder (FASD), autism spectrum disorder (ASD), and cerebral palsy (CP). "Little is currently known about the prevalence or severity of developmental disabilities among Aboriginal children," says Dr. Judy Illes, co-lead of NeuroDevNet's Neuroethics group. Dr. Illes and Dr. Nina Di Pietro, a researcher with Neuroethics, initially pursued a consultation with experts in Aboriginal child health and research ethics. "We were working to identify the best ways to move forward," adds Illes.

"A key insight from those meetings was the need to characterize past research with regard to FASD, ASD, and CP, to identify areas of strength and gaps," says Di Pietro. "One of our major findings was that little-to-no health research has been published on ASD or CP among Indigenous children. In contrast, we identified over 50 publications and reports for FASD.

"Ninety-eight percent of the publications we retrieved in our study focused on that single disorder," says Di Pietro. "The remaining article focused on CP." Prevention and intervention services were the primary topic areas, while clinical research, prevalence and incidence studies, FASD knowledge and awareness, and FASD and the criminal justice system were also strongly represented.

"Research on FASD remains a critical and valuable endeavor to improve the lives of Aboriginal children and their families living with this condition," observes Illes. "The absence of literature on ASD and CP raises three key questions that have yet to be answered," she adds. "What is the incidence of ASD and CP in Indigenous children? If the incidence is comparable to FASD, why is the research lacking? Lastly, if incidence estimates are not comparable, how can this be explained?"

Recently issued guidelines for Canadian research ethics require fairness and equity in research participation. "This introduces the expectation that Aboriginal populations will be included in all federally funded research," says Illes." Through its vast network of researchers, we believe that NeuroDevNet is well positioned to engage with Indigenous communities and health organizations across Canada for meaningful collaborations to address these critical research gaps."

In the meantime, Illes and Di Pietro have written a paper on their findings, which they intend to publish, and plan to share it with NeuroDevNet investigators and Aboriginal health researchers in the hope of promoting further collaborations.

Neuroinformatics Group

Neuroinformatics is the application of computational methods and information technology to research on the nervous system. The interdisciplinary and high-technology approaches used in NeuroDevNet research generate vast quantities of data that no human can handle or understand without the help of a computer. NeuroDevNet's Neuroinformatics group meets the Network's needs for sophisticated mechanisms for the collection, management, storage, distribution, and analysis of numerous types of data coming from multiple sites across Canada.

NeuroDevNet Boosts Research Quality with LORIS a Web-based Data Management System

Long-term, multi-site research projects that integrate brain imaging with clinical, behavioural, and genetic data require highly specialized data storage and management systems.

A key component of data handling and exploration within NeuroDevNet's research groups, and network as a whole is LORIS, also known as Longitudinal Online Research and Imaging System, and accessible on the web at http://cbrain.mcgill.ca/loris.

"Originally, LORIS was developed for the US National Institutes of Mental Health's 10-year Study of Normal Brain Development," says Dr. Alan Evans, imaging lead with NeuroDevNet's Neuroinformatics group. "LORIS was designed to ensure data transfer and confidentiality, the integration of behaviour and imaging information. As it has evolved, its capabilities have expanded in the areas of data acquisition, quality control, analysis, querying and visualization. It's currently deployed in a number of neurodevelopment and neurodegeneration projects globally."

"There are lots of products capable of storing, processing, and even managing data collection either on the behavioural side, or on the imaging side," says Dr. Paul Pavlidis, scientific director of NeuroDevNet's Neuroinformatics group. "We chose to use LORIS for NeuroDevNet because few systems tackle the full spectrum of data types being studied within our network. We're very pleased to have implemented LORIS for our colleagues in NeuroDevNet because it offers the advantage of being configured to follow work patterns and problems from an end-user's perspective."

"Being able to efficiently track workflow and integrate quality control were critical features that greatly improved the quality of data in research trials," adds Evans, who led the development of LORIS for the original NIH study.

"New modules are constantly being added," says Evans, "and functionality continues to be optimized and improved. A recent feature is "Brain Browser" a new 3-D image viewer that enables users to generate interactive graphics within a web browser."

"LORIS exemplifies the approach we are taking in NeuroDevNet to enabling coordination and collaboration among researchers located across Canada adds Pavlidis. Tools such as LORIS provide the informatics glue that helps ensure data quality, standardization and reproducibility."





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Neuroinformatics Group

It's a one-stop shop for researchers looking for candidate genes for any disorder of interest

Linking Genes to Behavioral and Physical Traits through a Customized Knowledge Base

Understanding the genetic basis of diseases is key to the development of better diagnosis and treatment for neurodevelopmental disorders. Unfortunately, only a small fraction of the existing data linking genes to phenotype -- a person's observable physical or behavioural traits-- is available through online public resources. When available, it is scattered across multiple access tools.

Neurocarta is a tool that brings together information on genes and phenotypes across multiple resources and allows tracking and exploring of the connections between them. The system, available at http://neurocarta.chibi.ubc.ca, enables automatic and manual entry or copying of data from other sources of evidence supporting each association, as well as user-enabled entry of their own annotations

NeuroDevNet's Neuroinformatics group developed this online platform to integrate information on genes for analysis and interpretation of neurodevelopmental data produced within the network.

Neurocarta is constantly growing and currently holds more than 30,000 lines of evidence linking over 6,800 genes to 1,800 different phenotypes. "It's a one-stop shop for researchers looking for candidate genes for any disorder of interest," adds Pavlidis. "In Neurocarta, they can review the evidence linking genes to phenotypes, and filter out the evidence they're not interested in."

"A major goal we have for Neurocarta is to build on existing and new knowledge emerging from the network, to increase our understanding of neurodevelopmental disorders and the relationships among them at the genetic and phenotypic levels," explains Pavlidis. "Beyond brain disorders,

Neurocarta includes information on a wide range of diseases, which makes it useful to the whole genetics research community. Our integrative approach makes our resource unique and takes advantage of new types of data arising from nextgeneration technologies.'



Neuroinformatics Group

Establishing NeuroDevNet as a Key Player in Neuroinformatics Nationally and Internationally

NeuroDevNet's Neuroinformatics group has been pursuing partnerships and collaborations with leading Canadian centres and researchers, as well as the major international organization in the field.

"We have an ongoing collaboration with the University of Alberta's Women's and Children's Health Research Institute's Clinical Research Informatics Centre as well as the Maternal Infant Child and Youth Research Network, based at the Child and Family Research Institute at British Columbia's Children's and Women's Health Centre," says Dr. Paul Pavlidis.

"We decided to join forces in an effort to improve data management standards across Canada, with a specific focus on expanding the use of the REDCap system for clinical research," adds Pavlidis. "We have expertise in data management, and more specifically in the use of REDCap, a web application specifically designed to support data capture for research studies."

As a first step in that direction, the Neuroinformatics group's manager participated in a one-day workshop in Ottawa entitled, "Data: Protection, Management and Meaningful Use." Several collaborations have followed, among them a relationship with the Treatable Intellectual Disability group, creators of an interactive tool for clinicians based at the University of British Columbia, as well as consultancy with the Childhood Hemiplegic Cerebral Palsy Integrated NeuroScience Discovery Network (CP-NET) led by NeuroDevNet researcher Dr. Darcy Fehlings at the Ontario Brain Institute.

In parallel, the group is leading an effort to organize and engage Canadian computational neuroscientists. "We recognized a broader need to build capacity in Canada, which would lead to increased international prominence and engagement, and the existence of NeuroDevNet as a network and our role has put us in a position to help push things forward," says Pavlidis. "In particular, we've been in discussion with the International Neuroinformatics Coordinating Facility (INCF) for some time about the possibility of Canada becoming a member nation. Our efforts had to start with organizing here in Canada."

We are excited at this opportunity to rally Canadian neuroinformatics researchers

Current members of the consortium include the US, many European countries, and Japan. "Being a member of the INCF would make Canada a formal partner in developing international and collaborative efforts to increase neuroinformatics research and capacity," he adds. The INCF funded a workshop in conjunction with the Canadian Association for Neuroscience meetings in May 2012, with NeuroDevNet's Neuroinformatics group as a featured partner. "We are excited at this opportunity to rally Canadian neuroinformatics researchers," says Pavlidis. "We plan to hold additional workshops and identify opportunities for further INCF engagement with Canada."



The faster the youth pedals the more power she/he has in the game... **77**



Nine collaborative projects funded by NeuroDevNet complement the work of our research groups,

or pioneer distinct areas involving other developmental disorders of the brain. NeuroDevNet's Opportunities Initiative projects all emphasize cross-laboratory and multidisciplinary approaches.

Four projects emerge from NeuroGAMe, NeuroDevNet's collaboration with the Graphics, Animation and New Media (GRAND) Network of Centres of Excellence. These co-funded projects and one additional NeuroDevNet funded project are developing novel therapies relying on virtual reality and computer gaming technologies to address behavioural issues in neurodevelopmental disorders (NDDs). Drawing on the combined expertise in computer science and neurodevelopment vested in each NCE, the NeuroGAMe collaboration has moved from pilot status to, in one case, more sustained funding through a recent Collaborative Health Research Projects award from the Natural Sciences and Engineering Research Council of Canada.

A selection of Opportunities Initiative projects are profiled on the following pages.



Investigation of the Utility of Computerized Cognitive Training in Children with FASD (Kimberly A. Kerns, University of Victoria, Jacqueline Pei and Carmen Rasmussen, University of Alberta)

Caribbean Quest, a computer game designed to improve attention and working memory in children has been grabbing headlines, and even been blogged about by occupational therapists in Australia. The videogame was designed to improve attention and working memory in children in children with FASD. "Executive functioning and attention issues are considered prime features of FASD," says Dr. Kimberley Kerns, a psychologist based at the University of Victoria. The inability to sit still, think before reacting, or understand personal boundaries means children with FASD face real obstacles to wellbeing. "Yet interventions for these children are lagging," says Kerns, "while at the same time, we see approaches to retrain attention and aspects of executive function are standard practice in adults with brain injuries. Our study has enrolled 25 children, who have each spent 12 weeks playing Caribbean Quest, with the assistance of an interventionist— a coach who offers suggestions or strategies when the children run into roadblocks, or can't resolve frustration." MRI scans taken by Dr. Christian Beaulieu at the University of Alberta during this time have shown changes in the white matter in the children's brains (see brain scan articles on pages 16 and 39). The study is in its early stages, but is already expanding to being trialed by educational assistants in Alberta and British Columbia.

NeuroDevNet's **Opportunities** Initiative

CP Fit 'n' Fun Project: Health & Social Benefits of Virtual Exercise Games in Adolescents with CP (Darcy Fehlings, University of Toronto, Nicholas Graham, Queen's University)

As children with cerebral palsy (CP) become teenagers, their physical functioning often decreases. Children who have been able to use a walker often need to start using a wheelchair to get around. If they use a walker, they tire easily, and walk shorter distances. Less mobility leads to social isolation and decreased quality of life. Low levels of physical fitness and muscle weakness are often part of the scenario. NeuroDevNet Investigator Dr. Darcy Fehlings, working in collaboration with GRAND investigator Dr. Nicholas Graham and their group have harnessed the appeal of video games to engage youth with CP in physical exercise and social interaction with their peers. Pedaling a stationary bicycle installed in their homes powers an avatar in a multi-player game, where the youth can see the avatars of other "pedalers." The faster the vouth pedals the more power she/he has in the game. The unit is also equipped with a microphone that enables live chat with other players in their homes. Exergame playdates are organized by the youth through a facebook site. "Our overarching research questions are whether virtual reality exergames can provide health benefits, including improved physical fitness and help enhance quality of life in youth with CP," says Dr. Fehlings. "GRAND and NeuroDevNet's expertise join together in our project to accelerate the use of virtual reality as a viable rehabilitation treatment option for children with disabilities."



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Strength-Based Intervention for FASD (Chris P. Bertram, University of the Fraser Valley)

Most treatment programs for children with fetal alcohol spectrum disorder (FASD) focus on areas where the children are the most challenged— in learning, thinking and appropriate social behaviour. An innovative research project being directed by Dr. Chris Bertram from the University of the Fraser Valley in British Columbia combines playing videogames and physical activity— two strengths identified in children with FASD. Bertram and his group have developed two programs, FAST Club, and Brain Gamers that enhance these abilities. Bertram hopes that encouraging movement and interest will bate a neuroplastic response --prompt the brain to remodel itself- with spillover effects into behaviour and capacity to focus. "The idea is that we use games as a way of getting at a hidden skill set, and do so in ways that are fun, challenging and engaging," says Dr. Bertram. "It's sort of invisible therapy, or 'stealth health.' Hopefully we can make the lives of these children and their families better in the long run."



NeuroDevNet's Opportunities Initiative

Functional Characterization of Autism Linked Genes (Ann Marie Craig, University of British Columbia)

Autism has been described as a disorder of the synapse- the point of connection between brain cells. Researchers believe autism may be due to an imbalance between factors that increase and decrease activity in the brain. Ann Marie Craig, a researcher at the University of British Columbia, is exploring how new genes linked to autism function at the synapse in ways that regulate activity in the brain. This kind of in-depth analysis will help clarify the genetic and biochemical basis of autism spectrum disorders (ASDs), according to Craig. "We hope to help sort through which genes contribute most to ASD, and perhaps, which aspects of the disorder. Understanding the biochemical pathways involved, in cell culture and animal models, will allow for the development of molecular and pharmaceutical treatments for humans with ASD."

Adaptive Training of Cognitive Function in **ASD and ADHD**

(Elizabeth Kelley, Daryl Wilson, James Reynolds, and Douglas Munoz; Centre for Neuroscience Studies, Queen's University)

Playing videogames can lead to increased capacity to pay attention and improved cognition. Drs. Kelley, Wilson, Reynolds and Munoz are developing a videogame training program that is engaging and fun, yet also adapts to individual children's cognitive strengths and weaknesses. "We expect this form of adaptive training will produce greater improvements in attention span, executive functioning, and overall skills, than a typically-structured videogame," says Dr. Kelley. The group will test its training process on children with autism and ADHD. "Adaptive training of this type has not yet been studied in these populations, but we believe this videogame could be a costeffective and efficient treatment for children with these cognitive challenges," adds Dr. Kelley.





NeuroDevNet's Opportunities Initiative

Pathophysiology Perinatal Stroke

(Adam Kirton, University of Calgary Dr. Patricia Massicotte, University of Alberta, and Dr. Kamran Yusuf, University of Calgary et al)

The greatest lifetime risk for stroke occurs during the first week after birth. Most survivors of ischemic stroke blockage of blood vessels in the brain— suffer weakness on the opposite side of the body, as well as problems with language, learning, development, behaviour and epilepsy. Ischemic stroke accounts for most cases of cerebral palsy. Despite being common and having profound effects, perinatal stroke "has been neglected in cerebral palsy research," says Dr. Adam Kirton. "In most cases, the cause is completely unknown. This poor understanding prevents the development of treatment and intervention strategies. Our Alberta Perinatal Stroke Project team is defining specific perinatal stroke diseases, to try to determine what causes them. A database of information from more than 800 affected children will serve as the basis of analyses exploring possible inflammatory, placental, and blood clotting abnormalities that might cause perinatal stroke," says Kirton. "This progress is essential," he adds, "to reduce the outcomes suffered by thousands of Canadian children with perinatal stroke."



Bioinformatics Analysis of Gene Networks in Neurodevelopment (Paul Pavlidis, University of British Columbia)

One of the challenges facing researchers seeking to understand the neurodevelopmental disorders is integrating information about genes and clinical observations. "Simply aggregating data from different sources is not enough," says Dr. Paul Pavlidis, lead of NeuroDevNet's Neuroinformatics research group. "We aim to address a gap between the huge amounts of genomics data on neurodevelopmental data that have already been collected, and researchers' ability to make use of those data. Incorporating knowledge of functional genomics and gene networks will help NeuroDevNet researchers to target genetics analyses more precisely, and interpret the results with greater power. Overall, our project will enable them to start identifying genetic origins shared among CP, ASD and FASD and other neurodevelopmental disorders, as well as develop new diagnostic and treatment strategies."







Education and Training

Solution NeuroDevNet is striving to enhance the development and integration of young researchers into the Network as well as the many settings where Canadians support the health and wellbeing of children with neurodevelopmental disorders.



NeuroDevNet Education and Training

Enhancing Canadian capacity in the research and treatment for neurodevelopmental disorders is central to NeuroDevNet's mission. It takes a network of scientists, clinicians, and educators to train the next generation of researchers. NeuroDevNet brings together diverse expertise from across Canada to provide multifaceted, cross-disciplinary training opportunities for our trainees. NeuroDevNet is striving to enhance the development and integration of young researchers into the Network as well as the many settings where Canadians support the health and wellbeing of children with neurodevelopmental disorders.

NeuroDevNet 101:

A key challenge for scientists interested in neurodevelopmental disorders is how to translate genetic findings into promising therapies. In January 2012, the NeuroDevNet Training Program inaugurated an interdisciplinary distance-learning course for NeuroDevNet trainees exploring this challenge using autism spectrum disorder (ASD) as a case study. Taking a collaborative, interdisciplinary approach, participants were asked to develop a strategy to validate genes linked to autism, to understand their function, and to identify genetically based targets for treatment.

This web-based, interactive lecture/workgroup course ran over a 14-week period with 22 sessions through April. Unique for its trans-Canadian scope, the course drew 27 participants, including 12 registered students and featured lectures from 15 NeuroDevNet faculty, and two special guest lectures from international experts. GoToWebinar software by Citrix enabled real-time interaction and discussion between presenters and students on topics ranging from basic biology of brain development and experimental approaches and analysis, to explorations of clinical understanding of developmental brain disorders.

Students were expected to work in teams with trainees from diverse backgrounds, in order develop a plan to validate autism genes through genetic, clinical, molecular and imaging research methods. Examples throughout the course were drawn from many developmental and adult neurological disorders as well as animal model systems. NeuroDevNet 101 culminated in three team grant proposals presented as reports, as well as 30-minute research presentation/discussions.

One participant developed her class research proposal into the basis of a NeuroDevNet fellowship application. Another, responding to an anonymous survey question regarding what was most valuable about the course wrote, "As I start to think about where I would like to see my research program go for my PhD, I become more and more interested in incorporating an element of genetics. The course provided the fundamentals for understanding what I might be able to do, and how I could go about doing it."

NeuroDevNet Education and Training

NeuroDevNet Education and Training

NeuroDevNet fellowships emphasize a multidisciplinary approach...

2011-2012 Fellowship Highlights

Two rounds of competition for NeuroDevNet fellowships have drawn strong representation from a growing range of doctoral, post-doctoral and clinical research students. In the 2011-2012 funding period, four training awards were granted, including two Postdoctoral and two Doctoral fellowships. NeuroDevNet fellowships emphasize a multidisciplinary approach, featuring a co-mentored training plan, where the trainee project itself spans more than one discipline. Two supervising network investigators bring their expertise and their laboratories to consider an expanded perspective they may not have entertained before the NeuroDevNet Fellowship class of 2011-2012 demonstrated the benefits of this approach.

Two students in the 2011-2012 cohort coming from computational science backgrounds are working with faculty specializing in neuroimaging and neurobehaviour. Postdoctoral fellow Carl Jackson's project combines mathematical modeling with sensory-motor processing in children, with the goal of developing a series of tests that will characterize the movement behaviour of typical children as they develop as well as the deficits in two-handed coordination found in children with FASD. Graduate fellow Shawn Andrews' project (see adjacent page) combines methods of image analysis with structural MRI imaging of the brain, with the aim of developing new methods for determining changes caused in white matter over time in children with CP. These changes can occur due to progressive deterioration following an injury, or improvements from therapy.

Both Jackson and Andrews will pursue data-driven analyses, in keeping with their primary training, but through interaction with their co-mentors and the children being assessed in their laboratories, the pair will also experience the clinical and personal aspects of their research.

"Through my NeuroDevNet-funded project, I've been able to work closely with neurologists at the BC Children's and Women's Health Centre," says Andrews "This opportunity has given me a firm foundation for the method I'm proposing for classifying white matter injury. It's also given me a deeper understanding of how my work may eventually be beneficial in a clinical setting."

Fellowships 2012-2013

NeuroDevNet launched its second fellowship competition in March, 2012 and is expecting increasing numbers of applications for training in a diversity of NDD fields. The network has also funded six additional training awards through partnerships with the Autism Research Training Program (ART), the Michael Smith Foundation for Health Research, and the Canadian Child Health Clinician Scientist Program, contributing nearly \$246,000. These collaborations have leveraged \$341,000 in partner contributions. These MRI images of the brains of pre-term infants were captured using a technique known as "diffusion tensor imaging" or DTI. Here, DTI captures simulations of tracts of white matter. Image A shows the brain of an infant at gestational age of 36 weeks, and shows no injuries to the white matter. Image B shows the brain of an infant a at gestational age of 32.5 weeks, with severe white matter injury.

Fiber tracts in the images are colour-coded according to their lengths, with red tracts being the longest, and blue tracts being the shortest. Differences in tract length and density are not typically as obvious as in these images, which were chosen because they portray these differences so clearly.



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NeuroDevNet Education and Training

Stewardship: NeuroDevNet's Education and Training Programs

City	Assoc/Tech	Masters Candidate	Ph.D. Candidate	Postdoctoral	Undergrads	Total
ABBOTSFORD	2	1			5	8
CALGARY	3	1		2	2	8
EDMONTON	10	11	7	3	2	33
HALIFAX	5		1			6
HAMILTON	1		4	1		6
KINGSTON	4	2	5			11
MONTREAL	16	1	8	3	4	32
SASKATOON	1		1			2
TORONTO	5	8	6	8	4	31
VANCOUVER	16	8	9	6	2	41
VICTORIA		3	2		3	8
WINNIPEG	1	1				2
Total	64	36	43	23	22	188

These numbers reflect trainees and young professional staff as reported by NeuroDevNet's research groups and Opportunities Initiative projects. NeuroDevNet's recruitment has exceeded projections in the initial network proposal. The fellowship applicant pool grew by about 50 percent between 2011-2012 and the previous year. The number of trainee abstract submissions to our annual conference also doubled in the same time period. The chance to participate in NeuroDevNet's Annual Brain Development Conference is one of several opportunities available to network-funded trainees. NeurDevNet also provides support to attend specialty workshops, and access to web-based courses such as NeuroDevNet 101 as well as the chance to experience research internships in industry settings.

Many additional trainees and young professionals— as many as 400 in total, are affiliated with NeuroDevNet but not reflected in the tally above as they may not work directly on a NeuroDevNet funded project, but are trainees or employees of one of NeuroDevNet's research faculty or other network affiliates. Others have come to know and have connected with NeuroDevNet through our outreach and knowledge mobilization efforts, as well as conferences and events, such as our annual Brain Development Conference and the ART-NeuroDevNet Winter Institute.



Internships in Neurodevelopment a Partnership between NeuroDevNet and Mitacs

NeuroDevNet is collaborating with Mitacs to arrange Accelerate Internships for trainees and their faculty supervisors to pursue research with partner organizations concerned with children's neurodevelopmental disorders. To date, NeuroDevNet has facilitated more than 20 internships with partners from industry, not-for-profit health organizations, and government. Our internships provide excellent opportunities for graduate students to explore research questions while addressing partner priorities. This, in turn, has opened new research relationships for faculty and increased NeuroDevNet's network of connections.

A Link or a Tangle: The Internet at the Intersection of Parents, Advocacy and Health Information for Neurodevelopmental Disorders

How do you tell science stories that are interesting, relevant and accurate for newspaper readers and for a television audience? Rebecca Cheung, a UBC Masters of Journalism student, faced just that challenge as a specialist reporter on neurodevelopmental disorders on a 2011 summer internship with the Vancouver Sun.

Supported by NeuroDevNet and Mitacs' Accelerate BC program, Cheung split her time between the Sun's editorial desk, and the National Core for Neuroethics at the University of British Columbia, with Dr. Judy Illes, co-leader of NeuroDevNet's Neuroethics group.

"The goal of my internship was to tell stories of interest to the Sun's readers, and that cover science and ethics with depth," says Cheung. Her work during the project included a multimedia examination of the challenges parents of children with conditions such as autism and fetal alcohol syndrome disorder face in evaluating web-based treatment information. The autism feature was published on the front page of the Sun Sept. 16, 2011, as well as video pieces posted on the paper's website.

Cheung also served as a panelist at NeuroDevNet's Second Annual Brain Development Conference in June 2011, and spoke about her research and reporting experiences at the National Association of Science Writer's (NASW's) Science Writer's Conference in Arizona in October of the same year, as well as the February 2012 American Association for the Advancement of Science meeting in Vancouver.

"It was such a terrific opportunity and great learning experience," says Cheung, "I feel extremely lucky to have held this internship."





Internships in Neurodevelopment a Partnership between NeuroDevNet and Mitacs

Internships in Neurodevelopment a Partnership between NeuroDevNet and Mitacs

Like the Other Kids Do: Rapid Toilet Training Technique Improves Quality of Life for Children with Developmental Disabilities

Delayed mastery of toilet training is a major obstacle to quality of life for children with autism and other developmental disabilities. In a summer 2011 NeuroDevNet internship, Katherine Rinald explored the effectiveness of a workshop-based, modified Rapid Toilet Training (RTT) protocol with children with autism and/or other developmental disabilities.

Modified RTT is a multi-pronged program designed to teach children continence. It involves increased fluid intake, scheduled sittings on the toilet, positive reinforcement, a neutral strategy for correcting mistakes, and teaches self-initiated toileting.

Rinald, a masters student in Special Education at the University of British Columbia, conducted the study under the supervision of UBC Professor Dr. Pat Mirenda, in collaboration with Coast Behavior Analysis. The program Rinald analyzed was the first to teach parents a home-based version of modified RTT. She found that parents were quick to learn the RTT techniques.

In the study, parents were trained in a 5-hour workshop— and successfully implemented them at home with telephone support from a behavior consultant. Of the five children in the study, most were selfinitiating use of the toilet at the one-month follow up point. An average time frame for success in toilet training is three to six months. "The study is an important contribution to the small body of toilet training research that involves parents," says Dr. Mirenda. Rinald's work was accepted for publication by the journal Research in Developmental Disabilities.

Delayed mastery of toilet training is a major obstacle to quality of life for children with autism and other developmental disabilities.

Under Pressure: Does an Inflatable Therapy Device Help Children with NeuroDevelopmental Disorders?

Deep pressure therapy, using devices such as weighted vests is widely used to treat autism spectrum disorders, yet little scientific evidence exists to support its effectiveness.

As an intern with Squeezease Therapy, a Vancouver-based start-up company during the Spring of 2012, Kayla Ten Eycke, studied the effects of the company's prototype inflatable vest for children with autism. The Squeezease vest is designed to apply air pressure to the torso. Ten Eycke, a doctoral student in psychology at the University of Victoria who pursued the internship under the supervision of Dr. Ulrich Mueller, tested blood pressure, heart rate, salivary cortisol, and various psychological and behavioural measures to gauge the impact of the vest.

"We found a significant interaction between treatment and capacity to pay attention," says Ten Eycke. "Parents gave better ratings of their child's attention after he or she wore the vest inflated, compared to control days, when they didn't wear it. We also found that wearing the vest significantly reduced salivary cortisol levels." Elevated cortisol levels indicate increased stress.

Attention, stress and problem behaviour are typical challenges facing children on the autism spectrum and their parents. "Further research is required to corroborate and extend these findings," says Ten Eycke, who has since submitted a paper on her study to the Canadian Journal of Occupational Therapy. Lisa Fraser, founder and principal of Squeezease concurs further research is needed, but says the pilot has been important to her business development. Both potential investors and government funders "took my company more seriously, because we could say we have done our own study that proved some positive results," says Fraser, who adds that she learned some important things about her product's usability during the research.

"Beyond the physiological and cognitive measures being tested," she says, "I could see how the kids interacted with the product. I could determine if they put it on properly, if the kids were comfortable, and if they could pump up the vest for themselves. All of these things gave me good feedback."





NeuroDevNet Events Highlight Knowledge Translation and the Importance of Policy Impacts

C The understanding of how early experience can alter gene expression and physical characteristics is providing a revolution in the biological sciences, including neuroscience.

NeuroDevNet's Second Annual Brain Development Conference

NeuroDevNet's second annual Brain Development Conference was held June 19-21, 2011 in Vancouver, BC, and attracted one hundred and ninety clinicians, trainees, and researchers who were joined by parents, policymakers and advocates with an interest in brain development and neurodevelopmental disorders.

A highlight of the gathering was the Fraser Mustard Keynote Lecture, delivered on short notice by Dr. Bryan Kolb, a member of NeuroDevNet's Research Management Committee.

Dr. Kolb stepped in when the Dr. Mustard, who has since passed away, was unable to attend due to declining health. Reflecting the dedication that characterized his life, Dr. Mustard was actively involved in the preparation of what Dr. Kolb describes as a joint presentation. The riveting address, entitled, "Environment, Genes, Health and Behaviour," explored the vital role of early development in healthy brain function.

"Laboratory research studies confirm that early experiences alter gene expression and the organization of neural networks in the brain," said Kolb. "Population studies provide evidence that early development programs have life-long consequences on physical and mental health. Early experience thus impacts upon physical and mental health, learning and behavior throughout one's lifetime.

"The understanding of how early experience can alter gene expression and physical characteristics is providing a revolution in the biological sciences, including neuroscience," added Kolb. "The implications for public policy are enormous and should become and important outreach effort of NeuroDevNet."





NeuroDevNet sponsors events that bring together diverse stakeholders to understand the developing brain and the challenges that face children with neurodevelopmental disorders and their families, and share best practices from clinical therapeutics, behavioral science, and the social sciences.

NeuroDevNet has embraced Kolb and Mustard's message, taking word of the importance of early development and genetic expression to policymakers through outreach on Parliament Hill. A workshop planned for the Third Annual Brain Development Conference in September 2012 will focus on translating neurodevelopmental research into policy, with the goal of increasing capacity for knowledge exchange among researchers in attendance.

NeuroDevNet Events

Highlight Knowledge Translation and the Importance of Policy Impacts

G Our afternoon reception, hosted by Senator Jim Munson, was attended by 50 parliamentarians and staff.

A Day on the Hill Produces Fruitful Exchange with Members of Parliament

Brain Awareness Week 2012 marked NeuroDevNet's debut venture reaching out to parliamentarians to raise the profile of children's neurodevelopmental disorders and the work of NeuroDevNet.

On March 15, three teams, combining NeuroDevNet staff, Network scientists, board members, representatives from partner organizations and parent advocates met with 11 MPs and three senior policy advisors across all political parties.

"We placed particular emphasis on meetings with members of the Standing Committee on Health and the Industry, Science and Innovation Committee," said Nicky Lewis, Executive Director of NeuroDevNet.

"Despite the competition of Spring Break in Ontario, and an afternoon session in the House, our afternoon reception, hosted by Senator Jim Munson, was attended by 50 parliamentarians and staff, " said Jim Brookes, NeuroDevNet's Chief Development Officer.

"Senator Munson and his staff went out of their way to help make the reception a success," added Brookes. "Our day on the Hill has led to ongoing collaboration with several MPs, and was very effective in raising the profile of NeuroDevNet and the NCE program. We are grateful for the support and participation of the Sinneave Family Foundation, CanAssist, and parent advocates Dr. Sheila Laredo, Gillian Horvath, and Elspeth Ross, who really concretized the importance and impacts of neurodevelopmental disorders."

A second Day on the Hill is planned for 2013.

From left to right: Henri Rothschild (Board Chair), Colin Carrie (MP). Gillian Horvath (Parent representative), James Reynolds (scientist) and Dan Goldowitz (Scientific Director).



NeuroDevNet Events Highlight Knowledge Translation and the Importance of Policy Impacts



DOHaD in Action - NeuroDevNet Sponsors a Workshop on the Developmental **Origins of Health and Disease**

Over the past 20 years, research has increased understanding of the processes in early development that are critical factors in the health and predisposition to disease in youth, adolescence and adult life.

As health care systems around the world struggle with sustaining standards of care, there is urgent need to apply new approaches to the care of individuals, families and populations.

On September 15-16, 2011, NeuroDevNet hosted DOHaD in Action - Developmental Origins of Health and Disease, a satellite meeting of the DOHaD 7th World Congress in Portland Oregon. The Vancouver gathering engaged 60 attendees in a discussion of why the developmental origins of health and disease should matter to policymakers, health leaders and the public, and how to make it happen through a shared strategy for change.

Topics at the one-and-half day meeting explored early childhood disease, heart disease, diabetes, obesity, mental health, and frailty in relative to socioeconomic and environmental impacts on fetal development.

The chair of DOHaD in Action was Dr. John Challis, University Professor Emeritus of the University of Toronto. "We learned we must align ourselves not only with our own needs, but with government needs that are based on cost controls, economic benefit and job creation, in addition to public health strategy," said Challis. "This agenda is a social agenda as well as a scientific one."

An international roster of speakers included Dr. Jane Harding, Deputy Vice-Chancellor (research) and Professor of Neonatology at the University of Auckland in New Zealand, Dr. Roberta Ballard, Professor of Pediatrics at the University of California, San Francisco, and Professor Andrew Calder, honorary Assistant Principal for Reproductive Health at the University of Edinburgh, in Scotland.

They were joined by British Columbians Moira Stilwell, Member of the Legislative Assembly, Vancouver-Langara, and Parliamentary Secretary for Industry, Research and Innovation in the Government of British Columbia, and Dr. Jeff Reading, of the of the University of Victoria's Centre for Aboriginal Health Research.



NeuroDevNet Events

Highlight Knowledge Translation and the Importance of Policy Impacts

G Bringing families clients, health professionals and scientists together — it is finally happening! Thank you!!

Holland Bloorview's Cerebral Palsy Cell to Person Symposium Showcases NeuroDevNet Research

Cerebral Palsy research group leads and researchers from NeuroDevNet headlined the May 13, 2011 "Advances in Cerebral Palsy - Cell to Person Symposium." The national conference, which drew 189 attendees, focused on sharing knowledge and information on advances in cerebral palsy (CP), was organized in partnership with NeuroDevNet.

Targeted to clinicians and health practitioners in the morning, and patients and families in the afternoon, the symposium received high marks – 4.8 out of a possible score of five in 64 evaluations.

Dr. Michael Fehlings, NeuroDevNet's Associate Scientific Director, gave a keynote entitled, "Repair and Regeneration of the Brain with Stem Cells in Cerebral Palsy, Hope or Hype?" Dr. Fehlings noted that while there is no current stem cell treatment proven effective for people with CP, a tremendous amount of research is underway in Canada, and NeuroDevNet is playing an important role in moving forward on promising therapies for the disorder.

Also presenting were Dr. Michael Shevell, lead of NeuroDevNet's CP research group, his co-lead Dr. Jerome Yager, and NeuroDevNet researchers Dr. Darcy Fehlings and Dr. Adam Kirton.

Dr. Shevell showcased the new multi-provincial CP Registry while Dr. Yager focused on promising evidence emerging from animal model research. Dr. D. Fehlings discussed brain changes observed following constraint therapy in children with CP and Dr. Kirton spoke on Transcranial Magnetic Stimulation (electrical impulses sent by a device through the scalp to the surface of the brain) to Understand and Enhance Motor Function in Hemiplegic CP.



The Cell to Person Symposium concluded with a panel discussion and a family forum. "Bringing families clients, health professionals and scientists together- it is finally happening! Thank you!!," wrote one participant.

The chance to interact with leading researchers was a great opportunity for many other parents, who appreciated the emphasis on sharing best practices with caregivers. "I am a parent of a 17 year old with CP," wrote one. "I was looking for this information when he was born please continue!"

NeuroDevNet Events Highlight Knowledge Translation and the Importance of Policy Impacts

G The Banff gathering was exceptional in that it also explored legal and educational challenges that are part of the complexity associated with FASD.

Banff International Conference on FASD a NeuroDevNet Collaboration

NeuroDevNet's Scientific Director, Dr. Dan Goldowitz served as co-chair on the organizing committee for the 44th Banff International Conference on Behavioural Science, presented March 18-21 in 2012.

Banff XLIV: Fetal Alcohol Spectrum Disorder: Challenges in Practice, Research and Policy examined challenges in FASD diagnosis through the lens of clinical and basic principles in brain development and discussed evidence-based interventions focused on improved outcomes for children with the disorder, as well as preventive strategies.

The conference drew an international audience of more than 100 clinicians, educators, researchers and policymakers working the field of FASD and children's mental health. NeuroDevNet made an effort to fund the attendance of trainees from areas of basic biology and animal models of FASD, to provide them with opportunities to listen to and discuss topics quite removed from their typical academic experience in the lab.

"The Banff gathering was exceptional," said Dr. Goldowitz, "in that it also explored legal and educational challenges that are part of the complexity associated with FASD. The conference was very successful in attracting a broad audience, including clinicians, educators and researchers.

"A real highlight was our collaboration with the Hon. Kristy Duncan MP (Etobicoke ON)," added Goldowitz. "It produced a motion regarding FASD research to be proposed from the floor of the House."



Financial Statements March 31, 2012



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INDEPENDENT AUDITOR'S REPORT

To the Directors of NeuroDevelopment Network Inc.

We have audited the financial statements of the NeuroDevelopment Network Inc. (the "Network"), which comprise the statement of financial position as at March 31, 2012 and statements of operations and fund balances and of cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with Canadian generally accepted accounting principles, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Canadian generally accepted auditing standards. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements present fairly, in all material respects, the financial position of the Network as at March 31, 2012, and its financial performance and its cash flows for the year then ended in accordance with Canadian generally accepted accounting principles.

Other matters

The financial statements as of March 31, 2011 and for the year ended March 31, 2011 were audited by other auditors, who expressed an unmodified opinion on those statements in their auditor's report, dated June 22, 2011.

-by + Watson

Hay & Watson Chartered Accountants Vancouver, British Columbia June 12, 2012

Financial Statements March 31, 2012 Neurodevelopment Network Inc.

STATEMENT OF FINANCIAL POSITION

as at March 31, 2012

ASSETS

Current assets Cash - restricted Cash - unrestricted Unspent research grants at participating institutions (note 5) Prepaid expenses

Equipment (note 6)

LIABILITIES **Current liabilities** Accounts payable and accrued liabilities

Deferred contributions (note 4a) Deferred capital contributions (note 4b)

Unrestricted funds

The accompanying notes are an integral part of these financial statements

APPROVED BY THE BOARD OF DIRECTORS

Jem Rould

Henri Rothschild, Chair, Board of Directors



2011

2012

\$	\$	
0.000 /05	0.070.00/	
2,238,435	2,079,394	
51,842	7,065	
815,902	1,340,611	
18,003	10,714	
3,124,182	3,437,784	
4,497	8,996	
3,128,679	3,446,780	
196,836	228,419	
2,874,004	3,200,800	
4,497	8,996	
3,075,337	3,438,215	
53,342	8,565	
3,128,679	3,446,780	

Bernard Bresder

Bernard Bressler, Member, Board of Directors



Financial Statements March 31, 2012 Neurodevelopment Network Inc.

Financial Statements March 31, 2012 Neurodevelopment Network Inc.

STATEMENT OF OPERATIONS AND FUND BALANCES

Year ended	2012 March 31 \$	2011 March 31 \$
Receipts		
Grants from NCE and host institution (note 4a)	4,299,133	2,766,443
Grants from other institutions (note 4a)	-	7,500
Other sources of funds	76,620	12,426
Amortization of deferred capital contributions (note 4b)	4,499	4,499
	4,380,252	2,790,868
Expenditures		
Communications	35,049	30,922
Amortization	4,499	4,499
Insurance	10,125	3,312
Miscellaneous	1,043	740
Networking	184,238	81,615
Platform startup	-	2,954
Professional and consulting fees	121,998	144,544
Research and training (note 5)	3,179,180	1,910,017
Salaries and benefits	565,750	434,731
Supplies and office costs	52,495	44,651
Travel and meetings	181,098	124,318
	4,335,475	2,782,303
Excess of receipts over expenditures for the year	44,777	8,565
Unrestricted funds - Beginning balance	8,565	_
Unrestricted funds - Ending balance	53,342	8,565

STATEMENT OF CASH FLOWS

Year ended

Cash flows from (used in) operating activities Excess of receipts over expenditures for the year Non-cash items Amortization of equipment Changes in non-cash working capital items Unspent research grants Prepaid expenses Accounts payable and accrued liabilities Deferred contributions
Cash flows from (used in) investing activities Equipment acquired
Increase in cash Cash - Beginning of year
Cash - End of year
Cash composed of Cash – restricted Cash – unrestricted

The accompanying notes are an integral part of these financial statements

The accompanying notes are an integral part of these financial statements

2012 March 31 \$	2011 March 31 \$
44,777	8,565
4,499	4,499
524,709	(1,340,611)
(7,289)	(10,714)
(31,583)	114,775
(331,295)	1,447,558
203,818	224,072
-	[6,486]
203,818	217,586
2,086,459	1,868,873
2,290,277	2,086,459
2,238,435	2,079,394
51,842	7,065
2,290,277	2,086,459

Notes to the Financial Statements March 31, 2012 Neurodevelopment Network Inc.

Notes to the Financial Statements March 31, 2012 Neurodevelopment Network Inc.

1. NATURE OF OPERATIONS

Neurodevelopment Network ("NeuroDevNet" or the "Network") is a not-for-profit program established by the Government of Canada's Networks of Centres of Excellence ("NCE") program. The Network was established to promote research in disorders of brain development and the implementation of real life solutions to improve the lives of affected children and families. The Network pursues its mission by distributing awards to its principal investigators through their participating institutions for approved research projects.

Neurodevelopment Network, Inc, the manager of the Network, was formally incorporated under Part II of the Canada Corporations Act as a non-profit organization on December 9, 2009.

On January 22, 2010, NeuroDevNet entered into a Network Agreement with the University of British Columbia ("UBC") under which UBC will serve as the host institution for the Network, providing facilities and services for NeuroDevNet's administrative centre.

These financial statements include only the contributions received by NeuroDevNet from the NCE program, its host institution and others, and disbursed on its behalf. NeuroDevNet may not be able to maintain its current level of operations should this funding be significantly reduced or ended.

2. SIGNIFICANT ACCOUNTING POLICIES

These financial statements have been prepared on the basis of Canadian generally accepted accounting principles ("GAAP") for non-profit organizations, using the deferral method of accounting for contributions. Significant policies include the following:

Cash - restricted and unrestricted

Grant funds received from NCE are considered restricted cash and are administered by UBC, the Network's host institution. Other funds are administered by the Network and are considered unrestricted cash.

Unspent research grants at participating institutions

Research grants paid to the participating institutions are deferred on the statement of financial position until the participating institution incurs eligible research costs, at which time they are recognized as research and training expenditures.

Recognition of receipts

Under the terms of the NCE agreement, the funding received from the NCE will be directed to the granting of awards to the Network's participating institutions and the payment of operating and capital expenditures. When received, NCE contributions are deferred and recognized as revenue in the period in which the related expenditures are incurred by the Network or a participating institution. Restricted contributions applied toward the purchase of furniture and equipment are deferred and recorded as receipts at the rate corresponding to the amortization rate of the related furniture and equipment. Unrestricted contributions are recognized as receipts in the current period if the amount to be received can be reasonably estimated and collection is reasonably assured.

2. SIGNIFICANT ACCOUNTING POLICIES (continued) Financial instruments

The Network has adopted the provisions of Section 3855, Financial Instruments - Recognition and Measurement, and Section 3861, Financial Instruments - Disclosure and Presentation, of the Canadian Institute of Chartered Accountants ("CICA") Handbook, as they apply to not-for profit organizations.

The standards require that all financial assets and liabilities be measured at fair value with the exception of investments held to maturity, loans and receivables, and other liabilities that are measured at amortized cost using the effective interest rate method. Cash is measured at fair value using Level 1 inputs. Accounts receivable and accounts payable and accrued liabilities are measured at amortized cost. As at March 31, 2012, the recorded amounts approximate fair values.

The Network classifies and discloses fair value measurements based on a three-level hierarchy:

- Level 1 inputs are unadjusted quoted prices in active markets for identifiable assets or liabilities;
- Level 2 inputs other than quoted prices in Level 1 that are observable for the asset or liability, either directly or indirectly; and
- Level 3 inputs for the asset or liability that are not based on observable market data

Equipment

Equipment is recorded at cost and amortized on a straight-line basis over its estimated useful life of three years.

Use of estimates

The preparation of financial statements requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities at the date of the financial statements and the reported amounts of receipts and expenditures during the reporting period. Actual results could differ from those reported. Items requiring the use of management estimates include the useful life of equipment.

Employee future benefits

NeuroDevNet's staff are eligible to join the UBC staff pension plan. The UBC staff pension plan provides benefits based on 2% of the average best three years' basic salary multiplied by the number of years of contributory service, less an adjustment to Canada Pension Plan contributory earnings. NeuroDevNet's contribution for staff is approximately 9% of salary. In the event of funding deficiencies, NeuroDevNet's contributions remain fixed and benefits for members may be reduced. Accordingly, NeuroDevNet records contributions to this plan as expenditures in the year the contributions are made. Benefit security for employees is improved by the plan maintaining a contingency reserve. The contingency reserve recommended by the plan's actuary and approved by the pension board and Canada Revenue Agency is 40% of liabilities. Contributions to the plan made during the year amounted \$26,782 (2011 - \$25,547).

Income taxes

NeuroDevNet is not subject to Federal or Provincial income taxes.

In-kind contributions

In-kind contributions from UBC (note 3) and other organizations are not included in these financial statements.

Notes to the Financial Statements March 31, 2012 Neurodevelopment Network Inc.

Notes to the Financial Statements March 31, 2012 Neurodevelopment Network Inc.

2. SIGNIFICANT ACCOUNTING POLICIES (continued)

Future accounting changes

In December 2010, the the Accounting Standards Board ("AcSB") of the Canadian Institute of Chartered Accountants ("CICA") released Part III of the CICA Handbook - Accounting, which consists of accounting standards for not-for-profit organizations. The standards will be effective January 1, 2012 and allow nongovernmental not-for-profit organizations to apply accounting standards for not-for-profit organizations with a reference to standards for private enterprises where appropriate or IFRS.

NeuroDevNet does not expect the adoption of the new accounting standards to result in material changes in its reported financial position, results of operations or cash flows.

3. RELATED PARTY TRANSACTIONS AND ECONOMIC DEPENDENCE

Grants from the NCE Network

Natural Sciences and Engineering Research Council ("NSERC"), the Social Sciences and Humanities Research Council ("SSHRC"), and the Canadian Institutes of Health Research ("CIHR") agreed to contribute funding of \$19,572,000 to the Network for the five years ending on December 23, 2014. These contributions are scheduled to be received as follows:

Fiscal Year	NSERC	SSHRC	CIHR	Total
2009 - 2010	\$ 733,865	\$ 1,151,500	\$ 28,500	\$ 1,913,865
2010 - 2011	302,500	400,000	3,453,500	4,156,000
2011 – 2012	527,000	1,000,000	2,292,000	3,819,000
2012 - 2013	576,000	1,000,000	2,364,000	3,940,000
2013 – 2014	530,000	1,000,000	2,296,000	3,826,000
2014 - 2015	-	-	1,917,135	1,917,135
Total Funding	\$ 2,669,365	\$ 4,551,500	\$ 12,351,135	\$ 19,572,000

The annual contributions will be released subject to:

- Parliamentary appropriation of the funds in each fiscal period
- Satisfactory progress, as determined by the NCE Secretariat, towards predetermined milestones ٠ for the NCE Network
- Continuing eligibility of the NCE Network Host and the NCE Network, and
- Compliance with the terms of the funding agreement

The funding of \$3,819,000 has been received for 2011-2012 (\$4,156,000 in 2010-2011) and has been reflected in these financial statements.

Grant from Host Institution

The Network Agreement between NeuroDevNet and UBC provides a cash grant of \$200,000 over 5 years to December 23, 2014 as well as in-kind support. Gifts in kind are not recorded in the financial statements and include legal service coordination; payroll, purchasing, and grant management; and management of intellectual property, IT support and web hosting services.

4. DEFERRED CONTRIBUTIONS

a) Deferred contributions relating to expenditures of future periods

Balance - Beginning of year

Contributions received during the year Grant from CIHR Grant from NSERC Grant from SSHRC Grant from Host Institution Grants from other organizations

Amounts recognized as receipts during the year Amounts applied toward furniture and equipment purchased during the year

Balance - End of year

b) Deferred capital contributions relating to equipment

Balance - Beginning of year Allocation of deferred contributions (note 4a) Amounts amortized to revenue

Balance - End of year

I.	n	C	=	

2012 \$	2011 \$	
3,200,800	1,755,229	
2,292,000	3,453,500	
527,000	302,500	
1,000,000	400,000	
20,000	20,000	
133,337	50,000	
7,173,137	5,981,229	
4,299,133)	(2,773,943)	
-	(6,486)	
2,874,004	3,200,800	

2012 \$	2011 \$
8,996	7,009
-	6,486
[4,499]	(4,499)
4,497	8,996

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Notes to the Financial Statements March 31, 2012 Neurodevelopment Network Inc.

Notes to the Financial Statements March 31, 2012 Neurodevelopment Network Inc.

5. EXPENSES

NeuroDevNet advances funds to researchers at their host institutions. Funds are held in trust by the institutions and as expenses are incurred they are expensed by NeuroDevNet. During 2012, the expenses for research and training totalled \$3,179,180 including \$2,782,764 of expenses incurred from funds transferred to institutions for research. An additional \$396,416 of expenses was incurred and expensed by the administrative centre for miscellaneous research and training programs.

	Balance	Current	Current	Balance	
	April 1,	Year	Year	March 31,	
	2011	Grant	Expenditure	2012	
	\$	\$	\$	\$	
Institution - Master grants					
Holland Bloorview	93,956	71,134	129,959	35,131	
Hospital for Sick Children	85,250	393,000	385,303	92,947	
IWK Health Centre	19,534	52,066	1,393	70,207	
McGill University	368,683	283,967	481,612	171,038	
McMaster University	11,000	37,500	48,500	-	
Queen's University	44,598	245,490	273,675	16,413	
University Health Network	40,215	65,785	106,000	-	
University of Alberta	183,049	174,285	325,679	31,655	
University of British Columbia	240,751	765,526	764,069	242,208	
University of Calgary	33,157	41,843	66,586	8,414	
University of Manitoba	-	20,000	9,008	10,992	
University of Montreal	16,003	48,084	64,087	-	
University of Saskatchewan	160,665	-	58,234	102,431	
University of the Fraser Valley	18,750	46,875	65,625	-	
University of Victoria	25,000	12,500	3,034	34,466	
	1,340,611	2,258,055	2,782,764	815,902	
Other research and training			396,416		
Total research and training			3,179,180		

6. EQUIPMENT

	Cost \$	Accumulated amortization \$	2012 Net book value \$	2011 Net book Value \$	
Computers	13,495	8,998	4,497	8,996	

7. CAPITAL MANAGEMENT

NeuroDevNet defines its capital as the amounts included in net assets, deferred contributions and deferred capital contributions.

NeuroDevNet's capital management objectives are to meet the requirements of the funders providing grants for research and to safeguard its ability to continue as a going concern in order to pursue the objectives of the Network.

NeuroDevNet has certain external restrictions on the use of deferred contributions and deferred capital contributions, as set out in note 4. NeuroDevNet has internal control processes to ensure that the restrictions are met prior to utilization of these resources and has been in compliance with these restrictions throughout the period.

8. FINANCIAL INSTRUMENT RISKS

NeuroDevNet is not exposed to significant credit, interest rate, or currency risk.

9. COMPARATIVE FIGURES

The comparative figures have been reclassificed where necessary in order to conform to the presentation used in the current year.

Partners

Partners

Our partnerships with industry, government, and not-for-profit organizations help us translate research to inform basic science and produce the best clinical outcomes possible for children and families affected by neurodevelopmental disorders.

Network Members

Dalhousie University Holland Bloorview Kids Rehabilitation Hospital Institut de recherches cliniques de Montréal (IRCM) IWK Health Centre Foundation (Halifax) McMaster University Montreal Heart Institute Queen's University Ryerson University Simon Fraser University The University of Toronto The Hospital for Sick Children Université de Montréal University Health Network (Ontario) University of Alberta University of British Columbia University of Calgary University of Lethbridge University of Manitoba University of Saskatchewan University of the Fraser Valley University of Victoria University of Western Ontario York University

Universities

Canadian Centre for Behavioral Neuroscience Croatian Institute for Brain Research (CIBR) Laval University McGill University San Diego State University Simon Fraser University The Hotchkiss Brain Institute - University of Calgary University of California, Los Angeles University of Ottawa University of Pittsburg University of Zagreb Vancouver Coastal Health Research Institute Vanderbilt University Oregon Health & Science University United Nations University Nipissing University - Muskoka Campus OCAD University University of Iowa College of Medicine

Industry

Cerner Corporation Vancouver Sun Electronic Arts Ideas for independent living Inc. Woods Homes NeuroChip **Bionetics** Squeezease Therapy Inc. Westcoast Child Development Group Premier Technology **TELUS** Communications Company PeriGen (Canada) Inc. GE Healthcare Kasian Architecture REDCap (Research Electronic Data Capture) Software

Federal departments and agencies

National Research Council-Institute for Biodiagnostics Networks of Centres of Excellence National Institutes of Health (NIH) Public Health Agency of Canada Canadian Institutes of Health Research (CIHR) Institute of Human Development, Child and Youth Health (IHDCYH) National Research Council (NRC) Department of Foreign Affairs and International Trade (DEFAIT)

Provincial departments and agencies

Alberta Innovates – Health Solutions Centre for Molecular Medicine and Therapeutics The Child & Family Research Institute Mount Sinai Hospital Nova Scotia Department of Health & Wellness Régie de l'assurance maladie du Québec The Commission d'accès à l'information du Québec (CAI) WCHRI Clinical Research Informatics Centre The Michael Smith Foundation for Health Research (MSFHR) Women's Health Research Institute BC Women's Hospital & Health Centre

CanAssist

Mitacs

In Australia

Not-for-Profit Organizations

- Autism Research Training (ART) Program
- Autism Speaks Canada
- Baby Siblings Research Consortium
- Canadian Association of Paediatric Hospitals (CAPHC)
- Canadian Epigenetics, Environment and Health Research
- Consortium (CEEHRC)
- Canada FASD Research Network (CanFASD)
- Canada-Israel FASD Consortium
- Canadian Autism Spectrum Disorders (ASD) Alliance
- Canadian Child Health Clinician Scientist Program (CCHCSP) Children's Hospital of Philadelphia (CHOP)
- Computational Approaches in Neuroscience Action Control & Transformations (CAN-ACT)
- CP International Research Foundation
- Early Intervention Services of York Region
- Enhancing the Scientific Study of Early Autism (ESSEA) Fondation Pere Favron
- Graphics Animation And New Media (GRAND) NCE
- Institute for Ethics, History and Theory of Medicine,
- University of Munich
- Institute of Neurosciences, Mental Health and Addiction (INMHA)
- Neurological Health Charities Canada (NHCC)
- Maternal Infant Child and Youth Research Network (MICYRN)
- National Institute of Mental Health and Neuro Sciences (NIMHANS)
- Norlien Foundation
- Ontario Brain Institute
- Ontario Science Centre/Café Scientifique
- Research Institute of the Cerebral Palsy Research Alliance
- R. Howard Webster Foundation
- SickKids Foundation
- Simons Foundation Autism Research Initiative
- Sinneave Family Foundation
- Stem Cell Network

Researchers

Network Investigators

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Associate Investigators continued

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Nicole Letourneau Christine Loock Jan Lutke Karon MacLean Frank MacMaster Krisztina Malisza Adam McCrimmin Audrey McFarlane Gerlinde Metz Fiona Miller Kishore Mulpuri Doug Munoz Diane Munz Andras Nagy David Nicholas Sarah Nikkel Lucy Osborne Marvam Oskoui Nicole Pigeon Quentin Pittman Marco Prado Mojgan Rastegar Urs Ribary Bryan Richardson A. Jane Roskams Dawa Samdup James Sanders Guillaume Sebire Sidney Segalowitz Isabel Smith Laurie Snider Marla Sokolowski Isabelle Soulieres Grea Stanisz Pat Stroman Jane Summers Heidi Sveistrup Margot Taylor Tracy Vaillancourt Esias van Rensburg Alexander Velumian John Vincent Naznin Virji-Babul Joanne Volden Charlotte Waddell Lucie Wade Wyeth Wasserman Rosanna Weksberg Ellen Wood Virginia Wright Jaynie Yang

Researchers

Network Trainees

Shawn Andrews Kimberly Armstrong Gillian Hanley Carl Jackson Danielle Levac Anath Lionel Keiko Shikako-Thomas Katarzyna Stepien Susan Walker Julia Wei Virginia Wright Farah Zahir Jill Zwicker

Associate HQP and Trainees

Megan Alexander Pamela Arstikaitis Quentin Ballev Omer Bar Yosef Lauren Baugh Emily Bell Terry Bennett Tamara Bodnar Heather Brown Susanne Brummelte Rebecca Cheung Isabelle Chouinard Jennifer Corrigan Colleen Curtis Charles de Leeuw Kennedy Denys Nina Di Pietro Krissy Doyle-Thomas Kelly Drummond Eric Duku Miriam Elfert Linda Ellis Stuart Falkner Trehani Fonseka Nicholas Foster Debra Fulton Sara Furlano Stelios Georgiades Satvinder Ghotra Allyson Graham Simone Griffin Layla Hall Ameer Hamza Kasey Hemington Hamilton Hernandes Amy Hewitt

Associate HQP and **Trainees continued**

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Founding Investigators

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Corporate Information

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Auditors

Hay & Watson, Chartered Accountants

Legal Counsel Borden Ladner Gervais LLP, Vancouver, BC

Staff

Bethany Becker, Communications Manager Jim Brookes, Chief Development Officer Darlene Cripps, Senior Administrator Bruno Grazzioto, Finance Administrator Anthony Santelices, Communications Assistant Douglas Swanson, Training and Education Manager Christine Tang-Ayushi, Administrative Assistant

making connections

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NeuroDevNet

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