Child health is of the greatest importance for the future health of a nation, since today's children grow up to become the next generation of parents and workers, and because health in early life is the basis of health in adult life.

Building the Leading Child Health Research Institute in Western Canada

The Alberta Children’s Hospital Research Institute (ACHRI) leadership team is pleased to present our 2015-2020 strategic plan. Since 2009, with the support of ACHRI founding partners (the University of Calgary, Alberta Health Services, and the Alberta Children’s Hospital Foundation), we have grown, increased the depth and breadth of our scholars and scholarship, and continued to conduct child health research and education for the benefit of Albertans.

This plan positions us to fulfill our mission to foster healthy developmental trajectories for babies, children and youth through excellence in research, innovation, knowledge translation and education. Specifically it outlines how we will build on our existing strengths to become the leading child health research institute in Western Canada.

We envision that ACHRI’s scientists and their research achievements will significantly improve Albertans’ health and wellness.

We will meet our goals through a strong, sustained commitment to translational research across the biological and psychosocial research spectrum—from before conception to adulthood.

Our emphasis will be on recruiting and retaining strong scientists and to support them with cutting-edge research platforms.

Our success will be benchmarked on metrics of academic excellence.

By 2020, we intend to be the leading child health research institute in Western Canada.

Sincerely,

Brent Scott, MDCM, FRCP
Executive Director
Professor, Cumming School of Medicine

Naweed Syed, PhD, FRCP (Edin)
Scientific Director
Professor, Cumming School of Medicine
The Opportunity

Research, innovation, novel technologies and improved medical practices in the 21st Century have allowed a deeper and more integrated understanding of the origins of health and disease. Three recent advances stand out as being revolutionary and create new research opportunities for ACHRI that hold transformative promise:

» Next-generation genomic sequencing permits charting of the human genome and a greater understanding of how genes, proteins and molecules interact at the molecular and cellular level to define life-long health outcomes

» New information technology supports multi-disciplinary research teams, large prospective cohort studies and clinical trials, massive databases, new imaging technologies and bio-banks to explore complex, multi-factorial influences of environment, medical care and the social determinants of health vis-à-vis our individual and societal well-being

» The emerging science of epigenetics opens the doors to a better understanding of the interactions between an individual’s genes and their environment including the effects on gene expression with long-term influences on the health of the current and future generations

These advances have redefined the science and our ability to understand human biological, psychosocial development and clinical outcomes. The developmental origins of human health and disease are well accepted. Furthermore, interventions and investments during early life have been shown to yield the greatest long-term impacts on individual and societal health and wellness.

The ACHRI team will seize this opportunity to increase understanding of the biological and psychosocial development of babies, children and youth. With our partners, we will create new knowledge to change practice and shape policy in ways that improve child health outcomes, enhancing the potential of children to mature as active, engaged and productive adults.

Vision

A healthier and more prosperous future for our children through research

Mission

ACHRI will foster healthy biological and psychosocial trajectories for babies, children and youth through excellence in research, innovation, knowledge translation and education

ACHRI’s vision and mission will build upon the University of Calgary Eyes High strategic direction1 with a goal of optimizing biological and psychosocial development and health—from before conception to adulthood.

ACHRI scientists will deliver innovative health care solutions in partnership with Alberta Health Services.

ACHRI Strategic Plan 2015-2010
The Alberta Children’s Hospital Research Institute (ACHRI) is a multi-disciplinary partnership Institute within the Cumming School of Medicine, governed by a Memorandum of Understanding between the University of Calgary, Alberta Health Services, and the Alberta Children’s Hospital Foundation. ACHRI’s membership encompasses a diverse community of scholars—over 90 full and 140 associate members—in the university’s faculties of Arts, Education, Kinesiology, Medicine, Nursing, Science, Social Work and Veterinary Medicine.

To become the leading child health research institute in Western Canada, the ACHRI team will pursue the following goals:

**Institute Goals**

ACHRI’s goals were developed to align with the Cumming School of Medicine’s Strategic Plan by organizing around strengths and building infrastructure for impact.

**Critical Success Factors**

- Perform against metrics of excellence and well-defined outcomes
- Empower and reinforce successful research programs
- Align with key strategic partners
- Recruit and retain high-quality faculty—essential for renewal and growth
- Create state-of-the-art and integrated research space and infrastructure
- Secure new peer-reviewed and additional funding opportunities
- Promote research discoveries and highlight their impact to government, funding agencies, philanthropists and the community at large
- Develop a leading administrative and management team to build future capacity and succession planning

**Strive for research excellence**

- Adhere to operational decisions that will help achieve our identified research goals
- Increase the number and quality of applications to competitive, peer-reviewed research funding opportunities
- Increase the total number of high-quality publications in peer-reviewed journals
- Build a research infrastructure to enable new scientific discoveries, the development of novel technologies, clinical trials and an impact on health policy
- Embrace a bench-to-bedside-to-community culture

**Focus on our priorities**

- Deliver biological and psychosocial child health research encompassing the three priority research themes
- Recruit, develop and retain high-quality researchers, students, and staff
- Support relevant and strong research platforms critical for theme success

ACHRI researchers identified the gene causing a severe childhood condition called cerebro-costo-mandibular syndrome (CCMS). External research funding has grown to $24 million in 2013-2014, a 15 per cent increase over previous year.

ACHRI will lead the development of a strong collaborative partnership amongst CSM, multiple institutes and faculties in support of the university’s strategic direction, culminating in a CSM Centre for Health Genomics and Informatics.
Strategic Priorities by Research Theme

The research activities of ACHRI members are organized into three priority themes which drive research from the bench-to-bedside-to-community. The research foci and objectives for each theme are:

Genes, Development and Health

The Genes, Development and Health theme is an interdisciplinary research team that exploits advanced genetic and genomic technologies to decipher the molecular and cellular basis of both normal development and pediatric genetic disorders. The research teams will be comprised of the following:

- Specialists in the field of molecular genetics seek to understand the genomic basis of childhood health to identify novel genes that cause rare childhood diseases and develop improved diagnostic techniques
- Stem cell and developmental biologists study the biological basis of development and disease in simple experimental model organisms to identify the genetic networks that control early development and the causative molecular mechanisms underlying childhood disease
- Computational biologists specializing in bioinformatics develop tools for the improved analysis of genomic, proteomic and metabolomic data
- Clinician investigators evaluating novel therapeutics in the realms of clinical trials

Create translational research pipelines with impact

- Become recognized as the leading child health research institute in Western Canada, as evaluated by Canadian Academy of Health Sciences metrics
- Inspire a culture of creativity and discovery built upon the science of biological and psychosocial development which translates new knowledge into improved child health outcomes
- Capture attainable synergies amongst the University of Calgary, Alberta Health Services and the Alberta Children’s Hospital Foundation
- Nurture and develop translational research teams for biomedical and patient-centred programs

Educate the next generation of child health scholars

- Establish one of the top Canadian graduate training environments in child development and healthy outcomes
- Attract the best national and international talent by offering competitive graduate and postdoctoral training and funding opportunities (ACHRI Scholars Program)

The Southern Alberta Cancer Research Institute and ACHRI are partners in a project to find alternative therapies to fight childhood cancer. Through Dr. Aru Narendran and his role in the POETIC consortium composed of major academic medical centres in North America, researchers have access to phase I and II cancer studies.

ACHRI allocates $1-million a year on a training program to support summer undergraduates, graduates and postdoctoral trainees and clinical fellows.

ACHRI researchers are finding the cause and mechanisms of childhood disease and transferring that knowledge to the discovery of new therapeutics, diagnostics and personalized medicine.
Collaboration across these groups results in mechanism-centred, fundamental and translational research to enhance patient diagnosis, develop novel disease therapies and improve child health outcomes.

Specific goals for Genes, Development and Health include the following:

- Recruit, retain and nurture scientists working in the fields of human genomics, bioinformatics, developmental biology and model organisms, whose research has translational potential
- Create a model organism experimental unit to study pediatric genetic disorders while supporting high-throughput cellular and zebrafish pharmacogenomics screening units, and the genomics-informatics platform
- Align the Model Organism Research for Pediatric Health (MORPH) program (a structured investigation of the biologic mechanisms underlying normal development and genetic disorders) with the Kidomics program (translational genomic diagnostic, therapeutic and clinical trials) as a bench-to-bedside translational research pipeline
- Enhance the Genes Development and Health graduate and postdoctoral training program

**Behaviour and the Developing Brain**

ACHRI’s Behaviour and the Developing Brain (BDB) research theme conducts fundamental and translational research on brain disorders with serious, lifelong consequences for the biologic and psychosocial development (neurologic and mental health) of newborns, children and youth. Three areas have been prioritized to develop multi-disciplinary, bench to bedside, translational research programs because they have a high potential for benefits that lead to improvement in health and well-being across the entire life span:

- Acquired Paediatric Brain Injury and Rehabilitation
  - Concussion and traumatic brain injury disproportionately affects children and youth. Despite improvements in care and reduced mortality, significant morbidity still exists and there are no effective therapies to improve outcomes. The Pediatric Brain Injury Research Program has the goal of understanding the neurobiology of brain injury and leveraging the new knowledge to develop novel therapeutics to improve long-term health outcomes. The following goals lead the research efforts and will be realized though the collaboration of health researchers and clinical scientists:
    - Understand the epidemiology and identify ways to prevent acquired brain injury
    - Identify new methods for diagnosis
    - Improve outcome predictions and prognoses
    - Discern the pathophysiology and mechanisms of disease
    - Establish evidence-based management and rehabilitation strategies

Paediatric Epilepsy

Epilepsy is the fourth most common neurological disorder in North America. In Alberta, this translates to a prevalence of more than 57,000 patients. Importantly, three-quarters of newly diagnosed epileptic patients are 16 years of age or younger, thus making epilepsy primarily a problem of infancy and childhood. Cognitive impairment, along with devastating impacts on the quality of life, are common. The single most important metric of successful treatment for children with epilepsy is the reduction of seizure frequency—with seizure-freedom being the ultimate goal. Despite numerous advances over the past 40 years in medical therapy, surgery and dietary knowledge, the overall range of individuals who do not achieve seizure-freedom remains above 30 per cent. Knowing this, the translational epilepsy bench-to-bedside program aims to achieve the following goals:

» Understand the fundamental mechanisms and the genetic and epigenetic basis of epilepsy using animal models
» Link the biology of epileptic seizures with novel techniques involving fundamental research and clinical practice, thus transforming the treatment of epilepsy
» Transform clinical practice by creating standardized pathways of care with continuous quality-improvement cycles for evaluation and adaptation
» Develop animal models of epilepsy research, such as the zebrafish, to interrogate new targets and drug molecules via high-throughput screening, assessing responsiveness for patient-tailored, pharmacotherapeutic treatment

Neurodevelopment and Child Mental Health

Neurodevelopmental disorders constitute one of the fastest-growing health problems in the world. Fifteen to twenty per cent of school-aged children suffer from a diagnosable disorder, and often more than one condition can co-exist. Developmental, behavioural and emotional problems are now collectively the leading cause of disability affecting children. The etiology of most of these conditions is unclear and there is an urgent need to devote resources to uncover the developmental origins of these disorders and to develop effective interventions for children and their families.

Neurodevelopmental disorders arise from the disruption of the normal growth and maturation of the brain and nervous system—the science encompasses the disciplines of embryology, developmental biology, neuropathology, psychology and psychiatry. Additionally, there is an interaction between environmental and genetic factors that significantly impacts the life course. The goals for this program are as follows:

» Advance our understanding of biological and psychosocial development of children and improve health outcomes through translational research
» Determine prenatal and early childhood social-environmental predictors of neurodevelopmental and behavioural disorders
» Identify mechanisms (e.g., neural, endocrine, genetic, metabolic) underlying the relationships among antecedents, predictors and neurodevelopmental and behavioural disorders
» Improve the diagnosis of neurodevelopment, using imaging, genomics, and metabolomic approaches
» Evaluate and improve clinical, supportive and rehabilitative treatments for children and families at risk for, and affected by neurodevelopmental and behavioural disorders

The research undertaken on neurodevelopmental disorders will utilize already established platforms in neuroimaging and genetics within ACHRI to answer questions pertaining to the genetic and biological bases of these disorders.
Healthy Outcomes

The scientific scrutiny of particular health care practices and interventions is the focus of outcomes research. The Healthy Outcomes theme is dedicated to high-impact, person-centred research promoting the health of children from before conception to adulthood by creating new knowledge. The theme has a diversity of talented members all sharing a passion for person centred outcomes research that improves the health and well-being of children and families. Our broad goals are to use discovery and outcomes research techniques to improve clinical practice in acute and chronic child health care. The spectrum of interest includes: health promotion, prevention, diagnostic, treatment and rehabilitation interventions.

Our research teams make a difference by focusing on knowledge generation and translation, quality improvement and person and family-centred outcomes.

The Healthy Outcomes theme strives to reduce suffering, improve outcomes and save lives. By 2020, the Healthy Outcomes research teams will translate knowledge into best practices, care pathways, and policy while promoting health system sustainability through improved access, quality, safety and reduced health care delivery costs.

Specific goals of Healthy Outcomes include the following:

» Work with key partners to identify high-priority issues and opportunities
» Conduct research that will change practice and shape policy through our teams at local, national and international levels
» Integrate research into clinical care and quality improvement with empirical studies

Two broad strategies for achieving these goals are as follows:

» Investing in scientists and infrastructure to complement areas of strength and promote success
» Recruiting a core team of child and family-centred outcomes research methodologists, biostatisticians and informatics experts

These goals and strategies will inform ACHRI’s approach to new opportunities. ACHRI has embraced collaboration with the Vi Riddell Pain and Rehabilitation Centre at the Alberta Children’s Hospital to create the Vi Riddell Pain and Rehabilitation Program. This program will bring together a multidisciplinary team of clinicians, child psychologists and basic scientists. The ACHRI team will improve pain management modalities to minimize the impact of medications, elucidate the fundamental mechanisms involved, characterize the genes underlying pain and determine novel treatments.

ACHRI researchers have:

» Reduced emergency visits for asthma
» Helped change policies on helmet use and body contact in sports to improve child safety
» Are leading the way to a better understanding and management of childhood obesity
» Saved lives through simulation resuscitation research
» Innovated therapies in childhood cancer
» Improved the developmental outcomes of children by enhancing the health of mothers

Rose Farrell and her daughter Gwen are part of an Alberta study led by Dr. Stephen Freedman to examine the leading causes of intestinal infections in children.
ACHRI Foundational Research Platforms

The primary function of ACHRI is to establish, nurture and sustain an optimal research environment, with particular emphasis on the foundational infrastructure (people, space and equipment) that enables institute success. To support its three research themes, ACHRI has identified five foundational infrastructure platforms that it deems essential for success:

Functional Imaging

The Paediatric Imaging platform includes the 3-Tesla MRI and MRI simulator for graduate and post-doctoral research. The 3-Tesla MRI scanner visualizes structure, function and chemical activity and is the anchor of the platform, supporting a broad range of research programs spanning neurodevelopment, cardiac and musculoskeletal biology. The platform is the result of a tripartite partnership with the Department of Radiology, Alberta Health Services and the University of Calgary.

Genomics and Informatics

The ACHRI genomics and bioinformatics research facility supports fundamental, translational and clinical research. ACHRI established the facility in 2011 with significant funding from the Cumming School of Medicine at the University of Calgary ($2 million), and the Alberta Children’s Hospital Foundation ($5.8 million). Since its founding, the facility has focused on clinical research sequencing projects through a close partnership with the Department of Medical Genetics and the Molecular Diagnostics Lab at Alberta Children’s Hospital (Alberta Health Services). It has developed new genomics and bioinformatics expertise within the entire Calgary research community enabling and securing international partnerships.

Clinical Research Infrastructure

ACHRI’s child health research capacity is enhanced through investments in research personnel and infrastructure. The child health research support platform provides direction, oversight and education in the areas of quantitative and qualitative project development, execution, analysis and reporting; biostatistical planning, analysis, and interpretation; and internal peer review of funding applications and manuscripts. Tailored consultations and supports include: in-person meetings with investigators and trainees, course lectures, small-group mentorship, educational seminar series instruction, and regular, drop-in, open-topic methodology question and answer sessions.

ACHRI Scholars Training Program

The ACHRI Scholars training program leverages research productivity and innovation while offering unique training opportunities for scholars in child health. Our graduates contribute locally and globally to improving the biological and psychosocial development of children and improved child health outcomes.

The program goals are as follows:
- Build and expand training capacity within the Cumming School of Medicine at the University of Calgary, across disciplines at the university, and within ACHRI
- Enhance training activities and special events in a transdisciplinary educational environment
- Improve opportunities for team-based research across themes and with national and international collaborators
- Communicate through knowledge translation the importance of ethical and social implications of child health genetics and research

As of April 1, 2016, over $20 million will have been committed through a new, collective Memorandum of Understanding among the Cumming School of Medicine at the University of Calgary (as part of the university’s Infection, Inflammation and Chronic Disease strategic research theme), the Southern Alberta Cancer Research Institute (SACRI), and the Alberta Children’s Hospital Research Institute, making them the founding partners in the Cumming School of Medicine Centre for Health Genomics and Informatics.

ACHRI’s resources complement and add to those available to our investigators through the Cumming School of Medicine Clinical Trials Strategy, AHS Strategic Clinical Networks, the Canadian Institutes for Health Research, and AHS Strategy for Patient-Oriented Research (SPOR).
These goals are accomplished through a variety of training awards and initiatives that help equip ACHRI trainees—undergraduate and graduate students, postdoctoral scholars and medical residents—with the necessary tools to succeed in an increasingly complex medical research environment, thereby creating the next generation of highly qualified health researchers.

The ACHRI-CiHR Training Program was a six-year (2009-2015) educational initiative that supported competitive graduate and postdoctoral awards and sub-specialty medical doctor trainees pursuing an additional graduate degree and research training. Of the $1 million in total annual funding, $325,000 came from a competitively awarded Canadian Institutes of Health Research (CIHR) Strategic Training Initiative in Health Research (STIHR) grant. Although the CIHR STIHR grants all terminate in fiscal 2015, we will be budgeting internally within ACHRI to maintain a similar level of investment going forward, with additional contributions from the Cumming School of Medicine (Postdoctoral Scholars Program) and the Faculty of Veterinary Medicine ($40,000 per year) at the University of Calgary, and a matching arrangement with Brain Canada.

In April 2015, we completed construction of 930 m² of dry laboratory research space. Named after the donor family, the Owerko Centre at the Alberta Children's Hospital Research Institute will house a research program focused on Neurodevelopment and Child Mental Health.

Commencing in June 2015, ACHRI will initiate redevelopment of 1850 m² of wet-lab research space dedicated to the Model Organism Research for Pediatric Health (MORPH) program. These new facilities and infrastructure will garner exciting opportunities to foster research excellence and clinical acumen for improved child health.

State of the Art Research Infrastructure

The research infrastructure platform at ACHRI is comprised of purpose-designed and built dry- and wet-lab space that houses advanced technology and facilitates cutting-edge translational research programs.
Community Engagement

Our institute’s goal is to be an integral part of southern Alberta and Calgary.

We feel privileged to have the opportunity to connect with families through the Alberta Children’s Hospital and the many philanthropic organizations supporting specific child health care research initiatives. Through our community-based research and our outreach efforts, we are able to build relationships which both inform our research and provide communities with new knowledge.

Public awareness of the importance and value of research is crucial. Through external communications such as public awareness campaigns in the media, we hope to continue to raise our profile as a leading provider of child health research.

Our community partnerships are key to our success. For example, through our participation in Let’s Talk Science, we were able to connect to students and help promote science literacy in Canada. Our institute also connects with the community through the many fundraising efforts led by our important partners—the Alberta Children’s Hospital Foundation and the fund development teams at the Cumming School of Medicine and at the University of Calgary. In collaboration with our partners we have opened our labs to the public and presented our accomplishments—through lectures, symposia, media tours, video and print—the research that underlies our excellence.

Our institute will continue to build relationships whenever possible with our community to explain and further our research goals and include the public in a conversation about our achievements in child health research.

Our goals:

» We will continue to involve the community through a range of mechanisms to ensure our research is being received and can inform the public through knowledge

» We will continue to collaborate with members of our community and develop partnerships which help to advance our research and demonstrate the impact of our work

» We will inform the public of the institute’s policy directions through our communication channels such as annual reports, strategic plans and our web site and social media

Our institute understands the value and power of relationships. When people come together, it is possible to create positive, significant and lasting differences.

Strategic Alignment

ACHRI’s research initiatives and themes are strongly aligned with the Cumming School of Medicine’s research priorities: brain and mental health, chronic diseases, and cardiovascular health.

In addition, ACHRI’s research goals are aligned with three of the six strategic research themes of the University of Calgary:

Brain and Mental Health

Within this theme, there is alignment between the university’s and ACHRI’s strategic plan:

» Optimizing child and adolescent development and behaviour

» Preventing and treating concussion and brain injury

Engineering Solutions for Health: Biomedical Engineering

ACHRI finds opportunity with each of the objectives within this theme:

» Health care delivery optimization

» Imaging and instrumentation

» Diagnostic and therapeutic products

» BioSensors and bio-control technologies

Infection, Inflammation and Chronic Diseases in the Changing Environment

ACHRI has strong potential research alignment with four of the objectives within this theme:

» Infection and immunity

» Inflammation

» Drugs and diagnostics

» Family and social health

The ACHRI research themes support partnerships around Alberta Health Service’s clinical and service missions for the Alberta Children’s Hospital and are synergistic with the Strategic Clinical Networks being implemented by AHS and Alberta Innovates Health Solutions (AIHS), particularly the Maternal, Newborn, Child and Youth Strategic Clinical Network (MNCY SCN) announced March, 2015. The inaugural Medical Director and Scientific Director of MNCY SCN are ACHRI members.
The ACHRI research strategic plan is well aligned with Alberta’s Health Research and Innovation Strategy, published in 2010, which highlights:

» The priority of child and maternal health, mental health, injury prevention, health promotion and chronic disease management
» The importance of a collaborative, multidisciplinary and provincial approach to clinical as well as biomedical research
» The integrating of the research agenda with health services priorities
» The importance of translating new knowledge into practice to achieve wellness or optimize health outcomes at every age
» The importance of partnerships to invest in technology platforms like clinical trials, personalized medicine and genomics for health, which will better support innovations in clinical care

ACHRI Impact by 2020

To become the leading child health research institute in Western Canada, we will adhere to our guiding principles and achieve the goals identified as critical factors for success. By 2020, our institute will have:

» Recruited and nurtured 20 new high-quality faculty within our priority translational research programs
» Increased the number and cumulative impact factor of publications and our competitive research funding, each by 30 per cent over the currently reported 2013/14 year
» Performed in the top tertile of all Cumming School of Medicine research institutes
» Positioned Calgary as a clinical and research leader in precision medicine for children and be a leader in multiple research programs that reduce the negative impact of the developmental origin of adult disease
» By virtue of the new knowledge generated across all four CIHR research pillars, change practice, shape policy and improve child health outcomes and well-being

In short, the aspirations, ambition and energy harnessed by the 2015-2020 ACHRI strategic plan positions the institute to be an asset, a partner and contributor to growth, and a success story for our community and partners.
References


Photo Credits

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