AllerGen

Innovation from cell to society

2013.2014

NCE RCE

Networks of Centres of Excellence of Canada | Réseaux de centres d'excellence du Canada

AllerGen NCE Inc. is hosted at McMaster University, Hamilton, Ontario, Canada.

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Created in 1989, the NCE program is a joint initiative of the Natural Sciences and Engineering Research Council, the Social Sciences and Humanities Research Council, the Canadian Institutes of Health Research and Industry Canada.

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Aussi disponible en français

Asthma and allergies have a profound impact on both individual and economic health: these illnesses cost the Canadian economy over $15 billion per year and are a leading cause of workplace absenteeism, diminished on-the-job productivity, hospital admissions and emergency department visits.

Corporate Profile

One in three Canadians is directly affected by allergic disease: nearly three million Canadians suffer from asthma; approximately 7.5% of the population self-reports at least one food allergy; and an estimated 21,000 Canadians die each year due to air pollution. The associated healthcare and economic burden reaches billions of dollars annually.

AllerGen NCE Inc. (AllerGen), the Allergy, Genes and Environment Network, is a national research network established in 2004 by Industry Canada through the Networks of Centres of Excellence (NCE) program to address these challenges to the health and productivity of Canadians.

AllerGen unites Canada's leading research and clinical care experts in allergic diseases and asthma with related industry and not-for-profit organizations. Working in transdisciplinary and multisectoral teams, and in partnership with organizations and stakeholders across sectors, AllerGen addresses gaps in knowledge and seizes opportunities to generate new preventive strategies, diagnostic tests, therapeutic approaches, medications, public policies and educational tools to reduce the morbidity, mortality and socioeconomic impacts of allergy, asthma, anaphylaxis and related immune diseases.

These teams are also training the next generation of researchers, innovators and clinician-scientists. Since its inception, AllerGen has provided education, training and capacity building opportunities to 1,227 trainees and new professionals, and disbursed $2.3 million in trainee awards, grants and fellowships.

2013-2014 At-a-Glance

354 Trainees and young professionals, research associates and technicians

136 Partner organizations across academia, industry, not-for-profit and government

97 Full-time equivalent Network participants

93 Network investigators

47 Active research projects and strategic initiatives

AllerGen's Vision

To create an enduring network of allergy and immune disease experts whose discovery and development efforts contribute to reducing the impact of allergic and related immune diseases nationally and globally.

AllerGen's Mission

To catalyze and support discovery, development, networking, capacity building, commercialization and knowledge translation to reduce the morbidity, mortality and socioeconomic burden of allergy, asthma and anaphylaxis for the benefit of Canadians and the global community.

Message from the Board Chair and Scientific Director

As AllerGen approaches its final NCE mid-term review in September 2015, we remain focused on ensuring that the Network's research investments translate into better health and an improved quality of life for Canadians living with allergic disease. We achieve this through the development of innovative education and training opportunities, improved clinical strategies, and new tools and technologies that generate sustainable Canadian jobs and productivity for the long term.

Throughout the past year, our research teams continued to identify opportunities to further integrate existing research projects and to refine legacy and sustainability strategies to ensure the Network's impact extends well beyond its final year of NCE funding in 2019.

Our Legacy Projects continue to yield a wealth of data for researchers around the globe. As the youngest children participating in the Canadian Healthy Infant Longitudinal Development (CHILD) Study approach their second birthday, this birth cohort now offers the largest pool of infant microbiome data in the world. To date, the CHILD Study has supported seven substudies and has released 13,000 biological samples for analysis by researchers studying the early-life development of asthma, allergy and other chronic non-communicable diseases, including diabetes, obesity, hypertension and cardiovascular disease.

A five-year operating grant, awarded to the CHILD Study in March 2014 by the Canadian Institutes of Health Research (CIHR) Institute of Circulatory and Respiratory Health, will allow CHILD researchers to expand their efforts to investigate how selected environmental factors affect allergies and asthma in children with different genetic backgrounds, as reflected in their Genetic Risk Scores.

The AllerGen Clinical Investigator Collaborative (CIC) has expanded to add severe asthma and allergic rhinitis to its existing expertise in conducting Phase II clinical trials in allergic asthma. This broadened capacity is allowing biotechnology and pharmaceutical companies to evaluate potential new therapeutic molecules affecting allergic diseases in both the upper and lower airways.

Knowledge from the Canadian Food Allergy Strategic Team (CanFAST) projects continues to contribute to improved clinical management of food allergies and to identify food safety thresholds that inform public health standards, regulations and food industry guidelines. The launch of the synergistic GET-FACTS: Genetics, Environment and Therapies: Food Allergy Clinical Tolerance Studies initiative earlier this year will assist CanFAST to transition from knowledge discovery to knowledge translation, and to catalyze the development of a national food allergy strategy to improve the lives of Canadians living with food allergies and anaphylaxis.

AllerGen's Legacy Projects are supported by ground-breaking work in the Gene-Environment Interactions, Biomarkers and Bioinformatics, and Patients, Policy and Public Health Enabling Platforms. In 2014, Dr. Michael Brauer, a Principal Investigator in the Gene-Environment Interactions platform, was recognized for his contributions toward improving the lives of Canadians suffering from asthma and allergies with two Asthma Society of Canada awards: the inaugural *Bastable-Potts Asthma Research Prize* and a *For Life and Breath Innovation Award*.

Over the past year, we have continued to welcome new investigators and mentors to the Network, and we have identified personalized health and bioinformatics/data integration as Network-wide initiatives that will provide a framework for future investment and application.

Our mandate to place the next generation of leaders in the field of asthma and allergy is being fulfilled as several more of our former trainees have "come of age" as new faculty members at Canadian universities. Since 2005, 47 AllerGen trainees have accepted academic appointments.

Our success is bolstered by the strength of our strategic, collaborative partnerships with other organizations both in Canada and abroad. This year, the Network secured its fifth international Memorandum of Understanding (MOU) through an agreement with The University of Queensland in Australia. AllerGen trainees have already benefitted by eagerly seizing upon new networking and research exchange opportunities with this world-class partner.

In November 2013, a much-needed asthma clinic opened in El Salvador's National Lung Hospital. The "Clínica del Asma: Dr. Dean Befus"—named after AllerGen Principal Investigator Dr. Dean Befus, who spearheaded the initiative to help establish the new facility—is already making a difference. Support from AllerGen, made possible by an NCE International Partnerships Initiative grant awarded in 2007, was essential in enabling Dr. Befus and his colleagues at the Alberta Asthma Centre to forge international partnerships and to secure an MOU with the country's Ministry of Health.

AllerGen has also taken a leadership role in advancing international efforts to tackle the rising burden of chronic, non-communicable diseases, which now pose a significant threat to global health. Network investigators Drs Jeff Brook, Anita Kozyrskyj and Tim Takaro presented at the 3rd Worldwide Universities Network (WUN) International Inflammation Network (In-FLAME) Annual Workshop in Cape Town, South Africa (March 30–31, 2014) to further our collective understanding of the early-life determinants of immune development and inflammation.

As we close the year, we extend our sincere congratulations and appreciation to the Board of Directors, the Research Management Committee and our many advisory committee members for their ongoing commitment and contributions to the Network.

In particular, we wish to thank Drs Richard Hegele, Bernard Prigent and Elinor Wilson, who completed terms on the Board of Directors, for their valuable contributions. We are delighted to welcome Dr. Mark Lundie and Dr. Harissios Vliagoftis as new members of the AllerGen Board of Directors.

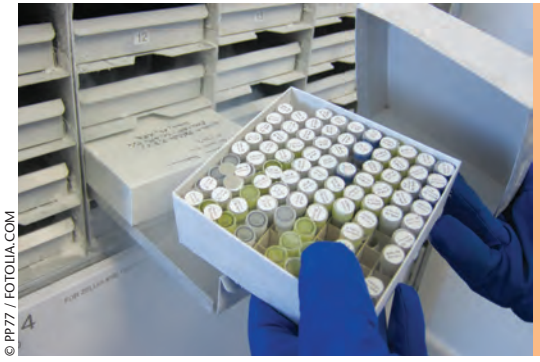
AllerGen's investigators, trainees, committee members, mentors, ASNPN executive members, national and global collaborators, stakeholder organizations and healthcare providers have been critical to the success of this Network. We thank them for their ongoing support and dedication to the goal of reducing the burden of allergic disease in Canada.

Dr. Howard Bergman, MD, FCFP, FRCP(C)
Chair,
AllerGen Board of Directors,
AllerGen NCE Inc.

Dr. Judah Denburg, MD, FRCP(C)
Scientific Director and CEO,
AllerGen NCE Inc.

What obligation do researchers have to return samples—and any unexpected findings from them—to patients and their families? Should patients have access to the results of experiments that use their specimens? Should patients give unlimited consent for the use of their samples?

2013-2014 Impacts



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As part of an AllerGen-supported project analyzing the legal and ethical dimensions of allergy and asthma research, Professor Caulfield is increasing our understanding of public attitudes towards biobanking and is contributing toward the development of ethical frameworks and policies to guide the practice.

Understanding public attitudes towards biobanking

The collection of biological samples for research use is called biobanking, and in 2009 *Time Magazine* flagged it as one of the top-ten ideas that is changing the world.

The practice began decades ago with small, university-based biobanks set up for specific research needs. Today, governments, research centres and other institutions manage their own biobank repositories, storing increasingly sophisticated specimens and information about the people who provided them. Several countries, Canada among them, have set up population-wide biobanks.

AllerGen investigator Timothy Caulfield, a University of Alberta law professor and Canada Research Chair in Health Law and Policy, is concerned with the complex ethical issues associated with biobanking. He is exploring such questions as: What obligation do researchers have to return samples—and any unexpected findings from them—to patients and their families? Should patients have access to the results of experiments that use their specimens? Should patients give unlimited consent for the use of their samples? What happens to the personal information that is shared?

"I consider biobanking one of the greatest challenges in research ethics, not just nationally but throughout the world," says Professor Caulfield.

As part of an AllerGen-supported project analyzing the legal and ethical dimensions of allergy and asthma research, Professor Caulfield is increasing our understanding of public attitudes towards biobanking and is contributing toward the development of ethical frameworks and policies to guide the practice.

In 2012, his research team polled over 1,200 Albertans, asking them about trust, consent, withdrawal of consent, access to data, and ownership of material. They also asked about a relatively new aspect of biobanking: commercialization.

The results revealed differing opinions on a number of issues. A slim majority of respondents (52%) are willing to provide "broad consent," meaning unconditional permission for researchers to repeatedly use their samples, while close to one in five (18%) would prefer to be consulted each time a sample is used. The remainder (30%) would like to have a say in *how* their samples are

used. Further, 44% of respondents felt specimens donated for research purposes belonged to the research institution, 26% thought specimens belonged to the individual donor, 23% thought the researcher retained ownership, and seven percent thought the research funder did.

On the topic of trust, however, most respondents agreed. "People have a lot of trust in university researchers, but their level of trust declines when industry is involved," says Professor Caulfield.

Professor Caulfield and his team also undertook a comprehensive analysis of the international literature on broad *versus* informed consent for biobanking. From an analysis of 593 articles, they learned that, like Canadians, people in other countries do not agree on questions of consent.

"It's not that we need public consensus to develop sound research policies," he says. We do, however, "need to understand how the public feels so we can prepare for future controversies."

Several academic papers have emerged from Professor Caulfield's work. Most recently, in March 2014, the *Journal of Law and the Biosciences* published "A review of the key issues associated with the commercialization of biobanks."

In another AllerGen-funded initiative, Professor Caulfield will investigate how the scientific community views these issues, especially the pressure to commercialize. With a handle on both the scientific and public views of biobanking, Professor Caulfield aims to contribute to the creation of ethical and enforceable biobanking guidelines and policies that will accelerate science, patient care and public health in Canada.

Helping asthma patients breathe easier in El Salvador

In November 2013, a much-needed asthma clinic opened in El Salvador—the smallest and most densely populated nation in Central America. The "Clínica del Asma: Dr. Dean Befus" is named after the AllerGen investigator who spearheaded the establishment of this new facility adjacent to the Dr. José Antonio Saldaña National Hospital in the country's capital, San Salvador.

Dr. Befus, a professor of pulmonary medicine at the University of Alberta and Director of the Alberta Asthma Centre (AAC), is well aware of the significant asthma problem in El Salvador. "It's a poor country by world health standards, and lung disease is especially prevalent there," says Dr. Befus. "Some of the major issues are burning wood and other biofuels for cooking, and smoke in the kitchen. When you add limited access to asthma medications, it's hardly surprising that so many of the country's inhabitants suffer from uncontrolled asthma."

Dr. Dean Befus signs a Memorandum of Understanding with El Salvador's Minister of Health, Dr. María Isabel Rodriguez.

In 2007, AllerGen received $828,000 from the Networks of Centres of Excellence (NCE) International Partnership Initiative (IPI) program to partner with international groups to reduce the global impact of allergies and other immune diseases. Dr. Befus's proposal to improve asthma care in El Salvador was one of five AllerGen projects to receive IPI funding.

A partnership with the International Union Against Tuberculosis and Lung Disease (the Union)—an aid organization known for bringing medications to low-income populations—was a

The clinic team tests its new lung function machine.

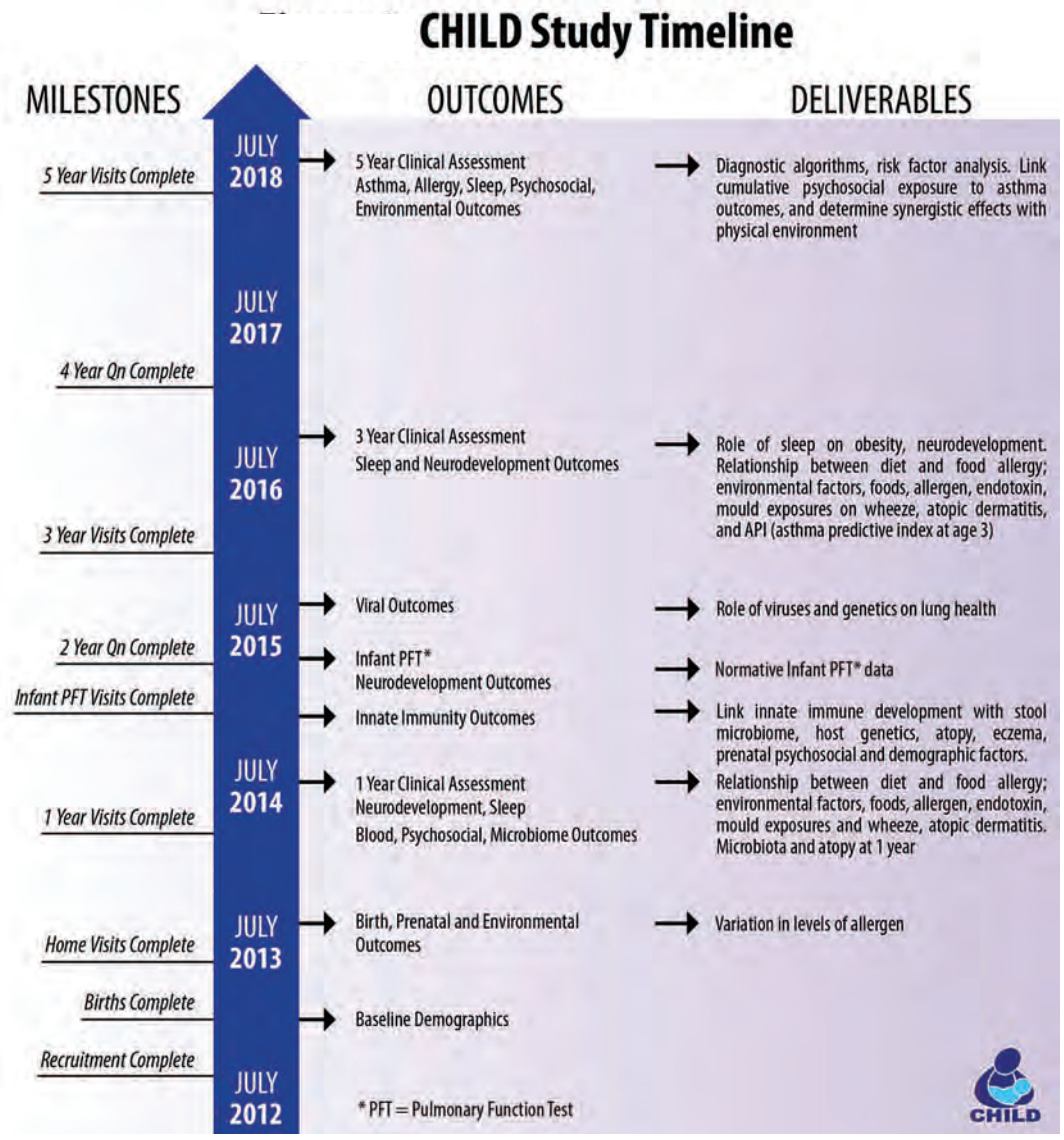
centrepiece of the program, and Dr. Befus and his AAC colleagues brokered a Memorandum of Understanding between the University of Alberta and the Salvadoran Ministry of Health.

In addition to facilitating access to low-cost asthma medications, Dr. Befus's team designed an educational program to help asthma patients properly use their medications and avoid behaviour that exacerbates the condition. A well-known Salvadoran artist created many of the illustrations used in the educational tools, enhancing their cultural relevance.

The AAC team also trained local health providers to diagnose and treat asthma in line with best international practices. A Salvadoran physician and nurse were invited to Canada for three months of intensive education in asthma diagnosis, drug therapies and patient management, including the use of asthma education programs.

Alberta Health Services donated refurbished equipment to the clinic, including a plethysmograph or "body box"—a sealed chamber the size of a small telephone booth to measure lung capacity—facilitating more accurate diagnoses of asthma and other lung diseases.

Although only 250 square feet in size, Dr. Befus believes that "the clinic's impact is big because of the expertise it houses." The project is also expanding beyond the clinic's walls, with Salvadoran health promoters sharing what they learn about asthma prevention and care with the wider community. "The plan is to disseminate this knowledge throughout society, from community hospitals to public health centres, schools and sports teams."



CHILD Study extends investigations into environmental impacts on asthma and allergy with $1 million CIHR grant

AllerGen's Canadian Healthy Infant Longitudinal Development (CHILD) Study has received a five-year operating grant, valued at over $1 million, from the Canadian Institutes of Health Research (CIHR) Institute of Circulatory and Respiratory Health. The CHILD Study application was ranked highest among 65 proposals reviewed by the Respiratory committee. The award will allow CHILD researchers to further explore how selected environmental factors to which children are exposed during pregnancy and in the first five years of life affect allergies and asthma in children with different genetic backgrounds, as reflected in their Genetic Risk Scores.

The CHILD Study has recruited over 3,600 pregnant mothers and is carefully assessing each child and its respective environment by collecting detailed housing, dietary and socioeconomic information, dust from homes, and biological samples such as breast milk, blood from parents and children, and children's urine, feces and nasal secretions.

This landmark birth cohort study has already amassed a wealth of data: as of March 31, 2014,

almost 13,000 biological samples had been released for analysis. By 2017, the project will have collected more than 500,000 questionnaire responses and over 600,000 biological samples that will be available to scientists for decades.

To date, 10 peer-reviewed papers directly related to the CHILD Study have been published and over 60 abstracts based on CHILD Study data have been presented at scientific meetings around the world. Five new papers have been submitted for publication and many more are in preparation.

Early findings have already received international attention. In a March 2013 article published by the *Canadian Medical Association Journal* (CMAJ), CHILD Study researchers reported that three- to four-month-old babies born by elective cesarean section had a relative lack of a type of gut bacteria found in babies delivered vaginally. The study also found that formula-fed babies had differences in their gut bacteria compared to those who were strictly or partially breastfed.

In follow-up studies, researchers found that babies born by elective cesarean section still had differences in their gut bacteria at one year of age compared to babies born vaginally, but the difference was reduced if they were breast fed. Another analysis of data from the one-year-olds suggested that partial and extended breastfeeding influences the gut microbiome to protect against early childhood overweight.

Now that the oldest children in the study are five years old and the youngest are approaching their second birthday, researchers are asking: "What happens next in terms of health and disease outcomes?"

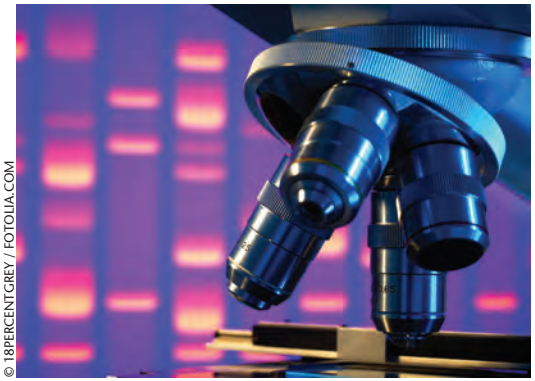
To tackle this question, CHILD Study researchers are using the data to examine many potential effects on health, including the impacts of: the infant microbiome, household phthalate exposure, maternal stress and anxiety, maternal and infant diet, living with pets, numbers of siblings, environmental exposures in and outside the home, and medication—especially antibiotic use—on the development of childhood allergies and asthma.

The results of these investigations may influence everything from building codes and household purchasing behaviours to decisions about childbirth and delivery, diet, breastfeeding, cleaning products used in homes, owning a family pet, and dealing with stress.

Throughout the year, our research teams have continued to identify opportunities to further integrate existing research projects and to refine legacy and sustainability strategies to ensure the Network's impact extends well beyond its final year of NCE funding in 2019.

AllerGen's Integrated Research Program

Helping Canadians address the challenges of living with asthma and allergic disease is at the core of AllerGen's integrated research program. Led by internationally recognized Canadian researchers with expertise across a wide range of disciplines, the Network's 47 active research projects and strategic initiatives employ multidisciplinary, cross-sectoral approaches to accelerate the development of new diagnostic tests, better medications, accessible patient education tools and effective public policies relevant to allergic disease.



Through strong partnerships, AllerGen leveraged its research investments to generate an additional $8.8 million in cash and in-kind support from partner and stakeholder organizations over the year—a leveraging ratio of 1:1.58.

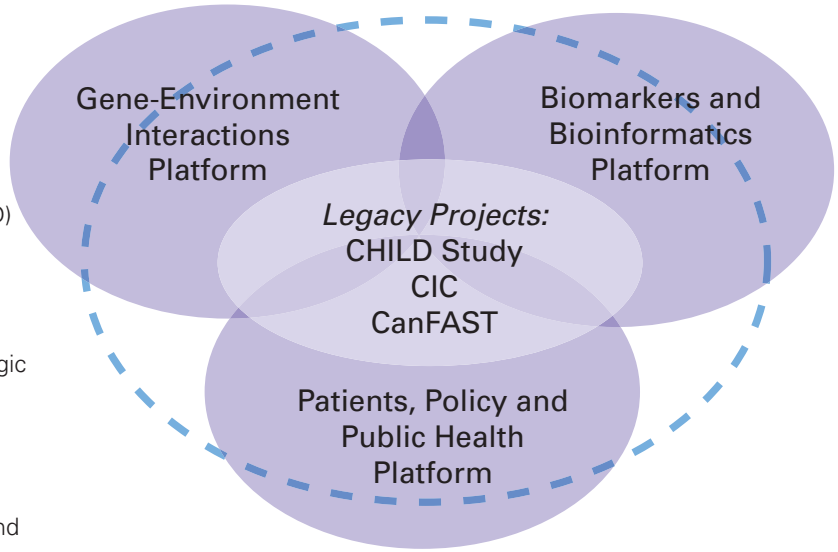
AllerGen's Integrated Research Strategy

Three Legacy Projects:

- The Canadian Healthy Infant Longitudinal Development (CHILD) Study;
- The Clinical Investigator Collaborative (CIC); and
- The Canadian Food Allergy Strategic Team (CanFAST).

Three Enabling Platforms:

- Gene-Environment Interactions;
- Biomarkers and Bioinformatics; and
- Patients, Policy and Public Health.



Malcolm Sears, MB

Paul O'Byrne, MD
Allergic Asthma CIC

Parameswaran Nair, MD, PhD
Severe Asthma CIC

Anne Ellis, MD, M.Sc.
Allergic Rhinitis CIC

Jean Marshall, PhD

Ann Clarke, MD, M.Sc.

The Canadian Healthy Infant Longitudinal Development (CHILD) Study

Research Leader:

Dr. Malcolm Sears, Professor,
Division of Respirology,
Department of Medicine,
McMaster University

Strategic Focus:

- a national birth cohort study following over 3,300 Canadian children from pre-birth to age five
- collects immunological, physiological and genetic data; dietary, housing and socio-economic information
- studies the impacts of genetics and the early-childhood environment on the development of asthma and allergies
- provides a platform to study the root causes of other chronic, non-communicable inflammatory diseases, including obesity, diabetes and cardiovascular disease
- involves over 40 investigators from 30 disciplines

The Clinical Investigator Collaborative (CIC)

Research Leaders:

Dr. Paul O'Byrne, Professor and Chair,
Department of Medicine,
McMaster University

Dr. Parameswaran Nair, Associate Professor,
Division of Respirology,
Department of Medicine,
McMaster University

Dr. Anne Ellis, Associate Professor,
Department of Biomedical and Molecular Sciences, Queen's University

Strategic Focus:

- a multicentre, Canadian-based Phase II clinical trials group
- evaluates promising new treatments for the treatment of allergic diseases in the upper and lower airways
- fast-tracks early-stage potential drug candidates for allergic asthma, severe asthma and allergic rhinitis

The Canadian Food Allergy Strategic Team (CanFAST)

Research Leaders:

Jean Marshall, Professor and
Head of Microbiology and Immunology,
Dalhousie University

Ann Clarke, Professor,
Division of Rheumatology,
Department of Medicine,
University of Calgary

Strategic Focus:

- a highly innovative, nationally networked research team studying food allergy and anaphylaxis
- contributes to our understanding of the origins, causes, prevalence and treatment of food allergy
- informs the development of improved diagnostic and treatment strategies, education programs, public health measures and public policy for the management of food allergy and anaphylaxis

Andrew Sandford, PhD

Jeffrey Brook, PhD

Kelly McNagny, PhD

Dean Befus, PhD

John Gordon, PhD

Allan Becker, MD, PhD

Gene-Environment Interactions

Research Leaders:

Dr. Andrew Sandford,
Associate Professor,
Department of Medicine,
The University of British Columbia

Dr. Jeffrey Brook,
Senior Scientist,
Air Quality Research Branch,
Environment Canada; Assistant Professor,
Division of Occupational & Environmental Health, Dalla Lana School of Public Health,
University of Toronto

Strategic Focus:

- a collection of national and international teams working to apply genetic and environmental research innovation and new knowledge on "nature and nurture"
- focuses on genetic, environmental and epigenetic research
- aims to discover novel therapies and diagnostics, and facilitate the development of public health interventions and policies in the areas of asthma and allergies

Biomarkers and Bioinformatics

Research Leaders:

Dr. Kelly McNagny, Professor,
Department of Medical Genetics,
The University of British Columbia

Dr. Dean Befus, Professor,
Division of Pulmonary Medicine,
Department of Medicine,
University of Alberta

Dr. John Gordon, Professor,
Division of Respirology,
Department of Medicine,
University of Saskatchewan

Strategic Focus:

- an integrated, world-leading systems-biology approach to the discovery, development and commercialization of diagnostic tests and treatments for asthma and allergies
- focuses on predicting disease susceptibility, enabling early diagnosis, discriminating disease subtypes, monitoring disease prevention and drug response, and identifying novel therapeutic targets
- facilitates biomarker identification and analyses

Patients, Policy and Public Health

Research Leader:

Dr. Allan Becker, Professor and Head,
Section of Allergy & Clinical Immunology,
Department of Pediatrics and Child Health,
University of Manitoba

Strategic Focus:

- a platform integrating interdisciplinary expertise to focus on the translation of AllerGen research that has policy, ethical, legal and/or social implications
- focuses on knowledge translation and knowledge mobilization to leverage the Network's research expertise to generate new knowledge, products and services
- aims to inform public policy, public health practices, patient and health professional outreach, and educational disease management tools

REEGLE uses biological samples from AllerGen's CHILD Study, the environmental exposure laboratories at UBC and the University of Toronto, and data from the Allergic Rhinitis Clinical Investigator Collaborative (AR-CIC). Samples from 145 babies participating in the CHILD Study and 120 tissue samples from subjects studied at Dr. Carlsten's Air Pollution Exposure Laboratory at UBC are currently being analyzed.

Research Highlights

Pan-Canadian team explores the epigenetics of allergic disease

AllerGen's new epigenetics study is taking a closer look at how environmental exposures in early life can regulate the activity of genes relevant to the development of allergic diseases and asthma.

The project, called Rapid Environmental Effects on Genes: the Lens of Epigenetics (REEGLE), aims to determine if exposure to common allergens such as diesel exhaust, particulate matter and pollen affects DNA methylation patterns, and to test for an association between such exposures and risk of allergic disease.

The project is led by Dr. Michael Kobor, an associate professor in the Department of Medical Genetics at The University of British Columbia (UBC), with support from co-Principal Investigator and respiratory disease expert Dr. Chris Carlsten (UBC), and Drs Stuart Turvey (UBC), Anne Ellis (Queen's University) and Frances Silverman (University of Toronto).

In DNA methylation, a specific chemical modification called a methyl group is added to the DNA backbone. If methylation occurs in a particular region of a gene, the gene function may be altered without affecting the underlying DNA.

"Any gene can have its activity regulated, in part by DNA methylation," says Dr. Kobor. "DNA methylation acts like a dimmer control on a light switch that allows the light to be turned on and off, or dialled up and down. Once methylation has occurred, its impact can persist for a very long time."

REEGLE uses biological samples from AllerGen's CHILD Study, the environmental exposure laboratories at UBC and the University of Toronto, and data from the Allergic Rhinitis Clinical Investigator Collaborative (AR-CIC). Samples from 145 babies participating in the CHILD Study and 120 tissue samples from subjects studied at Dr. Carlsten's Air Pollution Exposure Laboratory at UBC are currently being analyzed.

"REEGLE is a great example of how interdisciplinary research can really make a difference. The project is catalyzing the development of a pan-Canadian network of clinicians and scientists focused on the environmental regulation of allergic disease in children," says Dr. Kobor. "Eventually, this team hopes to integrate sociological data—information about maternal socioeconomic status, mental health, and reported stress—collected as part of the CHILD Study, into this project."

Improving asthma outcomes with air pollution research

An estimated 21,000 Canadians die each year due to air pollution—nearly nine times more than are killed in car accidents, according to an October 2013 *Canadian Medical Association Journal* (CMAJ) commentary by AllerGen investigator Dr. Michael Brauer and co-authors Dr. Conor Reynolds and Dr. Perry Hystad.

Their commentary links traffic-related air pollution to negative effects on health, and estimates that about 10 million Canadians, or one-third of the population, live close enough to highways or major urban roads to be at risk for pollution-related health problems, including asthma.

Dr. Brauer, a professor in the School of Population and Public Health at The University of British Columbia (UBC), and other AllerGen researchers at UBC, the University of Alberta and the University of Manitoba, have contributed to a body of groundbreaking research into traffic-related air pollution and its relationship to asthma in adults and children.

In February 2013, investigators involved with

the AllerGen-supported Traffic pollution, Asthma, Genetics (TAG) Study—in partnership with international collaborators in Sweden, Germany, and the Netherlands—discovered that children with a specific genetic profile may be at increased risk of developing asthma when exposed to traffic-related air pollution. The research combined data from over 15,000 children enrolled in six birth cohorts (two Canadian and four European) and represents the largest study of its kind.

Published in *Environmental Health Perspectives* in early 2014, the study's findings suggest that children with one variant of the gluathione S-transferase P1 (GSTP1) gene have double the expected risk of developing asthma associated with traffic-related air pollution. "This supports the plausibility of a causal relationship and brings us closer to understanding the mechanism of action of traffic pollution in vulnerable people," says Dr. Brauer.

Dr. Brauer's research and public policy advocacy continue to focus on the relationships between allergies, asthma and the environment, and to promote changes needed to reduce population exposure to traffic-related air pollution. In 2014, he was recognized for his contributions toward improving the lives of Canadians suffering from asthma and allergies with two Asthma Society of Canada awards: the inaugural *Bastable-Potts Asthma Research Prize* and a *For Life and Breath Innovation Award.*

Oral immunotherapy holds promise for milk allergic children

AllerGen researchers from five Canadian hospitals are working together to develop an effective and safe protocol for the treatment of cow's milk allergy with oral immunotherapy (OIT).

Cow's milk allergy—the most common food-related allergy in children—is frequently associated with severe allergic reactions and anaphylaxis. Treatment is based on strict avoidance, which may lead to nutritional deficiencies in growing children and is difficult to adhere to due to the widespread use of dairy products in Canadian foods.

OIT is a method of desensitizing the immune system by gradually exposing patients to incremental doses of a food allergen over time until tolerance is achieved. Led by Dr. Bruce Mazer and Dr. Moshe Ben-Shoshan at McGill University, the cow's milk OIT project involves immunologists, clinicians, dietitians, biostatisticians and epidemiologists from the McGill University Health Centre, McMaster Health Sciences Center, the University of Alberta Health Sciences Centre, Dalhousie University, the IWK Health Centre—and soon, The University of British Columbia.

In the study, 34 children with milk allergy are being treated with incremental doses of milk until a predefined dose (200 mL), or the maximum dose a patient can tolerate without experiencing symptoms, is reached.

The research aims to develop an effective OIT protocol for milk allergy, determine the time following completion of therapy that subjects remain desensitized, and improve our understanding of the immunological changes that accompany successful OIT.

The outcomes—a refined methodology for administering milk OIT and a better understanding of which patients it will work for—will have a profound effect on the quality of life of allergic children and their caregivers, including parents, schools and childcare institutions.

This AllerGen study has contributed to the creation of GET-FACTS: Genetics, Environment and Therapies: Food Allergy Clinical Tolerance Studies—a project that combines components of population genetics, immunology, clinical medicine and sociocultural analyses to study the nature of food allergies.

In June 2013, GET-FACTS was awarded a five-year operating grant from the CIHR Institute of Nutrition, Metabolism and Diabetes. The award, valued at almost $2 million, will allow AllerGen investigators and collaborators to study the genetic and environmental factors influencing allergy and tolerance, investigate the role of microbial contamination in immunological tolerance and sensitivity to foods, and search for novel biomarkers of clinical allergy and tolerance in existing Canadian therapeutic trials.

First prospective anaphylaxis study recruits 1,000 participants

AllerGen's Cross-Canada Anaphylaxis REgistry (C-CARE)—the first-ever prospective study on anaphylaxis—has recruited over 1,000 participants and is set to expand across the country.

C-CARE identifies cases of anaphylaxis through reports from "first responders," including ambulance paramedics, emergency department staff and allergists. If a patient is willing to be included in the study, information about the episode, including symptoms, possible triggers for the reaction and how the anaphylaxis was managed, is entered into the registry's database.

Now in its fourth year, C-CARE is led by AllerGen investigator Dr. Moshe Ben-Shoshan, a pediatric

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allergist and immunologist at the Montreal Children's Hospital. Dr. Ben-Shoshan says C-CARE will help researchers to assess the rate, triggers and management of anaphylaxis across the country. "As more results become available, physicians across the globe will be able to see that the registry provides important data," he says. "Likely, they will want to examine what is happening in their own centres and compare their results to Canada."

C-CARE currently recruits participants from centres in Quebec and British Columbia, and is set to expand into Ontario, Manitoba, Alberta and Newfoundland by 2015.

Health Canada has donated $50,000 to support the expanded registry and will use C-CARE results to evaluate the role of health policies, particularly those related to food labelling, in the prevention of anaphylaxis.

In September 2013, findings from the study's first year were published in the *Journal of Allergy and Clinical Immunology*. The study revealed that among 168 children with anaphylaxis admitted to the Montreal Children's Hospital, food triggered 84.5% of their reactions; 50% of milk- and peanut-induced reactions were attributable to inadvertent exposure to a known allergen; and epinephrine was under-used in treatment.

An article about the first C-CARE findings in adults has recently been accepted for publication. By comparing pediatric and adult populations and by following participants over the long term, Dr. Ben-Shoshan believes that C-CARE will provide the first reliable estimate of anaphylaxis rates in Canada and open the door to new ways of preventing and treating the condition.

Expanded Clinical Investigator Collaborative tests new drugs for asthma and allergies

Since 2005, AllerGen's Clinical Investigator Collaborative (CIC)—a multicentre, Phase II clinical trials consortium—has created 40 jobs in the healthcare and private sectors, conducted more than 20 clinical trials and attracted over $23 million in partner funding, representing an AllerGen-to-industry investment ratio of one-to-seven.

With the addition of severe asthma (SA) and allergic rhinitis (AR) to its existing expertise in allergic asthma (AA), the CIC offers biotechnology and pharmaceutical companies an opportunity to evaluate promising new drug molecules for the potential treatment of allergic diseases in both the upper and lower airways.

AA-CIC:
Led by AllerGen investigator Dr. Paul O'Byrne (McMaster University), the AA-CIC integrates six research sites in Canada and one site in Sweden.

In 2013-2014, the AA-CIC provided "proof-of-concept" for an effective antibody treatment for asthma and published breakthrough research findings in the *Journal of Allergy and Clinical Immunology* (JACI), the *New England Journal of Medicine* (NEJM) and *Science Translational Medicine*.

AA-CIC researchers have published 10 peer-reviewed manuscripts and 15 abstracts, and collaborated on numerous joint publications.

SA-CIC:
Led by AllerGen investigator Dr. Parameswaran Nair (McMaster University), the SA-CIC integrates six research sites across Canada.

Although only 5-10% of asthmatics suffer from severe asthma, the condition accounts for over 50% of the costs related to asthma care.

The SA-CIC has undertaken clinical trials with pharmaceutical partners (Novartis and Astra-Zeneca) to study the prednisone-sparing effects of biologic molecules in patients with severe atopic eosinophilic asthma. These collaborations have produced four manuscripts: two published and two in preparation. Further, three new industry partnerships are in development. Funding from CIHR, NSERC and the Grand Challenges Canada-Stars in Global Health program is allowing these researchers to develop and validate point-of-care biomarker tests with commercial potential.

AR-CIC:
Led by AllerGen investigator Dr. Anne Ellis (Queen's University), with co-PI Dr. Helen Neighbour (McMaster University), the AR-CIC consists of five participating research sites across Canada.

The incidence of allergic rhinitis, or hay fever, is even higher than asthma, with a lifetime prevalence between 30-50% among Canadians.

The AR-CIC has secured a partnership with Adiga Life Sciences Inc., a Canadian biotechnology subsidiary of UK-based Circassia Ltd. The partnership will utilize the AR-CIC's standardized operating protocols for nasal allergen challenge to measure biomarkers for a novel peptide-based immunotherapy treatment for cat and ragweed allergies, developed by AllerGen investigator Dr. Mark Larché at McMaster University.

This year, the Network secured its fifth international Memorandum of Understanding through an agreement with The University of Queensland. AllerGen trainees have already benefitted by eagerly seizing upon new networking and research exchange opportunities with this world-class partner.

Network Partners, Collaborators and Knowledge Users

AllerGen magnifies the impact of its research by leveraging resources and expertise with partners in the private, public and non-profit sectors. AllerGen's partners play an integral role in shaping and enhancing research outcomes, and in facilitating the commercialization of Network technologies, products and services.

In 2013-2014, AllerGen worked with 136 partners, collaborators and knowledge users, engaging an average of 4.75 collaborators per research project.

Partners, Collaborators and Knowledge Users (n=136)

Universities (n=44)
(25 Canadian, 19 International)

Acadia University
American University
Brock University
Charité - Universitätsmedizin Berlin
Dalhousie University
Harvard University
Indiana University
Karolinska Institute
Lakehead University
McGill University
McMaster University
Northwestern University
Queen's University
Simon Fraser University
Southern Methodist University
Stanford University
The University of British Columbia
The University of Newcastle
The University of Queensland
The University of Western Australia
The University of Winnipeg
Université de Montréal
Université du Québec à Chicoutimi
Université Laval
University College Cork
University of Alberta
University of Calgary
University of Copenhagen
University of Groningen
University of Guelph
University of Manitoba
University of Nebraska
University of New Brunswick
University of Ottawa
University of Oxford
University of Saskatchewan
University of Sherbrooke
University of Toronto
University of Victoria
University of Waterloo
University of Wisconsin
Utrecht University
Western University
Yeshiva University

Hospitals and Health Centres (n=11)

Centre hospitalier universitaire (CHU) Saint-Justine, Montréal
Hôpital du Sacré-Cœur de Montréal, Montréal
Hospital Nacional General de Neumologia y Medicina Familiar "Dr. Antonio Saldaña," San Salvador, El Salvador
Institut universitaire de cardiologie et de pneumologie de Québec (IUCPQ), Québec City
Kingston General Hospital, Kingston
Montreal General Hospital, Montreal
St. Joseph's Healthcare, Hamilton
St. Joseph's Hospital, Toronto
St. Michael's Hospital, Toronto
The Hospital for Sick Children, Toronto
The McGill University Health Centre, Montreal

Industry (n=34)
(29 Canadian, 5 International)

Adiga Life Sciences Inc.
AIM Therapeutics Inc.
AstraZeneca Canada Inc.
Axikin Pharmaceuticals Inc., USA

Boehringer Ingelheim (Canada) Ltd./Ltée
Carr-Gordon Limited
Charles Frankish Consulting
CHENOMX Inc.
CTI Life Sciences Fund
David Brener & Associates
Deborah Danoff Consulting
Elinor Wilson Consulting
GlaxoSmithKline Inc.
Kincora Innovation
Leap Learning Technologies Inc.
Lincoln Diagnostics Inc./ALK, USA
Lumira Capital
Maple Leaf Foods
Mark Bisby Consulting
Merck Canada Inc.
Neo Stem Inc., USA
Norlien Foundation
Northtaste Flavourings Ltd.
Novartis Pharma Canada Inc.
Ono Pharmaceuticals Co. Ltd., Japan
Oxford University Press
Pfizer Canada Inc.
Pro-Bio Associates
Roche Canada
Sanofi Pasteur Ltd.
Shoppers Drug Mart Corporation
Suzanne Tough Consulting
TEC Edmonton
TVM Capital

Federal Agencies (n=8)
Canadian Institutes of Health Research
Cancer Stem Cell Consortium
Compute Canada
Environment Canada
Health Canada
Natural Science and Engineering Research Council
Office of the Privacy Commissioner of Canada
Public Health Agency of Canada

Provincial Agencies (n=7)
Alberta Health Services
Alberta Innovates
Fonds de recherche du Québec
Healthy Child Manitoba
Michael Smith Foundation for Health Research
Ontario Ministry of Health and Long-Term Care
Province of Nova Scotia

Non-Profit, Networks and Professional Associations (n=26)
Agriculture and Food Development Authority, Ireland
Alberta Asthma Centre
Allergy/Asthma Information Association (AAIA)
Anaphylaxis Canada
Association Québécoise des Allergies Alimentaires (AQAA)
Asthma Society of Canada
Canadian Lung Association/Canadian Thoracic Society
Canadian Network for Respiratory Care
Canadian Society of Allergy and Clinical Immunology
Centre for Drug Research and Development (CDRD)
Centre of Excellence for Prevention of Organ Failure (PROOF Centre)
Childhood Asthma Foundation
Children's Hospital Foundation of Manitoba
Dairy Farmers of Canada
EMBO, Germany
European Respiratory Society, Switzerland
Family Physician Airways Group of Canada
Grand Challenges Canada
Immune Tolerance Network, USA
Montreal Children's Hospital Foundation
National Institutes of Health, USA
Ontario Lung Association
Parker B. Francis Research Fellowship Program, USA
Stem Cell Network
The Hospital for Sick Children Foundation
The Sandbox Project

Research Institutes (n=6)
Alberta Centre for Child, Family and Community Research
Centre de recherche du Centre hospitalier de l'Université de Montréal (CHUM)
James Hogg Research Centre
Helmholtz Zentrum München, Germany
Munich Allergy Research Center (MARC), Germany
St. John's Research Institute, India

International Partnerships

AllerGen continues to cultivate national and international partnerships that enrich training and skill acquisition opportunities for AllerGen students, new professionals and Network researchers. In January 2014, AllerGen signed a Memorandum of Understanding (MOU) with The University of Queensland's Faculty of Medicine and Biomedical Sciences in Queensland, Australia. Collaborating centres at that university include the Lung & Allergy Research Centre (LARC), led by Professor John Upham, and the Queensland Children's Medical Research Institute (QCMRI), headed by Professor Peter Sly.

The LARC pursues scientific research to understand the pathogenesis of asthma and other chronic pulmonary diseases, with particular interest in allergic inflammation and host defence against respiratory viral infections. The QCMRI is a child and adolescent health-focused research institute developed jointly by Children's Health Services (Queensland Health), the Children's Health Foundation (Queensland) and The University of Queensland.

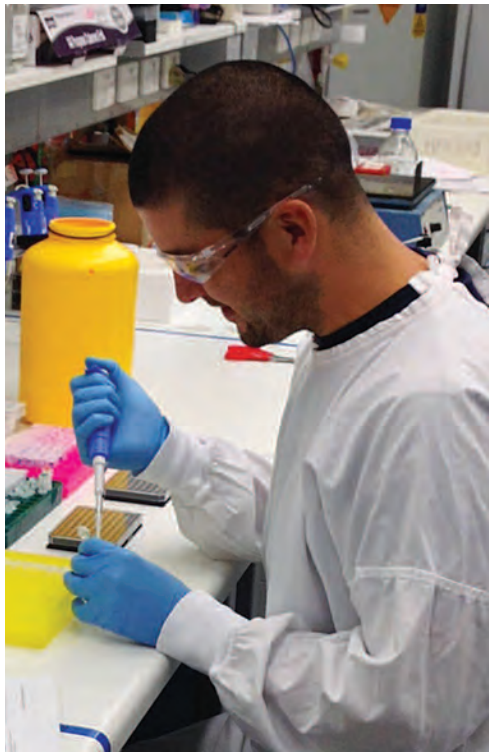
This agreement represents AllerGen's fifth international MOU based on a shared interest in promoting allergy, asthma and immune disease health research and related capacity building.

AllerGen also has long-standing agreements with the Centre for Allergy Research (CfA) at the Karolinska Institute in Sweden, The University of Newcastle in Australia, and three centres in Germany: the Allergie-Centrum-Charité at Charité-Universitätsmedizin Berlin; the Munich Allergy Research Center (MARC)-Technische Universität München (TUM); and Helmholtz Zentrum München-German Research Centre for Environmental Health.

In 2013-2014, several Network trainees undertook research visits to international partners. These experiences provided unique opportunities for research collaboration, knowledge exchange, networking and new skill development.

AllerGen-Australia exchanges pave the way for future collaboration

Dr. Jeremy Hirota, a Banting Postdoctoral Fellow, spent eight weeks working with Professor Philip Hansbro at The University of Newcastle's Priority Research Centre for Asthma and Respiratory Diseases in New South Wales, Australia. During his stay, Dr. Hirota performed *in vitro* and *in vivo* experiments to study how uric acid—an antioxidant naturally produced by the body—may contribute to airway health and disease. He



"Ongoing collaborations with Professor Hansbro will allow for more impactful translational research studies that may improve the lives of Canadians, Australians, and indeed the general population throughout the world."

Jeremy Hirota, PhD
The University of British Columbia

"Since returning from Queensland, I have applied new statistical methods to AllerGen datasets. I have demonstrated that by leveraging information across different layers of a biological system, we can improve the identification of different asthma phenotypes."

Amrit Singh, PhD (c)
The University of British Columbia

hopes to determine how the lung copes with environmental insults with the goal of informing public policy to improve air quality for Canadians.

Dr. Hirota is supervised by AllerGen investigator Dr. Chris Carlsten at The University of British Columbia (UBC). Dr. Carlsten, Professor Hansbro and he plan to seek collaborative grants to further their work on respiratory health.

Amrit Singh, a PhD candidate supervised by AllerGen investigator Dr. Scott Tebbutt at UBC's James Hogg Research Centre, spent three months working at The University of Queensland's Facility for Advanced Bioinformatics.

Mr. Singh worked with statistician Dr. Kim-Anh Le Cao to learn cutting-edge statistical methods addressing a range of study questions in high-dimensional biology, and to implement these methods using the statistical computing program "R." Mr. Singh continues to collaborate regularly with Dr. Le Cao as this research progresses towards publication.

Food allergy research enhances understanding of parental decisions

Lianne Soller, a McGill University PhD candidate, spent six months working with Drs Audrey Dunn Galvin and Jonathan Hourihane and their teams in the School of Applied Psychology at University College Cork in Cork, Ireland.

Using the Food Allergy Quality of Life Questionnaire-Parent Form (FAQLQ-PF), Ms. Soller investigated the role of information in parental decision-making when considering whether or not their child should undergo a food allergy challenge. Working with Dr. Dunn Galvin, a psychologist and expert in qualitative research, Ms. Soller enhanced her understanding of the psychology behind parental behaviours and decisions affecting food-allergic children.

Ms. Soller is supervised by AllerGen investigator Dr. Ann Clarke, University of Calgary. While in Cork, Ms. Soller collaborated with research teams at McGill University and the University of Calgary to develop a protocol to use the FAQLQ-PF with children participating in Canadian food allergy registries. Using this protocol, the questionnaire was distributed to 1,445 patients involved in McGill University's peanut, sesame, and seafood allergy registries. Research collaborators Drs Edmond

"Replicating this study in Canada will allow an improved understanding of how Canadian parents make treatment decisions for their food-allergic children. This knowledge could lead to changes in healthcare policies related to food allergy."

Lianne Soller, PhD (c)
McGill University

Chan and Alex Lyttle at The University of British Columbia will analyze the data in 2015 to measure quality-of-life indicators among children with food allergies.

Laboratory internship fuels research interest

Laura Zuccaro completed a two-month research internship at the Karolinska Institute (KI) in Stockholm, Sweden. Ms. Zuccaro worked under the supervision of AllerGen collaborator Professor Sven-Erik Dahlén, and Anna James and Mikael Adner, members of his research group, to examine the expression of bitter taste (TAS2R) receptors on human bronchial smooth muscle (hBSM) after stimulation with different cytokines and drugs.

Ms. Zuccaro holds a B.HSc. from McMaster University where she worked with AllerGen investigator Dr. Parameswaran Nair. Currently, she attends medical school at the University of Ottawa.

"Our research was presented at the 2014 American Thoracic Society conference and will generate future publications. My experience at the Karolinska Institute fuelled my desire to solve research problems for my future patients. I look forward to my medical training with this goal in mind."

Laura Zuccaro, medical student
University of Ottawa

Former ASNPN President chosen for international anaphylaxis research

Dr. Jennifer Protudjer, an ASNPN past-President, received a postdoctoral fellowship to investigate anaphylaxis and the risk factors associated with severe allergic reactions from the Karolinska Institute's Centre for Allergy Research (CfA). This new research initiative—funded through a donation from Karin and Sten Mörtstedt CBD Solutions AB—will study factors that precipitate anaphylactic reactions with the goal of improving diagnosis and developing new treatments. Dr. Protudjer's research will examine the prognosis of food allergy from childhood through to adolescence.

The Karolinska Institute is a longstanding AllerGen partner and one of the world's leading medical universities. Dr. Protudjer originally developed her relationships at the Institute during a six-week trainee exchange facilitated by AllerGen's International Partnership Initiative, which aims to produce globally-engaged scientists in the fields of allergy and asthma.

In March 2014, AllerGen facilitated the development of a non-exclusive, non-revenue generating license agreement between the University of Alberta and Anaphylaxis Canada. AllerGen's commercialization program, which helps Network researchers secure knowledge mobilization and commercialization opportunities for their research outcomes, facilitated the process.

Knowledge and Technology Exchange and Exploitation (KTEE)

AllerGen's KTEE activities continue to advance the Network's goal to bridge the gap between the research lab and "real life" for Canadian families, educators, healthcare providers and policymakers dealing with asthma and allergies. AllerGen invests in targeted, strategic knowledge mobilization and commercialization initiatives to improve the relevance, uptake and application of its research results by partner organizations, stakeholders and receptor communities across the country.

Knowledge Mobilization

AllerGen *Success Stories*

AllerGen has published and distributed seven issues of *Success Stories* to over 1,200 Network participants, partners and knowledge users. Written for Canadian families and healthcare providers, *Success Stories* offers those living and dealing with allergic conditions and related immune diseases practical information about the Network's latest research results.

In addition to diverse topics in the areas of asthma and allergies, *Success Stories*, available in English and French, features the accomplishments of the Network's Highly Qualified Personnel.

AllerGen and AQAA team up against food allergies

Food allergy and anaphylaxis are growing concerns for Canadians. In 2010, a nationwide AllerGen-supported study revealed that approximately 2.6 million Canadians, or 7.5% of the population, self-report suffering from at least one food allergy.

On November 9, 2013, AllerGen promoted awareness of food allergies and anaphylaxis, and shared highlights from the Network's CanFAST research projects, at a food allergy fair hosted by the Quebec Food Allergy Association (AQAA).

The free, all-day event attracted over 2,000 participants and featured expert speakers, one-on-one

Left to right: Diana Royce (Managing Director and COO, AllerGen), Dominique Seigneur (Director of Communications and Finance, AQAA) and Kim Wright (Manager of Communications and Knowledge Mobilization, AllerGen).

consultations with allergists, interactive workshops, cooking demonstrations and sponsor displays at the Complexe Desjardins shopping mall in downtown Montreal.

AllerGen investigators Drs Moshe Ben-Shoshan and Yuka Asai from McGill University presented research on filaggrin gene mutation associations with peanut allergy and AllerGen's C-CARE registry for tracking cases of anaphylaxis.

2013 Cafés Scientifiques mark World Immunology Day

AllerGen's Café Scientifique series travelled to Vancouver and Montreal on April 29, 2013, to mark World Immunology Day. The Cafés brought outstanding panels of Canadian clinicians and researchers into these communities to discuss advances in the fields of immunology and allergy. Both events featured expert presentations followed by interactive discussions, and displays of sponsor information and resource materials.

Allergies—what can be done? was held in Vancouver, BC, hosted by the Child & Family Research Institute and the CIHR Human Immunology Network, and co-sponsored by AllerGen NCE.

Allergies—what are they all about? was held in Montreal, QC, and co-sponsored by the McGill University Health Centre, Centre hospitalier de l'université de Montréal, the CIHR Human Immunology Network and AllerGen NCE.

The audience learns more about the management of allergies (Montreal, QC).

Dr. Stuart Turvey explains how asthma develops (Vancouver, BC).

The economics of asthma

Asthma and allergies have a profound impact on both individual and economic health: these illnesses cost the Canadian economy over $15 billion per year and are a leading cause of workplace absenteeism, diminished on-the-job productivity, hospital admissions and emergency department visits.

Is there any indication that improved asthma and allergy policy can enhance an individual's quality of life and improve the health of nations?

In July 2013, AllerGen hosted an international group of academics, policymakers and health advocates for the *2nd International Symposium on the Economics of Asthma and Asthma Care* in Sydney, Australia, to debate this question.

The Symposium was a pre-conference event affiliated with the *International Health Economics Association (iHEA) 9th World Congress on Health Economics.*

Keynote speakers at the AllerGen symposium included:

- **Larry Lynd, PhD,** AllerGen investigator; Associate Director, Collaboration of Outcomes Research and Evaluation (CORE), Faculty of Pharmaceutical Sciences, The University of British Columbia
- **Richard Loh, MD,** President, Australasian Society of Clinical Immunology and Allergy (ASCIA), Subiaco, Western Australia
- **Wendy Ungar, PhD,** AllerGen investigator; Senior Scientist, Child Health Evaluative Sciences, The Hospital for Sick Children

Symposium participants discussed important lessons learned from the Western Australian anaphylaxis strategy; identified strategies, tactics and stakeholder groups essential for the development and implementation of a national asthma strategy; and discussed country- and culture-specific barriers facing coordinated asthma care and ways to overcome them.

The 12th Annual Re$earch Money Conference, *Checking the Pulse of Canada's Innovation Policies,* took place in Ottawa, ON, in April 2013.

AllerGen's Managing Director and COO, Dr. Diana Royce, chaired a session called "Priorities for Action" featuring innovators from Aonix Advanced Materials Corporation and Innoventures Canada.

CHILD Study in the Media 2013-2014

Commercialization

Online support a lifeline for kids with food allergies

For children and teens with severe food allergies, dealing with discrimination, missing out on activities with their peers, and finding support when they feel isolated and lonely can be everyday challenges.

A multi-site, multipartner project supported by AllerGen has led to the launch of Allergy Pals, an online mentorship program designed to provide peer support to children affected by food allergies.

Program materials were designed by an interdisciplinary project team led by Dr. Miriam Stewart, a professor of nursing at the University of Alberta, with research funding provided by AllerGen and Alberta Innovates-Health Solutions.

The team piloted the program among children (ages 7-11) and teens (ages 12-15) recruited from across the country. The sessions included interactive discussions, games and activities designed to promote communication, problem-solving, and support-seeking skills. Each group was led by a peer mentor (ages 13-25)—someone who knows what it's like to live with severe allergies—and supported by a Health Support and Education Specialist.

Anaphylaxis Canada, one of the project's collaborators, expressed interest in licensing the program to provide ongoing support to children and youth with food allergies.

In March 2014, AllerGen facilitated the development of a non-exclusive, non-revenue generating license agreement between the University of Alberta and Anaphylaxis Canada. AllerGen's commercialization program, which helps Network researchers secure knowledge mobilization and commercialization opportunities for their research outcomes, facilitated the process.

"I was able to pursue intellectual property protection for this project with support and expertise provided by AllerGen and TEC Edmonton, which have been invaluable in finalizing this agreement with Anaphylaxis Canada," says Dr. Stewart.

Kyle Dine, Anaphylaxis Canada's youth project coordinator, believes the launch of Allergy Pals illustrates how academic research can be mobilized from the university setting to community organizations to Canadian households. "Allergy Pals is important to our communities as it empowers children to tell their own stories, share experiences and learn from each other while they make new friends," says Dine.

AllerGen and Health Canada target phthalate exposure in Canadian children

In March 2014, AllerGen concluded its third research project in partnership with Health Canada to determine whether exposures to phthalate plasticizers during fetal development and infancy contribute to the burden of asthma in Canada.

Canadian children are continuously exposed to phthalates—chemicals used in the manufacture of an array of everyday household products, such as vinyl flooring, fragrances, plastic bottles and utensils, and personal care products such as shampoo. Phthalates can be absorbed orally or through the respiratory tract or skin, and may contribute to the development of health problems, including asthma and reproductive effects.

As part of the federal government's Chemicals Management Plan (CMP)—co-managed by Environment Canada and Health Canada—Dr. Tim Takaro, a professor of Health Sciences at Simon Fraser University, led a trilogy of AllerGen studies over a five-year period.

The most recent study, "Phthalate Exposures in Canadian Children During the First Three Years of Life," received over $500,000 in support from Health Canada from 2011 to 2014. The study measured

the presence of phthalates in more than 800 Canadian children and tracked changes in phthalate levels at 12 and 36 months of age, using data and information obtained as part of AllerGen's CHILD Study. This group was a subset of CHILD Study subjects previously analyzed with phthalate measurements at three months of age.

The research also identified the sources of phthalates using questionnaires to estimate exposures from diet, consumer products, medications and the home environment. With support from Health Canada's Indoor Air Contaminant Assessment Section, the project further aimed to determine if exposure to these pollutants makes children more vulnerable to respiratory illnesses, including asthma.

The study's findings showed that by three months of age, over 99% of Canadian children have been exposed to at least one phthalate, with several more exposures occurring during the first three years of life. Since an asthma diagnosis cannot be definitively made until age five, the findings on the development of asthma are as yet inconclusive.

Together with results from two earlier studies, this AllerGen-Health Canada collaboration will contribute to the development of preventive policy measures, with potentially significant impacts on consumer product regulation and on the information available to parents as they make lifestyle and consumption choices with their children's health in mind.

AllerGen partners with the Canadian Respiratory Research Network (CRRN)

On February 24, 2014, Minister of Health Rona Ambrose announced the launch of the Canadian Respiratory Research Network (CRRN)—a new pan-Canadian research network that will study chronic obstructive pulmonary disease (COPD) and asthma, which together affect almost 15% of Canadians.

Through advocacy, in-kind support, mentoring, program collaboration and thought leadership, AllerGen has supported the establishment of this new network, which brings together 50 investigators from 20 institutions across the country to address key knowledge gaps in respiratory health.

"The Canadian Respiratory Research Network is delighted to work closely with AllerGen to advance lung research and lung health for Canadians," comments CRRN Director Dr. Shawn Aaron. "Our Networks share many common interests and expertise, and our collaboration has thus far been seamless and productive. We look forward to many years of synergistic scientific partnership with AllerGen."

A number of AllerGen researchers provide leadership and expertise to the CRRN's themed research platforms. Collaboration between CRRN investigators and AllerGen's CHILD Study, involving five

Left to right: Dr. Alain Beaudet, CIHR President; Dr. Shawn Aaron, CRRN Director; Dr. Duncan Stewart, Director of the Ottawa Hospital Research Institute and the Canadian Vascular Network; The Honourable Rona Ambrose, Minister of Health; Dr. Jeff Healey, Director of the Canadian Stroke Prevention Network.

sites across Canada, will advance the exploration of environmental and gene-environment effects in childhood asthma. AllerGen research teams in the Clinical Investigator Collaborative (CIC), and in the Biomarkers and Bioinformatics, Gene-Environment Interactions and Knowledge Mobilization research platforms, are well positioned to participate in collaborative research initiatives with the CRRN.

Further, AllerGen is partnering with the CRRN, the Canadian Lung Association, the Heart and Stroke Foundation and others to invest in the *Emerging Research Leaders Initiative* (ERLI)—a grant program for early-career researchers in the areas of cardiovascular, cerebrovascular and/or respiratory health research.

Ongoing collaboration with CRRN's research and training initiatives will leverage AllerGen's existing capacity building programs and extend the reach of Canadian research results for the benefit of those living with respiratory disease in Canada and around the world.

Our mandate to place the next generation of leaders in the field of asthma and allergy is being fulfilled as several more of our former trainees have "come of age" as new faculty members at Canadian universities. Since 2005, 47 AllerGen trainees have accepted academic appointments.

Tomorrow's Leaders: AllerGen's Highly Qualified Personnel (HQP)

"AllerGen provides trainees with 360-degree training for the modern world of science—fundamental bench and clinical scientific tools, communication and negotiating skills, and rich layers of networking come together in a complete package."

Christopher Carlsten, MD, MPH
AllerGen investigator, The University of British Columbia

Since 2005, AllerGen has provided education, training and capacity building opportunities to 1,227 Highly Qualified Personnel (HQP) and disbursed over $2.3 million in trainee awards and fellowships.

By assimilating students and young professionals into multidisciplinary and multisectoral research and clinical training environments at over 20 sites across Canada, AllerGen's HQP training program creates value-added, capacity building opportunities that promote knowledge acquisition, national and international networking, and the development of professional skill sets that enhance employment opportunities for graduates.

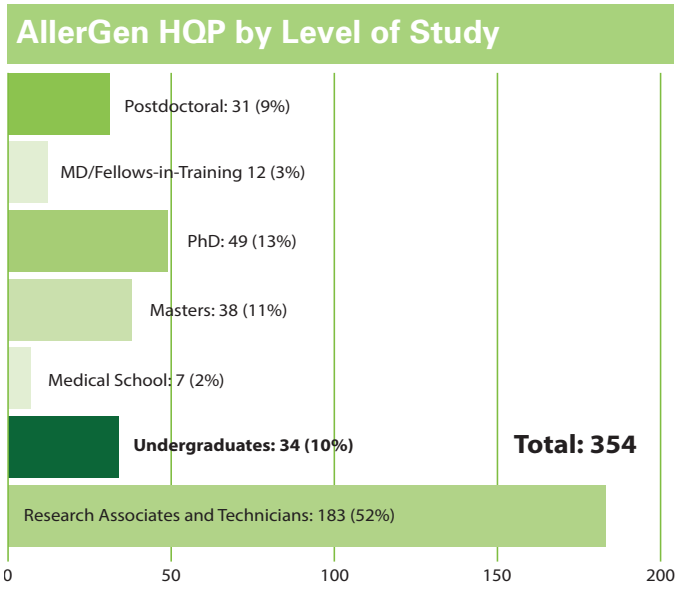
AllerGen trainees graduate from the Network with unique experiences and are mature, connected and confident of their ability to strengthen Canada's knowledge base, innovative capacity and workforce productivity.

AllerGen Students and New Professionals Network (ASNPN)

Founded in 2007 to foster networking, knowledge exchange and professional skill development, the ASNPN comprises trainees (undergraduate students to postdoctoral fellows), new professionals and research staff working in the fields of allergy and asthma research.

Led by ASNPN President Lianne Soller, a PhD candidate at McGill University, the elected ASNPN Leadership Committee provides advice to AllerGen's Advanced Education and Training Opportunities Advisory Committee (AETOAC).

HQP working on AllerGen-funded projects are automatically enrolled as ASNPN members. Individuals not directly working on an AllerGen project may apply to become an ASNPN member and access the associated benefits. In 2013-2014, there were 354 ASNPN members: 278 HQP actively involved in Network research and 76 students/new professionals working in related research areas.



Investment in undergraduates: A foundation for future success

AllerGen's investment in the next generation of allergic disease researchers and clinician-scientists begins at the undergraduate level. Undergraduate students are fully integrated into the Network's HQP training program and provided with opportunities to train alongside established AllerGen investigators and research teams.

"AllerGen's academic and professional training has elevated my experience above that of most undergraduate students pursuing research. My involvement with AllerGen has truly been a highlight of my undergraduate studies."

Laura Feldman, B.Sc., 4th-year
University of Toronto
(The Hospital for Sick Children)

These opportunities promote inquiry-based learning, scholarship and creative accomplishments to enrich the undergraduate academic experience and encourage students to pursue advanced degrees.

Opportunities available to AllerGen undergraduates include:

- Research experience and mentorship
- Summer Studentships
- Poster Competitions
- Travel Awards
- Research skills acquisition support
- Annual Trainee Symposium
- Capacity building workshops

Undergraduate Summer Studentships spark interest in research

In 2013, AllerGen funded 10 outstanding undergraduate students from seven Canadian universities and related research institutes to work alongside

AllerGen 2013-2014 *Undergraduate Summer Studentships* Recipients

Institution	AllerGen Funding	Partner Funding	Total Award Value
McMaster University			**$12,000**
Richard Hae	$3,000	$3,000	
Ashley Yu	$3,000	$3,000	
McGill University			**$6,000**
John Ren	$3,000	$3,000	
The Hospital for Sick Children			**$12,000**
Laura Feldman	$3,000	$3,000	
Ayanna Boyce	$3,000	$3,000	
The University of British Columbia			**$6,000**
Angie Lam	$3,000	$3,000	
University of Alberta			**$12,000**
Timothy Chung	$3,000	$3,000	
Ryan Persaud	$3,000	$3,000	
University of Calgary			**$4,600**
Abid Qureshi	$2,300	$2,300	
Université du Québec à Chicoutimi			**$6,000**
Valérie Gagné-Ouellet	$3,000	$3,000	
Total	**$29,300**	**$29,300**	**$58,600**

AllerGen investigators. For each studentship, AllerGen provided up to $3,000 in support, matched 1:1 by Canadian partner organizations for a total program award value of nearly $60,000.

"My AllerGen summer studentship helped me to achieve a better understanding of the rigorous process of scientific enquiry and confirmed my commitment to pursue a career as a clinician-scientist."

Abid Qureshi, B.Sc., 3rd-year
University of Calgary

The AllerGen *Summer Studentships* program aims to foster interest in allergic and related immune disease research among undergraduate students, leading to advanced studies and potentially a career in related research and/or clinical practice.

AllerGen's *Summer Studentships* provide undergraduates with opportunities to acquire new laboratory techniques and skills, develop expertise with study designs and protocols, and handle and code large datasets. Students also develop soft skills, such as communications, critical thinking, problem solving, public speaking and time management.

AllerGen trainees selected for Young Canadians Roundtable on Health

AllerGen trainees **Timothy Chung** from the University of Toronto and **Ryan Persaud** from the University of Manitoba are among a select group of 17- to 26-year-olds chosen from across Canada for The Sandbox Project's 2013 *Young Canadians Roundtable on Health* (YCRH).

The YCRH brings together motivated young Canadians from coast-to-coast-to-coast in order to make real change to the health prospects of children and youth. The group provides leadership in research, public debate and education on issues affecting the present and future health of Canadian youth, including injury prevention, mental health, growing healthy bodies and the environment.

Timothy Chung with the Honourable Kellie Leitch, Minister of Labour and Minister of Status of Women, at The Sandbox Project's Annual Conference, Toronto, ON, January 23, 2014.

Mr. Chung and Mr. Persaud both held AllerGen *Summer Studentships* in 2013. Mr. Chung worked with Dr. Brian Rowe at the University of Alberta on the management of acute asthma in an urban Emergency Medical Service. Under the supervision of Dr. Anita Kozyrskyj at the University of Alberta, Mr. Persaud's research focused on the impact of perinatal infant antibiotic exposures on allergic outcomes in the Winnipeg cohort of AllerGen's CHILD Study.

Students pitch research at Trainee Poster Competition

AllerGen's annual Trainee Poster Competition places the Network's student research "front and centre," offering trainees the opportunity to showcase their work and receive feedback from leading clinicians and scientists. Since 2005, more than 350 trainee posters have been presented and adjudicated.

In 2013, AllerGen hosted its poster competition in partnership with the Canadian Society of Allergy and Clinical Immunology (CSACI) at the CSACI Annual Scientific Meeting from October 3-6 in Toronto, Ontario. The competition attracted more than 30 research posters on projects undertaken within the context of AllerGen's Enabling Platforms, which include Gene-Environment Interactions; Biomarkers and Bioinformatics; and Patients, Policy and Public Health.

Trainees participating in the AllerGen Poster Competition at the 2013 CSACI Annual Scientific Meeting, Toronto, ON, October 3-6, 2013.

During the competition's lightning round of oral presentations, trainees were allotted one minute to highlight their findings to a panel of 12 judges. During the poster viewing, trainees provided a 10-minute presentation of their research to a pair of judges.

Eight AllerGen trainees, including three undergraduate students, took top honours at the 2013 CSACI poster competition. The winners were:

Gene-Environment Interactions:

First Place

Dr. Elinor Simons, University of Toronto
Supervised by Dr. Teresa To,
The Hospital for Sick Children

Second Place

Dr. Michelle North, Queen's University
Supervised by Dr. Anne Ellis,
Queen's University

Honourable Mention

Sami Shariff, University of Calgary
Supervised by Dr. Richard Leigh,
University of Calgary

Biomarkers and Bioinformatics:

First Place

Amrit Singh, The University of British Columbia
Supervised by Dr. Scott Tebbutt,
The University of British Columbia

Second Place

Claudia Hui, McMaster University
Supervised by Dr. Judah Denburg,
McMaster University

"The CSACI/AllerGen meeting was a unique experience where I had the opportunity to present my research findings to both clinical and basic science researchers. I received very useful advice that I can take back and apply to my research."

Amrit Singh, PhD (c), Experimental Medicine
The University of British Columbia

Honourable Mention
Jenny Thiele, Queen's University
Supervised by Dr. Anne Ellis,
Queen's University

Patients, Policy and Public Health:
First Place
Linda Warner, The University of British Columbia
Supervised by Dr. Stuart Turvey,
The University of British Columbia

Second Place
Laura Feldman, University of Toronto
Supervised by Dr. Teresa To,
The Hospital for Sick Children

Honourable Mention
Timothy Chung, University of Toronto
Supervised by Dr. Brian Rowe,
University of Alberta

Undergraduate Honours:
Laura Feldman, University of Toronto
Supervised by Dr. Teresa To,
The Hospital for Sick Children
Timothy Chung, University of Toronto
Supervised by Dr. Brian Rowe,
University of Alberta

Ayanna Boyce, University of Waterloo
Supervised by Dr. Padmaja Subbarao,
The Hospital for Sick Children

Canadian Medical Hall of Fame laureate inspires trainees


Dr. Phil Gold

In May 2013, over 50 trainees from across Canada gathered in Montreal, Quebec, to enhance their career development at AllerGen's 8th *Annual Trainee Symposium*.

The three-day symposium provided an ideal networking environment to foster new collaborations among trainees and young professionals who share interests in allergy and asthma research and clinical practice.

Dr. Phil Gold—a 2010 Canadian Medical Hall of Fame laureate known for his distinguished record of scientific achievement in immunology and cancer—delivered the Symposium's opening address, providing trainees with advice on achieving success in research.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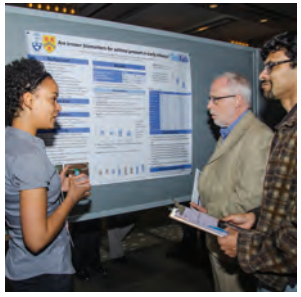
Dr. Gold is the Douglas G. Cameron Professor of Medicine and Professor, Departments of Physiology and Oncology at McGill University, and the Executive Director of the Clinical Research Centre of McGill University Health Centre's Research Institute.

The *Annual Trainee Symposium* provides trainees and ASNPN members with unique professional development opportunities that go well beyond the type of training typically provided in the academic classroom or laboratory.



"Presenting my project alongside graduate students and postdoctoral fellows allowed me to explore options for the next steps in my education and to appreciate the scope and calibre of research being conducted by young Canadian scientists in the fields of allergies and asthma."

Ayanna Boyce, Health Studies, 4th-year
University of Waterloo

AllerGen *Travel Awards*

AllerGen's *Travel Awards Program* supports attendance and participation in national and international conferences, symposia and workshops that are aligned with AllerGen's mission and vision.

Travel awards provide Network trainees and investigators with unique opportunities for public speaking, networking, research collaboration, knowledge exchange, and skill acquisition and development.

"Presenting my research at AllerGen's *Symposium on the Economics of Asthma* in Sydney, Australia, allowed me to receive collaborative, constructive feedback from experienced researchers in my field. I gained experience defending my methods, fielding questions, and presenting to a large international audience."

Lilla Roy, M.Sc (c), Pharmaceutical Sciences
The University of British Columbia

AllerGen trainees among an elite cadre of early-career researchers

Drs **Meghan Azad** from the University of Alberta and **Jeremy Hirota** from The University of British Columbia were named Banting Postdoctoral Fellows in 2013. The fellowships are Canada's most prestigious awards for postdoctoral research and place these AllerGen trainees among an elite group of Canadian researchers recognized for demonstrating excellence and leadership in their fields of study.

Meghan Azad studies the role of gut bacteria in childhood asthma and allergies. Dr. Azad's research uses data and biological samples from AllerGen's CHILD Study to investigate the impact of antibiotics and other environmental factors on infant gut microbiota and the subsequent development of allergic disease.

Dr. Azad holds a PhD in Biochemistry and Medical Genetics from the University of Manitoba. She joined the University of Alberta as a Killam Postdoctoral Fellow in 2011, under the supervision of AllerGen researcher Dr. Anita Kozyrskyj.

Jeremy Hirota focuses on understanding the contribution of environmental exposures to asthma development and exacerbations. Dr. Hirota examines how air pollution interacts with airway epithelial cells by collecting samples from subjects who have been exposed to diesel exhaust.

"Drs Azad and Hirota are exceptional early-career scientists who are making substantial contributions to our understanding of the genetic and environmental influences of allergy and asthma."

Dr. Judah Denburg, Scientific Director and CEO
AllerGen NCE Inc.

Dr. Hirota completed his PhD at McMaster University, specializing in asthma, and is a post-doctoral fellow at The University of British Columbia under the supervision of AllerGen investigator Dr. Chris Carlsten.

Young engineer receives competitive leadership award

Natalia Mykhaylova, a PhD candidate in chemical engineering at the University of Toronto, received the *Professor Douglas Reeve Leaders of Tomorrow Award* in March 2014. This award recognizes graduate students in the Department of Chemical Engineering and Applied Chemistry who have shown the potential to become outstanding leaders. Natalia serves as a co-chair for the University's Leadership Education in Engineering: Graduate program (ILead:Grad), a role that has allowed her to support and mentor others developing their leadership skills.

Natalia is part of the AllerGen-funded Better Exposure Avoidance Measures (BEAM) research project that is developing inexpensive air-quality monitoring devices under the supervision of AllerGen investigator Dr. Greg Evans. These devices could eventually be mounted on utility poles, carried by individuals at risk for asthma or respiratory conditions, or placed in the homes of research participants to measure personal exposure to air pollution.

Abstract receives highest score at European conference

Elaine Fuertes was honoured at the 6th Annual European Public Health Conference in Brussels, Belgium, in November 2013. Her abstract, "Traffic-related air pollution as a risk factor for the development of childhood allergic diseases: the Traffic, Asthma and Genetics (TAG) project," received the highest score, placing first out of 796 submitted abstracts.

In August 2013, Ms. Fuertes was the lead author on a paper publishing results from the TAG project in the *Journal for Allergy and Clinical Immunology* (JACI). The paper, titled "Childhood allergic rhinitis, traffic-related air pollution, and variability in the GSTP1, TNF, TLR2, and TLR4 genes: Results from the TAG Study," reported on the potential link between traffic-related air pollution and allergic rhinitis.

Ms. Fuertes is a PhD candidate supervised by Drs Chris Carlsten and Michael Brauer at The University of British Columbia. She is completing an extended internship at the Helmholtz Zentrum München-German Research Centre for Environmental Health, under the guidance of Dr. Joachim Heinrich.

FRQS-partnered award recognizes allergic diseases research

Dr. Moshe Ben-Shoshan was awarded the 2013-2014 Fonds de recherche du Québec-Santé (FRQS)/ AllerGen *Clinical Research Scholars Career Award*.

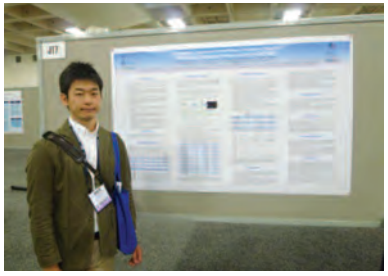
The award, which recognizes outstanding young clinical investigators who wish to pursue research on allergic and related immune diseases, will further Dr. Ben-Shoshan's work with the AllerGen-funded C-CARE study and allow him to study the environmental, genetic and socio-demographic factors associated with food allergies.

A former AllerGen trainee, Dr. Ben-Shoshan also received AllerGen's inaugural *Emerging Clinician-Scientist Fellowship* in 2011. Dr. Ben-Shoshan is an assistant professor of pediatrics at McGill University, a physician in the Department of Allergy/ Immunology at Montreal Children's Hospital and a Principal Investigator with AllerGen's Canadian Food Allergy Strategic Team (CanFAST).

AllerGen trainees receive ATS Abstract Scholarships

Drs **Francesco Sava** and **Masatsugu Yamamoto** were honoured with Environmental and Occupational Health scholarships at the 2013 American Thoracic Society (ATS) conference in Philadelphia, PA. The ATS awards a limited number of abstract scholarships annually. Drs Sava and Yamamoto completed postdoctoral training at The University of British Columbia, supervised by AllerGen investigator Dr. Chris Carlsten.

Dr. Francesco Sava, MD, M.Sc.
Abstract: *Peripheral Blood DNA Methylation Changes Associated with Acute Diesel Exhaust Exposure in Asthmatics*



Dr. Masatsugu Yamamoto at the May 2013 American Thoracic Society (ATS) Conference in Philadelphia, PA

Dr. Masatsugu Yamamoto, MD, PhD
Abstract: *Controlled Human Exposure to Inhaled Diesel Exhaust Increases Circulating MiR-144, Which is Attenuated by Antioxidant Supplementation*

HQP alumni embark on careers across diverse sectors

The NCE program aims to provide cross-disciplinary expertise and an enhanced skill set to increase the employability of its HQP. Since 2005, 149 AllerGen alumni have found employment with stakeholders across various sectors, including academia (48%), industry and the private sector (30%), provincial and federal governments (17%) and hospitals (5%).

In 2013-2014, over 40 AllerGen trainees secured employment—the highest single-year employment figure for HQP in the past decade. Examples of areas where these graduates are employed include:

Academia

Yuka Asai (MD, M.Sc.) joined the Division of Dermatology at Queen's University in Kingston, ON. She also provides consultation services to the Kingston General Hospital and outpatient services at the Hotel Dieu Hospital. Dr. Asai is currently completing her PhD at McGill University under the supervision of AllerGen investigator Dr. Ann Clarke. Dr. Asai is a former member of the ASNPN Leadership Committee.

Elinor Simons (MD, M.Sc.) is an assistant professor/ clinician scientist in the Section of Allergy, Department of Pediatrics and Child Health, at the University of Manitoba. Dr. Simons is currently in the final stages of completing her PhD at The Hospital for

Sick Children under the supervision of AllerGen investigator Dr. Teresa To. Dr. Simons is one of only a few population epidemiologists working in pediatrics in Canada.

Victoria Arrandale (PhD) is Senior Research Associate in the Occupational Cancer Research Centre at Cancer Care Ontario and an assistant professor in Occupational and Environmental Health at the University of Toronto's Dalla Lana School of Public Health. Dr. Arrandale completed her PhD studies at the University of Toronto's Gage Occupational & Environmental Health Unit under the supervision of AllerGen investigators Drs Frances Silverman and Linn Holness. Dr. Arrandale is a former member of the ASNPN Leadership Committee.

Clinical practice

Karine Issa El-Khoury (MD) is a practicing allergist and partner at the Clinique d'allergie et d'asthme de Montréal. Dr. Issa El-Khoury completed her allergy and clinical immunology training in pediatrics at McGill University.

Zainab Abdurrahman (MD) is a pediatric clinical immunologist and allergist at Kindercare Pediatrics in Toronto, ON. Dr. Abdurrahman is an assistant clinical professor (adjunct) in the Department of Pediatrics at McMaster University and also works at McMaster Children's Hospital in Hamilton. Dr. Abdurrahman completed her subspecialty training in Clinical Immunology and Allergy at McMaster University where she worked with AllerGen investigator Dr. Susan Waserman on the AllerGen CanGoFAR team.

Government

Sri Chaudhuri (M.Sc.) works at the Ontario Ministry of the Environment. Ms. Chaudhuri trained in the Department of Chemical Engineering and Applied Chemistry at the University of Toronto under the supervision of AllerGen investigator Dr. Miriam Diamond.

Not-for-Profit

Kathleen McLean (MPH) is an Environmental Health Scientist at the British Columbia Centre for Disease Control. Prior to and during her graduate studies in Public Health at Simon Fraser University, Ms. McLean worked with AllerGen investigator Dr. Tim Takaro on projects measuring biomarkers of phthalate exposure in CHILD Study participants.

Farzian Aminuddin (MBA) is a business analyst at the Ontario Genomics Institute. Mr. Aminuddin

worked as a laboratory researcher at The University of British Columbia (UBC) James Hogg Research Centre with Dr. Andrew Sandford prior to pursing his MBA at Simon Fraser University. He is a former member of the ASNPN Leadership Committee.

Industry

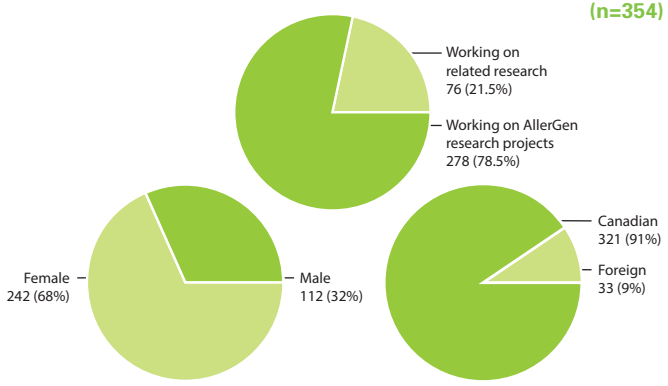
Marie-Josée Martel (PhD) was hired as the Director of Scientific Client Strategies at Xcenda in Palm Harbor, Florida. Dr. Martel completed her graduate training at the Université de Montréal under the supervision of AllerGen investigator Dr. Lucie Blais. Dr. Martel also serves as adjunct faculty at the Faculty of Pharmacy at the Université de Montréal.

Hospital

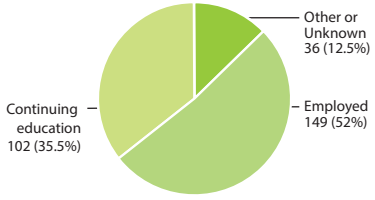
Lilla Roy (M.Sc.) is employed as a Clinical Research Project Coordinator at The Hospital for Sick Children's Peter Gilgan Centre for Research & Learning. A registered nurse, Ms. Roy completed her Masters of Science in Pharmaceutical Sciences (epidemiology and health economics) at The University of British Columbia. She has worked with AllerGen investigator Dr. Larry Lynd on the Platform for Outcomes Research in Asthma and Allergy (PORTAL)—an AllerGen-funded research project.

A Snapshot of AllerGen HQP, 2013-2014

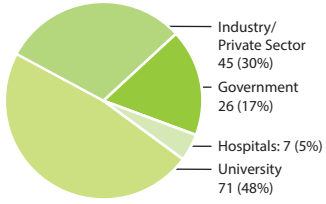
(n=354)



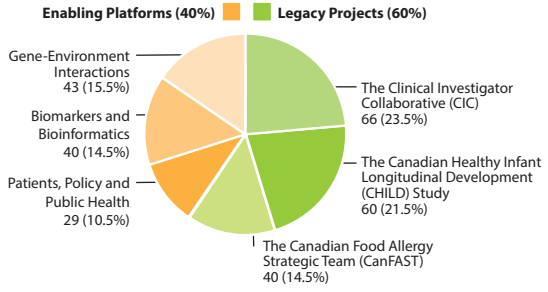
AllerGen HQP Graduates 2005-2014 (n=287)



AllerGen HQP Employment by Sector 2005-2014 (n=149)



AllerGen HQP by Research Program (n=354)



Trainees, New Professionals, Research Associates and Technicians by Province		
Ontario	110	31%
Alberta	85	24%
British Columbia	79	22%
Quebec	42	12%
Manitoba	28	8%
Saskatchewan	7	2%
Outside Canada	3	1%
Total	354	100%

Trainees, New Professionals, Research Associates and Technicians by University		
The University of British Columbia	75	21.2%
University of Alberta	51	14.5%
McMaster University	46	13.0%
Affiliated Institutions and Organizations	33	9.3%
University of Calgary	32	9.0%
University of Manitoba	27	7.6%
McGill University	21	5.9%
Queen's University	17	4.8%
Université Laval	13	3.7%
University of Toronto	12	3.4%
University of Saskatchewan	7	2.0%
Simon Fraser University	4	1.2%
University of Waterloo	4	1.2%
Université de Montréal	3	0.8%
Université du Quebéc à Chicoutimi	3	0.8%
Outside Canada	3	0.8%
University of Guelph	1	0.3%
University of Winnipeg	1	0.3%
Western University	1	0.3%
Total	354	100%

Through strong partnerships, AllerGen leveraged its research investments to generate an additional $8.8 million in cash and in-kind support from partner and stakeholder organizations over the year — a leveraging ratio of 1:1.58.

Financial Overview

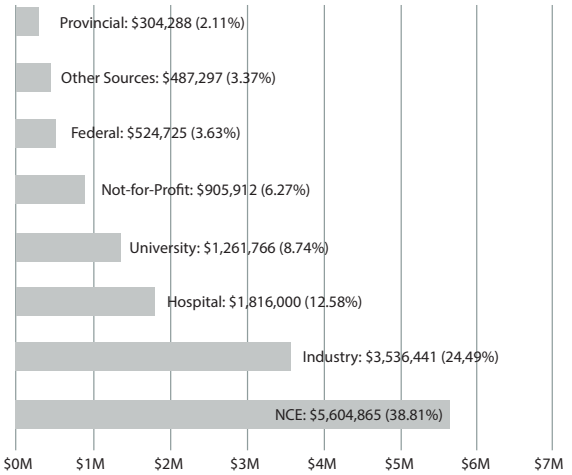
AllerGen NCE Inc. Financial Summary 2013–2014

	2012-2013 (Year 8)	Percentage	2013-2014 (Year 9)	Percentage
Revenues (Cash)				
NCE Award	6,828,135	91.94%	5,604,865	91.09%
Non-NCE Funds	598,972	8.06%	548,538	8.91%
	7,427,107	**100.00%**	**6,153,403**	**100.00%**
Expenditures (Cash)				
Research Programs	4,639,700	74.66%	3,859,854	69.31%
Networking	27,314	0.44%	210,333	3.78%
Training	279,131	4.49%	315,373	5.66%
Communications	47,948	0.77%	71,088	1.28%
Administration	1,220,406	19.64%	1,112,484	19.98%
	6,214,500	**100.00%**	**5,569,132**	**100.00%**
Committed Amounts for Future Research	1,789,000		1,210,140	
NCE and Non-NCE Cash Reserves	1,302,607		584,271	

All Revenue Sources (Cash and In-Kind) 2013/14 NCE and Non-NCE

	Cash	In-Kind	Total	Percentage
NCE (38.81%)	5,604,865	–	5,604,865	38.81%
Industry (24.49%)	3,000,259	536,182	3,536,441	24.49%
Hospital (12.58%)	300,000	1,516,000	1,816,000	12.58%
University (8.74%)	84,070	1,177,696	1,261,766	8.74%
Not-for-Profit (6.27%)	473,437	432,475	905,912	6.27%
Federal (3.63%)	50,000	474,725	524,725	3.63%
Other Sources (3.37%)	414,972	72,325	487,297	3.37%
Provincial (2.11%)	52,300	251,988	304,288	2.11%
Total	**$ 9,979,903**	**$ 4,461,391**	**$ 14,441,294**	**100%**

All Revenue Sources (Cash and In-Kind) 2013/14 NCE and Non-NCE (n=$14,441,294)



In 2013-14, AllerGen's income from all sources (cash and in-kind) was $14,441,294. Of this amount, $5,604,865 was received as a base grant from the NCE program.

For every dollar that AllerGen received from the NCE program, it leveraged an additional $1.58, resulting in an additional investment of $8,836,429 from the private, public and not-for-profit sectors.

Over the past year, we have continued to welcome new investigators and mentors to the Network and we have identified personalized health and bioinformatics/data integration as Network-wide initiatives that will provide a framework for future investment and application.

Network Participants

Investigators (n=93)

Name	Affiliation
Edmond Chan	BC Children's Hospital
Heather Castleden	Dalhousie University
Jean Marshall	Dalhousie University
Jeff Brook	Environment Canada
Sandy Kapur	Halifax Allergy & Asthma Associates
Sébastien La Vieille	Health Canada
Cathy Gillespie	Health Science Centre Winnipeg
Wade Watson	IWK Health Centre
Diane Lougheed	Kingston General Hospital
Jeremy Scott	Lakehead University
Moshe Ben-Shoshan	McGill University
Lawrence Joseph	McGill University
James Martin	McGill University
Bruce Mazer	McGill University
Celia Greenwood	McGill University Health Centre
Ciriaco Piccirillo	McGill University Health Centre
Sonia Anand	McMaster University
Judah Denburg	McMaster University
Sarah Garside	McMaster University
Gail Gauvreau	McMaster University
Manel Jordana	McMaster University
Paul Keith	McMaster University
Anthony Levinson	McMaster University
Joseph Macri	McMaster University
Parameswaran Nair	McMaster University
Helen Neighbour	McMaster University
Paul O'Byrne	McMaster University
Malcolm Sears	McMaster University
Susan Waserman	McMaster University
Carlo Marra	Memorial University
Anne Ellis	Queen's University
Ryan Allen	Simon Fraser University
Fiona Brinkman	Simon Fraser University
Timothy Takaro	Simon Fraser University
Sharon Dell	The Hospital for Sick Children
Theo Moraes	The Hospital for Sick Children
Felix Ratjen	The Hospital for Sick Children
Sanja Stanojevic	The Hospital for Sick Children
Padmaja Subbarao	The Hospital for Sick Children
Wendy Ungar	The Hospital for Sick Children
Michael Brauer	The University of British Columbia
Chris Carlsten	The University of British Columbia
Denise Daley	The University of British Columbia
Del Dorscheid	The University of British Columbia
Mark FitzGerald	The University of British Columbia
Michael Kobor	The University of British Columbia
Tobias Kollmann	The University of British Columbia
Larry Lynd	The University of British Columbia
Kelly McNagny	The University of British Columbia
Peter Paré	The University of British Columbia
Andrew Sandford	The University of British Columbia
Scott Tebbutt	The University of British Columbia
Stuart Turvey	The University of British Columbia
Catherine Lemière	Université de Montréal
Catherine Laprise	Université du Québec à Chicoutimi
Louis-Philippe Boulet	Université Laval
Jamila Chakir	Université Laval
Marie-Renée Blanchet	Université Laval - IUCPQ
Dean Befus	University of Alberta
Stuart Carr	University of Alberta
Timothy Caulfield	University of Alberta
Catherine Field	University of Alberta

Name	Affiliation
Malcolm King	University of Alberta
Anita Kozyrskyj	University of Alberta
Piush Mandhane	University of Alberta
Irvin Mayers	University of Alberta
Miriam Stewart	University of Alberta
Harissios Vliagoftis	University of Alberta
Tavis Campbell	University of Calgary
Ann Clarke	University of Calgary
Gerry Giesbrecht	University of Calgary
Bonnie Kaplan	University of Calgary
Richard Leigh	University of Calgary
Nicole Letourneau	University of Calgary
Katherine Wynne-Edwards	University of Calgary
Allan Becker	University of Manitoba
Marni Brownell	University of Manitoba
Mariette Chartier	University of Manitoba
Kent HayGlass	University of Manitoba
Jeffrey Masuda	University of Manitoba
Darryl Adamko	University of Saskatchewan
Don Cockcroft	University of Saskatchewan
John Gordon	University of Saskatchewan
Peter Hull	University of Saskatchewan
Miriam Diamond	University of Toronto
Greg Evans	University of Toronto
Richard Hegele	University of Toronto
Wendy Lou	University of Toronto
James Scott	University of Toronto
Frances Silverman	University of Toronto
Peter Vadas	University of Toronto
Kathi Wilson	University of Toronto
Susan Elliott	University of Waterloo

NCE Standard Agreement Signatories (n=33)

Centre de Recherche du CHUM
Centre hospitalier universitaire (CHU) Saint-Justine
Dalhousie University
Helmholtz Zentrum München
Hôpital du Sacré-Coeur de Montréal
Institut universitaire de cardiologie et de pneumologie de Québec (IUCPQ)
Karolinska Institute
Lakehead University
McGill University
McGill University Health Centre
McMaster University
Queen's University
Simon Fraser University
St. John's Research Institute, India
St. Joseph's Healthcare, Hamilton
St. Michael's Hospital, Toronto
The Hospital for Sick Children
The University of British Columbia
The University of Western Australia
The University of Winnipeg
Université de Montréal
Université du Québec à Chicoutimi
Université Laval
University of Alberta
University of Calgary
University of Guelph
University of Manitoba
University of New Brunswick
University of Ottawa
University of Saskatchewan
University of Sherbrooke
University of Toronto
University of Waterloo

HQP and Research Staff (n=354)

Shelley Abercromby
Karim Abou-Moustafa
Daniel Adams
Omid Aghamirian
Loubna Akhabir
Kim Allan
Sheka Aloyouni
Mustafa Al-Saiedy
Nelly Amenyogbe
Vidyanand Anaparti
Yasmin Arfeen
Jason Arnason
Muhammad Asaduzzaman
Yuka Asai
Ghazal Assadian
Susan Attridge
Katrina Au
Séverine Audusseau
Hana Awad
Jane Awawias
Meghan Azad
Prithy Babu
Bahar Bahrani
Salma Bahreinian
Jyoti Balhara
Susan Balkovec
Kendra Barrick
Shirley Beauchamp
Suzanne Beaudin
Pierrick Bedouch
Philippe Bégin
Emilie Bernatchez
Mylène Bertrand
Hilary Bews
Litsa Blanis
Marie-Ève Boulay
John Bousfield
Jodie Bousfield
Katie Bowden
Miranda Bowen
Ayanna Boyce
Julyanne Brassard
Graeme Bredo
Karin Breuer
Sarah Bridgman
May Brydges
Sarah Burningham
Bing Cai
Maureen Campbell
Francesca Cardwell
Sylvie Carette
Simone Chaboillez
Michelle Chakraborti
Sarah Charlesworth
Mariette Chartier
Wenjai Chen
Roy Chen
Carol Chen
Joyce Chikuma
Rishma Chooniedass
Angela Chow
Derek Chu
Timothy Chung
Laura Churchman
Rachel Clifford
Lisa Colizza
Caroline Conway
Victoria Cook
Marie-Ève Côté
Melanie Courtot
Fiona Cowley
Melanie Cowley
Rowena Cua
Beth Davis
Wojciech Dawicki
Carlo De Olim Rugginenti
Phillip Deng
Francine Deschesnes
Marylin Desjardins
Benny Dua
Aimee Dubeau
Curtis Dumonaceaux
Joanne Duncan
Stacey Dunn
Judy Durocher
Ann Efthimiadis
George Ellis
Caroline Ethier
Kelsey Falk
Laura Feldman
Penelope Ferrie
Catherine Field
Mike Filia
Nick Fishbane
Jennifer Fitzpatrick
Andrea Fong
Amir Foroushani
Annie-Pier Fortin
Tosha Freitag
Silvia Frias
Elaine Fuertes
Cathy Fugère
Melissa Gabruck
Myriam Gagné
Valérie Gagné-Ouellet
Jessica Galo
Vivek Gandhi
Tresa George
Brenda Gerwing
Sagal Ghelle
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Luisa Giles
Matt Gold
Susanna Goncharova
Emma Goosey
Susan Goruk
Krista Gray
Tara Grey
Maja Grubisic
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Linda Hui
Saiful Huq
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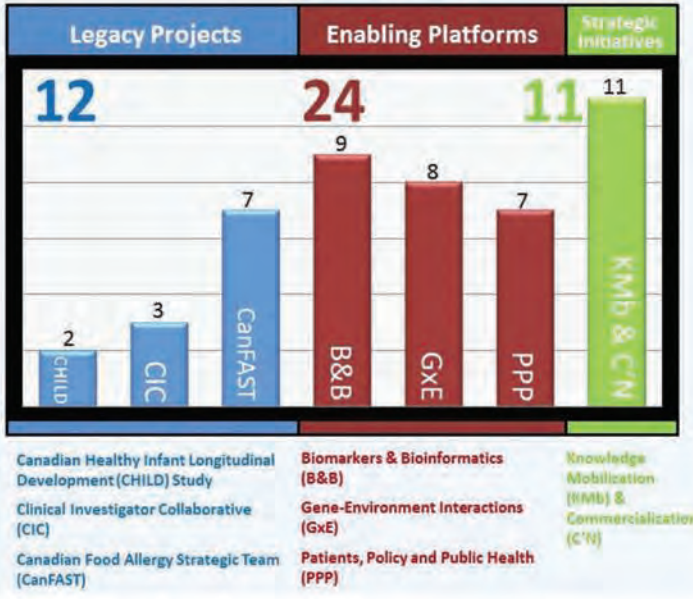
Marshall Beck	Administrative Coordinator, Communication and Knowledge Mobilization

AllerGen FAST FACTS
2013-2014

NCE : Non-NCE investment leverage ratio
1 : 1.58

Research Investments **47**



Canadian Healthy Infant Longitudinal Development (CHILD) Study

Clinical Investigator Collaborative (CIC)

Canadian Food Allergy Strategic Team (CanFAST)

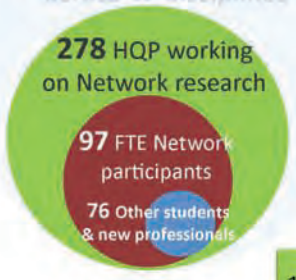
Biomarkers & Bioinformatics (B&B)

Gene-Environment Interactions (GxE)

Patients, Policy and Public Health (PPP)

Knowledge Mobilization (KMb) & Commercialization (C'N)

93 Principal Investigators and Co-Investigators across 47 disciplines



Researchers **136**

136 Partnerships

2005-2014

3161
Publications
(including refereed, specialized and other)

1227
Total Highly Qualified Personnel (HQP)
participants in the Network since 2005

AllerGen

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