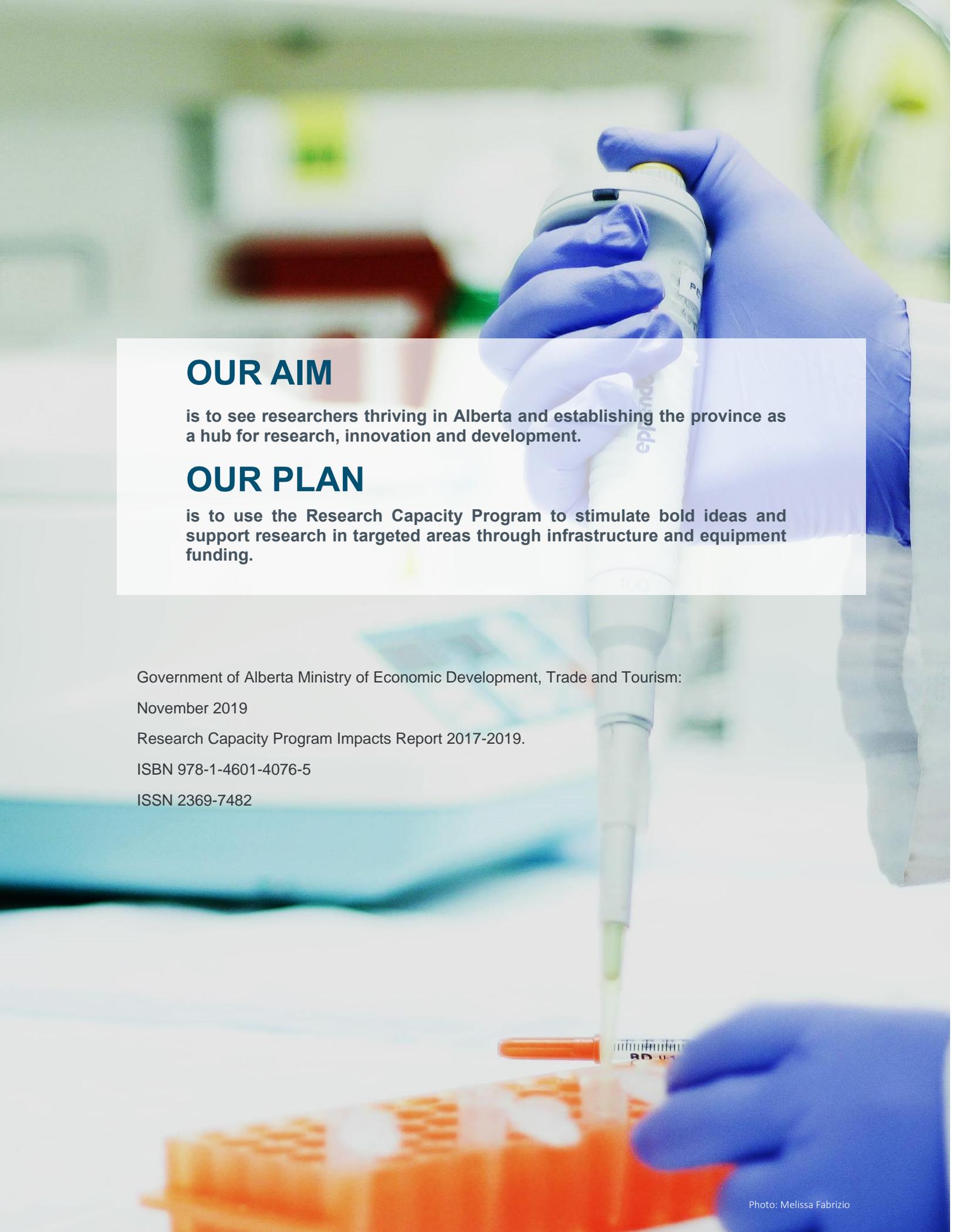




Research Capacity Program  
**Impacts Report**  
**2017-19**

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## OUR AIM

is to see researchers thriving in Alberta and establishing the province as a hub for research, innovation and development.

## OUR PLAN

is to use the Research Capacity Program to stimulate bold ideas and support research in targeted areas through infrastructure and equipment funding.

Government of Alberta Ministry of Economic Development, Trade and Tourism:

November 2019

Research Capacity Program Impacts Report 2017-2019.

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Pursuing innovation  
requires a passion to make  
the world better. It focuses  
on our strengths and  
harnesses that power to  
build communities.



## Research Capacity Program

The Research Capacity Program (RCP) is a competitive funding program, delivered by the Government of Alberta's Ministry of Economic Development, Trade and Tourism (EDTT), designed to build research capacity in Alberta's post-secondary institutions. The RCP supports the acquisition of small equipment and large research infrastructure to attract, retain, and develop researchers undertaking transformative and applied research programs.

Since 2001, the RCP and its predecessor programs have been active funders of research infrastructure for Alberta's post-secondary institutions. The program has made considerable investments to strengthen Alberta's research system and ensures that Alberta's researchers have cutting-edge tools to conduct innovative science that is relevant and impactful, as well as nationally or internationally competitive.

The intent of the RCP is to:



Support research and innovation



Attract and retain lead researchers



Advance research in Alberta's target areas



Increase Alberta's research leadership

This report provides a snapshot of the scope of RCP's activities and highlights select exemplary researchers and their projects to showcase the benefits of investment in state-of-the-art research infrastructure, targeted innovation, and research talent.



## Program Details

Alberta's post-secondary institutions play a key role in producing ground-breaking and impactful research and innovation. Achieving this requires years of work and commitment that is only possible with stable, long-term investment and support from the RCP and other funding partners.

## RCP Funding Streams

The RCP has four separate funding streams to ensure that all research equipment investments complement provincial targets and can evolve to meet the needs of Alberta's institutions and their researchers, covering the full spectrum of research from discovery to technology development. The RCP funding streams also aligns with, and complement, the federal Canada Foundation for Innovation (CFI) funding streams. The CFI is an independent corporation created by the Government of Canada that funds state-of-the-art facilities and equipment in Canadian research institutions, and the RCP serves as Alberta's only mechanism for leveraging support from this organization.

### RCP FUNDING STREAMS

#### Small Equipment Grants (SEG)



Supports small research equipment for individual researchers or small teams

#### Research Infrastructure (RI)



Supports large research infrastructure for research teams of up to 10 people

#### College-Industry Innovation (CII)



Supports applied research infrastructure in colleges and polytechnics

#### Cyberinfrastructure (CYB)



Supports the infrastructure needs of computationally and data-intensive research

## Funding Architecture

The RCP uses a cost-shared funding approach to provide up to 40 per cent of total eligible project costs for successful proposals. The program's goal is to attract the remaining 60 per cent from the CFI and other funding sources, which the RCP is currently surpassing – currently, 77 per cent of total project costs are attracted from other sources.

Since 2001, the RCP has invested more than \$357 million and has leveraged \$1.22B from other sources (including \$516 million from the CFI federal infrastructure investment), bringing a total investment of \$1.58 billion to Alberta. An additional \$155 million was awarded under the CFI's Infrastructure Operating Fund (IOF) to help institutions with the incremental operating and maintenance costs associated with the acquisition of new infrastructure.

# \$357M

of RCP investment  
has attracted funding of

# \$1.22B

ATTRACTED FUNDING

GOAL 60%

ACTUAL 77%

RCP has been instrumental in enabling

# 950+

researchers to carry out research in Alberta



Research and innovation is a critical component of Alberta's economic, environmental and social landscape. It generates important discoveries, develops talent, and commercializes products and services for today and the future.

## Talent Generation

By attracting and retaining highly qualified personnel (HQP) with state-of-the-art equipment and facilities, the RCP is creating a climate that fosters collaborations amongst leading researchers within Alberta and internationally. The RCP recognizes the importance of investing in Alberta's future by building research and innovation capacity and supporting attractive training opportunities for students – the next generation of talented innovators.

RCP has funded

# 625+

research projects at  
Alberta post-secondary  
institutions and colleges



**HIGHLY QUALIFIED PERSONNEL (HQP)** is a term used by the RCP to define the people who are being trained with leading-edge research skills. They are mostly students who are completing their honours bachelor's, college, master's, or doctorate degrees, as well as post-doctoral fellows, research scientists and other members of the research team, such as lab assistants. These individuals comprise the top research talent Alberta is known for.

## Academic Innovation

A sustainable environment for cutting-edge academic research and innovation not only helps inspire and cultivate brilliant minds, but is also critical for a thriving and globally competitive economy. Fostering strong research and innovation from academic institutions will fuel the new ideas, inventions, and ways of thinking about social and economic challenges: from oil sands efficiency, cancer treatments, agriculture sustainability, and much more. These advancements improve how Albertans live and work, and help keep Alberta competitive on an international scale.

*“Fruits of innovation do not materialize out of thin air. They grow out of the wellspring of knowledge, ideas, and insights that originate largely, albeit not exclusively, from basic research.”*

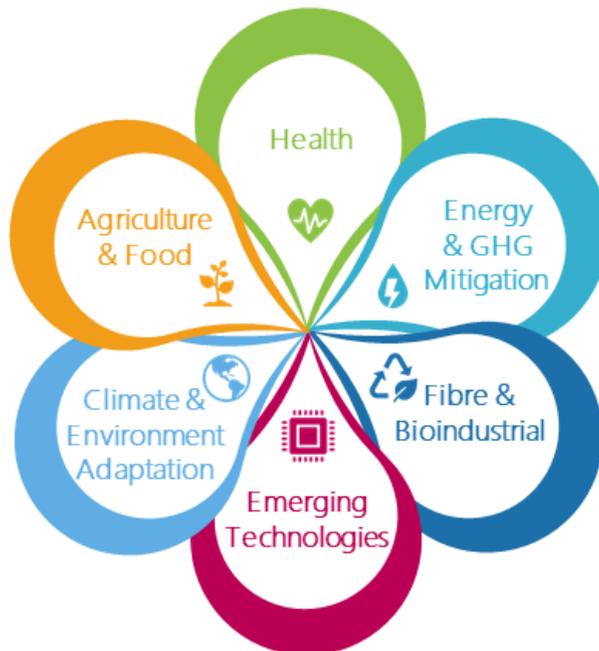
Canada's Fundamental Science Review (2017)

The work produced by Alberta institutions has led to major innovation developments, company creation, collaborations, world recognition, and countless patent awards. Across the province's universities and colleges, many outstanding scholars build successful industry partnerships to turn innovative ideas into valuable products and services. Alberta's post-secondary institutions foster a supportive environment for faculty and students to advance and apply cutting-edge knowledge.

## Research Outcomes

The Alberta government recognizes that pursuing innovation requires building research capacity and capability. The RCP therefore strongly encourages the submission of proposals that align with the Government's [Alberta Research and Innovation Framework \(ARIF\)](#) and the research priorities expressed in the strategic plans of Alberta's institutions. The ARIF also establishes Innovation Targets, which research and innovation stakeholders can rally around to deliver results for Albertans.

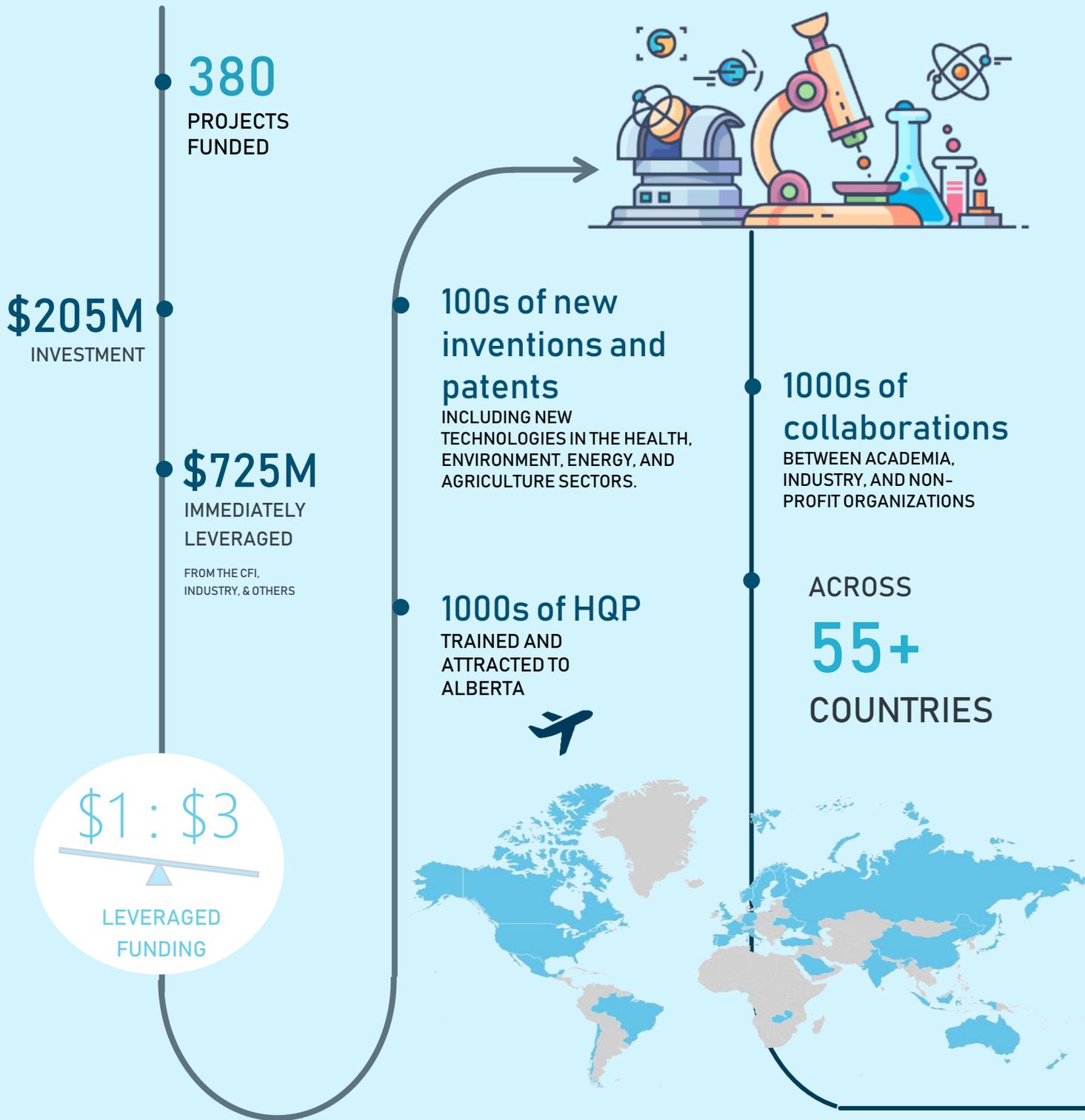
### 2030 INNOVATION TARGETS



The Innovation Targets are intended to inspire transformational solutions in priority areas. The targets, developed by the Government of Alberta, Alberta Innovates, post-secondary institutions, and industry leaders, support Alberta's competitiveness, growth, and export readiness in all sectors. Their anticipated outcomes include stimulating economic diversification and job creation, environmental stewardship and climate leadership, effective resource management, and improved health for Albertans.

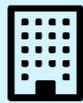
The RCP has always aligned with ARIF priorities, which helps ensure that research creates meaningful impacts, including significant technology developments across sectors, improved health outcomes, environmentally sustainable practices, and the creation of start-up companies in new areas of expertise. These investments play a key role in driving Alberta's research and innovation presence on the national and international stage. This report identifies how each project is aligned with one or more 2030 Innovation Target(s).

# 10 Years of RCP: 2008 – 2018 RESULTS



# FUNDING STREAMS

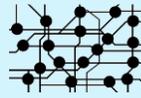
**313**  
SMALL  
EQUIPMENT  
GRANTS



**51**  
RESEARCH  
INFRASTRUCTURE

**1**  
EXCEPTIONAL  
OPPORTUNITY

**4**



CYBERINFRASTRUCTURE

**11**  
COLLEGE INDUSTRY  
INNOVATION



**1/4**



OF PRIMARY  
INVESTIGATORS ARE  
WOMEN

## SECTOR ADVANCEMENT

Percent of projects funded with a primary focus in the following sectors:

**48%**

Health and Health Sciences

**2%**

Agriculture and Food Science

**9%**

Engineering and Advanced Materials

**4%**

Biotech and Clean Technology

**5%**

Oil and Gas

**8%**

Fundamental Sciences

**3%**

Information Technology

**4%**

Space and Astrophysics

**14%**

Environmental and Earth Sciences

**3%**

Social Sciences and Humanities



# Featured Researchers

2017 – 2019

This report highlights select exceptional researchers in various stages of their careers that have received RCP funding in the past. The features will showcase each researcher, their program, and how the program has impacted Alberta. These researchers have attracted talented people, facilitated local and global collaborations, generated companies, and attracted additional funding from other sources.



13

Outstanding researchers and their projects will be featured in this year's report



\$163M

In additional funding has been attracted by their research

*“The CFI – RCP infrastructure opens avenues for strengthening great partnerships: transparency in science and engineering, support for partners to participate equitably, dissemination of knowledge and acceleration of innovation.”*

Dr. Vita Martez, PhD  
NSERC Industrial Research Chair for Colleges in Oil Sands In Situ Steam Generation  
SAIT Applied Research and Innovation Services Researcher

## 2017 – 2019 FEATURED RESEARCHERS

**DR. MICHAEL SERPE**

Creating countless sensors for everyday applications.



**DR. MARC STROUS**

Using microbes to create energy and improve energy processes.



**DR. VITA MARTEZ**

Designing and testing innovative and environmentally safe technologies.



**DR. ANDREA SEDGWICK**

Improving oil sands sustainability and reducing their environmental impact.



**DR. DEBORAH KURRASCH**

Researching new epilepsy drugs using zebrafish.



**DR. RICK CHALATURNYK**

Advancing Alberta's oil and gas recovery processes.



**DR. DAVID EATON**

Using seismology to optimize Alberta's hydraulic fracturing.



**DR. AFSANEH LAVASANIFAR**

Improving the lives of cancer patients through enhanced drug delivery.



**DR. GERLINDE METZ**

Investigating how to combat Parkinson Disease.



**DR. PAUL BARCLAY**

Developing ultra-energy-efficient sensor technology.



**DR. JIANPING WU**

Improving the health of Albertans using nutrients from poultry.



**DR. NADIR ERBILGIN**

Saving Alberta's forests from the mountain pine beetle.



**DR. ROBERT WOLKOW**

Creating the next generation of electronics using quantum technology.



# Sensing the Future

## Dr. Michael Serpe

### THE RESEARCH

Before Dr. Serpe started research in responsive polymers, little was known about how they could be used to solve common problems in society. By following his curiosity, Dr. Serpe discovered a highly unique, and globally prestigious method for researching these molecules, which led to a grant of \$128,000 in 2011 from the RCP to allow him to conduct research on polymers and establish Alberta as a world leader in the field.

### Did You Know?

Polymers are made up of many molecules that are strung together to create long, repeating chains. Responsive polymers can alter themselves in response to external stimuli.



Dr. Serpe posing with a vital piece of equipment for his laboratory.

“ I am training my students to be curious, and not just see what they think is a bad result and forget about it – try to understand it, and then it could lead somewhere. ”

-Dr. Michael Serpe

### ABOUT DR. SERPE

Dr. Michael Serpe first became interested in stimulus polymers during his graduate studies at Georgia Institute of Technology. After completing his PhD and postdoctoral studies, Dr. Serpe found many positions requiring his skillset, but was attracted to the province by the impressive infrastructure at the University of Alberta, such as NanoFab and the NRC-UAlberta Nanotechnology Initiative, and the ability to apply for RCP and CFI funding.

In under a decade working at the University of Alberta, Dr. Serpe has designed a sensor technology with numerous real-world applications, which has attracted talented HQP and collaborations with industry, academia, and government agencies worldwide. With every project ultimately fuelled by an experiment gone wrong, Dr. Serpe's curiosity and open-mind was the key to these new opportunities. This rare skill - following one's curiosity and being open to new experiments - is something Dr. Serpe tries to teach his students, both in the lab and out.

Also vital to his success are his close connections to his team. Giving students career advice and weekly basketball tournaments has made this tight-knit team feel like a family, and has helped create the synergy needed for successful experiments.

# DR. MICHAEL SERPE



INSTITUTION:



PROJECT COST:

\$337,049



RCP AWARD:

\$128,000

DR. SERPE HAS ATTRACTED  
**\$2,883,637**  
SINCE RECEIVING RCP FUNDING IN 2011

## FUNDING ATTRACTION BREAKDOWN:

Dr. Serpe has attracted almost \$3 million from the following sources since receiving RCP funding:



**8** SPECIAL AWARDS & HONORS

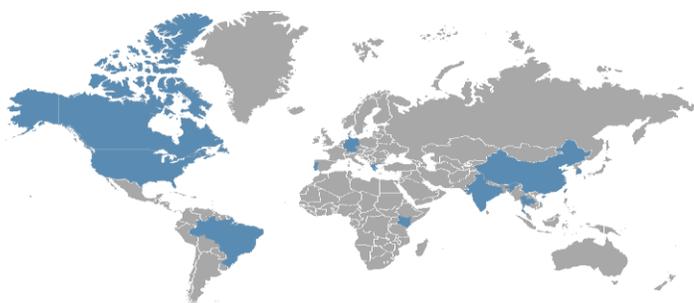
Including:

2012 Grand Challenges Canada Rising Star in Global Health

*"Using leading-edge sensor technology that Dr. Serpe and his group discovered and developed, Keystone Labs will generate a low cost, real-time cannabis analysis kit. Because of the versatility of the sensor technology, and its ability to be used for a myriad of applications, commercialization is imminent, and will help position Alberta as a leader in cannabis testing and analysis."*

Mr. Rod Szarka, BSc  
VP, Marketing and Business Development at Keystone Labs

ARIF ALIGNMENT:

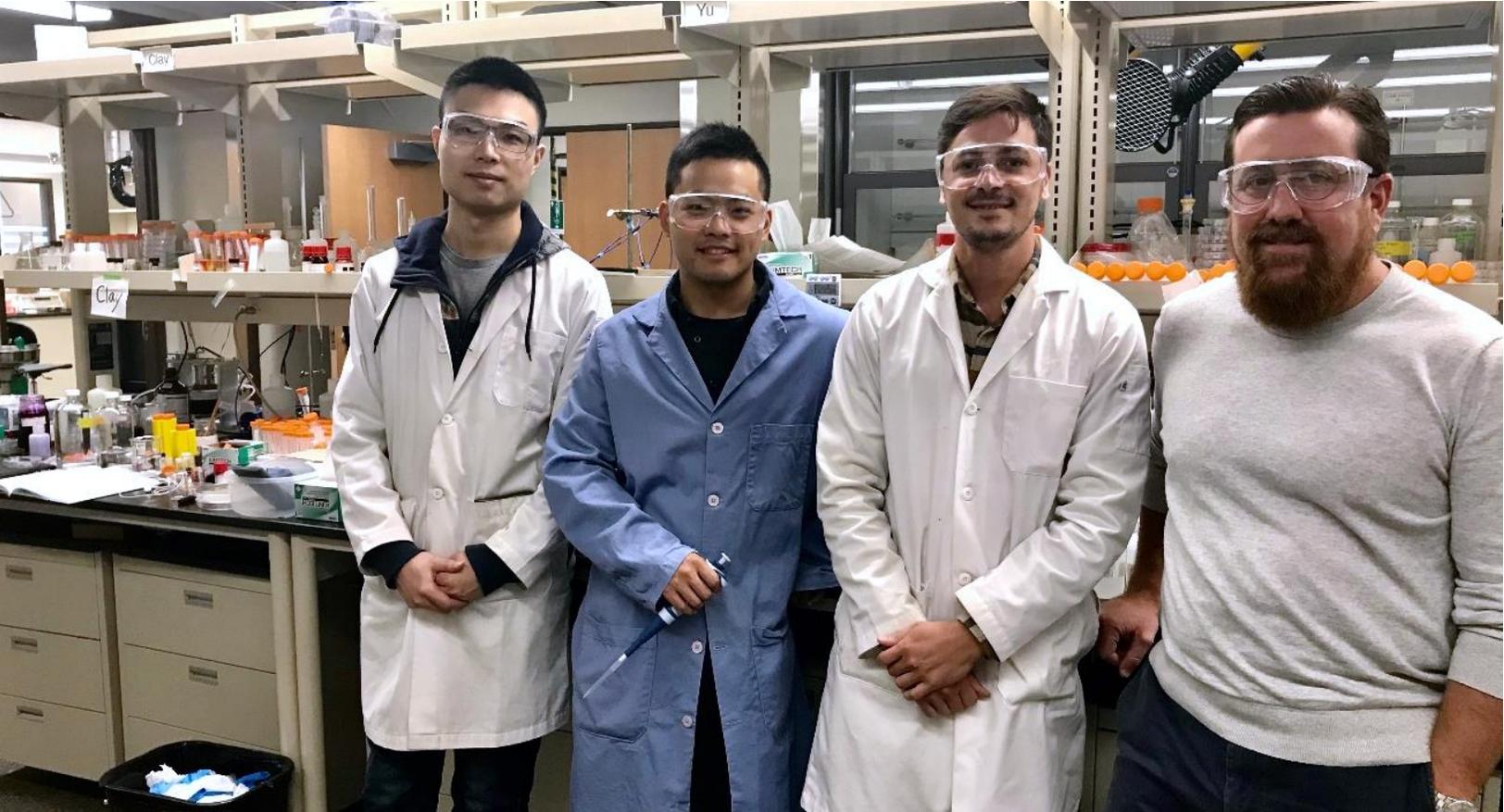


**12** NETWORKS ACROSS 12 COUNTRIES:  
20+ Industry and Academia Collaborations  
130 Presentations and Workshops

**1** SPIN-OFF COMPANY **mosic**  
& **1** PATENT

**172** HQP TRAINED





Dr. Serpe (far right) with a few students from his lab.

### THE SERPE GROUP

Complete with custom equipment funded by the RCP, CFI, and others, the Serpe Group has one of the best-equipped chemistry labs at the University of Alberta. Their most prized piece of equipment, unique worldwide, is a surface plasmon resonance spectrometer. Used for studying polymer conformations as they are brought within 10s of nanometers of each other, it is a critical component for developing and perfecting their sensor technologies. The infrastructure has allowed the team to pursue unique opportunities with industry collaborators and has attracted researchers to Alberta to work with the high-quality equipment.

#### Did You Know?



To inspire students to pursue their ideas, Dr. Serpe endorses exceptional undergraduate students with unique ideas, and provides them with training and laboratory access.

### TALENT GENERATION

Students that train in the Serpe Group are attracted by Dr. Serpe's well-known reputation in the academic and industry communities, as well as the impressive infrastructure in his lab. After graduating, many HQP pursue positions in industry, mostly working for oil and gas, environmental, or instrument companies.

Since receiving RCP funding in 2009, Dr. Serpe has attracted and trained over 170 HQP and has delivered 130 presentations on his exemplary research across 12 different countries.

## COMMERCIAL ACTIVITY

### COMPANY GENERATION

With many different developments underway, Dr. Serpe created a spin-off company to help commercialize the sensor technology and further pursue collaborations with industry. The company, **Mosaic Sensors**, will work with government and industry to create and commercialize sensor technology to test water quality, THC and CBD concentrations in cannabis, and hormones and bacteria concentrations in milk.



### TECHNOLOGY DEVELOPMENT AND COLLABORATIONS

Dr. Serpe has industry, academic and government partners, and several unofficial collaborators. One major academic-government-industry collaboration is Dr. Serpe's partnership with the German government through the German-Canadian Centre for Innovation and Research (GCCIR), and industry partners KeyStone Labs and Mildendo.

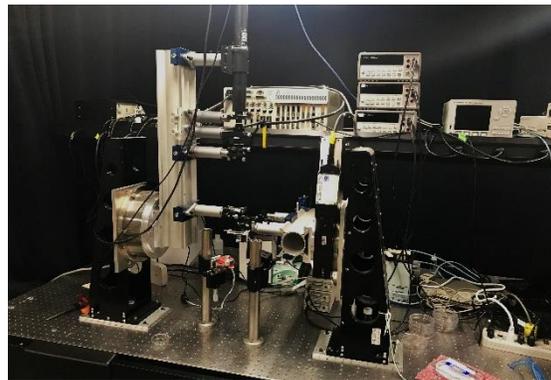
#### Did You Know?

The GCCIR is an initiative for the development of Canadian-European research and business relations, focusing on enhancing international knowledge and technology transfer.

This team of experts is coupling the coloured sensors made by the Serpe Group to quantify important components in plants and create testing kits for people growing cannabis to ensure the composition of the product being consumed.



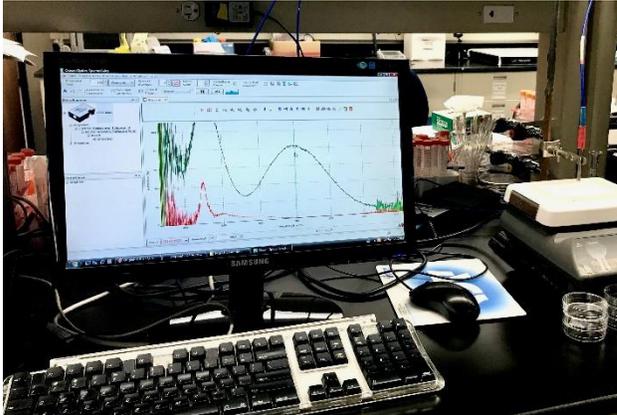
A hydrogel-based material that the group is using to make artificial muscles.



The surface plasmon resonance spectrometer, a highly specialized tool unique worldwide to the Serpe Group.

Other collaborations that Dr. Serpe has pursued include:

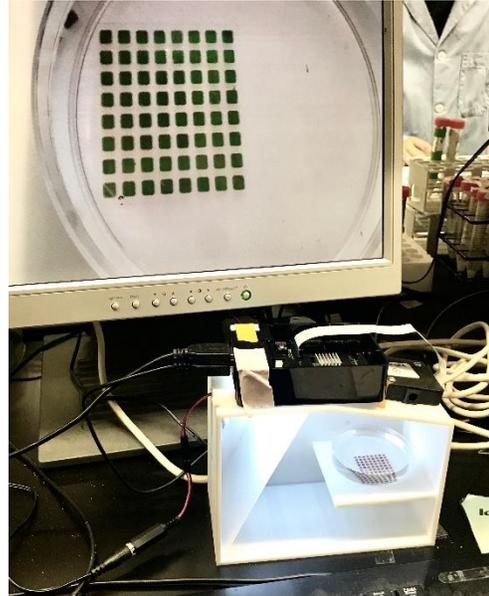
- Beijing's University of Science and Technology, to create sensors for detecting performance-enhancing drugs in urine
- Delta Remediation, to create sensors for remediating soil after oil and gas spills
- Exciton Technologies, to determine a way to embed nano particles in wound dressings to help heal wounds and prevent infections
- ...and many others!



This software measures the different colours emitted by the team's sensors to determine how the sensor reacted to the solution it was in.

### Investment Attraction

Since 2011, Dr. Serpe has received considerable funding support from the Canadian, German, Indian, and Chinese governments; provincial government; and private companies and organizations. The vast applications for his work have attracted \$2.88 million in funding support since 2011.



The sensor technology the team is working on. Each tiny square will turn a different colour in solutions, indicating the solution composition.

*“Being the first person to find and discover a certain phenomenon gives you a real thrill – and if that is with a student and they get to feel that too, then that is even better.”*

-Dr. Michael Serpe

### FUTURE PLANS

Working on a number of exciting projects, the Serpe Group is looking forward to many more inventions and attracting more collaborations to Alberta. One new project the group has started involves trying to make materials that react when touched and revert to the resting position when you want it to. Applications for this work could be in artificial muscles, or more abstract applications, such as in furniture and design, as Dr. Serpe pointed out after being approached by a multinational furniture company.

The team is also designing a sensor technology capable of identifying different solutes dissolved in water, such as various types of salts. The sensor will be composed of hundreds of nanocavity-based sensors that will respond to their environment in slightly different ways, making them each turn a slightly different colour in a solution. Using artificial intelligence and pattern recognition, the team will be able to identify the exact composition of complex liquid mixtures. These sensors will be used in water remediation technologies, and is on track to have prototypes released next year.



## Enhancing Drug Delivery

### Dr. Afsaneh Lavasanifar

#### THE RESEARCH

The need for creating a better quality of life for patients undergoing chemotherapy and other intensive drug therapies has gained prominence as a priority for public and private healthcare providers, pharmaceutical companies, and governments in many countries around the world. Intensive drug therapies are extremely tough on the body and often damage or kill healthy cells, at times, causing more pain and discomfort to patients than the disease itself.

As a pharmacist, Dr. Lavasanifar saw first-hand the effects of toxic drug therapy treatments on patients' physical and mental health, and began investigating methods to reduce these effects to improve her patients'

lives and quality of life. In 2011, the RCP awarded Dr. Lavasanifar \$377,614 to develop a targeted drug treatment to improve the quality of life for patients with cancer and inflammatory diseases. She has since developed a new nanotechnology for targeted drug delivery, submitted four additional patents, and has created a spin-off company to commercialize her technology.

There are many types of targeted drug therapies and Dr. Lavasanifar's team is developing many different methods, including new responsive and biodegradable gels and nanocarriers for smart drug delivery.

# DR. AFSANEH LAVASANIFAR



INSTITUTION:  
 UNIVERSITY OF ALBERTA



PROJECT COST:  
 \$974,322



RCP AWARD:  
 \$377,613

Recently celebrated as a Keynote Speaker at the 2019 TEC Edmonton Innovation Awards



ARIF ALIGNMENT:



DR. LAVASANIFAR HAS ATTRACTED

**\$4,153,028**



SINCE RECEIVING RCP FUNDING IN 2011

**1** SPIN-OFF COMPANY



**& 5** INVENTIONS/PATENTS

*"Dr. Lavasanifar's efforts have advanced drug delivery research and improved the possibility that patients will one day benefit from safer and more effective therapies."*

Joanna Preston  
 Associate Director, Technology Management, TEC Edmonton

**16** AWARDS & HONORS

Including:

- 2007 GalaxoSmithKline Early Career Award
- 2009 Sanofi-aventis/AFPC New Investigator Research Award
- 2014 Top cited paper in Current Cancer Drug Targets

**11** INDUSTRY & ACADEMIA COLLABORATIONS  
 including:



**60** HQP TRAINED



## ABOUT DR. LAVASANIFAR

Dr. Afsaneh Lavasanifar began her professional career as a pharmacist in Iran to combine her interests of understanding drug interactions with the body, and of providing patient-centered care. In 1996, Dr. Lavasanifar decided to pursue her PhD in Pharmaceutical Sciences to determine a way to decrease the side effects from intensive medical treatments.

After many offers, she chose to complete her studies at the University of Alberta, because of its excellent global reputation in pharmaceutical education and research. The knowledgeable researchers and supportive environment kept her in Alberta and her work has attracted students worldwide to the province. Training students that share her passion of improving the quality of life of patients and helping them succeed has been the most rewarding aspect of her role as a professor.

Looking forward to the near future, Dr. Lavasanifar is excited to see her innovations in a commercial environment. She envisions her innovations reigniting the interest of pharmaceutical companies worldwide, as she is pushing for development to be completed within the province to ensure synergy between her research team and the manufacturing process.

## THE LAVASANIFAR LAB

The Lavasanifar Lab focuses on the design and development of innovative delivery technologies to improve drug performance, with a particular focus on nanotechnology for improving cancer therapy. The RCP provided key infrastructure to the lab, including a facility for an important piece of specialized equipment, called the NMR, which is shared by other researchers at the university.

The unique infrastructure at Dr. Lavasanifar's lab, together with her innovative research, has spurred multiple academic collaborations within the University of Alberta, and beyond the institution. Dr. Lavasanifar's network stretches across Canada, the United States, Mexico, the United Kingdom, and China, incorporating researchers from pharmacy, medicine, and engineering backgrounds.

## TALENT GENERATION

Dr. Lavasanifar has trained over 60 HQP on the RCP-funded equipment, including students from Egypt, Saudi Arabia, Iran, and China. Roughly 60% of students that graduate from Dr. Lavasanifar's lab pursue careers in academia and 40% find positions in industry, such as pharmaceutical companies.



Dr. Lavasainfar's Lab.

## COMMERCIAL ACTIVITY

### COMPANY GENERATION

To commercialize the technology developed in her lab, Dr. Lavasanifar created a spin-off company, **Meros Polymers**, which has been pivotal in protecting her lab's technology and establishing collaborations with industry. The company is currently developing three separate systems for enhanced delivery of drugs to the body in collaboration with biotechnology, pharmaceutical, and polymer manufacturing companies in Canada, the United States, Japan, and Europe.



### TECHNOLOGY DEVELOPMENT AND INDUSTRY PARTNERS

Dr. Lavasanifar has teamed up with Cardiol Therapeutics, an Ontario-born biotechnology company specializing in the commercialization of novel drug therapies, to help develop and commercialize her new technology. This collaboration focuses on the development of anti-inflammatory nano-drugs designed to

enhance the delivery and concentration of the drug at the site of disease. This targeted drug delivery works by making drugs more accessible to the diseased cells in the body, and less accessible to the healthy tissues, which will decrease the drug's toxicity and side effects while enhancing its ability to work, allowing patients to take back their lives. Together with Caridol Therapeutics, Dr. Lavasanifar hopes to begin clinical trials in a few years and later partner up with large pharmaceutical companies to incorporate her technology into a wide range of drugs.

Dr. Lavasanifar has also pursued work with TEC Edmonton. In 2018, her and her team developed a topical gel that slowly releases medication to skin cells, which may have implications for melanoma (skin cancer) therapy. In addition, in 2016 and 2013, her and her team won TEC Edmonton Innovation Awards, which are awarded to researchers with revolutionary technologies, to help bring their innovations from the lab into the world.

#### Investment Attraction

Since obtaining the RCP and CFI awards, Dr. Lavasanifar and her team have attracted an additional \$4.15 million in funding from industry and private organizations, and federal and provincial government agencies.

#### FUTURE PLANS

Dr. Lavasanifar has ambitious plans for the future. With technology speeding up many processes, we are beginning to see more cancer breakthroughs and success stories, taking cancer from a fatal disease to a chronic illness. In ten years, Dr. Lavasanifar hopes to contribute to finding a cure for different types of cancers with a team of scientists from Alberta.



Drs. Somayaji (left) and Lavasanifar (right), with an NMR machine funded by the RCP.

# Microbes and Energy

## Dr. Marc Strous

### THE RESEARCH

As vital components of the province's economy, continuous work is required to ensure that Alberta's energy and mining sectors are functioning as efficiently and sustainably as possible. In 2013, Dr. Strous was recruited by the University of Calgary to apply his expertise in microbial processes to the province's energy and mining sectors. He began using microbes and metagenomics for bioenergy production, determining the effect of stray gas from hydraulic fracturing, and improving marine oil spill remediation. His exemplary work led to RCP funding of \$399,205 in 2014 to help pursue this research, as well as investigate energy bioengineering to further diversify and strengthen the province's energy sector.

Since receiving funding, Dr. Strous has made great strides across all of his projects. For his bioenergy project, he has combined algae with

### Did You Know?

Metagenomics is the study of the genomes of all microorganisms in a sample. It is used to determine what those microbes might be doing.

organic solar cells for cost effective generation of electricity while capturing carbon dioxide (CO<sub>2</sub>) from the atmosphere. To improve Alberta's mining sustainability, Dr. Strous used microbial communities in groundwater to map the impacts of hydraulic fracturing operations on groundwater, which is important for enabling the assessment of water quality impacted by mining activities. Lastly, he has explored extracting electricity from oil fields using microbes and supports collaborative research to de-risk offshore oil exploration.

### ABOUT DR. STROUS

Since childhood, Dr. Marc Strous was interested in the environment and the effects of pollution on ecosystems. As he began his PhD studies at Delft University of Technology in the Netherlands, he was introduced to microbial communities and their important roles in the environment. Pivoting his career to include these interesting microbes, Dr. Strous' expertise was highly sought after, and was recruited to various positions in Australia, the Netherlands, and Germany.

When Dr. Strous received a job offer to come to Alberta as a Campus Alberta Innovation Program Chair and Professor of Geoscience at the University of Calgary in 2013, he was excited about the unique opportunity and the ability to collaborate with skilled Albertan researchers.

Since his tenure at the University of Calgary, Dr. Strous has received an 'Established Career Research Excellence Award' (2016-2017) for his exceptional research, and a 'U Make a Difference Award' (2017) for creating an inclusive and diverse work environment.

# DR. MARC STROUS



INSTITUTION:



PROJECT COST:

\$1,132,338



RCP AWARD:

\$399,205

**2** SPIN-OFF COMPANIES



**& 2** INVENTIONS/PATENTS



ARIF ALIGNMENT:



DR. STROUS HAS ATTRACTED

**\$6,100,000**

SINCE RECEIVING RCP FUNDING IN 2014

LAUNCHED AN ANNUAL RESEARCH WORKSHOP

for academia and industry collaborators from all over the world.



## FUNDING ATTRACTION BREAKDOWN:

Dr. Strous has attracted over \$6 million from the following sources since receiving RCP funding.



■ RCP ■ Federal Government ■ Provincial Government ■ International Governments ■ Industry ■ Other

**2** AWARDS & HONORS

**42** HQP TRAINED

**12** NETWORKS IN 12 COUNTRIES





A few of Dr. Strous' HQP in the lab.

### THE ENERGY BIOENGINEERING AND GEOMICROBIOLOGY LAB (EBG)

The EBG is home to two research groups, with the Energy Bioengineering group led by Dr. Strous. The state-of-the-art infrastructure has attracted many HQP from Germany and Australia, as well as from across Canada. Students in Dr. Strous' lab gain valuable skills in metagenomics, chromatography, and DNA sequencing, and since 2014, over 40 HQP have been trained using the RCP-funded equipment. As well, with mentorship being the most rewarding aspect of Dr. Strous' career, he allocates one-on-one mentoring to each of his students and HQP, which has made them highly sought after by industry and academia upon graduation.



Researchers came to Calgary from almost every continent to participate in Dr. Strous' Metagenomics workshop.



“ *Research is a really great opportunity for economic diversification, and although it is hard to predict research outcomes, when you get that research that gives you a breakthrough, truly exciting things can happen.* ”

-Dr. Marc Strous

### COLLABORATIONS

Since 2018, Dr. Strous has been hosting week-long Metagenomics workshops, where more than 50 industry and academia investigators gather in Calgary from around the world to learn from Dr. Strous' research findings.

Dr. Strous and his team led workshops on metagenome library preparation and data analysis. The team also had lecture sessions hosted by Dr. Strous and Dr. Laura Sycuro from Alberta, and two additional researchers from Ontario and British Columbia.



More information on Synergia Biotech

## COMMERCIAL ACTIVITY

### COMPANY GENERATION

Dr. Strous co-founded the spin-off company **Synergia Biotech**, and helped a post-doctoral fellow create the spin-off company **SpiraVeg**. Synergia Biotech is scaling up a carbon capture and conversion technology, generating revenue by sales of a natural product. This technology will achieve CO<sub>2</sub> emissions reductions while creating revenue. SpiraVeg produces and delivers fresh algae as a superfood. Their product is already being used in restaurants across Alberta that specialize in high-quality nutrition.

## TECHNOLOGY DEVELOPMENT

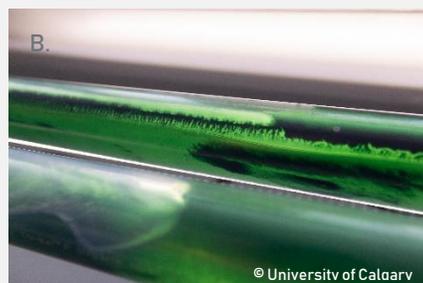
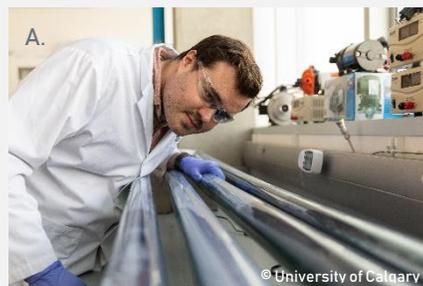
Currently, the team has printed organic electronics solar cells and is now working on combining these solar cells with algae. The algae will convert the red light from the sunlight into biomass and oxygen, and the organic solar cells will convert the remaining sunlight into electricity. Using the biomass produced by the algae, this device will eventually enable cost and energy effective CO<sub>2</sub> capture.

### Investment Attraction

Since obtaining the RCP award in 2014, Dr. Strous and his team have attracted an additional \$6.1 million in funding from federal and provincial government agencies, and industry partners. Dr. Strous believes that the RCP was instrumental in supporting his research and in garnering funds from other investors.

## FUTURE PLANS

Over the next five years, Dr. Strous is working towards creating a process to convert CO<sub>2</sub> into energy by using microbial communities. He currently is investigating how much CO<sub>2</sub> per unit of land in Alberta can be converted, and will next explore which microbial communities would be most effective. With so many discoveries and exciting work continuously happening, he wants to take advantage of this great opportunity for diversification and harness Alberta's CO<sub>2</sub> emissions to create sustainable electricity.



A. HQP Richardson inspecting the solar biocells.

B. A close-up of Dr. Strous's solar biocells.

C. HQP Tervahauta holding a jar of algae.

# The Parkinson Puzzle

## Dr. Gerlinde Metz

### THE RESEARCH

Affecting thousands of Albertans, Parkinson disease (PD) is the second most common neurodegenerative disease, after Alzheimer's. Triggered by a chemical imbalance in the brain causing improper signaling to the body, PD results in tremors, rigidity, and slowed movements. These symptoms are why PD is commonly mistaken for the natural signs of aging. As the disease worsens, patients lose their motor skills, and roughly 65% of patients pass away within the first six-years of the disease onset.

Noticing Alberta's high rates of PD, Dr. Metz began investigating the link between the brain and neurodegenerative processes. In 2005, Dr. Metz received RCP funding of \$47,450, and has now uncovered a link between elevated levels of stress hormones and the degenerative effects of PD on the brain. This breakthrough spurred partnerships between Dr. Metz and top clinicians and neurologists across Canada to begin looking into how stress affects patients with other types of neurodegenerative diseases and traumatic brain injuries.

### TALENT GENERATION

Since obtaining RCP-funding, Dr. Metz has raised the University of Lethbridge's profile as a leader in neurological research by establishing a long-term research program.

The RCP-funded infrastructure played a significant role in fostering interdisciplinary collaborations and training opportunities. From the 171 HQP trained in Dr. Metz's Lab, the University of Lethbridge has received over 250 recognitions, awards, and/or studentships.

### Did You Know?

PD has a huge impact on Alberta's economy, costing public health care approximately \$1,000 per month per patient, surpassing \$45.8 million per year, as calculated by the Parkinson Association of Alberta.



Dr. Metz training a student.

## COMMERCIAL ACTIVITY

### COMPANY GENERATION

Dr. Metz's passion to pursue impactful and translational research has inspired her students to develop medical technologies for commercialization and generate companies.

The company, **Synbiologica Ltd.**, was developed by Dr. Metz's student, Isaac Ward. With her guidance, Isaac developed a medical device that can identify increased levels of different hormones, indicating risk of certain diseases. Commercialization of this device will give neuroscientists, diagnosticians, and medical and livestock researchers, the ability to immediately observe hormonal changes in patients and treat patients before the disease shows symptoms.



Isaac Ward (far right) and his team.

## COLLABORATIONS

Since receiving RCP funding, Dr. Metz has expanded her collaborations with other researchers at the University of Lethbridge's renowned Canadian Centre for Behavioural Neuroscience. New connections have also been formed with investigators in various disciplines (including neurology, rehabilitation medicine, and biology) across Alberta, Canada, the United States, Australia, and Germany.

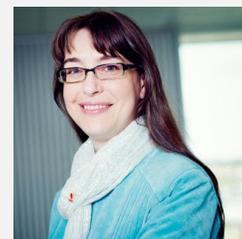
Furthermore, Dr. Metz's collaborative efforts have reached into the private sector, partnering with Alberta companies and organizations interested in PD and similar diseases. Recently, Dr. Metz partnered with the Hotchkiss Brain Institute, and found evidence indicating that motor performance could be modified by lifestyle factors, such as poor nutrition, limited exercise, and adverse experiences. These factors cause elevated levels of stress hormones, which increases a person's risk for developing Parkinson disease.

## FUTURE PLANS

This research has the potential to improve the accuracy of brain diagnoses and identifying appropriate therapeutic programs. The Metz team soon hopes to expand their expertise to personalized medicine, therapy, and rehabilitation for patients.

### ABOUT DR. METZ

Dr. Gerlinde Metz has always been intrigued by stress, how it affects our brains, and its relation to neurodegenerative diseases. After pursuing her studies in Germany and Switzerland, Dr. Metz became interested in the unique training opportunity in behavioural neuroscience at the University of Lethbridge. Still passionate for this rapidly expanding area, Dr. Metz continues to teach as a professor of Neuroscience and a Tier 1 Board of Governors Research Chair at the Canadian Centre for Behavioural Neuroscience.



# DR. GERLINDE METZ



INSTITUTION:  
 University of Lethbridge



PROJECT COST:  
**\$310,135**



RCP AWARD:  
**\$47,450**

DR. METZ HAS ATTRACTED OVER  
**\$51,848,724**  
 SINCE RECEIVING RCP FUNDING IN 2005



Including a \$500K grant from NSERC in 2019.

*"More than 8,000 Albertans are affected by Parkinson disease. The disease devastates the nervous system, causing tremors and making it hard to move, walk and balance. It robs people of their voices, leaving behind only a whisper. Parkinson's changes a person's moods, thinking and concentration, and makes it hard to sleep."*

The Parkinson Association of Alberta

## FUNDING ATTRACTION BREAKDOWN:

Dr. Metz has attracted over \$51 million from the following sources since receiving RCP funding.



**19** INDUSTRY, GOVERNMENT & ACADEMIA COLLABORATIONS

**171** HQP TRAINED

ARIF ALIGNMENT: 



**1** SPIN-OFF COMPANY 

# Advancing Clean Energy Technologies

## Dr. Vita Martez

### THE RESEARCH

Recognizing the need for innovative clean energy technologies with a minimal environmental impact, Dr. Martez is investigating barriers to energy efficiency and zero GHGs in steam generation, including water treatment to enhance recycle and conservation. Her success led to two RCP awards in 2013 and 2018 which helped establish the Centre for Energy Research and Clean Unconventional Technology Solutions (CERCUTS). This centre implements environmentally sound, reliable, and highly efficient clean energy solutions with industry collaborators.

#### Did You Know?

CERCUTS' unique infrastructure include Once Through Steam Generators (OTSGs) – the first of their kind in Canada- and fuel cells and energy storage systems.

Funding support has developed many SAIT facilities which include:

- Mobile air quality and environmental laboratories
- Water Research and Innovation Laboratory
- Steam Generation Research Facility-OTSG Labs
- Clean Technology and Innovation Laboratory

Using this infrastructure, Dr. Martez and her team are working on clean technologies that integrate unconventional and alternative energy, testing natural gas or biogas fuel cells with electric micro-grids and battery storage systems for low-carbon power generation and clean water supply. This research will help advance high value, clean energy and water technology solutions with a reduced environmental footprint and low carbon advantage.



### ABOUT DR. MARTEZ

Dr. Vita Martez was recruited by SAIT's Applied Research and Innovation Services (ARIS) for her renowned expertise in conducting multi-disciplinary applied research in chemical technologies, process and environmental engineering.

A rewarding aspect of her role has been the ability to deliver two water treatment trailers. The first trailer generated clean water and power, and the second trailer provided clean drinking water for community generation or disaster relief. Her creativity, ingenuity and hard work has led to patents and some environmentally and economically sustainable solutions for the benefit of society and industry.

Dr. Martez currently holds the NSERC Industrial Research Chair for Colleges in Oil Sands in Situ Steam Generation, and serves as a technical advisor for Cleantech. She is a recognized leader in her field, with over 20 years of industry experience and award-winning applied research.



The Applied Research and Innovation Services (ARIS) laboratory at SAIT.

## TALENT GENERATION

The unique infrastructure and equipment from RCP funding continues to attract many industry experts and provide experiential training to HQPs. Dr. Martez has provided applied research opportunities for real world problem solving and hands-on skills to students from SAIT, Universities of Calgary and Western Ontario, including professionals (faculty and investigators). 12 PhD engineers from GE's Global Research centre and others have sought training in SAGD water treatment. The relevance of hands-on training in energy and water has resulted in HQPs receiving STEAM job offers from the transportation, bio-tech, construction, energy IOT and other sectors; including placement of HQPs at Imperial Oil and Shell.

## COMMERCIAL ACTIVITY

### TECHNOLOGY DEVELOPMENT

Dr. Martez's four patents have been transferred to local companies to enable greater economic contribution and spur employment opportunities. The first US patent is a dust control product from plant sources. The product enabled Q-X Enviro Products to reduce erosion on unpaved roads and protect trees at the Siksika First Nation, provide feed lot soil stabilization at

Vegreville, and dust control solutions for secondary roads in many municipalities in Alberta and at Teck, British Columbia.

The second US and Canadian patent is a novel electrolyzer which enabled Volker Stevin Canada to build a 52 foot transportable system for both surface and sub-surface water remediation. Voluntary revenues from the patent was directed to the next generation of students.

Lastly, the international Patent Cooperation Treaty patent for the innovative hybrid water desalination system enabled Trilogy Environmental Systems Inc. to turn seawater into clean drinking water for rural, remote and small communities, and for emergencies overseas. Overall, her research has enabled many companies sustain their technology competitiveness.

In November 2019, Dr. Martez received a fourth patent, *Beneficial Reuse of Drill Cuttings*, in partnership with Newalta, now Tervita Corporation, an Alberta-based waste and environmental services company. The patent could enable a circular economy from waste to resource stewardship.

## INDUSTRY & ACADEMIC COLLABORATIONS

As a strong believer in collaborations, Dr. Martez works with R&D researchers from NAIT, InnoTech, the Universities of Calgary and Alberta, scientists from NASA's ALIAS program and ConocoPhillips, USA. Industry collaborations include partners, ranging from start-ups/small- and medium-size enterprises to international energy companies. Industry partners use these results to launch prototypes at higher technology readiness levels, in order to test technology pilots for markets or future scale-up.

## FUTURE PLANS

In 10 years, Dr. Martez hopes to have made multiple impactful contributions to Canada's in-situ sector by pushing energy efficiencies towards net zero GHG emissions, and integrating clean energy technologies with low carbon-energy systems. She envisions energy transformation capable of using local natural resources without compromising the environment and the needs and prosperity of current and future generations of Canadians.

# DR. VITA MARTEZ



INSTITUTION:



PROJECT COST:

\$1,999,535



RCP AWARD:

\$799,525

## FUNDING ATTRACTION BREAKDOWN:

Dr. Martez has attracted over \$8 million from the following sources since receiving RCP funding.



DR. MARTEZ HAS ATTRACTED  
**\$8,060,000**  
 SINCE RECEIVING RCP FUNDING  
 IN 2013



**4** PATENTS

**436**  
 HQP TRAINED

**12** AWARDS & HONORS

Including:

2006 - Water Innovation in the Oil Patch Conference-PTAC

2015 - Innovative Thinker Award, from the World Oil Awards

2015 - Team Award- Best Health, Safety, Environment and Sustainable Development - Onshore Award, from the World Oil Awards

ARIF ALIGNMENT:



**25+**

INDUSTRY & ACADEMIA COLLABORATIONS



# Diamonds & Technology

## Dr. Paul Barclay

### ABOUT DR. BARCLAY

Dr. Paul Barclay completed his PhD at Caltech (California Institute of Technology) in 2007 and joined Hewlett-Packard Labs in 2008 to study the emerging field of diamond quantum nanophotonics. Attracted by the province's early investments in quantum and nano research, Dr. Barclay chose to pursue his career in Alberta, and in 2011, became a professor at the University of Calgary and a member of Quantum Alberta.

Dr. Barclay's impressive research and his innate intrigue for creating sensors that advance the state-of-the-art by combining unique materials, innovative engineering, and new physics has attracted many young minds to Alberta to study in his lab. Most recently, he and his team pioneered a technique to create nanomechanical force sensors from diamond, arguable the ultimate mechanical material, which may soon be used in many different quantum sensing technologies.

Also passionate about providing impactful and relevant opportunities to his students, Dr. Barclay established the first lab partnership between the University of Calgary and the NRC-UAlberta Nanotechnology Initiative. This partnership provides students with unique training opportunities and the tools needed to solve real-world problems.

### THE RESEARCH

Nanomechanical resonators have recently received significant attention from the scientific community for their wide range of applications – from the early detection of diseases like cancer, to enhanced performance of touch-screen technology. To ensure Alberta's position as a leader in the fields of both quantum and nano technology, the RCP awarded Dr. Barclay with funding of \$290,057 in 2012 to establish the Quantum

Nanophotonics Lab (QNL) and create ultra-sensitive and ultra-efficient devices.

The devices created by the QNL are among the most sensitive in the world and have the potential to enhance the performance and speed of technologies that rely on mechanical sensing, such as cell phones, navigation devices, hand-held drug testing devices, and environmental sensing devices.

This work has provided insight into the fundamental properties of quantum systems, and created a physical platform for testing new concepts in quantum computing. Advancements by Dr. Barclay and the QNL have helped establish Alberta's known leadership in nanophotonic sensor technology.

#### Did You Know?

Quantum nanophotonics involves transmitting light through wires. It is like fibre optic technology, but at a much smaller and complex scale, allowing large amounts of information to be transmitted rapidly.

# DR. PAUL BARCLAY



INSTITUTION:  
UNIVERSITY OF CALGARY



PROJECT COST:  
\$776,542



RCP AWARD:  
\$290,057

DR. BARCLAY HAS ATTRACTED  
**\$10,234,000**

SINCE RECEIVING RCP FUNDING IN 2012



**45**

HQP TRAINED



**1**

INVENTION /PATENT

## FUNDING ATTRACTION BREAKDOWN:

Dr. Barclay has attracted over \$10 million from the following sources since receiving RCP funding.



■ RCP

■ Federal Government

■ Provincial Government

■ Industry

■ Other

*"We have been working with Dr. Barclay and his collaborators at Quantum Alberta over the past 5 years. As a high-tech Canadian company, and an Alberta SME with exports to more than 40 countries worldwide, we see a tremendous value in collaborating on frontier technologies developed by his group. Technologies developed under this project are major milestones in our long term product road-map and we plan to stay engaged with the team to help with the commercialization of this technology in the next few years."*

Hooman Hosseinkhannazer, MSc, PEng, PMP  
VP Business Development, Norcada Inc

**5**

INDUSTRY & ACADEMIA COLLABORATIONS

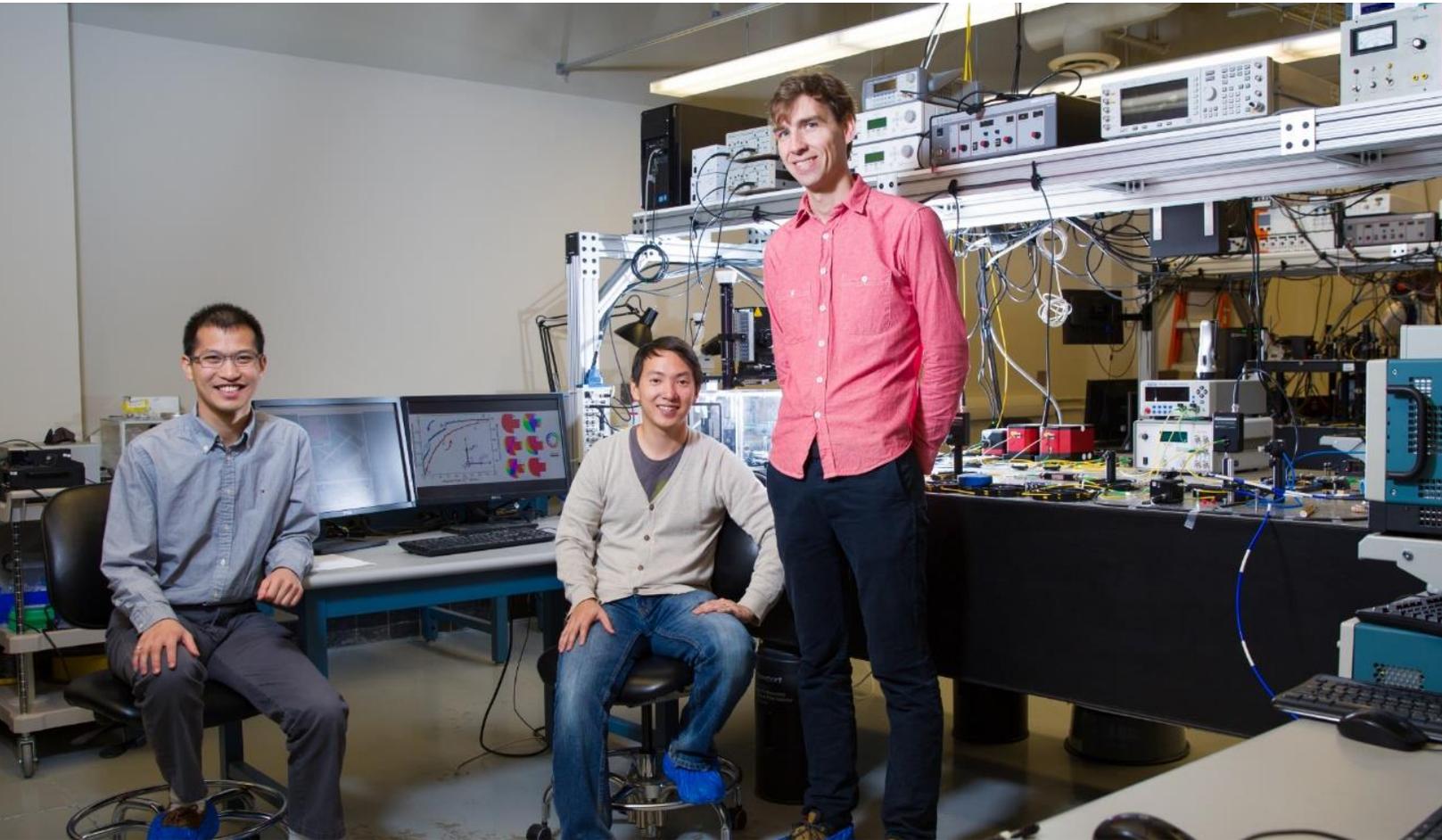


National Institute for Nanotechnology



ARIF ALIGNMENT:





Dr. Barclay (right) with his students.

### THE QUANTUM NANOPHOTONICS LAB (QNL)

RCP funding enabled Dr. Barclay to attain valuable equipment for the QNL, such as:

- Optical testing and spectroscopy equipment
- A cryogenic cooling system
- Computer hardware and software

The QNL is the first collaborative venture between the University of Calgary's Institute for Quantum Science and Technology (IQST) and the NRC-UAlberta Nanotechnology Initiative.

Since its launch, the QNL has established Alberta as a leader in nanophotonic sensor technology and has been awarded an NSERC Discovery Accelerator Supplement for its exceptional contributions.

In 2019, Dr. Barclay was awarded the prestigious Canadian Association of Physicists Herzberg Medal for his outstanding achievements in research. Awarded to one Canadian physicist annually,

Dr. Barclay is the first Albertan to win the medal since it was established in 1970.

### ACADEMIC COLLABORATIONS

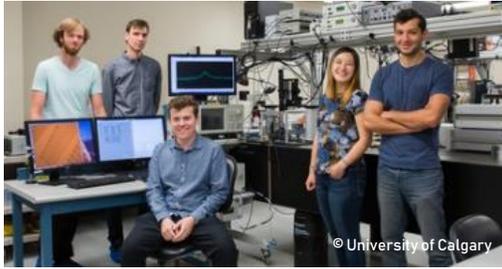
The QNL collaborates with top researchers in at the University of New Mexico and the National Institute of Standards and Technology; and has several active collaborations with researchers across Alberta. Working in close relation to the University of Alberta's nanoFAB, both teams continuously collaborate to take advantage of the facilities, benefiting academic and industrial users.

#### Did You Know?

NanoFAB is a national, open-access training, service, and collaboration centre, focused on academic and industrial applications in micro- and nanoscale fabrication.

## TALENT GENERATION

Dr. Barclay enjoys teaching and helping students make impactful contributions to the world of quantum computing and nano research. The QNL has played a pivotal role in providing students with the skills needed to develop entrepreneurial activity in this sector. Since receiving RCP funding, the QNL has hosted students from around the world, training over 45 students.



Dr. Barclay (second from the left) and his team.

## COMMERCIAL ACTIVITY

The team's research has opened many opportunities for company generation, and Dr. Barclay continuously offers support and guidance to his students that are developing technology and database related companies.

## TECHNOLOGY DEVELOPMENT

Recently, Dr. Barclay was involved in the development of a nanosized device with new sensor technology made from a single crystal of diamond. This technology could lead to applications ranging from highly sensitive sensors and enhanced magnetic storage of computer information, to a "laboratory-on-a-chip," used for analyzing materials in any nanoscale condensed matter system. The team continues to work to bring this technology to the commercialization stage.

### Did You Know?

Diamonds are excellent for the ultra-sensitive sensors in Dr. Barclay's highly complex devices because of their tough structure and compatibility with extreme environments.

## INDUSTRY PARTNERS

Dr. Barclay's research regularly intersects with the private sector. To date, the QNL has partnered with several companies, including Norcada, an Edmonton company that designs and manufactures micro-electro-mechanical devices, and Lumerical, a Vancouver company that develops photonic simulation software. Dr. Barclay has also worked with Hewlett Packard Labs in California, and the University of Alberta's nanoFAB and Nanotechnology Research Centre.

## INVESTMENT ATTRACTION

Since obtaining the RCP and CFI awards, Dr. Barclay and his team have received an additional \$10 million in funding from federal, provincial, and industry agencies.

## FUTURE PLANS

Dr. Barclay is passionate about pursuing foundational and innovative research to ensure Alberta is at the forefront of the quantum technology explosion, which is anticipated to emerge in the near future. Working to provide opportunities to learn with leading-edge technology, Dr. Barclay and the QNL are actively seeking more collaborations with industry and academia to advance their technology and develop real-world solutions, particularly in lasers and sensors.

# Sustainable Solutions in the Oil Sands

## Ms. Andrea Sedgwick

### THE RESEARCH

With more than 165 billion barrels of bitumen in reserves, Alberta's oil sands are among the world's largest deposits of crude oil. While the oil sands play an important role in influencing energy markets, jobs, and revenue in the province, many top researchers are developing novel solutions to reduce their ecological footprint. In 2012, the RCP awarded infrastructure funding of \$798,204 to establish the Centre for Oil Sands Sustainability (COSS) at the Northern Alberta Institute of Technology (NAIT), which works with industry to develop technologies that improve the economic and environmental performance of the oil sands.

Leading the team since 2016, Sedgwick has made great strides in tailings pond management and remediation, water technology for reducing freshwater use, advancing water treatment techniques, and improving measuring and monitoring technologies to reduce the cost and environmental impact of oil sands operations.



HQPs working through an experiment in the COSS.

### Did You Know?

Oil sands are a mixture of sand, clay, water, and bitumen. Bitumen is extra-heavy crude oil, some of which is so viscous that it cannot flow on its own, and about 80% of the recoverable bitumen reserves in Alberta are buried too deep to mine and can only be recovered by drilling wells.

### CENTRE FOR OIL SANDS SUSTAINABILITY (COSS)

The RCP provided infrastructure funding to help establish the COSS, a state-of-the-art research lab that carries out applied research, pilot testing and technology development to meet the needs of Alberta's oil sands industry.

Led by Sedgwick, the team is comprised of expert applied scientists, engineers, technicians and students. Students working at the COSS acquire critical research skills and are highly sought after by industry upon graduation, with many recruited to Alberta based companies, including Syncrude.

## ABOUT MS. SEDGWICK

As a mining engineer by study, Ms. Andrea Sedgwick took an interesting journey to begin her career at the Northern Alberta Institute of Technology (NAIT). She pursued her engineering career after graduation, but later left her mining design work to enter the oil sands field. Growing up in Northern Alberta, she always had an affinity for preserving Alberta's unique and beautiful landscape and started looking for a career to combine all of her interests. In 2007, she began working at Total E&P Canada, a French petroleum refining company, and launched a research-working group for tailings ponds. It was with this group that she began working with NAIT as an industry collaborator. She immediately saw a vision of where NAIT could go and decided to enter the realm of applied research and work at the institution.

Although Sedgwick has only worked at NAIT for four years, the program has grown significantly since she joined, garnering more industry and academia collaborators, and teaching HQP critical skills for success in the oil and gas sector. This progress, and the excellent team of scientists and engineers that she works with, are the most rewarding aspect of her role. Sharing their passion for Alberta's oil and gas success in an environmentally sustainable way fuels Ms. Sedgwick's work and further pushes her curiosity.

## COMMERCIAL ACTIVITY

### INDUSTRY & ACADEMIC COLLABORATIONS

Sedgwick strongly believes that the key to developing impactful technologies and progressing the oil sands' sustainability is in collaborating with industry.

Currently the group has teamed up with Canada's Oil Sands Innovation Alliance, to build a one of a kind high pressure, high temperature water treatment pilot. This pilot, when completed in 2020, will be able to test low cost polymeric membrane technologies in SAGD conditions. The work with this pilot will de-risk new technologies by allowing them to test on a smaller scale, with successful technologies having the correct data to qualify for large scale testing at the WTDC (Water Treatment Development Centre).

Sedgwick is also working with Enbridge and TC Energy to reduce the toxicity of multiple common tests used in the lab. The team is in the process of sourcing non-toxic chemicals capable of achieving the same or better results than the current chemicals, and will begin rigorous testing once promising results are obtained.



Ms. Andrea Sedgwick

## FUTURE PLANS

To reach her ultimate goal of bringing increased sustainability to the oil sands, Sedgwick has devised a two-pronged approach:

- Developing environmental technologies that can help reduce the greenhouse gases in the atmosphere and speed up reclamation processes
- Focusing on obtaining reliable data to approach the problems in a holistic, transdisciplinary, and multisectoral manner.

# MS. ANDREA SEDGWICK



INSTITUTION:



PROJECT COST:

\$2,043,710



RCP AWARD:

\$798,204

## FUNDING ATTRACTION BREAKDOWN:

Ms. Sedgwick has attracted over \$10.5 million from the following sources since receiving RCP funding.



**11** INDUSTRY & ACADEMIA COLLABORATIONS



MS. SEDGWICK HAS ATTRACTED

**\$10,586,989**

SINCE RECEIVING RCP FUNDING

IN 2011

ARIF ALIGNMENT:



Since the grant award, NAIT has developed specialties in tailings management processes, method improvements, and water management. The use of the infrastructure has allowed industry to better understand the impacts of water treatment techniques and how they can be used to return water back into the ecosystem.



# The Power of Protein

## Dr. Jianping Wu

### THE RESEARCH

Eggs have long been recognized as an excellent source of protein and nutrients. The increased demand for Alberta's high-quality eggs and egg whites however, has resulted in an increase of wasted poultry products.

Looking for ways to reduce this issue, the RCP awarded Dr. Wu with \$120,000 in 2009 to investigate alternative uses of poultry by-products. Dr. Wu and his team have since identified an important protein found in egg yolk, **phosvitin**, which greatly enhances bone health, and the team is now developing a method to extract the phosvitin from egg yolks. Looking for commercialization support and industry expertise, Dr. Wu partnered with

Michael Foods, a leading innovative food processing company, to create a natural supplement for improved bone health.

### Did You Know?

2 million Canadians have severely poor bone health, or osteoporosis.

The commercialization of these natural health supplements, coupled with the reduction in egg yolk wastage and Dr. Wu's newly developed protein extraction method is expected to have a large global impact on the poultry, pharmaceutical, and health foods industries.



### ABOUT DR. WU

Dr. Jianping Wu's curiosity about the uses and benefits of proteins led him to pursue many research opportunities within Canada and the United States after completing his PhD at Jiangnan University in Food Science. After working in the field, he was drawn to Alberta for its collaborative network between researchers, industry, and government in agriculture and food science. Dr. Wu continues his passion to collaborate with industry and government and produce results for real-world problems with an even greater impact.

## THE POULTRY RESEARCH CENTRE (PRC)

The PRC is an international leader in poultry research, located at the University of Alberta. The lab supports the poultry industry with scientific input on production and food issues, and works on a wide range of poultry research – from improving animal welfare, to identifying uses for undervalued by-products. This work greatly improves industry efficiency and sustainability.

The RCP funding allowed Dr. Wu to acquire specialized equipment to further Alberta's poultry sector. The infrastructure has enabled Dr. Wu and his team to establish partnerships with research facilities and organizations to achieve greater outcomes.

### TALENT GENERATION

In the PRC, highly qualified personnel develop essential skills to become leaders in Alberta's poultry and egg industries and Canada's livestock industry. 25 trainees use the infrastructure on an annual basis, and students are attracted from the United States, Mexico, Brazil, Chile, Japan and China.

The critical skills garnered from the PRC has provided opportunities for students at various companies, including KraftHeinz and Loblaw's.



Dr. Wu and his students in the PRC Lab.

### COLLABORATIONS

Aside from Michael Foods, the PRC has many longstanding partnerships, including ongoing relationships with the Egg Farmers of Canada and Alberta to promote the health benefits of eggs and develop higher-value food products.

### COMMERCIAL ACTIVITY

#### TECHNOLOGY DEVELOPMENT

Dr. Wu and his team are in the process of partnering with industry to translate their research into commercial activity. The team is developing technology to identify proteins with great health benefits for use in natural health supplements. Currently underway are supplements to enhance bone health and to combat common chronic diseases associated with aging.

#### Did You Know?

Eggs contain natural proteins that improve health and help prevent diseases such as cardiovascular disease, metabolic disease and hypertension.

### FUTURE PLANS

Within the next ten years, Dr. Wu and his team expect to have commercialized natural health products on the market. These products will use proteins found naturally in eggs to combat aging diseases.

# DR. JIANPING WU



INSTITUTION:



PROJECT COST:

\$384,897



RCP AWARD:

\$120,000



DR. WU HAS ATTRACTED

**\$7,564,897**

SINCE RECEIVING RCP FUNDING IN 2011

*"As an innovator in egg science and technology, Dr. Wu has been an integral part of our Research Program at Egg Farmers of Canada. His expertise in non-food uses of eggs bolsters our industry and has applicability both provincially and nationally."*

Mr. Tim Lambert  
Chief Executive Officer, Egg Farmers of Canada

ARIF ALIGNMENT:



*"Dr. Wu has made significant contributions to the fundamental understanding of the avian egg leading to new applications for egg and egg components for food, nutritional, and pharmaceutical application. His leadership is felt around the world through his active involvement in research. He brings value to the industry through his insights and new opportunities."*

Dr. Jonathan Merkle  
VP, Research, Development and Innovation; Chief Science Officer at Michael Foods

## FUNDING ATTRACTION BREAKDOWN:

Dr. Wu has attracted over \$7 million from the following sources since receiving RCP funding.



■ RCP ■ Federal Government ■ Provincial Government ■ International Governments ■ Industry ■ Other

**4**

INDUSTRY & ACADEMIA COLLABORATIONS

**1**

PATENT

**65**

HQP TRAINED



# Zebrafish for Epilepsy

Dr. Deborah Kurrasch

## THE RESEARCH

Epilepsy is a neurological disorder caused by sudden, excessive electrical discharges in the brain, resulting in seizures. While severity of the condition varies from person to person, some epilepsy sufferers experience hundreds of seizures per day. As the current treatment for epileptic seizures has no effect in about 30% of patients, many researchers are investigating new solutions to combat the disorder.

Epilepsy affects people of all ages and backgrounds, and even affects animals. Because of this, and their close genetic makeup to humans, **zebrafish** are being studied to identify potentially new treatment options. In 2012, Dr. Kurrasch received RCP funding of \$245,720 to apply her knowledge in zebrafish genetics to neural development and epilepsy in children. Recently, she identified how different mutations affected zebrafish brain function and, using her newly developed drug-screening platform, identified drugs that stopped their seizures. With such positive results, Dr. Kurrasch is now applying this knowledge in clinical trials at the Alberta Children's Hospital.

## TALENT GENERATION

The state-of-the-art zebrafish facility has allowed the recruitment and training of 37 HQP at the University of Calgary in neurology and drug development. The RCP-funded infrastructure has enabled the team to undertake diverse approaches to understand and address why some patients remain unresponsive to common treatment methods.

## ABOUT DR. KURRASCH

Dr. Deborah Kurrasch pursued her studies in the United States at Purdue University and the Universities of Texas and California in pharmacology and genetics. Dr. Kurrasch was attracted to Alberta for the University of Calgary's unique relationship with the Alberta Children's Hospital. This relationship and the research environment at the University of Calgary has allowed her to work directly with families and clinicians to tackle childhood disorders, such as epilepsy and autism, in creative and impactful ways.



Dr. Kurrasch and HQP Dr. Ibhazehiebo

## COLLABORATIONS

Dr. Kurrasch strongly believes that strategic partnerships between industry and academia are critical for research success, emphasizing that "science is bigger than just one lab." To advance neuro-development research, the Kurrasch Lab has ongoing projects with research labs and industry partners with key players across North America and Europe. These collaborations, together with her partnership with Dr. Jong Rho from the Alberta Children's Hospital Research Institute, have raised the University of Calgary's profile worldwide, and has led to major drug discovery research for neurological disorders.

## COMMERCIAL ACTIVITY

### COMPANY GENERATION

Dr. Kurrasch's work has led to the creation of a spinoff company, **Path Therapeutics**, which houses her newly created zebrafish drug-screening platform. The platform uses precision genomics to identify genes that cause neurological diseases and disorders, such as epilepsy, and design new therapeutic drugs to treat these conditions. Path Therapeutics is currently in discussions with investors for product commercialization, and large pharmaceutical companies looking to use her platform to design new drugs.



## FUTURE PLANS

With the first clinical trials to begin in summer 2018 at the Alberta Children's Hospital, Dr. Kurrasch's research has been a ray of hope for the families of children who suffer from hundreds of epileptic seizures daily. She is continuously working to improve patient livelihood and identify effective treatment for epilepsy sufferers, and hopes to soon adapt the platform to identify treatment for other disorders, such as autism.



Dr. Kurrasch holding a zebrafish tank.

# DR. DEBORAH KURRASCH



INSTITUTION:



PROJECT COST:

\$736,880



RCP AWARD:

\$245,720

DR. KURRASCH  
HAS ATTRACTED  
**\$6,618,000**  
SINCE RECEIVING  
RCP FUNDING  
 IN 2011

**1** SPIN-OFF  
COMPANY   
& **2** INVENTIONS/  
PATENTS 

ARIF ALIGNMENT:



*"Dr. Kurrasch's contribution in the area of precision medicine has the potential of uncovering targeted therapeutic treatments for patients based upon their unique genetic profile. The long-term benefit of more personalized medical intervention is the potential for preventing or treating diseases which have historically burdened Alberta's healthcare system."*

Mr. Jason Orbaugh  
Director of Business Development, Path Therapeutics, Inc.

## FUNDING ATTRACTION BREAKDOWN:

Dr. Kurrasch has attracted over \$6.6 million from the following sources since receiving RCP funding.



**11** INDUSTRY &  
ACADEMIA  
COLLABORATIONS

**37** HQP  
TRAINED



# Saving Alberta's Forests

## Dr. Nadir Erbilgin

### THE RESEARCH

Due to climate change, many insects in Canada's forests are undergoing an accelerated rate of reproduction and growth, and natural controls to prevent pest infestations (e.g. freezing winters) are weakened. Scientists have discovered that trees are unable to adapt to the rapid pace of pest attacks.

#### Did You Know?

The forest industry contributed \$24.6 billion to Canada's gross domestic product (GDP) in 2017. In Alberta alone, 70 communities are dependent on the forest industry for 15,000 direct jobs.

The mountain pine beetle (MPB) is the biggest insect threat to western Canada's forests, killing more than half of the total commercial lodgepole pine forests in British Columbia. Now spreading east, the MPB poses a major threat to Canada's 347 million hectares of forest, the jobs it supports, and the economic value it adds to Canada.

To combat this risk, Dr. Erbilgin received RCP funding of \$90,994 in 2013. He is currently working on the [Resilient Forests project](#) with colleagues, industry, and government agencies to produce MPB and drought-resistant trees. Their work will shorten the tree-breeding cycle by 20 years, increasing the sustainability, competitiveness, and employment in the forest industry.

### ABOUT DR. ERBILGIN

Dr. Nadir Erbilgin, Professor in Forest Entomology and Invasion Biology, completed his education in Istanbul, Texas, Wisconsin, and California, and was attracted to Alberta for its critical location between Canada's western and eastern forests. Since high school, he has been greatly intrigued by the rapidly changing insect-tree relationships and continues to pursue his passion of protecting Alberta's diverse tree population from insect attacks, and improving forest health as a professor at the University of Alberta.



## THE FOREST ENTOMOLOGY & INVASION BIOLOGY LAB

RCP funding allowed for the creation of a state-of-the-art Forest Entomology and Invasion Biology Lab at the University of Alberta. The successful outcomes of Dr. Erbilgin's projects were due in part to the high quality of the infrastructure, which led to the enhanced scientific reputation of the team and the establishment of new collaborations.

## TALENT GENERATION

Since obtaining RCP funding, Dr. Erbilgin has trained 44 highly qualified personnel at the University of Alberta in Forest Entomology and Invasion Biology. With these new skills, students will be able to significantly enhance restoration efforts across Canada's forests.

## COLLABORATIONS

Aside from the current Resilient Forests project, Dr. Erbilgin also works closely with industry players Weyerhaeuser and West Fraser. In his experience, establishing long-term relationships with industry is critical to solving critical issues in the forest industry.

Dr. Erbilgin is working with Alberta's Ministry of Agriculture and Forestry on its Healthy Pine Strategy. This strategy aims to contain infestations and minimize the spread of mountain pine beetles in Alberta and across forests in central and eastern Canada.

The RCP-funded state-of-the-art lab has also attracted collaborations with other government agencies and post-secondary institutions around the world. Notable partnerships include: Parks Canada, the



Dr. Erbilgin and RCP-funded equipment.

Canadian Forest Service, Alberta Innovates, the University of Wisconsin – Madison, University of California – Berkeley, University of British Columbia, the Swedish University of Agricultural Sciences, and Misión Biológica de Galicia (Spain).

## FUTURE PLANS

By comparing the health of Canada's forests with international partners and diversifying their current approach to pest control, the FEIB Lab hopes to find creative solutions to Canada's emerging insect pest problems.

Dr. Erbilgin also hopes to aid the forest bioenergy sector with his work in the Resilient Forests Project, as bioproducts are an excellent low- or no-waste alternative for non-renewable resources

### Did You Know?



Small mountain pine beetle populations prefer stressed, mature, or over-mature pine trees (80+ years old).

# DR. NADIR ERBILGIN



INSTITUTION:



PROJECT COST:

\$225,112



RCP AWARD:

\$90,994

ARIF ALIGNMENT: 

INDUSTRY & ACADEMIA COLLABORATIONS



Swedish University of  
Agricultural Sciences



Weyerhaeuser



West Fraser

DR. ERBILGIN HAS  
ATTRACTED

**\$1,933,301**

SINCE RECEIVING  
RCP FUNDING  
IN 2011



## FUNDING ATTRACTION BREAKDOWN:

Dr. Erbilgin has attracted almost \$2 million from the following sources since receiving RCP funding.



■ RCP

■ Federal Councils

■ Provincial Agencies

■ International Agencies

*"Dr. Erbilgin is a pivotal contributor to the science required to manage and control the spread of the Mountain Pine Beetle. His scientific contributions, along with those of his students, have aided significantly in our understanding of pheromones as they affect spread dynamics of the beetle. Dr. Erbilgin's research is crucial to Alberta's fight against the beetle as it spreads eastward, and possibly into boreal pine forests"*

Dr. Keith McClain  
Mountain Pine Beetle Ecology Program Lead, fRI Research

**34** HQP  
TRAINED

**20** AWARDS &  
HONORS

Including:

Genome Canada Large-Scale Applied Research Project Competition (2016-20)

The Swedish Research Council Formas-Grants for Research and Development Projects (2016-21)



Dr. Chalaturnyk training a few of his HQP.

© University of Alberta

# Advancing Unconventional Resource Recovery in a Carbon Constrained World

## Dr. Rick Chalaturnyk

### THE RESEARCH

Bringing in 27% of Alberta's GDP in 2018, the mining, quarrying, and oil and gas extraction sector is rapidly evolving to undertake safer and more sustainable practices for extracting petroleum products and reducing its environmental impact. In 2009, Dr. Chalaturnyk and his team, Dr. Gonzalo Zambrano and Dr. Nathan Deisman, received \$1,630,061 in RCP funding as part of a \$4.3M Canada Foundation for Innovation (CFI) award to establish the **Geomechanical Reservoir Experimental Facility (GeoREF)**. The team uses the facilities to investigate how geological materials behave under various conditions to safely and responsibly develop Alberta's oil and gas resources and implement Carbon Capture and Storage (CCS) technology.

#### Did You Know?



Alberta has the third largest oil reserve in the world, after Venezuela and Saudi Arabia.

#### Did You Know?



Geomechanics is the study of how rocks and soils deform.

CCS is a technology that can capture up to 90 per cent of the carbon dioxide emissions produced from fossil fuels, preventing the release of harmful carbon dioxide into, and extracting previously emitted carbon dioxide from, the atmosphere. Because of these huge environmental benefits, the Alberta government has committed \$1.3 billion to CCS projects, one of the largest commitments in the world.

RCP funding has allowed Dr. Chalaturnyk to pursue further innovations in geological materials testing to overcome challenges posed by new resource recovery processes.

# DR. RICK CHALATURNYK



INSTITUTION:  
 UNIVERSITY OF ALBERTA



PROJECT COST:  
**\$4,078,511**



RCP AWARD:  
**\$1,630,061**

DR. CHALATURNYK  
 HAS ATTRACTED  
**\$20,984,000**  
 SINCE RECEIVING RCP  
 FUNDING  
 IN 2009

*"Dr. Chalaturnyk's world class research into reservoir geomechanics of petroleum recovery has had, and will continue to have, a profound economic impact for industry and the province."*

Mr. Duke Anderson  
 President, Energi Simulation

ARIF ALIGNMENT:



## FUNDING ATTRACTION BREAKDOWN:

Dr. Chalaturnyk has attracted over \$20 million from the following sources since receiving RCP funding.



Dr. Chalaturnyk holds an Energi Simulation Endowed Research Chair in Reservoir Geomechanics

**18**

INDUSTRY & ACADEMIA COLLABORATIONS

**1**

INVENTION/PATENT

**81**

HQP TRAINED

## ABOUT DR. CHALATURNYK

Growing up in the Northwest Territories and Northern Alberta, Dr. Rick Chalaturnyk found a natural interest in oil sands tailings, tunnels and excavations. He pursued his geotechnical engineering PhD at the University of Alberta, and began his career after being recruited for the Steam-Assisted Gravity Drainage (SAGD) project at the Alberta Oil Sands Technology and Research Authority (AOSTRA) Underground Test Facility.

Now a professor in civil and environmental engineering at the University of Alberta, Dr. Chalaturnyk has launched the Reservoir Geomechanics Research Group, which has attracted students from Spain, Iran, China, Colombia, Mexico, and across Canada, to study Alberta's geological applications to the petroleum industry. The diverse range of backgrounds is what makes this team so impactful to Alberta and guiding them has been the most rewarding aspect of Dr. Chalaturnyk's career.

## THE GEOMECHANICAL / RESERVOIR EXPERIMENTAL FACILITY (GEOREF)

The funded infrastructure includes the establishment of GeoREF, a world-class research innovation facility designed for high temperature/high pressure multiphase testing of geomaterials. GeoREF houses Western Canada's first geotechnical beam centrifuge and a 3-D printer capable of creating high-quality rock samples from sand, making it possible to replicate test specimens and conduct in-lab "field tests" at a lower cost.

Major users of GeoREF include students, academics, and oil sands mining companies, such as Shell, Suncor, Imperial, Syncrude and COSIA (Canada's Oil Sands Innovation Alliance). Research outcomes from GeoREF underpin the science and technology for CCS projects and support the sustainable, safe development of Alberta's oil and gas sector. The testing facilities have also factored into significant decisions in tailings amendments and treatments.

### Did You Know?

GeoREF can test materials at temperatures of up to 350° Celsius!

## TALENT GENERATION

The training opportunities at the GeoREF are key to attracting young, promising researchers to the University of Alberta: The GeoREF facilities have attracted 81 highly qualified personnel. GeoREF provides critical skills for advancing sustainable and economic extraction of Alberta's oil sands and unconventional resources.



Dr. Chalaturnyk and a few members of his team.

## COMMERCIAL ACTIVITY

### TECHNOLOGY DEVELOPMENT

RCP-funded infrastructure enabled the development of the Reservoir Geomechanical Pressuremeter (RPG) device. With this tool, the GeoREF team has conducted field tests with colleagues in Canada (Canadian Natural Resources Ltd.), China (RIPED) and Switzerland (Nagra) and will soon bring the RPG to the commercialization stage.



The GeoREF team working with the Helmholtz Germany Research Group.

### INDUSTRY PARTNERS

In 2009, Dr. Chalaturnyk partnered with Helmholtz, Germany's largest research organization. The teams investigated concerns related to CCS, focusing on how to detect the most secure location for containment of carbon dioxide in reservoirs.

The work of GeoREF members has put Alberta on the map as a leader in geomechanics, and has established vital relations with researchers and companies worldwide, most notably in Australia, Germany, Scotland, and Saudi Arabia. Dr. Chalaturnyk also regularly partners with industry collaborators, such as Shell, Syncrude, Suncor, Cenovus, CNOOC, ConocoPhillips, PetroChina Canada and CNRL.



### INVESTMENT ATTRACTION

Since obtaining the RCP and CFI awards, the GeoREF team has generated an additional \$21 million in funding from federal, provincial, and industry agencies.

### FUTURE PLANS

Further development of the team's RPG device will allow for product commercialization and its incorporation into drilling programs within Alberta and worldwide.

Within the next ten years, Dr. Chalaturnyk hopes to fully embrace machine learning and remote sensing into the geomechanics world. Using advanced sensors and satellites to detect subsurface processes will provide a wealth of data that will allow Alberta to further advance the oil and gas sector safely and sustainably.

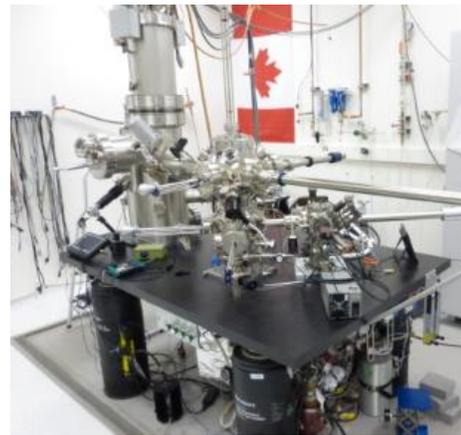
GeoREF has attracted collaborators and HQP from all over the world, as highlighted in blue.

# The New Tech Standard

## Dr. Robert Wolkow

### THE RESEARCH

Focusing on very small, atom-scale technologies his entire career, Dr. Wolkow caught the University of Alberta's attention and was recruited to his current position as a physics professor and iCORE Chair of Nanoscale Information and Communications Technology. In 2005, Dr. Wolkow was awarded \$181,500 from the RCP to develop faster, greener, smaller technology. Since then, he and his team have become world leaders in atom scale technologies, and have made fundamental advances for revolutionary and practical applications in our current technologies.



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When Dr. Robert Wolkow began his undergraduate studies at the University of Waterloo, he started searching for existing research on atom-scale technologies and found there were currently none of great significance. His curiosity and interest in this subject led him to a postdoctoral position at IBM Laboratories in New York where, starting with an empty room, he established a state-of-the-art laboratory and became the first in the world to gain an atom-resolved view of a chemical reaction, work for which he received IBM's highest award.

### ABOUT DR. WOLKOW

After being invited to the province to work at the University of Alberta, Dr. Wolkow's goal was to turn Edmonton into an international hub for nanotechnology. Helping design the University of Alberta's Nanotechnology Research Centre (NINT), now the NRC-Nanotechnology Research Centre, Dr. Wolkow ensured the centre housed all the vital pieces of equipment needed to create cutting edge, world-leading research.

Since starting at the university, Dr. Wolkow has positioned Alberta as a world leader in atom scale fabrication – a newly-emerging area with a certainty of limitless future growth. He has also received awards for outstanding achievement, adding to his collection of awards from almost every institution he has worked at. His most recent awards include the 2017 Innovation Patent Award, 2017 NRC's NINT Research Award, and the 2015 ASTech Outstanding Leadership in Alberta technology. Most recently, Dr. Wolkow has been awarded the AVS NSTD Nanotechnology award, in recognition of his place among the who's who of nanotechnology.



# DR. ROBERT WOLKOW



INSTITUTION:



PROJECT COST:

\$658,899



RCP AWARD:

\$181,500

## FUNDING ATTRACTION BREAKDOWN:

Dr. Wolkow has attracted almost \$12 million from the following sources since receiving RCP funding.



■ RCP ■ Federal Councils ■ Provincial Agencies

DR. WOLKOW HAS  
ATTRACTED  
**\$11,796,000**  
SINCE RECEIVING  
RCP FUNDING  
IN 2005

**1** SPIN-OFF  
**Quantum Silicon**  
& **4** PATENTS

**68** HQP  
TRAINED

ARIF ALIGNMENT:



**5** INDUSTRY &  
ACADEMIA  
COLLABORATIONS



AWARDS &  
HONORS



Including:

ASTech Outstanding Leadership  
in Alberta technology (2015)

Innovation Patent Award (2017)

Innovation Makes Sense Spin Off  
Award (2015) and Innovation  
Makes Sense Patent Award  
(2016)

Dr. Wolkow's newest technology is conservatively predicted to consume 100x less energy than optimized traditional transistor circuitry, which is used in today's electronics. Currently, the team is working to make computer technology smaller, more powerful, and more energy efficient, to enable their use in artificial intelligence and machine learning technology. This will open an all-new approach to unsupervised learning, allowing machine decision-making in complex, changing environments, thereby enhancing human capabilities. The team's unique technology enables the lowest power-consuming and fastest electronics known in the world.

### THE WOLKOW LAB

The RCP-funded infrastructure in the Wolkow Lab ensures that the team remains among the best in the world in nanotechnology, with no labs in Canada and fewer than 10 labs in the world comparably equipped.

This equipment is used extensively to create products for commercialization and train HQP. The team attracts exceptional students and visiting researchers from across Canada and worldwide to become experts in running scanning probe microscopes on this rare equipment. Dr. Wolkow's technology will be 100% compatible with our current technologies, so current infrastructure can still be used.



Wolkow Team member, Roshan Achal, PhD student.

### TALENT GENERATION

The HQP trained in the Wolkow Lab gain valuable skills and are highly sought after by industry and academia. Roughly 65% of the graduating HQP enter industry and have been hired by industry giants Hitachi Canada, D-Wave, Google, DTU Nanotech, and others. Many students pursuing academia become post-doctoral students and research associates with Dr. Wolkow's spin-off company, QSi.

Since receiving RCP funding, Dr. Wolkow has trained 68 HQP using the RCP-funded infrastructure.

*“Computers consume an enormous amount of energy and that consumption is increasing at an alarming rate. Left unchecked, computers would consume about a quarter of all the world's energy in a decade - an unsustainable trend. There is an urgent need for our green approach to computing and A.I.”*

-Dr. Robert Wolkow

## COMMERCIAL ACTIVITY

### COMPANY GENERATION

To further promote, develop and commercialize his technology breakthroughs, Dr. Wolkow created the spin-off company **Quantum Silicon Inc. (QSi)**. At QSi, the team is developing the world's leading tools for nanoscale manufacturing, as well as fast and very energy-efficient computers.

For years, organizations around the world have sought an automated manufacturing process using atom-scale technologies. QSi now has created that process, and they use it to make their unique devices, which will soon be ready for commercialization.



### TECHNOLOGY DEVELOPMENT

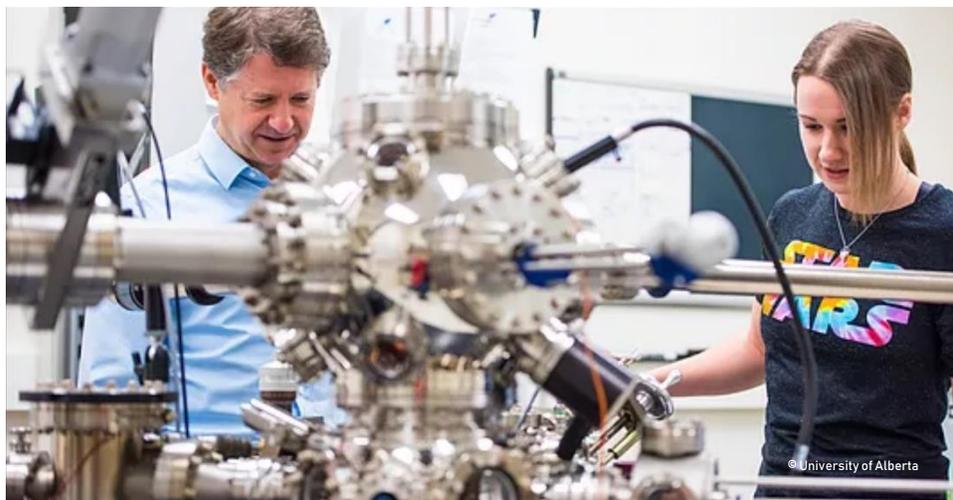
QSi is a key player in Alberta's artificial intelligence and machine learning landscape. After nearly three years of targeted development, QSi has its first product: a design intended to meet the needs of the machine learning market for faster and more energy-efficient neural network training.

Current techniques involve using compute intensive software approximations at critical stages in the training process. QSi replaces that slow software approximation with fast, accurate, and energy efficient hardware. As well, because the components are made of silicon, the team's new technology will be compatible with the technology that powers today's electronics, providing an easy entryway to market. All of this is possible because QSi's ability to manufacture at the atomic scale is among the best in the world.



The world's smallest maple leaf, 10,000 times smaller than human hair, made from individual atoms.

Additionally, under the guidance of Dr. Wolkow, PhD student Mr. Roshan Achal created a memory chip that exceeds the capabilities of current hard drives by 1,000 times, making it possible to store all 45 million songs on iTunes on the surface of one quarter. To celebrate their new discovery, the team fabricated the world's smallest maple leaf for Canada's 150<sup>th</sup> birthday.



Dr. Wolkow and Taleana Huff, PhD student.



### INDUSTRY PARTNERS

The impressive work coming out of the Wolkow Lab has created an international reputation for Alberta, resulting in collaborations between the lab and multi-national corporations, including Hitachi High Technologies (Japan), Nanonis (Switzerland), Bruker (Germany), and Nanotronics (United States).

Additionally, QSi has been contracted by a leading instrument maker company to develop a vital component for a new product.

### INVESTMENT ATTRACTION

Since obtaining the RCP and CFI awards, the Wolkow team has attracted the attention of the federal government and many collaborators. From his RCP award in 2005 of \$181,500, he has since attracted an additional \$11.7 million in funding from federal and provincial agencies to continue his exceptional work and keep Alberta at the forefront of nanotechnology research.

### FUTURE PLANS

Looking forward, Dr. Wolkow is working on creating an ultra-fast, energy efficient prototype using his unique all-silicon platform technology. He and his team have big plans for Alberta over the next 5 years, including making the province an internationally known hub for ultra-low energy nanotechnology and electronics manufacturing.



Wolkow Team member, Jeremy Croshaw, Masters student.

*“By the year 2025, we will be the leaders in manufacturing ultra low power atom-scale electronics. The result of this improved efficiency will drastically reduce the ICT sector’s global electricity consumption, while also enabling ultra high-speed computers. Because we will play a leading role in supplanting conventional electronics, Alberta will be host to a large industrial base.”*

-Dr. Robert Wolkow

# Seismic Impact

## Dr. David Eaton

### ABOUT DR. EATON

Beginning his studies in geophysics and seismology at the University of Calgary, Dr. David Eaton was always interested in the planet and the geological processes happening beneath its surface. His specialization in seismology made him highly sought after by the public, private, and academic sectors, and after many positions in each sector, he came back to the University of Calgary as a professor in Geoscience and an NSERC/Chevron Industrial Research Chair in Microseismic System Dynamics in 2007.

Ultimately, the ability to collaborate with industry partners and apply the skills garnered while working in eastern Canada led him to Alberta. In 2012, there was an urgency for his knowledge in induced earthquakes and its possible connection to hydraulic fracturing and carbon capture and storage (CCS). Solving these problems and collaborating with industry ultimately resulted in an Excellence in Research Award (2017) from the University of Calgary's Faculty of Science and a Distinguished Collaborator Award (2018) from the Schulich School of Engineering.



### THE RESEARCH

Hydraulic fracturing is a technique used to break up rocks deep inside the earth to recover oil and natural gas. Occasionally, hydraulic fracturing can result in small seismic events. In 2009, the RCP awarded Dr. Eaton \$303,236 to use his knowledge in seismology to study these events. Dr. Eaton's work focuses on improving the efficiencies and effectiveness of Alberta's hydraulic fracturing

techniques, and optimizing the development of unconventional oil and gas reservoirs.

Through collaboration with industry, government, and researchers around the world, Dr. Eaton's team has developed new world-leading insights into induced earthquake activity and hydraulic fracturing, and are

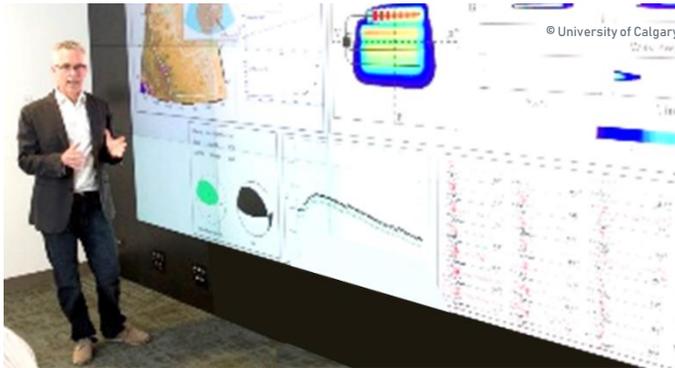
### Did You Know?

Most of the natural gas in Alberta is extracted using hydraulic fracturing.

now investigating the process of hydraulic fracturing that feeds back into reservoir simulators used by industry.

“ The opportunities to interact with people in industry are unequalled anywhere else in the world. As an academic researcher interested in problems that directly impact industry and Canada's oil and gas sector, this is the place to be. ”

-Dr. David Eaton



Dr. Eaton giving a presentation.

### Did You Know?

Seismology is the branch of science concerned with earthquakes and related phenomena.

### FUTURE PLANS

Dr. Eaton currently has work under review that has the potential of completely reshaping our understanding of induced earthquakes for hydraulic fracturing.

In addition to this, he has also launched two collaborative initiatives to improve communications across sectors. The first initiative is a national training program for the responsible development of hydrocarbon resources, where HQP from across Canada come to Calgary to collaborate with industry and First Nations peoples, discuss science, engineering, and policy, and train on the specialized equipment.

The second ambitious initiative, EON-ROSE (Earth-System Observing Network/ Réseau d'Observation du Système terrestre), is a major national initiative which will use real-time monitoring to create a truly trans-disciplinary network of researchers working towards a comprehensive earth system observation network to combat climate change.

### COMMERCIAL ACTIVITY COMPANY GENERATION

Dr. Eaton has created the spin-off company **ASEISMIC**, which stands for Advanced Simulation Environment for Induced Seismicity Mitigation and Integrated Control. His postdoctoral researcher, Dr. Thomas Eyre, will lead the company by developing and commercializing new intellectual property and software focused on risk analysis and mitigation.

### INDUSTRY COLLABORATIONS

Together with his research partner, Dr. Mirko van der Baan from the University of Alberta, Dr. Eaton established the **Microseismic Industry Consortium** in 2010. The Consortium is a novel, applied-research geophysical initiative dedicated to the advancement of research, education and technological innovations in microseismic methods, and their practical applications for resource development. With over 20 industry partners, including Shell and Chevron, the Consortium is working on critical advancements for Alberta's oil and gas industry, including improving the strength of fracturing sites, investigating changes in reservoir conditions, studying induced seismicity, and more.



Important field equipment for Dr. Eaton's work.

# DR. DAVID EATON



INSTITUTION:  
 UNIVERSITY OF CALGARY



PROJECT COST:  
 \$1,142,148



RCP AWARD:  
 \$303,236

DR. EATON HAS ATTRACTED  
**\$9,730,000**  
 SINCE RECEIVING RCP FUNDING IN 2009

1

SPIN-OFF COMPANY



LAUNCHED THE MICROSEISMIC INDUSTRY CONSORTIUM IN 2010

ARIF ALIGNMENT:



## FUNDING ATTRACTION BREAKDOWN:

Dr. Eaton has attracted almost \$10 million from the following sectors since receiving RCP funding.



*"Through our research collaborations, Dr. Eaton has demonstrated leadership in the advancement of knowledge of seismology for microseismic characterization of hydraulic fracturing and induced seismicity due to hydraulic fracturing. His professionalism and understanding of the four stated goals of the RCP - to support research and development technology excellence, attract and retain promising and established researchers, build capacity for innovation and promote initiatives of strategic benefit to Alberta - are aligned with Chevron Canada's goals of improving our understanding of induced seismicity and developing ways to reduce risk so that we can safely and responsibly develop Canada's unconventional resources."*

Mr. John Evans  
 Chevron

**20+** INDUSTRY & ACADEMIA COLLABORATIONS

**39** HQP TRAINED



## Looking Forward

The following pages list the RCP's 2017-2018 and 2018-2019 research project awards. The projects include new researchers brought to Alberta universities and current researchers who require support for renewal of their research equipment. Whether funding is awarded at the start of a researcher's career or in the middle of a well-established project, these individuals play a key role in strengthening Alberta's reputation as a world-class research hub and the place to innovate.

In the 2017-2018 and 2018-2019 award years, the RCP:



A complete list of awards from previous years can be found on the [RCP website](#).



## 2017-2018 Awards List

### THE VITAMIN A LABORATORY (VITAL) RESEARCH PROGRAM

Dr. Robin Clugston  
University of Alberta

Vitamin A is an essential micronutrient with multiple biological functions. It is becoming clear that abnormal vitamin A metabolism and signaling can contribute to impaired health. This integrated research program aims to discover the mechanisms linking abnormal vitamin A function with different diseases, including liver disease and congenital birth defects.

RCP Award: \$114,137  
Total Project Cost: \$382,370



### ESTABLISHMENT OF A CANADIAN CENTER FOR HYDRODYNAMICS (CCH)

Dr. Borries Demeler  
University of Lethbridge

The CCH will be established at the University of Lethbridge by the new Canada 150 Research Chair, Dr. Demeler. RCP funding allowed the team to acquire a Beckman Optima AUC instrument which will enable detailed measurements of nanoscale macromolecules and assemblies. The resulting discoveries will advance fundamental research in structural biology, biophysics, computing and material science.

RCP Award: \$249,377  
Total Project Cost: \$623,441

### DYNAMIC BIAXIAL MATERIALS TESTING SYSTEM FOR CHARACTERIZING WHOLE-BONE FRACTURE AND FATIGUE

Dr. William Edwards  
University of Calgary

Dr. Edwards' research is focused on the underlying mechanisms of skeletal fractures and the development of diagnostics and interventions to reduce their occurrence. The RCP-funded infrastructure will enable Dr. Edwards to establish new patient-specific fracture risk assessment techniques and facilitate personalized exercise prescriptions and interventions to maximize bone health.

RCP Award: \$170,000  
Total Project Cost: \$466,957



### RADIOSENSITIZATION OF SOLID TUMORS BY SMALL MOLECULE INHIBITORS TARGETING THE DNA DAMAGE RESPONSE

Dr. Armin Gamper  
University of Alberta

Radiation Therapy, a main pillar of cancer treatment, is based on the eradication of tumour cells by eliciting DNA damage. This projects aims to identify small molecules (drugs) that target the DNA Damage Response as radiosensitizers and test them in mouse models for their efficacy in improving radiation therapy.

RCP Award: \$190,000  
Total Project Cost: \$499,977



### IMMUNITY OF HOST-MICROBIAL INTERACTIONS

Dr. Markus Geuking  
University of Calgary

Chronic inflammatory and infectious diseases are important health issues in Alberta. The intestinal microbiota clearly contributes to such diseases. This project will investigate the crosstalk of the microbiota with the immune system during health and disease in order to identify new approaches for prevention or treatment of these disorders.

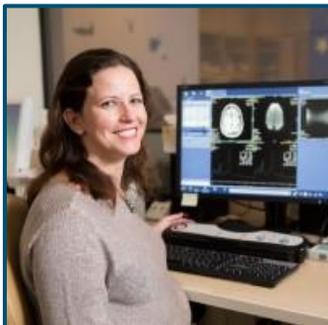
RCP Award: \$272,716  
Total Project Cost: \$682,613

### EXCELLENCE IN PERIODONTOLOGY

Dr. Monica Gibson  
University of Alberta

Periodontitis, is a gum disease affecting millions of Canadians. This disease causes breakdown of the tooth supporting tissues and can lead to tooth loss. The research will focus on understanding the nature of the bacteria that cause this disease, and the factors that determine the body's response to the bacteria.

RCP Award: \$120,000  
Total Project Cost: \$314,377



### MAGNETIC RESONANCE SPECTROSCOPY IN BRAIN INJURY

Dr. Ashley Harris  
University of Calgary

This project will develop and apply magnetic resonance spectroscopy to study brain injury (e.g. concussion or cerebral palsy) and novel therapies. Focussing on chemicals for communication with in the brain, this project will study the neurochemistry that underlies brain dysfunction to identify targets for therapy and improved patient outcomes.

RCP Award: \$152,500  
Total Project Cost: \$381,232

### A ZEBRAFISH FACILITY FOR THE STUDY OF EYE DISEASE

Dr. Jennifer Hocking  
University of Alberta

Zebrafish is a small vertebrate with many experimental advantages for the study of human disease. The RCP-funded aquatics facility will finally bring this widely adopted animal model to the UofA Faculty of Medicine and Dentistry, with a primary focus on research into the mechanisms and treatment of eye disease.

RCP Award: \$159,912  
Total Project Cost: \$399,781





### UNCOVERING THE HIDDEN ACTIVE CONFORMATIONS OF PROTEINS

Dr. Peter Hwang  
University of Alberta

Proteins are the nanomachines (roughly a billionth of a meter) that drive all life processes. The RCP-funded equipment will mass-produce, purify, and study proteins, which will help Dr. Hwang’s team to understand life processes at the molecular level so that he and his team can more effectively diagnose diseases and develop new drugs to treat them.

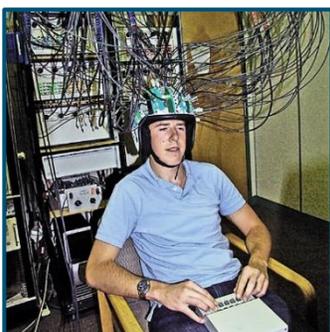
RCP Award: \$120,000  
Total Project Cost: \$319,277

### GENOMICS AND GENETICS OF STROKE AND NEUROLOGICAL DISEASE

Dr. Glen Jickling  
University of Alberta

Stroke is a leading cause of death and disabilities in Alberta. Dr. Jickling’s translational research program will develop personalized biomarkers for stroke diagnosis, and novel therapies to reduce the impact of stroke. The program will advance Alberta’s internationally recognized strength in stroke to better diagnose and treat stroke. It will improve access to stroke treatments, and permit more efficient delivery of stroke care.

RCP Award: \$160,000  
Total Project Cost: \$413,374



### NON-INVASIVE OPTICAL IMAGING OF OSCILLATIONS IN BRAIN ACTIVITY RELATED TO ATTENTION

Dr. Kyle Mathewson  
University of Alberta

The unique research program will combine electroencephalogram (EEG) with non-invasive optical imaging in novel ways to get distinctive and informative views of ongoing brain activity. The research will combine a world-class optical imaging system with state-of-the-art existing EEG equipment in innovative ways to measure oscillations in the brain.

RCP Award: \$143,238  
Total Project Cost: \$358,096

### INTERACTION STUDIES OF PURIFIED BIOMOLECULES

Dr. Trushar Patel  
University of Lethbridge

Dr. Patel’s world-class research will provide insights into interactions between viral nucleic-acids and host-proteins, and will facilitate the development of molecules treat viral infections, benefiting Albertans and Canadians. RCP funding allowed Dr. Patel to purchase a liquid chromatography and microscale thermophoresis devices to deliver the objectives of the research.

RCP Award: \$137,383  
Total Project Cost: \$343,458





### NEUROMUSCULAR GENETICS PROGRAM

Dr. Gerald Pfeffer  
University of Calgary

The goal of this research program is to identify new genetic causes of neuromuscular disease, to understand how genetic mutations cause disease on a molecular level, and identify biomarkers of disease that will be helpful in the diagnosis and treatment of neuromuscular diseases.

RCP Award: \$230,500  
Total Project Cost: \$578,178

### DESIGN FOR ADDITIVE MANUFACTURING: DEVELOPING ASSEMBLY & LIFECYCLE MODELS FOR ADDITIVE MANUFACTURING PROCESSES

Dr. Ahmed Qureshi  
University of Alberta

The project will use the RCP funds for procurement of a research metal additive manufacturing system that will be used to develop additive manufacturing materials, design processes, tools, and methods for additive manufacturing of parts and assemblies for energy, aerospace, and automotive industry. The equipment will enable the University of Alberta and other Alberta institutions carry out cutting edge research.

RCP Award: \$66,669  
Total Project Cost: \$177,450



### ESTABLISHMENT OF A MULTIDISCIPLINARY AND TRANSLATIONAL LABORATORY TO STUDY HEART DISEASE

Dr. Robert Rose  
University of Calgary

Dr. Rose's laboratory studies cardiac arrhythmias (abnormal patterns in the heart beat). The goal of this work is to discover new treatment strategies for use in patients with arrhythmias. The RCP-funded highly innovative equipment will uniquely position his research to tackle this major medical issue.

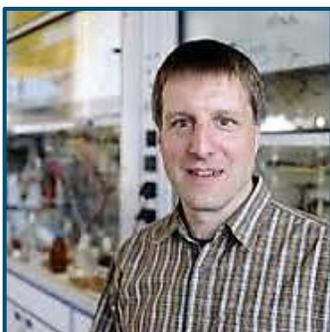
RCP Award: \$250,000  
Total Project Cost: \$661,855

### INFRASTRUCTURE FOR RESOLVING STRAIN AND GENE FUNCTION IN THE MICROBIOME

Dr. Laura Sycuro  
University of Calgary

Disturbance of the vaginal microbiome commonly causes women to seek healthcare and increases their risk of preterm birth. Dr. Sycuro is applying state-of-the-art DNA sequencing technologies to learn how her and her team may optimize the maternal microbiome to lower Alberta's preterm birth rate and establish a healthy microbiome in Albertan children.

RCP Award: \$330,098  
Total Project Cost: \$825,245



### FOUR STEPS TO NEW ORGANIC SEMICONDUCTORS: DESIGN, SYNTHESIS, CHARACTERIZATION, AND IMPLEMENTATION

Dr. Rik Tykwinski  
University of Alberta

Organic molecules and materials will be synthesized with new and potentially transformative properties. These compounds will function as semiconductors for applications in organic electronics, a new era of technology based on organic molecules.

RCP Award: \$120,000  
Total Project Cost: \$370,156

## EXERCISE-INDUCED TISSUE-SECRETED FACTORS THAT PROMOTE MITOCHONDRIAL HEALTH & REDUCE OBESITY-RELATED CARDIOMETABOLIC RISK

Dr. John Ussher  
University of Alberta

Dr. Ussher's team will study proteins released into the blood from our organs during exercise, and identify/characterize which proteins are responsible for how exercise improves whole-body health. This will lead to novel strategies to mimic the actions of exercise and improve health in obese patients at risk of diabetes and heart disease.

RCP Award: \$85,422  
Total Project Cost: \$364,523



## PRECISION MEDICINE FOR CANCER CONTROL AND MANAGEMENT (PRECANCERCM)

Dr. Edwin Wang  
University of Calgary

The RCP-funded HPC Cluster and lab equipment will allow Dr. Wang to develop intelligent precision management of cancer patients using artificial intelligent (AI) and deep learning to improve patient quality of life, improve healthcare systems and decrease healthcare cost in Alberta.

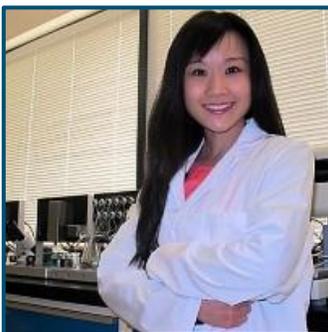
RCP Award: \$373,473  
Total Project Cost: \$989,598

## BIOPHYSICAL AND BIOCHEMICAL ANALYSIS OF DNA REPAIR COMPLEXES

Dr. Gareth Williams  
University of Calgary

The RCP-funded infrastructure will complete Dr. Williams's innovative research pipeline to understand structural mechanisms of DNA repair. These structural insights are critical for understanding how these proteins protect against cancer by fixing DNA damage to maintain genomic stability, and how they malfunction in human diseases such as cancer.

RCP Award: \$191,942  
Total Project Cost: \$479,855



## NEURAL REGULATION OF METABOLISM: AN IN VIVO LABORATORY

Dr. Jessica Yue  
University of Alberta

This project unveils novel actions of stress-related hormones in the brain that alter our whole-body balance of sugar, fat, and energy (feeding and physical activity behaviours), under conditions of normal health, diabetes and obesity, and nutrient deprivation, using in vivo experimentation, aiming to restore metabolic balance in these disease states.

RCP Award: \$201,280  
Total Project Cost: \$521,857

## NAIT CENTRE FOR CULINARY INNOVATION

Dr. Chris Dambrowitz  
Northern Alberta Institute of Technology

The NAIT Centre for Culinary Innovation addresses industry-defined needs within the regional food-sector; working with regional SMEs and entrepreneurs to develop new food products. The Centre will have a dedicated research chef with a professional research kitchen; extending our ability to assist companies and organizations in the food industry.

RCP Award: \$1,000,000  
Total Project Cost: \$2,550,000



## RESEARCH AND INNOVATION IN STEAM PRODUCTION AND ENVIRONMENTAL SUSTAINABILITY

Dr. Vita Martez  
Southern Alberta Institute of Technology

RCP funding will allow SAIT to create a once through steam generator laboratory, clean technologies laboratory and a mobile laboratory for field trials to enable industry-driven applied research in steam production, energy efficiency and environmental intensity reduction while supporting environmentally sustainable energy production in Alberta and Canada.

RCP Award: \$1,000,000  
Total Project Cost: \$2,500,000

## CENTRE FOR INNOVATION AND RESEARCH INTO UNMANNED SYSTEMS

Dr. Ken Whitehead  
Southern Alberta Institute of Technology

RCP-funded will allow SAIT to conduct renovations and outfitting of a dedicated research lab and procure UAV platforms, sensors, computer workstations and software, and a mobile ground station to enable CIRUS to address the applied research challenges of the UAV industry and help to further advance Alberta's leading role in unmanned systems.

RCP Award: \$425,800  
Total Project Cost: \$1,064,500



## LINCS: LINKED INFRASTRUCTURE FOR NETWORKED CULTURAL SCHOLARSHIP

Dr. Denilson Barbosa  
University of Alberta

LINCS will use Semantic Web technologies to meaningfully and systematically link Canadian cultural research materials with related cultural data online, mobilizing the cultural record, transforming our access to human culture and history, enabling Canadians to explore, analyze, visualize, and learn about their culture in transformative ways, through data not previously accessible.

RCP Award: \$405,648  
Total Project Cost: \$5,000,000

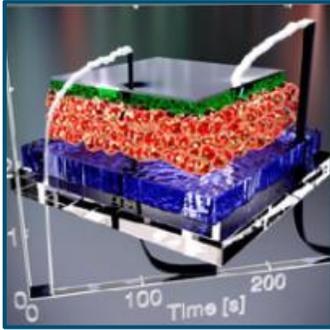
## AURORA X

Dr. Eric Donovan  
University of Calgary

AuroraX is a Cyberinfrastructure initiative to build enhanced tools and a data platform for auroral science. AuroraX will include enhanced metadata, such as machine vision classification that will help scientists mine and exploit decades of auroral images to better understand space weather and how to mitigate its impact on technology.

RCP Award: \$967,054  
Total Project Cost: \$2,880,108





### ADVANCED INTEGRATED MANUFACTURING OF MICRO/NANO SYSTEMS (AIMMS)

Dr. Jillian Buriak  
University of Alberta

AIMMS targets the development of high-value manufacturing in Alberta by building upon nation-leading strengths in micro- and nanotechnologies. The integration of high-end processing and advanced materials will target applications in renewable energies, printable flexible electronics, and ultrahigh sensitivity sensing systems. AIMMS will support innovation, economic diversification, and entrepreneurship in Alberta.

RCP Award: \$6,202,815  
Total Project Cost: \$15,507,038

### SMARTFORESTS CANADA: A NETWORK OF MONITORING PLOTS AND PLANTATIONS FOR MODELING AND ADAPTING FORESTS TO CLIMATE CHANGE

Dr. Phil Comeau  
University of Alberta

Through advanced monitoring of natural forests and experimental plantations Dr. Comeau's team will improve our understanding of how complex forest ecosystems respond to environmental stressors and disturbances. This knowledge will be used to inform development of novel means to adapt our forests to rapidly changing conditions that are threatening their sustainability.

RCP Award: \$522,618  
Total Project Cost: \$9,532,570



### PRECISION MEDICINE AND THE GENETIC DISEASES OF CHILDHOOD (PREDC)

Dr. James Cross  
University of Calgary

Technology allows the rapid collection of genetic information, but the many thousands of normal variations between people obscures the identification of disease-causing genes. Our research targets this challenge in order to speed diagnosis and find therapies by using modern data analysis that integrates genetic and complex patient information.

RCP Award: \$3,877,614  
Total Project Cost: \$11,671,012

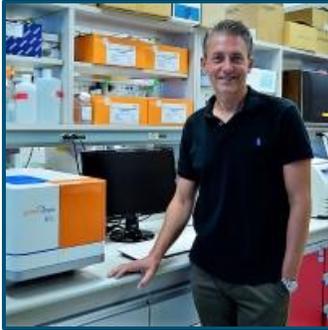
### SMILE-UVI: A UV IMAGER FOR THE INTERNATIONAL SOLAR WIND MAGNETOSPHERE IONOSPHERE LINK EXPLORER SATELLITE

Dr. Eric Donovan  
University of Calgary

SMILE-UVI will be an UltraViolet Imager (UVI) on the joint European Space Agency/Chinese Academy of Sciences Solar wind Magnetosphere Ionosphere Link Explorer (SMILE) satellite. SMILE-UVI will be a Canadian instrument playing a key role on a major international scientific satellite mission, and will provide global images of the northern hemisphere aurora to support space weather and space science.

RCP Award: \$10,000,000  
Total Project Cost: \$29,080,000





### HEART FAILURE TRANSLATIONAL RESEARCH CENTRE

Dr. Jason Dyck  
University of Alberta

Researchers at the UofA are poised to make significant advances in understanding and treating heart failure. The RCP-funded infrastructure will allow for sophisticated research in animals that aligns with clinical research to provide the strongest foundation essential for truly translational research that improves the treatment of heart failure.

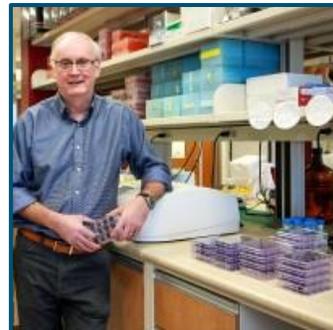
RCP Award: \$2,903,547  
Total Project Cost: \$7,258,868

### INFRASTRUCTURE TO SUPPORT THE DISCOVERY AND DEVELOPMENT OF INNOVATIVE VIROCEUTICALS

Dr. David Evans  
University of Alberta

The Canadian Virus and Immunology Consortium (CVIC) is a multi-institutional project building upon research programs in viral pathogens (University of Alberta), vaccinology (Dalhousie University), and virus-based therapeutics (University of Ottawa) to enhance the discovery, development, clinical testing and commercialization of new treatments to benefit the health of Albertans and Canadians.

RCP Award: \$766,713  
Total Project Cost: \$14,726,307



### PERMAFROST ARCHIVES SCIENCE (PACS) LABORATORY

Dr. Duane Froese  
University of Alberta

Permafrost in northern Alberta is an extension of northern Canada's vast permafrost region, and is impacted by environmental change and human activity. The Permafrost Archives Science Laboratory will collect and host permafrost cores, permitting academic, government and industry researchers to study permafrost landscapes and assess their sensitivity to environmental change.

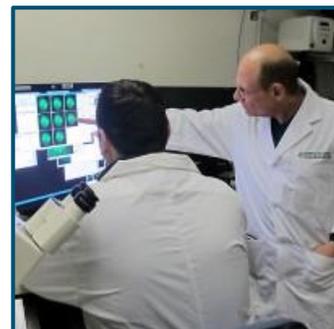
RCP Award: \$1,619,599  
Total Project Cost: \$4,049,001

### MULTI-SCALAR NANOSCOPY FOR ADVANCED CELL BIOLOGY

Dr. Michael Hendzel  
University of Alberta

RCP funding allowed a new generation of microscopes that will enable Dr. Hendzel's team to study important cellular molecules under conditions of health and disease as they assemble into the molecular machines that are the basis of life. The objective is to improve the long-term health outcomes related to infectious and single gene diseases as well as human cancers.

RCP Award: \$3,069,025  
Total Project Cost: \$7,672,564





### PICO-500 A NEW ULTRA-SENSITIVE DARK MATTER DETECTOR FOR SNOLAB

Dr. Carsten Krauss  
University of Alberta

The search for dark matter is one of the most exciting mysteries facing today's scientific community. PICO 500 utilizes unique detector techniques to create the world's most advanced sensitivity to dark matter particles. With RCP-funding, the world's best researchers were brought to Alberta to develop new hardware crucial to this project.

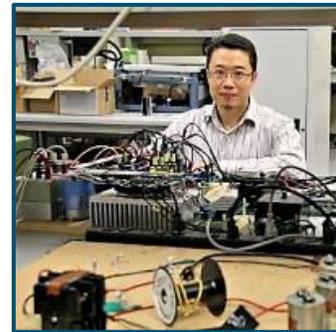
RCP Award: \$400,000  
Total Project Cost: \$4,671,356

### FUTURE SMART GRID TECHNOLOGIES LAB

Dr. Yunwei Li  
University of Alberta

The Future Smart Grid Technologies Lab and research will develop next generation smart grid technologies in renewable energy generation, energy storage, more efficient loads, grid structure, and power system cyber security. The research, conducted by a multidisciplinary team through institutional and industrial collaborations, will support research excellence, strengthen Alberta's energy sector, and create economic, social and health benefits.

RCP Award: \$2,509,149  
Total Project Cost: \$6,272,872



### CHIPMARC: CANADIAN HIGH POLARIZATION MAGNETIC RESONANCE CENTRE

Dr. Vladimir Michaelis  
University of Alberta

The ability to produce new materials for renewable energy and health will have a major impact on the future economy and well-being of Canadians. DNP is a revolutionary high-sensitivity magnetic resonance technique that will provide critical structural information of materials that is essential in this endeavor.

RCP Award: \$2,610,139  
Total Project Cost: \$6,525,348

### MR GUIDED FOCUSED ULTRASOUND RESEARCH PLATFORM

Dr. Bruce Pike  
University of Calgary

The Magnetic Resonance (MR) guided Focused Ultrasound research platform works with an MRI scanner to focus ultrasound waves to a targeted brain region as small as a grain of rice. The platform will enable incision-free neurosurgery, and innovative research to precisely deliver drugs or modulate brain activity for transformative brain treatments.

RCP Award: \$3,200,000  
Total Project Cost: \$8,090,300





### UNLOCKING THE RADIO SKY WITH NEXT-GENERATION SURVEY ASTRONOMY

Dr. Erik Rosolowsky  
University of Alberta

Dr. Rosolowsky's team will convert enormous data streams from next-generation telescopes into sophisticated digital databases, with which they will make new discoveries in catastrophic cosmic explosions and how the Universe converts gas into stars. As these databases are created, the team will address Big Data challenges that cut across Alberta's key economic sectors.

RCP Award: \$369,000  
Total Project Cost: \$9,405,834

### QNET - A QUANTUM NETWORK RESEARCH FACILITY

Dr. Tittel Wolfgang  
University of Calgary

QNET will result in a Calgary-wide quantum network. The world-wide unique network will fill a critical gap between world-class UofC and UofA academic research and commercial activity, place Alberta center stage in the emerging quantum technology economy, and provide future leaders with the skills to succeed in the 21<sup>st</sup> century.

RCP Award: \$2,710,526  
Total Project Cost: \$9,818,587



### THE CRDCN TRANSITION TO HIGH PERFORMANCE COMPUTING: LIBERATING DATA FOR RESEARCH AND POLICY

Dr. Richard Wanner  
University of Calgary

The RCP-funded high performance thin-client computing system with enhanced security arrangements will allow the Canadian Research Data Centres Network (CRDCN) to facilitate ground-breaking research in the social and health sciences and accelerate the translation of research findings to inform key areas of public policy.

RCP Award: \$231,023  
Total Project Cost: \$9,294,648

### PROGRAM IN NEURAL-IMMUNE INTERACTIONS FOR STUDIES OF VISCERAL PAIN AND INFLAMMATION

Dr. Gerald Zamponi  
University of Calgary

Abdominal pain is an area of considerable unmet clinical need and a constant frustration to patients and their physicians. Dr. Zamponi's expert team of fundamental and clinical scientists will identify new ways of treating this condition by combining their expertise in the areas of immunology and neuroscience.

RCP Award: \$1,336,853  
Total Project Cost: \$4,014,349



## 2018-2019 Awards List

### MOLECULAR INJURY AND REPAIR ASSESSMENT IN EX VIVO PERFUSED SOLID ORGAN TRANSPLANTS

Dr. Benjamin Adam  
University of Alberta

The goal of this project is to develop a new test for more precisely measuring the degree of damage in organs that are donated for transplantation. This will allow us to better assess and repair these organs so that a greater proportion of them can be used for treating patients.

RCP Award: \$60,000  
Total Project Cost: \$150,000



### EARLY LIFE BACTERIAL AND FUNGAL MICROBIOME IN ASTHMA DEVELOPMENT

Dr. Marie-Claire Arrieta  
University of Calgary

Dr. Arrieta's team will advance research that explores the role of the intestinal microbial community (microbiome) in pediatric asthma. Her research involves the analysis of samples collected from children enrolled in a birth cohort study, as well as mechanistic studies in mouse models of this disease.

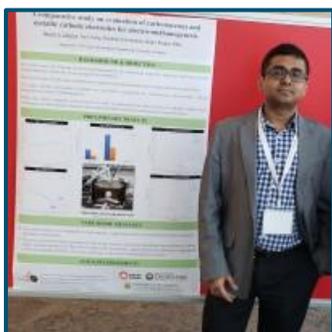
RCP Award: \$78,400  
Total Project Cost: \$199,406

### CHARACTERIZATION OF THE ROLE OF MICROPARTICLES IN REGULATING IMMUNE RESPONSES AGAINST COLORECTAL CANCER

Dr. Kristi Baker  
University of Alberta

Colorectal cancer is a deadly disease for Canadians whose progression is regulated by small particles that are present in the tumor environment. Dr. Baker's project will study these particles in great detail in order to determine how they can be used to evaluate tumor status and improve patient treatment and survival.

RCP Award: \$164,181  
Total Project Cost: \$414,763



### ENVIRONMENTAL BIOPROCESS DEVELOPMENT LABORATORY FOR WASTE AND WASTEWATER

Dr. Bipros Dhar  
University of Alberta

RCP funding supported research infrastructure needs of the newly established Environmental Bioprocess Development Laboratory at the University of Alberta. As first of its kind in the Alberta, this facility will develop smart and innovative technologies for engineering bioenergy and resources recovery from waste and wastewater.

RCP Award: \$108,000  
Total Project Cost: \$270,001

## SYSTEM-WIDE INVESTIGATION OF RHEUMATOID ARTHRITIS PATIENTS USING MASS SPECTROMETRY

Dr. Antoine Dufour  
University of Calgary

Dr. Dufour's research is focused on investigating the mechanisms of rheumatoid arthritis (RA) and the development of diagnostics to characterize diseased protein signatures. The RCP-funded infrastructure will enable him to facilitate the unbiased identification of pathogenic proteins in RA and characterize diverse drug response in patients.

RCP Award: \$400,000  
Total Project Cost: \$1,234,571



## TARGETED ANALYSES USING TRIPLE QUADRUPOLE MASS SPECTROMETRY TO ASSESS THE PERFORMANCE OF LAND/WATER RECLAMATION SYSTEMS

Dr. Mohamed Gamal El-Din  
University of Calgary

The RCP-funded triple quadrupole mass spectrometry systems for liquid and gas chromatography will be used for targeted analysis to characterize samples treated using different land-water reclamation strategies and to monitor different approaches for micropollutant removal and by-product generation and relate them to toxicity endpoints.

RCP Award: \$232,000  
Total Project Cost: \$767,379

## AN IN VIVO TWO-PHOTON (2P) IMAGING PLATFORM TO STUDY CELL TYPES, NEURAL NETWORKS, AND MECHANISMS OF MEMORY

Dr. Jesse Jackson  
University of Alberta

Two-photon imaging will be used to study neural activity in the neocortex while mice learn and perform behavioral tasks, and during sleep. The results will provide discoveries regarding how memories are formed, and how neurodegenerative diseases impair memory.

RCP Award: \$220,001  
Total Project Cost: \$550,327



## QUANTITATIVE PROTEOMICS INFRASTRUCTURE FOR BOTH FUNDAMENTAL AND APPLIED AGRICULTURAL AND HEALTH SCIENCE RESEARCH

Dr. Olivier Julien  
University of Alberta

The RCP-funded mass spectrometry infrastructure will allow quantification of protein abundance, regulation and post-translational modifications in medical and non-medical biological systems. This system means to increase public health of Albertans through the development of next generation plant breeding and agriculture technologies, as well as advancements in medicine.

RCP Award: \$686,000  
Total Project Cost: \$1,717,152

### INTEGRATED POWER CONVERTER MODULES FOR RENEWABLE DISTRIBUTED NANO-GRIDS

Dr. Ali Khajehoddin  
University of Alberta

Modern renewable energy systems components such as resources, storages and loads are formed by arrays of distributed cells connected in parallel/series to increase power levels. This facility provides a testbed to conduct research and design integrated converters. Cell-level power-converters provide scalability and improve the performance and efficiency of the system.

RCP Award: \$74,996  
Total Project Cost: \$192,081



### DISINFECTION BYPRODUCTS IN RECLAIMED WASTEWATERS

Dr. Susana Kimura-Hara  
University of Calgary

Alberta's freshwater resources are increasingly challenged by contamination by municipal and industrial wastewater. Dr. Kimura-Hara's research integrates chemical and toxicity indicators to evaluate new engineering processes and their efficacy to produce safe waters from wastewater-impacted sources.

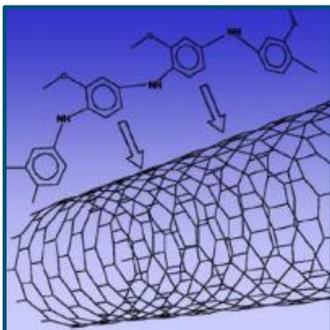
RCP Award: \$285,000  
Total Project Cost: \$716,726

### RECONFIGURABLE MODULAR MULTILEVEL CONVERTER SYSTEM FOR HYBRID AC-DC POWER SYSTEMS RESEARCH

Dr. Gregory Kish  
University of Alberta

This project will tackle the key component and systems level challenges hindering the development of future hybrid AC-DC electric power systems. The RCP-funded infrastructure comprises a rapidly reconfigurable modular multilevel converter system, power supply, and software that enables experimental-based research into next generation hybrid AC-DC systems.

RCP Award: \$75,000  
Total Project Cost: \$187,500



### DEVELOPING INNOVATIVE FUNCTIONAL MATERIALS AND TECHNOLOGIES FOR ENVIRONMENTAL REMEDIATION BASED ON INTERACTION STUDIES

Dr. Qingye Lu  
University of Calgary

The RCP-funded infrastructure will expedite Dr. Lu's development of novel, bioinspired nanocomposite materials for use in environmental remediation. These nanocomposites will help to reduce the environmental footprint of Alberta's oil sands exploitation, which will contribute to the sustainable development of the province's energy resources.

RCP Award: \$150,000  
Total Project Cost: \$396,676

## CONTROLLING IMMUNE RESPONSES THROUGH THE SIGLECS

Dr. Matthew Macauley  
University of Alberta

Immunotherapies targeting immune inhibitory receptors are revolutionizing strategies to treat human disease. Dr. Macauley studies a family of immune inhibitory receptors, called Siglecs, which bind sugars. Many unanswered questions remain about Siglecs. This project will enable elucidation of these mechanisms and develop of new approaches to modulate immune cells.

RCP Award: \$280,000  
Total Project Cost: \$709,708



## GNOTOBIOLOGY AND SYSTEMS IMMUNOLOGY TO UNDERSTAND HOST-MICROBIAL INTERACTIONS IN HEALTH AND DISEASE

Dr. Kathy McCoy  
University of Calgary

Our bodies are home to trillions of microbes that regulate the development and function of the immune system and other organs. This project will investigate the pathways involved in order to harness the microbiome to treat or prevent the chronic diseases that reduce the quality of life for many Albertans.

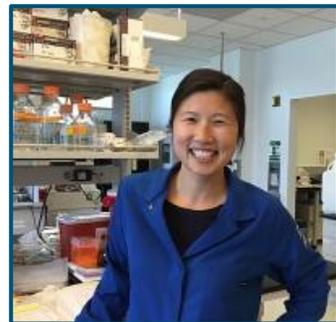
RCP Award: \$220,000  
Total Project Cost: \$598,835

## HIGH-THROUGHPUT DISCOVERY OF CELLULAR TARGETS AND RESEARCH TOOLS FOR NEURODEGENERATIVE DISEASES

Dr. Sue-Ann Mok  
University of Alberta

As Alberta's population ages, there is an increasing risk for developing fatal neurodegenerative diseases, such as Alzheimer's disease. Dr. Mok's goal is to rapidly define which molecular events in our cells lead to these diseases to ultimately develop the much needed tools and drugs for prevention or treatment.

RCP Award: \$120,000  
Total Project Cost: \$300,000



## COLLOIDS: BUILDING BLOCKS TOWARDS NEW MATERIALS

Dr. Giovannantonio Natale  
University of Calgary

The RCP-funded infrastructure will allow characterization and control of microstructures (organizations of nano and micro particles) in polymeric fluids to generate multifunctional nanocomposites and "smart" materials. This will benefit the nanomaterial/nanotechnology related industries in Alberta/Canada by developing new manufacturing solutions for innovative materials.

RCP Award: \$147,102  
Total Project Cost: \$375,556

### SOLVING THE PUZZLE OF ACUTE AND CHRONIC PEDIATRIC PAIN: INTEGRATIVE EXAMINATIONS OF MECHANISMS AND TARGETED TREATMENTS

Dr. Melanie Noel  
University of Calgary

By integrating approaches in Psychology, Neuroscience, and Medicine, Dr. Noel's research aims to improve the health of Albertans by: (1) understanding and harnessing modifiable mechanisms underlying trajectories of acute and chronic pediatric pain, (2) informing new approaches to reduce children's pain and suffering, (3) preventing pain from persisting into adulthood.

RCP Award: \$150,000  
Total Project Cost: \$383,496



### CLEAN ENERGY RESEARCH MICRO-GRID

Dr. Majid Pahlevani  
University of Calgary

Integrating solar energy into the power system through micro-grids will facilitate the development of clean, affordable electricity. The hybrid micro-grid infrastructure will allow for AC distribution as well as DC distributions in order to enable cutting-edge research in key technologies for renewable energy and energy storage systems.

RCP Award: \$150,000  
Total Project Cost: \$433,236

### ULTRA-LOW RADIOACTIVITY GASES FOR NEW RARE EVENT SEARCHES AND NEW DETECTOR TECHNOLOGY

Dr. Marie-Cecile Piro  
University of Alberta

The purpose of this project is to develop new purification techniques with direct application for experiments of rare event searches and to build new detector technology. The originality is the versatility of the research, which can be used in all fields where ultra-low radioactivity is required, such as medical applications, condensed matter, and bio-medical imaging.

RCP Award: \$200,000  
Total Project Cost: \$521,743



### SUSTAINABLE TECHNOLOGIES FOR CO<sub>2</sub> UTILIZATION AND RARE EARTH ELEMENTS EXTRACTION

Dr. Sathish Ponnurangam  
University of Calgary

Creating sustainable technologies for renewable energy storage (CO<sub>2</sub> to fuels) and mineral separations (green extraction of rare earth elements) are growing sectors. The RCP-funded infrastructure will critically enable research in these areas through comprehensive mapping of properties in-operandi of different surfactant-mineral combinations and new catalysts-support-promoters systems.

RCP Award: \$137,870  
Total Project Cost: \$351,481

## CALIBRATION SUITE FOR FAR-INFRARED ASTROPHYSICS INSTRUMENTATION

Dr. Locke Spencer  
University of Lethbridge

The far-infrared spectrum allows study of astrophysics including early star and planet formation, distant star-forming galaxies, and the very early Universe. Next-generation observatories require instrumentation characterized to a level 2-3 orders of magnitude better than current facilities. RCP funding purchased tools for the calibration and characterization of far-infrared Astrophysics instrumentation.

RCP Award: \$150,000  
Total Project Cost: \$395,164



## PROPERTIES OF GEOLOGIC FLUIDS: LINKING PHYSICAL AND ATOMIC-SCALE PROPERTIES AT ELEVATED TEMPERATURES AND PRESSURES

Dr. Matthew Steele-MacInnis  
University of Alberta

Fluids are crucial to many important geologic processes, but the fundamental controls on properties of fluids are poorly known. This research will illuminate how interactions between molecules in fluids govern the properties of fluids and how they react with rocks to form ore deposits and geothermal energy.

RCP Award: \$211,440  
Total Project Cost: \$650,925

## IDENTIFICATION OF NOVEL THERAPEUTIC TARGETS IN CHEMOTHERAPY- INDUCED CARDIOTOXICITY

Dr. Gopinath Sutendra  
University of Alberta

Our research program aims to: a) understand how tumor-secreted factors are able to enhance the susceptibility of heart cells to die in response to standard chemotherapeutics and b) discover novel therapeutic targets that will result in prevention of chemotherapy-induced heart failure while enhancing chemotherapy-induced tumor regression.

RCP Award: \$160,000  
Total Project Cost: \$400,787



## PAIN AND ADDICTION LABORATORY

Dr. Anna Taylor  
University of Alberta

A mechanistic exploration of factors contributing to the affective or emotional dimensions of chronic pain using advanced rodent behavioural, imaging, and genetic techniques. Results will advance our understanding of the mechanisms driving the transition from acute to chronic pain, and will identify novel non-narcotic interventions to treat this troubling disease.

RCP Award: \$155,983  
Total Project Cost: \$398,744

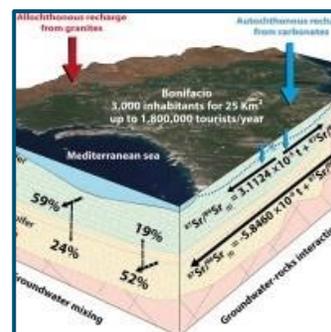
## INNOVATIVE CHARACTERIZATION OF WATER-ROCK INTERACTION FOR A NEW GENERATION OF MODELS OF SUSTAINABLE ENERGY UTILIZATION

Dr. Benjamin Tutolo  
University of Calgary

RCP funding allowed Dr. Tutolo's group to purchase experimental and analytical equipment designed to quantify water-rock interactions. The goal of the research program is to use these experimental and analytical results to produce improved numerical models of geochemical processes occurring during oil/gas extraction, geological carbon storage, and geothermal energy utilization.

RCP Award: \$250,000

Total Project Cost: \$631,436



## DISSECTING MOLECULAR MECHANISMS REGULATING BRAIN DEVELOPMENT AND REGENERATION

Dr. Anastassia Voronova  
University of Alberta

The RCP-funded infrastructure provided essential support for Dr. Voronova's research, which investigates how neural stem cells build the brain and how perturbations in these processes lead to neurodevelopmental disorders. She will apply neurodevelopmental discoveries to develop novel compounds to engage adult neural stem cells for brain repair in neurodegenerative and neurodevelopmental disorders.

RCP Award: \$147,094

Total Project Cost: \$367,735

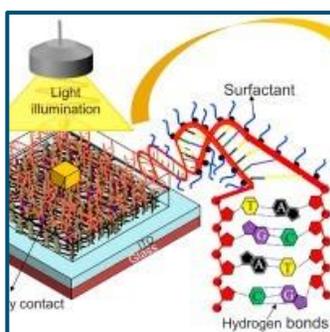
## METAL RESOURCE RECOVERY DURING CARBON CAPTURE UTILIZATION AND STORAGE IN WASTE MINERALS AND WASTE WATER

Dr. Siobhan Wilson  
University of Alberta

This project will develop novel approaches to CO<sub>2</sub> sequestration that will enable recovery of industrially useful metal resources from mineral waste produced by hard-rock mining and waste water generated by the oil and gas industry. The results will help make Alberta's resource sector more environmentally sustainable and economically competitive.

RCP Award: \$180,455

Total Project Cost: \$453,045



## DEVELOPMENT AND CHARACTERIZATION OF AN INNOVATIVE HYBRID PHOTOSENSOR

Dr. Juan Pablo Yáñez Garza  
University of Alberta

This project will develop an innovative hybrid photosensor with unprecedented capabilities. The sensor merges principles of classic photon detection with state-of-the-art Canadian semiconductor technology, and it boasts a design that may easily be implemented in large-scale production.

RCP Award: \$200,000

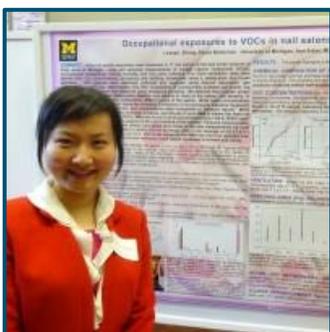
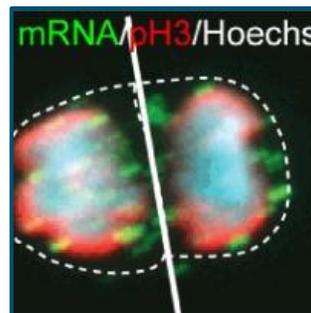
Total Project Cost: \$512,089

## TRANSLATIONAL CONTROL OF MAMMALIAN BRAIN DEVELOPMENT

Dr. Guang Yang  
University of Calgary

Failure to generate/regenerate neural cells in the brain causes devastating diseases, such as autism and multiple sclerosis. Alberta has some of the world's highest rates of these incurable diseases. RCP funding allowed Dr. Yang to purchase a state-of-the-art microscope to reveal how neural cells are made, ultimately leading to potential cures.

RCP Award: \$200,000  
Total Project Cost: \$680,138



## EXAMINATION OF HVAC SYSTEMS ON INDOOR GASEOUS POLLUTANT TRANSMISSION AND DEVELOPMENT OF EFFECTIVE CONTROL STRATEGIES

Dr. Lexuan Zhong  
University of Alberta

This project intends to explore the relationships between ventilation, air movement, moisture, chemicals, particles, and occupant behaviours, and develop advanced air purification technologies and other HVAC related control strategies to prevent pollutant transmission in buildings. The expertise and outputs of the research can improve Canadian's health, indoor environments, and life quality.

RCP Award: \$97,223  
Total Project Cost: \$243,058

## DIGITAL PCR ANALYSIS FOR NEUROSCIENCE DISCOVERY

Dr. Douglas Zochodne  
University of Alberta

RCP funding supported the University of Alberta's Neuroscience and Mental Health Institute (NMHI) laboratories to analyze ribonucleic acid (RNA), a critical component of cell function. Funding allowed a new quantitative system, known as digital PCR, for measurements of messenger RNAs, microRNAs and long non-coding RNAs.

RCP Award: \$79,869  
Total Project Cost: \$199,674



## CENTRE FOR SUSTAINABLE FOOD PRODUCTION

Dr. Ken Corscadden  
Lethbridge College

Alberta farmers want to increase food production while reducing environmental impact. RCP funding enabled Lethbridge College's Centre for Sustainable Food Production to support farmers by partnering with industry to develop new products and technologies such as soluble organic fertilizers, optimized fertigation systems, biopesticides and vertical aquaponics systems.

RCP Award: \$1,000,000  
Total Project Cost: \$2,631,780

**MULTIPURPOSE CONTENT PRODUCTION STUDIO RESEARCH INFRASTRUCTURE  
UPGRADES SUPPORTING THE NAIT CENTRE FOR INNOVATIVE MEDIA (CIM)**

Mr. Wade Muri

Northern Alberta Institute of Technology

The RCP-funded facility will provide Alberta based SMEs with access to applied research infrastructure to support innovation in digital platforms and digital content creation within the Interactive Digital Media (IDM) industry. The facility will complement currently existing services within the NSERC funded NAIT Centre for Innovative Media.

RCP Award: \$454,885

Total Project Cost: \$1,137,336



# Thank You

## Contributions

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Ms. Joanna Preston of TecEdmonton

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Mr. Jason Orbaugh of Path Therapeutics Inc.

Mr. Tim Lambert of Egg Farmers of Canada

Dr. Jonathan Merkle of Michael Foods

Dr. Keith McClain of fRI Research

Mr. Duke Anderson of Energi Simulation

Mr. John Evans of Chevron

## Contact Us

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