Research

HIGHLIGHTS 2010-2011

Parkinson
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Canada

Parkinson Society Canada
Société Parkinson Canada
Since
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1965

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Message from the Chair and the President & CEO

Bruce Ireland
Chair

This year, 2010, is Parkinson Society Canada's 45th year of supporting Canadians living with Parkinson's. As the only organization that specifically funds Parkinson's research in Canada, we are especially proud that Canada has some of the best Parkinson's researchers in the world and that scientists in Canada have contributed a tremendous amount of knowledge to our understanding of the causes, progression and treatment of Parkinson's.

Science works in increments, with each finding building on the next. There is no way to tell which nugget of information will lead to a breakthrough, so Parkinson Society Canada has created a National Research Program that funds smaller grants and awards to reach a greater number of scientists across Canada, rather than offering large amounts to a handful of researchers. This helps us achieve one of our main goals of building capacity in the Parkinson's research community. The funding goes toward genetic studies, projects on mitochondrial function, neuroprotection, cognitive function, improving caregiving practice and quality of life, among other areas.

Since 1981, Parkinson Society Canada has contributed $18 million towards 350 awards. Our program funds basic science research to expand our knowledge and understanding of Parkinson's, and to also serve as a stepping stone for larger research projects that will, in turn, yield significant findings and new discoveries. We also fund research addressing quality of life and other issues that affect people with Parkinson's and their families.

Joyce Gordon
President & CEO

Among other awards, we fund Clinical Movement Disorders Fellowships that encourage neurologists to build expertise in the diagnosis and management of Parkinson's disease and/or other movement disorders. Over the past eight years, this program has supported the training of 10 neurologists and helped to increase the number of Parkinson's and movement disorders specialists in Canada.

The success of our research program is reflected in the publication of research findings and the leveraging of Parkinson Society Canada-funded research results into larger research grants from other organizations. Since revamping the program in 2003, we have directed almost $9 million towards over 140 research projects which have generated 140 research papers and more than 100 abstracts, presentations and invited talks. Parkinson's researchers have also leveraged our support to receive an additional $4.55 million in funding to take their research to the next level.

Each individual that Parkinson Society Canada supports goes on to train and nurture new scientists and clinicians, ensuring that there is a solid base of researchers and clinicians in Canada looking into finding a cure for Parkinson's and improving the quality of life for people with Parkinson's and their care partners.

For the July 2010 - June 2012 Research Program cycle, Parkinson Society Canada will invest a total of $1.3 million. This is in addition to the $336,454 already committed to support existing 2009-2011 cycle awards in their second year.

Our thanks to all who contribute to the success of the National Research Program. Thanks especially to our regional partners, generous donors, volunteers and partners from other funding organizations who allow us to maximize our resources and expand our reach in the Parkinson community. Your investment in the Parkinson's research community is highly valued.

Bruce Ireland, Chair
Parkinson Society Canada

Joyce Gordon, President & CEO
Parkinson Society Canada

Dr. Pierre Blanchet
Chair, Research Policy Committee

Dr. Pierre Blanchet
Chair, Research Policy Committee

Dr. Pierre Blanchet received his MD from the University of Montreal in 1984, followed by certificates in Neurology and Clinical EEG from McGill University and the Montreal Neurological Institute in 1990. From 1990-97, Dr. Blanchet undertook his Ph.D. and post-doctoral training. During this period, he worked with the internationally-recognized Parkinson pharmacologist Dr. Thomas N. Chase at the National Institute of Neurological Disorders and Stroke, National Institutes of Health in Bethesda, Maryland, where he contributed to define, for the first time, the precise role of the drug amantadine as a strategy against dyskinesia in Parkinson's. This older, inexpensive compound is now often used in that situation as part of the treatment of Parkinson's.

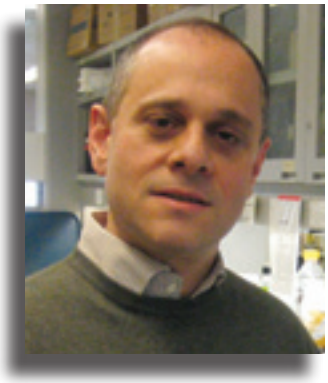
Dr. Blanchet is an Associate Professor in the Department of Stomatology of the Faculty of Dentistry at the University of Montreal, where he directs the Experimental Neuropsychopharmacology Laboratory. He is a neurologist at the Movement Disorders Unit, University of Montreal Hospital Centre.

Dr. Blanchet's team works on the contribution of the basal ganglia to the mechanisms responsible for the persistent motor complications induced by antipsychotic drugs. The team conducts clinical trials aiming to identify predictive factors for the occurrence of dyskinesia and parkinsonism in older people after long-term treatment with antipsychotic drugs.

Research Policy Committee

Dr. Pierre J. Blanchet, Chair	Quebec
Mr. Barry Johnson	Alberta
Dr. Jim Emmett	Alberta
Dr. Edward Fon	Quebec
Dr. Anne-Louise Lafontaine	Quebec
Dr. Mark Guttman	Ontario
Dr. Douglas Hobson	Manitoba
Dr. Fran Squire	Ontario

Dr. Edward Fon
Chair, Scientific Advisory Board



Dr. Edward Fon
Chair, Scientific Advisory Board

Dr. Edward Fon obtained his MD from the University of Montreal in 1989. He completed a Comprehensive Residency in Neurology, as well as a Clinical and Research Fellowship in Neurogenetics at McGill University. He joined the Montreal Neurological Institute and Hospital in 1999, after four years at the University of California, San Francisco (UCSF), on a post-doctoral research fellowship. At UCSF, he conducted genetic studies leading to a breakthrough in the understanding of dopamine transmission. He was Chief Neurology Resident at the Montreal Neurological Hospital in 1994.

Dr. Fon is an Associate Professor in the Department of Neurology & Neurosurgery at McGill University. He is Attending Neurologist at the Montreal Neurological Institute and Hospital and Director of the McGill Parkinson Program.

Dr. Fon's research at the Montreal Neurological Institute focuses on the molecular events leading to the degeneration of dopamine neurons in Parkinson's disease. In the past decade, several genes have been identified that cause forms of the disease. Dr. Fon is particularly interested in a gene called parkin, which functions as a key enzyme in the main protein degradation

pathway in the cell. This pathway utilizes ubiquitin, a protein that can mark target proteins for degradation. Dr. Fon's lab has been working on understanding the various functions of ubiquitin in the nervous system and on how defects in parkin could lead to Parkinson's disease. This research could provide important clues about the mechanisms of dopamine neuron death in Parkinson's disease and potentially lead to innovative new therapeutic strategies.

Scientific Advisory Board (2009-2010)

Dr. Edward Fon, Chair	McGill University, QC
Dr. Richard Camicioli	University of Alberta
Dr. Francesca Cicchetti	Laval University, QC
Dr. Susan Fox	University of Toronto
Dr. Zelma Kiss	University of Calgary
Dr. Martin McKeown	University of British Columbia
Dr. David Park	University of Ottawa
Dr. Alex Rajput	University of Saskatchewan
Dr. Harold Robertson	Dalhousie University, NS
Dr. Anurag Tandon	University of Toronto
Dr. Louis-Eric Trudeau	University of Montreal

Donald Calne Lectureship

The Donald Calne Lectureship recognizes a distinguished neurologist of international reputation, whose work is primarily in the area of Parkinson's disease. Awarded annually, the recipient will deliver a "state of the illness" lecture on Parkinson's disease to the Parkinson community. This lectureship was established in 2002 to honour Dr. Donald Calne for his outstanding service to the Parkinson's community as Professor of Neuroscience, University of British Columbia and past chair and long time member of the Scientific Advisory Board, Parkinson Society Canada.

Donald Calne Lectureship Awardees

2010 Dr. Stanley Fahn, Director, Movement Disorder Division, Neurological Institute, New York, New York, U.S.A.

2009 Dr. Andrés Lozano, Toronto Western Hospital, Toronto, Ontario

2008 Dr. J. William Langston, Scientific Director of the Parkinson's Institute in Sunnyvale, California, U.S.A.

2007 Dr. Anthony Lang, Director of the Morton and Gloria Shulman Movement Disorders Centre, Toronto Western Hospital, Toronto, Ontario

2006 Dr. Jon Stoessl, Director of the Pacific Parkinson's Research Centre at the University of British Columbia in Vancouver, British Columbia

2005 Dr. Zbigniew Wszolek, Mayo Clinic Jacksonville, Florida, U.S.A

2004 Dr. Oleh Hornykiewicz, The Brain Research Institute at the University of Vienna, Vienna, Austria

2003 Dr. Yoshikuni Mizuno, Neurology Department, Juntendo University Medical School, Tokyo, Japan

Research Program

PILOT PROJECT GRANT PROGRAM

Duration 1 year
Funding Amount Maximum $45,000

As a committed supporter of Canadian research potential, Parkinson Society Canada encourages established investigators to enter into the study of Parkinson's disease and perform research in new, specifically targeted, high priority areas. We provide 'seed money' to professionals engaged in novel or emerging research in areas relevant to the cure, cause, prevention, improved treatment and/or understanding of Parkinson's disease and its effects on society. This strategic investment is expected to lead to subsequent substantial grants from larger funding institutions.

NEW INVESTIGATOR AWARD PROGRAM

Duration 2 years
Funding Amount Maximum $45,000 /year

Parkinson Society Canada is actively investing in the future of Canadian Parkinson's research, by supporting individual researchers in their professional development. During the initial period of their independent careers, new investigators are in a good position to formulate innovative and fertile research projects. This program provides an opportunity for new investigators to develop and demonstrate their ability to initiate and conduct independent health research.

BASIC RESEARCH FELLOWSHIP PROGRAM

Duration 2 years
Funding Amount $40,000 - $50,000 /year

Through the provision of salary support, Parkinson Society Canada has attracted promising young scientists to the field of biomedical research into Parkinson's disease. Investing in their research training ensures a solid foundation of researchers offering promise for future work in the area of Parkinson's.

CLINICAL RESEARCH FELLOWSHIP PROGRAM

Duration 2 years
Funding Amount $50,000 /year

Relative to the needs of people with Parkinson's in Canada, there is a shortage of leaders involved in Parkinson's services and clinical research programs in Canada. Parkinson Society Canada believes that this shortage of medical specialists, neurologists or neurosurgeons with experience both in the critical management of Parkinson's and in its clinical research, has the potential to worsen in the next few years.

To address physician shortages, we are encouraging scientists to enter the field of Parkinson's clinical research while simultaneously investing in research training that offers promise for future work in the area of Parkinson's disease.

CLINICAL MOVEMENT DISORDERS FELLOWSHIP PROGRAM

Duration 1 year
Funding Amount $50,000

Parkinson Society Canada wants to ensure that each person in Canada with Parkinson's receives appropriate medical expertise, drug treatment, support services, continuous care, educational resources, respect, dignity, help and hope. This fellowship represents the first step in achieving part of our goal of ensuring that these critical elements in the day-to-day management of Parkinson's are accessible and available. Clinicians entering into clinical training in the subspecialty of Movement Disorders are trained to gain expertise in the diagnosis and management of Parkinson's disease and other movement disorders.

GRADUATE STUDENT AWARD PROGRAM

Duration 2 years
Funding Amount $15,000 /year*

Parkinson Society Canada wishes to encourage continued growth and revitalization in the fields of Parkinson's research in Canada. By providing salary support to talented young scientists, master's and doctoral students have an opportunity to choose Parkinson's research as their area of focus during the early stages of their training.

* Additional $5,000 /year is contributed by the student's supervisor for a total award amount of $20,000 per annum.

PSYCHOSOCIAL RESEARCH STREAM

This strategic initiative is aimed at increasing interest in and encouraging research directed toward closing the gap in understanding and treating motor and non-motor symptoms of Parkinson's, improving quality of life or addressing caregiving issues, as well as investigating behavioural and cognitive changes.

Research topics identified as priority issues by Parkinson Society Canada are:

1. Investigating the Psychological Well Being of People Living With Parkinson's, Partners and Families
2. Evaluating the Benefits of Standardized Care
3. Assessing Medical Services
4. The Economic Burden of Parkinson's

RESEARCH GRANT

Duration 2 years
Funding Amount Maximum $50,000 /year

In partnership with the Canadian Institutes of Health Research, Institute of Neurosciences, Mental Health & Addiction, this research grant provides operational support to an investigator.

DOCTORAL AWARD

Duration Up to 3 years
Funding Amount $21,000 + $1,000 travel allowance/year

In partnership with the Canadian Institutes of Health Research, Institute of Neurosciences, Mental Health & Addiction, this doctoral award provides salary support to a student who is pursuing a PhD.

CARE PRACTICE IN COGNITIVE IMPAIRMENT IN AGING PARTNERSHIP

Parkinson's disease is the second most common neurodegenerative disease (after Alzheimer's disease); 48% to 80% of people living with Parkinson's will develop dementia. The primary objective of this program is to better inform nursing care practice and to improve the quality of clinical care provided to cognitively impaired older adults in various care settings, including acute care facilities, long term care institutions, and community care settings such as day programs or people's homes.

It is expected that grant support under this program will help address challenges in care practice, be they the result of evidence gaps or barriers to knowledge translation and exchange. Such investments will also increase our knowledge of how to improve the translation of research into nursing care practice.

Funding for these grants has been provided by Parkinson Society Canada, Institute of Aging and the Canadian Nurses Foundation. Parkinson Society Canada has contributed $50,000 over two years to this program.

Dr. Janice Keefe — Year 1: $87,831
Mount Saint Vincent University — Year 2: $79,041
Title: Does timing of caregiver assessment make a difference?: evaluating the impact with older spousal caregivers of persons with cognitive impairment

Dr. Belinda Parke — Year 1: $33,803.56
University of Alberta — Year 2: $40,089.06
Title: Understanding emergency department care transitions for older adults with dementia

Pilot Project Grant

The impact of inflammation on the pathogenesis of Parkinson's disease

Dr. Francesca Cicchetti

Dr. Cicchetti received her BA in Psychology from McGill University before moving to Laval University where she obtained her MSc and PhD in Neurobiology. She undertook her post doctoral training in post-doctoral neurodegeneration at the McLean Hospital, Harvard Medical School before returning to Quebec. She is currently an Associate Professor and researcher at Laval University.

One Year Award $45,000

Researchers know that inflammation occurs in the brains of people with progressive, degenerative brain diseases such as Parkinson's. But they disagree over the inflammatory response's exact role: is inflammation beneficial or detrimental to the degeneration of brain cells?

At Laval University, Francesca Cicchetti is studying the brain's immune system and the inflammation triggered when brain cells are injured – either by a stroke, a lesion, or a progressive disease.

"When cells begin to degenerate, they send signals to surrounding cells," Cicchetti says. "Some of these helper cells are called microglia, and their tasks include cleaning up cell debris."

Those microglial cells are part of the inflammatory response. Their primary role is to act as scavengers of the brain and to clean house. But if degenerating brain cells signal these helper cells continuously, they could promote a second wave of neurodegeneration by releasing various agents during this process that can become toxic in high concentrations.

Because Parkinson's disease is progressive, the inflammatory response occurs over several years, becoming chronic and potentially further contributing to the death of brain cells.

Cicchetti also hopes to determine whether the inflammatory response is a byproduct of Parkinson's, or contributes to it. She also wants to find out where inflammation first takes place, such as in the gut or the olfactory system. If her findings point to inflammation as a key player in the death of neurons, her research could eventually lead to medication that can alter or interrupt this inflammatory response.

"It will be critical to follow the progression of the inflammatory response, and see where it affects the (body's) systems over time, and where, if possible, we should be targeting drug application," she says.

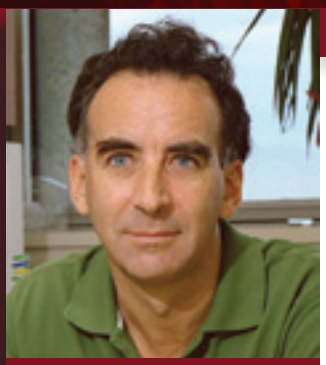
If Cicchetti could establish that inflammation that begins first in other parts of the body is instrumental in causing or worsening Parkinson's disease, researchers might be able to treat the problem at an earlier stage in the illness.

Cicchetti has long been fascinated by the brain and why brain cells degenerate. She believes deciphering the inflammatory response could uncover pathways of degeneration common to other neurodegenerative and mental disorders as well. But she plans to stay focused on Parkinson's disease.

"Once you invest yourself in this type of work, you get so passionate and so committed to trying to find the solution, it's difficult to imagine doing anything else," she says.

Pilot Project Grant

Sub-lineages of midbrain dopaminergic neurons: molecular identity and neurodegenerative susceptibility



Dr. Jacques Drouin

Dr. Drouin received his BSc in Biochemistry and DSc in Physiology from Laval University. He undertook post-doctoral training at the MRC Laboratory of Molecular Biology at Cambridge, England with two times Nobel laureate, Fred Sanger and later moved to the University of California to complete his training in biochemistry & biophysics. Dr. Drouin is presently Director, Laboratory of Molecular Genetics at the Clinical Research Institute of Montreal, Professor of Biochemistry and Faculty Member of the Graduate Program in Molecular Biology at the University of Montreal and Adjunct Professor in the Departments of Biochemistry and Experimental Medicine, as well as Associate Member in the Department of Anatomy and Cell Biology at McGill University.

One Year Award $45,000

Within one part of the brain of people with Parkinson's disease, a particular group of dopamine-producing cells is the most sensitive to degeneration. At the Clinical Research Institute of Montreal, molecular biologist Jacques Drouin is determined to find out why those brain cells are the first to die.

"The loss of these neurons … correlates with the loss of motor deficits that are the first manifestation of Parkinson's disease, so it's important to understand why this subgroup of neurons is lost first," Drouin explains.

Drouin and his colleagues at the Institute have discovered a particular protein – known as PITX3 – that is only expressed in these particular dopamine-producing neurons. They are located in the ventral portion of the midbrain. Because PITX3 regulates gene activity, Drouin believes this protein holds the key to the unique nature of the ventral neurons that are the first brain cells lost in the Parkinson's process.

Drouin's research project involves isolating neurons marked with fluorescent proteins from the brains of mice with Parkinson's symptoms to identify the genes that PITX3 targets. Finding the most relevant genes involved in the cell death process will, Drouin hopes, eventually lead to a drug that could halt or stop the progression of the disease.

"Those pathways that are so critical would become targets for drug development," Drouin says.

Drouin got his first taste of the importance of research and what he calls "the beauty of proteins and what they do" when he was still a high school student in Quebec City. He got a part-time job at a research lab at Laval University.

"That got me reading," Drouin says. "That's when I saw the first papers that described protein structure and linked the structure of proteins with their function. The fact that you could explain biology through the structure of proteins was quite startling to me."

Drouin chose a research career in molecular genetics and biology because of his love for charting previously unknown scientific territory. He particularly enjoys discovering new structures in the brain, and the way different pathways work.

"That's the fun of it," he says.

Funded by Parkinson Society British Columbia

Pilot Project Grant

Endogenous stimulation of the basal ganglia "hyperdirect pathway" in Parkinson's disease

Dr. Martin McKeown

Dr. McKeown received his BEng summa cum laude in Engineering Physics from McMaster University and completed his MD at the University of Toronto. He was a Neurology Resident at the University of Western Ontario and has certification as a Fellow of the Royal College of Physicians of Canada FRCP(C). Dr. McKeown is currently an Associate Professor, Medicine (Neurology) and core Faculty member of the Pacific Parkinson's Research Centre, at the University of British Columbia. As a clinical neurologist, with a background in Engineering, Dr. McKeown marries his expertise to use engineering principles to learn more about disease mechanisms and potential treatments.

One Year Award $44,950

Deep brain stimulation is an operation doctors perform to help some people with Parkinson's disease relieve their symptoms of stiffness, tremors, rigidity and difficulty walking. Surgeons implant a medical device in the brain that sends electrical pulses to stimulate regions that control movement.

At the Pacific Parkinson's Research Centre in Vancouver, Dr. Martin McKeown is investigating how to trigger the same results in the brain without surgery.

McKeown, who is an engineer as well as a neurologist, is using functional Magnetic Resonance Imaging – commonly known as fMRI – to map a natural pathway in a tiny region of the brain called the subthalamic region.

The subthalamic region is about the size of a fingernail, so small it's ordinarily difficult to identify even on an MRI image, which is why surgeons must use recordings during placement of the electrodes while the subject is awake to ensure that the stimulating electrodes are in the right place. But McKeown is combining imaging with mathematical modeling to locate the region and trace the pathway that connects the subthalamic region to the frontal area of the brain.

By identifying this pathway, McKeown hopes to characterize the subthalamic region's relationship to other areas of the brain that are involved in Parkinson's disease. Then he will see if he can stimulate the pathway, just as the electrodes in deep brain stimulation do.

McKeown and his graduate students are looking for triggers, such as visual stimuli, that would activate the pathway and relieve the motor symptoms of Parkinson's.

"Not all people are appropriate for surgery, so if we can activate the subthalamic region with pathways that are normally present, there may be a way to get some of the effects of surgery without any operation," McKeown says.

Deep brain stimulation has also been implicated in impulse control problems, such as pathological gambling, that some people with Parkinson's disease develop as a side-effect of their treatment.

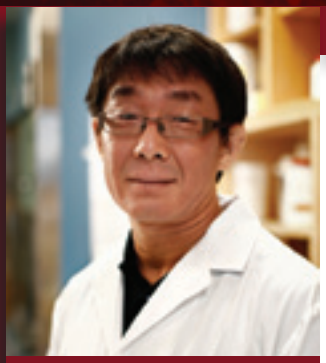
Although McKeown's long term goal is to find new treatments for Parkinson's disease, an important benefit of his research will be to assess whether the pathway he's investigating is disrupted in people with impulse control disorders.

For McKeown, who likes to tackle problems he can measure, working on Parkinson's disease employs all his knowledge and skills.

"I really enjoy assisting people with Parkinson's and I enjoy collaborating with my engineering colleagues," he says. "This is a rewarding area where we've been able to bring recent advances in engineering to assist in problems in clinical neurology."

Pilot Project Grant

The role of a scaffold protein JIP1 in dopaminergic neuron loss in MPTP mouse model of PD



Dr. David Park

Dr. Park received his PhD from Rutgers University, New Jersey and undertook post-doctoral training with Dr. Lloyd Greene at Columbia University in New York. He is currently Assistant Dean of Research and a Professor in the Department of Cellular Molecular Medicine at the University of Ottawa. He is Co-Director of the Ottawa Parkinson Research Consortium and a career investigator of the Heart and Stroke Foundation. His main interest is in uncovering the mechanisms governing neuronal death and dysfunction, particularly in the context of Parkinson's disease and stroke.

One Year Award $45,000

At the University of Ottawa, neuroscientist David Park is hot on the trail of a couple of proteins that he thinks hold the key to what causes brain cells to die.

Park, a biochemist, is unravelling the interaction between a critical protein called CDK-5, and a second protein called JIP1. CDK-5 is what Park calls a master signal, which acts like a switch to regulate the death of dopamine-producing neurons.

"CDK-5 is a jack-of-all trades. It does many things, many of which are important for a good healthy life," Park says. "But it also does bad things. We need to identify the bad things it's modifying and target those, rather than stop the good things."

One of the things that CDK-5 is modifying, Park believes, is another protein called JIP1. JIP1 controls how different proteins come together in large structures within a cell, and those structures, in turn, regulate important biological processes. Park thinks CDK-5 is modifying JIP1, and in a process that has somehow gone awry, is causing JIP1 to swap in molecules that kill dopamine-producing cells.

"We think this is abnormal. It shouldn't happen. So we need to stop it," Park says.

If Park's research confirms that the interaction between CDK-5 and JIP1 is happening the way he believes it is, he will have isolated JIP1 as a potential drug target.

In addition to providing a target for medication that could improve the lives of people with Parkinson's disease, Park hopes identifying the relationship between CDK-5 and JIP1 will also have wider application.

"CDK-5 probably acts as a conduit for many kinds of damaging conditions that lead to the death of many types of brain cells," he says.

After testing to see if they can alter the interaction to change JIP1's behaviour, Park hopes his research can also determine the point at which to intervene in the process that's occurring in the brain.

"Usually, by the time a patient goes to their doctor, there's already a very significant portion of brain cell dysfunction," he says. "So we need to better figure out how to catch people earlier."

Park's research is motivated by the curiosity that drives him forward, and his desire to find something that can ease people's suffering.

"This is something that really needs to be addressed," he says.

Funded by Parkinson Society British Columbia

Pilot Project Grant

An examination of the impact of chronic oxidative stress and changes in mitochondrial trafficking in neurodegeneration and Parkinson's disease

Dr. Gordon Rintoul

Dr. Rintoul received his BSc (Honours) from the University of Western Ontario and his PhD from the University of British Columbia. He undertook his post-doctoral training in Mitochondrial Biology at the University of Pittsburgh. He has been an Assistant Professor in the Department of Biological Sciences at Simon Fraser University since 2006. Dr. Rintoul's lab focuses on mammalian neuronal mitochondria, particularly the role they play in neurodegeneration.

One Year Award $45,000

Mitochondria – the microscopic structures found inside cells – are usually described as the cells' "powerhouse" because they convert nutrients into energy for cells to use. But as neurobiologist Gordon Rintoul is discovering, that description is misleading.

"A powerhouse implies they are a stationary structure," says Rintoul, an assistant professor at Simon Fraser University in Burnaby, B.C. "During my post-doctoral fellowship at the University of Pittsburgh, we observed that these little things were quite mobile, within neurons. They're like little Meals on Wheels – they go to where energy is needed."

Rintoul believes that mitochondria in healthy brain cells usually zip up and down those cells, pausing at the areas that need energy the most. But as neurons age, the delivery process – the mitochondria's mobility – might be disrupted. That could make the neurons more susceptible to Parkinson's disease.

The mitochondria's mobility might also be disrupted by a process known as chronic oxidative stress. Oxidative stress is a by-product of energy generation, caused by the production of too many destructive, oxygen-containing molecules. Oxidative stress may be responsible for the aging process, and some researchers have also linked it to Parkinson's disease and progressive brain disorders.

Rintoul and his students are investigating whether chronic oxidative stress disrupts the way mitochondria move to deliver energy to necessary parts of brain cells, making those cells more vulnerable to Parkinson's disease or contributing to the disease itself.

"We hope this will give us insight into the underlying cause or susceptibility to disorders like Parkinson's disease … and potentially provide targets for treatment," says Rintoul.

He will try to prove his thesis by studying cell cultures, using fluorescent probes that light up the mitochondria to watch them move around in the cells, and then comparing cells treated with chemical antioxidants to those not treated with antioxidants.

Rintoul's research into what causes neurons to die is driven by his interest in figuring out exactly how things are put together.

"Every once in a while you make some little discovery, and it's exciting – some little piece of information that you know and nobody else knows," he says.

Mitochondrial research is at the centre of the investigation of the cause of Parkinson's disease – and Rintoul is at the forefront of that research.

Pilot Project Grant

Identification of the genetic factors responsible for the Rapid Eye Movement (REM) sleep behaviour disorder

Dr. Guy Rouleau

Dr. Guy A. Rouleau has been full professor at the Faculty of Medicine, University of Montreal since 2004. He is also Director of the CHU Ste-Justine Research Centre, the Centre of Excellence in Neuromics of the Université de Montréal (CENUM) and the Network of Applied Genetic Medicine of Québec.

Dr. Rouleau's work is focused on understanding the genetic basis of brain diseases. He has mapped more than 20 loci and has made a major contribution toward the identification of more than 10 genes responsible for diseases including Parkinson's, as well as a better understanding of their pathogenesis.

One Year Award $45,000

Neurologist Guy Rouleau has long believed that Parkinson's disease is not just one disease, but a group of diseases with a lot in common. That's why Rouleau is searching for genes associated with a particular sleep disorder that could be an early warning sign for Parkinson's.

Usually, the only things that move while we dream are our eyes – the reason this period of sleep is called Rapid Eye Movement sleep. About two percent of all people develop REM behaviour disorder, a failure of the normal paralysis that occurs when people dream. "The paralysis of the rest of our body during REM sleep is a protective mechanism that keeps us from actually leaving the bed while we're dreaming of climbing a mountain, for example," says Rouleau. But people with REM behavioural disorder sometimes become agitated or violent, striking out during their dreams.

According to experts in REM behavioural disorder, like Rouleau's colleague Dr. Jacques Montplaisir, about 50 percent of people with this disorder develop a particularly difficult form of Parkinson's disease. It does not respond well to medication and often includes dementia.

"It seems as if there's a strong link between Parkinson's and this REM disorder, and it may define a particular subgroup (of patients)," says Rouleau.

Rouleau and Montplaisir will study people with REM behaviour disorder to see if they also carry mutated genes, such as the parkin gene, which have been linked to Parkinson's. If none of the patients with REM behaviour disorder carry mutated genes that have already been linked to Parkinson's, they may share mutations that had not previously been considered part of the Parkinson's puzzle. That would open a new line of inquiry.

Rouleau hopes his work will enable researchers to identify, early, people disposed to developing this more severe form of Parkinson's.

"If we could define it better and identify a genetic cause of it, we could design new treatments," he says.

Rouleau is excited by the prospect of opening a new door into Parkinson's disease, as well as the possibility of helping people who develop dementia.

"Dementia is a terrible thing but on top of that it also limits the ability to treat (Parkinson's) because a lot of the drugs you use can make people confused," he explains.

Porridge for Parkinson's Toronto

Pilot Project Grant

Characterization and validation of pharmacologically-driven signalling pathways to lower alpha-synuclein: Implications for Parkinson's disease

Dr. Michael Schlossmacher

Dr. Schlossmacher received his MD from the University of Vienna, Austria and undertook post-doctoral training at Harvard University. He completed adult neurology training in the Harvard Longwood Neurology Program and a clinical fellowship in movement disorders at Massachusetts General Hospital and Brigham & Women's Hospital. He is currently an Associate Professor, Department of Medicine (Neurology) with a cross-appointment in the Department of Cellular & Molecular Medicine and holds the Canada Research Chair in Parkinson Disease at the University of Ottawa.

Dr. Julianna Tomlinson

Dr. Tomlinson received her BSc Honours and PhD in Biochemistry from the University of Ottawa. She is currently a Post Doctoral Fellow at the Ottawa Hospital Research Institute in the division of neurosciences training under the supervision of Dr. Michael Schlossmacher.

One Year Award $45,000

Researchers investigating the causes of Parkinson's disease often focus on the interaction among different proteins, to see if they can find one or more that could be the target of a new drug that could prevent or even halt the progression of this degenerative illness.

But at the University of Ottawa, Julianna Tomlinson and Dr. Michael Schlossmacher think existing drugs may hold the key to promising new treatments.

Tomlinson and her colleagues are screening drugs that the U.S. Food and Drug Administration and Health Canada have already approved to treat other illnesses. They're testing them to see if they lower the amount of one particular protein called alpha-synuclein, which has been linked to Parkinson's disease.

"People who make too much of the alpha-synuclein protein risk developing Parkinson's disease," says Tomlinson, a biochemist and neuroscientist. Lowering the amount of alpha-synuclein in brain cells could prevent the deaths of dopamine-producing cells.

So far, Tomlinson and Schlossmacher's team has screened more than 1300 drugs.

"What we've been doing is treating nerve cells with these drugs, and then measuring their effects on the level of proteins in these cells," Tomlinson says.

To date, they have already found some promising candidates that they will ultimately test further.

"Finding drugs that have already been approved represents a possible shortcut to clinical trials that take years to conduct," says Schlossmacher, a neurologist who treats people with Parkinson's in his practice.

"Rather than spending years and millions of dollars in the development of new pharmacological agents, medications already in use for other diagnoses could be 'repositioned'," he says.

"Once identified and validated, we could then identify those patients with Parkinson's disease where we have a high level of confidence that they suffer from an accumulation of alpha-synuclein in their nervous system," Schlossmacher says.

"Then those patients could be enrolled in clinical trials with one or more of the repositioned drugs," he says.

The eventual proof of whether Tomlinson and Schlossmacher's theory works will be whether they can halt the progression of Parkinson's disease in the people who get the repositioned drugs, once the medications have been identified.

For Tomlinson, who has long been drawn to science and research, working with the Parkinson's community in Ottawa is important because it exposes her to the realities of living with the disease, instead of pure research.

"There's a great community to engage with," she says.

Pilot Project Grant

Maladaptive neuroplasticity in Parkinson's Disease

Dr. Alexander Thiel

Dr. Thiel began his research career at the Max-Planck-Institute for Neurological Research following receipt of his MD from Bonn University in Germany. In 2000, following the receipt of the prestigious Max-Planck-Society's Otto-Hahn-Medal, he became a research fellow at the Montreal Neurological Institute and later returned to Cologne University to complete his residency in neurology and psychiatry. In 2005, he received his Venia Legendi, the highest academic designation obtainable in certain European countries. Dr. Thiel is an Associate Professor for Neurology at McGill University and Director of the neuroplasticity research program and a staff neurologist in the Department of Neurology at the Sir Mortimer B. Davis – Jewish General Hospital.

One Year Award $45,000

Neural plasticity is an exciting new concept in brain research, revolving around evidence that even the adult brain is able to change itself. Plasticity promises hope for people with many kinds of brain damage, such as learning disabilities and stroke. But in Parkinson's disease, it may not be beneficial.

That's what Dr. Alexander Thiel investigates at Montreal's McGill University. Thiel, a stroke neurologist, knows the new synapses – the junctions that cells use to signal to each other – that form in the adult cortex after a stroke, can help people recover and use new areas of their brain. So can dendrites, the branch-like parts of brain cells that conduct electrochemical signals in the brain.

But Thiel believes that in Parkinson's disease, those same new synapses and dendrites may be connected to the uncontrollable movements, called dyskinesias, that many people with Parkinson's experience.

Dyskinesias primarily result from the medication people with Parkinson's disease take. But because they are so repetitive, neural plasticity may cause hard-wired changes in the brain's architecture that intensify and maintain the dyskinesias, making them more permanent.

Thiel uses an imaging procedure known as Positron Emission Topography – PET scanning – to measure the number and density of neurons in the pre-motor cortex of the brain. By comparing the responses of people with Parkinson's and dyskinesias when he stimulates the pre-motor cortex to the responses of people with Parkinson's but without dyskinesias, he hopes to determine if there are changes in that area of the brain in people with Parkinson's.

If the changes are occurring, Thiel hopes to use non-invasive brain stimulation therapy involving magnetic coils that change the excitability of nerve cells to block the activity in the pre-motor cortex.

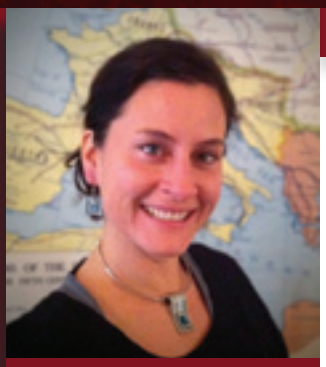
"If we can confirm the hypothesis that at least part of this dyskinesia problem is long-lasting neuroplastic changes in certain areas of the cortex, then we may have the tools at hand to do something about it," Thiel says.

Thiel has been hooked on science since his aunt gave him a chemistry kit for Christmas when he was six years old. His interest in Parkinson's research grew from his investigations into plasticity and the role it can play in chronic, degenerative diseases.

"This is a new angle to look at Parkinson's disease," Thiel says.

New Investigator Award

Investigating the role of the D3 dopamine receptor in dyskinesias: Positron Emission Tomography Studies



Dr. Isabelle Boileau

Dr. Boileau received her BA in Psychology from the University of Concordia in Montreal and her MSc in Neuroscience from the University of Montreal. She completed her PhD at McGill University in 2006 and undertook post-doctoral training in Psychiatry at Columbia University, New York. Dr. Boileau is currently a Clinical Research Scientist at the Centre for Addiction and Mental Health in Toronto, Ontario and an Assistant Professor in the Department of Psychiatry at the University of Toronto.

Year 1 $45,000 Year 2 $45,000 Total Award: $90,000

New imaging tools are allowing researchers like Isabelle Boileau a unique opportunity to peer into the brains of people with Parkinson's disease, to try to pinpoint the molecular mechanisms that cause the symptoms and progression of the illness.

At the Centre for Addiction and Mental Health in Toronto, Boileau is using Positron Emission Tomography, also known as a PET scan, to take images of the brains of people with Parkinson's. She's focusing on a particular protein in the brain called the D3 receptor that attaches to dopamine, a chemical in the brain that transmits signals from one neuron to the next.

Too little dopamine is believed to cause Parkinson's disease. But the drugs that people take to replace the dopamine they lack can also cause uncontrollable movements (dyskinesias). Those dyskinesias may be linked to too many D3 receptors in some areas of the brain.

"Is it possible that treatment with dopamine replacement medication increases the levels of these receptors, as is the case with animals?" Boileau asks. That's what she intends to find out.

Using nuclear medicine techniques to tag D3 receptors in the brain so they show up in a PET scan, Boileau is investigating a theory that dyskinesias that occur following repeated doses of medication can partly be explained by an increased sensitivity to the drugs' motor effects.

If she discovers that D3 receptors are involved in dyskinesias, that knowledge could be used to develop new drugs that either reduce the number of D3 receptors in certain areas of the brain, or partially block the receptors.

In fact, some drugs that block D3 receptors already exist, but researchers don't yet know if they would help reduce the side effects of dopamine replacement therapy or if they would increase the symptoms of Parkinson's disease. "The number one question is, are these receptors involved in some of the symptoms of Parkinson's disease or some of the negative side-effects of the medication?," Boileau says.

Boileau, who earned an undergraduate degree in psychology before choosing neuroscience for her PhD, is following in her neurologist father's footsteps by devoting her life to the study of the brain. She can't conceive of doing anything else.

"I don't know what else there is – it's the ultimate question," she says.

In her spare time, Boileau likes to climb mountains – and for her, understanding what causes Parkinson's disease is just another peak to conquer.

"It's just a challenge," she says, with confidence.

Funded by Parkinson Society British Columbia

New Investigator Award

Modulation of the DAT/DJ-1 interaction by oxidative stress

Year 1 $45,000 Year 2 $45,000 Total Award: $90,000

Dr. Frank Lee

Dr. Lee received his BSc, MSc and PhD in Pharmacology from the University of Toronto. In 2001 he undertook post-doctoral training in Neuroscience at the Boston Children's Hospital in Boston at Harvard Medical School. Following his return to Toronto in 2004, he was a Senior Research Associate at the Centre for Addiction and Mental Health and was the recipient of a Parkinson Society Canada Basic Research Fellowship from 2006-2008, training under the supervision of Dr. Fang Liu. Dr. Lee is currently an Assistant Professor at Simon Fraser University in the Faculty of Health Sciences.

Many researchers investigating the causes of Parkinson's disease have focused on the death of the brain cells that produce dopamine. While too little dopamine affects the mobility of people with Parkinson's, neurobiologist Frank Lee thinks too much dopamine can be just as destructive to brain cells.

"If there's too much dopamine, it can flood the system's ability to regulate it within a neuron," says Lee, an assistant professor at Simon Fraser University.

Lee is examining the relationship between two proteins involved in controlling how much dopamine brain cells produce. One of those proteins is called DAT, a dopamine transporter, and the other is DJ-1, which has been linked to familial forms of Parkinson's disease.

Other research groups have demonstrated that when mice are genetically engineered to lack DJ-1, DAT, the dopamine transporter, gets increasingly active. The relationship between the two proteins appears to affect the transmission of dopamine. The interaction between those proteins and oxidative stress, a by-product of the process that occurs when cells use oxygen to generate energy, also appears central to the accumulation of dopamine.

Oxidative stress can produce toxic molecules that attack proteins and DNA, causing cell death. If Lee can confirm his characterization of the relationship among the proteins and oxidative stress, he believes researchers will be able to design a small, synthetic protein – called a peptide – to disrupt the interaction.

That, he hopes, would prevent the accumulation of too much dopamine within brain cells, and stop cell death.

Lee has been drawn to science ever since he watched What Will They Think of Next?, a popular science show that ran on Global Television when he was in public school. But when he was in graduate school, the role of dopamine began to capture his attention.

"Dopamine is fascinating to me because it's involved in so many different diseases, like Parkinson's disease, schizophrenia, and drug addiction," Lee says.

He hopes by determining the role of different protein partners in regulating dopamine, his work will have broad applications to these other diseases as well.

New Investigator Award

Evaluation of Pragmatic Deficits and the Neuroconnective Process in Individuals with Parkinson's Disease

Dr. Laura Monetta

Dr. Monetta received her Masters in speech and language therapy from the University of San Luis, Argentina in 1997 and her PhD in biomedical sciences from the University of Montreal in 2003. Dr. Monetta undertook post-doctoral training in cognitive neuroscience at McGill University and the University of Montreal. Dr. Monetta is currently an Assistant Professor at Laval University.

Year 1 $36,400 Year 2 $32,000 Total Award: $68,400

Speech pathologist Laura Monetta is frustrated by a language comprehension problem that as many as 50 percent of people with Parkinson's disease experience – their inability to understand indirect speech.

Most adults have learned to understand that sometimes, when we talk to each other, we don't mean things literally. When we use irony, for example, to make a point, or choose metaphors to compare one thing to another, or make a sarcastic comment, people use the context of the conversation and situation to grasp the deeper meaning of our words.

But people with Parkinson's often lose their ability to understand non-literal speech, a problem known as pragmatic language deficit.

Monetta, who sees patients clinically in addition to conducting research and teaching at Quebec's Laval University, wondered why dopamine replacement medication that most people with Parkinson's take doesn't appear to help this problem.

So Monetta launched a trial focused on pragmatic language deficits. She uses magnetic resonance imaging to scan people's brains as they read and interpret a paragraph that contains indirect language. By comparing the responses of people with Parkinson's who are taking medication to those with Parkinson's who are not, Monetta hopes to answer her question about whether dopamine replacement therapy helps. If, as she suspects, it does not help, she wants to pinpoint why not – perhaps because the medication doesn't reach the affected area of the brain.

"If we have a better understanding of what is happening in their brains, we'll be able to help them," Monetta says.

"Other people with pragmatic language deficits, such as those with traumatic brain injuries or lesions, receive speech and language rehabilitation that helps them," Monetta says. But there are no specific programs to help Parkinson's patients with this language comprehension problem.

"I would like in the future to develop a better instrument to evaluate and treat these language problems," she says.

For Monetta, who has always loved language, and who speaks French, Italian, and English as well as her native Spanish, helping people communicate better is a passion and a joy.

"People with Parkinson's disease are great to work with," she says. "They are always collaborative, and they always want to know more."

New Investigator Award

Exploring the role of the subthalamic nucleus in rodent gambling tasks in hypo- and hyper-dopaminergic states

Dr. Catharine Winstanley

Dr. Catharine Winstanley obtained a first class honours degree in Psychology and Physiology from the University of Oxford in 2000, and subsequently completed a PhD at the Department of Experimental Psychology at the University of Cambridge. She was a post-doctoral researcher from 2004-2007 at the University of Texas Southwestern where she focused on how manipulating intracellular signaling pathways can affect impulse control and cognitive function, and applied such knowledge to models of drug addiction. Dr. Winstanley is currently an Assistant Professor in the Department of Psychology at the University of British Columbia.

Year 1 $45,000 Year 2 $45,000 Total Award: $90,000

Problem gambling and other impulsive behaviours are among the most devastating side-effects of medication used to treat Parkinson's disease. Recently, researchers have also become concerned that another form of treatment – deep brain stimulation – is also linked to impulse control issues.

At the University of British Columbia, psychologist Catharine Winstanley is probing the origins of impulsivity in the part of the brain called the subthalamic nucleus. Passing a current through electrodes positioned in this brain region can improve the motor symptoms of Parkinson's. Dopamine replacement medications, such as levodopa, also affect the activity in this part of the brain in a way that improves motor control. For some people, though, these changes also result in impulsivity and problem gambling.

Winstanley wants to pinpoint the cause of this increased impulsivity. She hopes to develop recommendations about who is most at risk of developing this problem gambling behaviour, so doctors can seek alternative treatments for them.

"It's just heartbreaking listening to some of the stories about this," Winstanley says. "You've got people whose support networks, spouses and friends, have stayed with them through the onset of this debilitating disease, but who just can't cope with this gambling behaviour."

Winstanley works with rats that have the chance to gamble to earn tasty sugar pellets. Some rats adopt a high-risk, high-reward strategy, which gives them fewer pellets in the long run: they become problem gamblers.

She studies the effects of inhibiting the subthalamic nucleus on the gambling behaviour of rats who have been given Parkinson's disease. Some of the animals will also be treated with medication to improve their dopamine levels.

"We want to see at what stage some rats develop this problem gambling behaviour, and what it is about those that differentiate them from the rest of the group," she says.

By determining why the subthalamic nucleus appears so sensitive to changes in dopamine levels in some individuals, Winstanley hopes she will eventually spare people with Parkinson's from having to choose between not getting treatment, or receiving treatment that causes problem gambling.

Winstanley became interested in the psychological basis for behaviours, as well as the biochemical ones, when a close friend developed schizoaffective disorder.

"I really didn't think there was enough we could do to help him, and I wanted to be part of finding a solution," she says.

"Getting to the root of impulse control issues could be relevant to brain disorders often called mental illnesses as well as neurodegenerative diseases such as Parkinson's," Winstanley says.

She calls a career in science "the best job in the world."

"You're discovering new things about how the brain works every day – what could be better than that?"

Lois Harper Estate

Basic Research Fellowship

The role of the dopaminergic system in the development of impulse control disorders in Parkinson's disease patients on dopamine agonists

Dr. Nicola Ray

Dr. Ray received her BSc Hons in Psychology in 1999 from the University of Bolton and her MSc in 2002 from the University of Reading, United Kingdom. She attended the University of Oxford, from 2002-2009 where she undertook her PhD and post-doctoral training in Neuroscience. Dr. Ray is currently a post-doctoral fellow at the University of Toronto studying under the supervision of Dr. Antonio Strafella.

Year 1 $50,000 Year 2 $50,000 Total Award: $100,000

Pathological gambling is one of the most difficult side-effects that some people with Parkinson's disease develop, as a result of taking medications designed to manage their motor control symptoms. But if researchers knew why some people are more vulnerable to impulse control disorders than others, those at risk might never be prescribed the drugs that cause the problem.

At the University of Toronto, neuroscientist Nicola Ray is using imaging technology to try to figure out just what makes some people vulnerable. She's using Positron Emission Tomography (PET) scanners to compare images of the basal ganglia portion of the brain in people who have impulse control issues, with those who do not. She will also look at what happens in the dopamine centres in the brain when people are on dopamine-replacement drugs, and when they are off them.

Ray hopes that by better understanding the mechanisms in the brain that these medications stimulate, and how they affect the brain's reward centres, she will help develop screening tools to predict who should and should not receive medications that could trigger pathological gambling or other impulse disorders.

"If we find a way to determine who these patients are beforehand, then they never have to develop a problem," says Ray, who is also appointed to the Centre for Addiction and Mental Health.

She is also interested in exploring similarities between the impulse control disorders that some people with Parkinson's experience and the way the brain is affected in people in the general population who have addictions.

"There's already a lot of work out on addictions, so if we can show this is a similar thing, then we know what we're dealing with," Ray says.

Ray, whose interest in neuroscience was sparked by the popular science magazines her father read, believes research into Parkinson's disease will ultimately provide critical answers about the workings of the basal ganglia. She enjoys working in a field that can improve current treatments, and hopes her discoveries will improve the lives of people with Parkinson's disease.

"If you're working on something that's already on the market and trying to improve it, then you can see things change a bit sooner," she says.

Basic Research Fellowship

In vivo interaction of parkin and endophilin-A and their roles in the regulation of synaptic endocytosis and protein degradation

Dr. Jean-Francois Trempe

Dr. Trempe received his BSc in 2000 and MSc in 2002 in Biochemistry from McGill University. He attended the University of Oxford, United Kingdom from 2002-2006 and obtained his D.Phil. He is currently a post-doctoral fellow at the Montreal Neurological Institute, McGill University, training under the supervision of Dr. Edward Fon.

Year 1 $50,000 Year 2 $50,000 Total Award: $100,000

Researchers looking for the cause of Parkinson's disease are increasingly focusing on proteins and their role in the death of dopamine-producing brain cells. At McGill University in Montreal, Jean-Francois Trempe is deciphering the relationship between two particular proteins.

About a decade ago, researchers linked a protein named parkin to a form of Parkinson's disease that runs in families and strikes people in their 30s and 40s. When parkin is missing or mutated, dopamine-producing brain cells die and people get Parkinson's disease. Now Trempe is unravelling the relationship between parkin and another protein, called endophilin.

"We know that these proteins interact," Trempe explains. "But we'd like to know what endophilin does and how that helps parkin degrade (kill) other proteins. If we find what's being degraded, then that will give us a clue as to what we can do to remediate the situation."

Researchers don't yet know how loss of function of the protein parkin interferes with the dopamine-producing cells that are the key to Parkinson's disease. But they believe it is somehow involved in protecting dopamine-producing neurons. When parkin is mutated or deleted, those brain cells die.

Trempe will use mice that have been engineered to display Parkinson's symptoms to try to figure out how parkin interacts with endophilin and what that means for Parkinson's disease.

Trempe's interest in biology was triggered by an organic chemistry professor, who sparked his fascination with enzymes and proteins. He enjoys applying his problem-solving skills to Parkinson's, a "very complex" disease.

"It's really the challenge that motivates me – trying to understand the unknown," Trempe says.

Basic Research Fellowship

The role of genes that extend lifespan in the pathogenesis and treatment of Parkinson's disease

Dr. Jeremy Van Raamsdonk

Dr. Van Raamsdonk obtained his BSc (Hons) from the University of British Columbia and his MSc from McMaster University. In 2005, he received his PhD in Medical Genetics from the University of British Columbia. Dr. Van Raamsdonk is presently a post-doctoral fellow in the Department of Biology at McGill University working under the supervision of Dr. Siegfried Hekimi.

Year 1 $50,000 Year 2 $50,000 Total Award: $100,000

Finding the secret of longevity has never been closer than today, when the science of genetics has identified genes that can extend lifespan in worms, flies and mice. At McGill University, geneticist Jeremy Van Raamsdonk investigates the role those genes may play in Parkinson's disease.

Most people who get Parkinson's disease begin displaying symptoms when they are 60 or older, except in some cases of people who exhibit symptoms earlier because they have the familial form of the disease. Researchers don't yet know why the disease takes years to develop, even though mutations in the genes that cause it are present from birth.

The theory Van Raamsdonk is pursuing is that changes that occur during the aging process make cells more vulnerable to the harmful effects of genetic mutations implicated in Parkinson's disease.

If scientists could slow down the aging process by altering those longevity genes, they might be able to slow or halt the progression of Parkinson's.

By breeding round worms engineered to have the same genetic defect present in people with Parkinson's disease with worms whose longevity genes have been mutated to slow aging down, Van Raamsdonk hopes to produce worms with both mutations.

"It will test the idea about whether slowing down the aging process will be beneficial to Parkinson's disease," he says.

Ultimately, he hopes to discover whether the aging process does contribute to the onset of Parkinson's disease. If it does, then turning those longevity genes on or off may prove to be an effective therapy for Parkinson's disease. Van Raamsdonk has long been interested in biology, but he turned to research into Huntington's disease, and then Parkinson's, after his initial studies on bacteria were not rewarding enough.

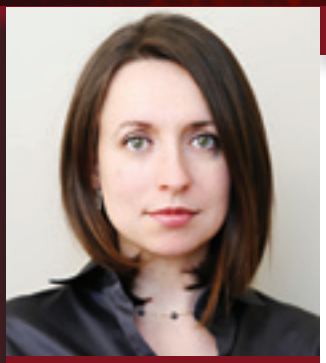
"Since then I started focusing on biology that would have a more direct benefit to people," he says.

Van Raamsdonk's earlier research into Huntington's disease - another progressive brain disorder - contributed to treatments now being tested in clinical trials. He believes both diseases share some common attributes at the molecular level.

"Ideally, moving forward, I will be working on Parkinson's and will keep (working) on Huntington's, and look at overlap and what is unique about each disease," Van Raamsdonk says.

Clinical Movement Disorders Fellowship

Clinical management of Parkinson's disease and related movement disorders



Dr. Justyna Sarna

Dr. Sarna received her BSc in biochemistry from the University of Lethbridge and her MD/PhD from the University of Calgary where she is presently in the Neurology Residency Program. Dr. Sarna will be training in the Movment Disorders program under the supervision of Dr. Oksana Suchowersky in the Department of Clinical Neurosciences at the University of Calgary.

One Year Award $50,000

Most people with Parkinson's disease respond to treatment. But medication and other treatments are not as effective for people with Progressive Supranuclear Palsy (PSP), which produces some symptoms similar to Parkinson's.

At the University of Calgary, Dr. Justyna Sarna is spending a year on a Clinical Movement Disorders Fellowship to learn more about PSP and other forms of neurodegenerative diseases known as Parkinson's Plus disorders.

People with PSP have more rigidity and slowness of movement than those with Parkinson's. When the disease is very advanced, they can't move their eyes.

Sarna, a neurologist, is becoming a specialist in Parkinson's and these related disorders so she can take care of her patients "in a more evidence-based way," she says.

During a combined MD/PhD program at the University of Calgary, Sarna investigated the degeneration of Purkinje cells, one of the key cells in the cerebellum, a part of the brain that is critical for motor control. This degeneration has been linked to cerebellar ataxia and other ataxia disorders of the nervous system that result in a loss of balance and coordination.

"We're trying to find out why specific cells die while their neighbours do not, and what makes them more susceptible to cell death," she says.

The results from research into Purkinje cell damage and death can be extrapolated to other neurodegenerative diseases, such as Parkinson's and Huntington's disease.

Sarna is also participating in a multi-centre clinical trial to test a medication to treat PSP, and is also searching for new ways to diagnose these less common subtypes earlier. Early diagnosis would help people plan their long-term care and steer them towards the correct treatment, once a therapy is found.

Sarna's goal is to stop neurodegenerative diseases including Parkinson's, PSP and degenerative forms of cerebellar ataxia.

"If we understand the pathways that are involved in degeneration, we will be able to, down the road, come up with neuroprotective strategies," she says.

Sarna finds neurology fascinating because of the extensive history and interesting physical examination required to make a diagnosis.

Her passion is to care for patients with movement disorders. During her fellowship, Sarna will spend most of her time following and treating patients with Parkinson's disease and other related disorders.

Clinical Movement Disorders Fellowship

Clinical Movement Disorders Training

Dr. Richard Walsh

Dr. Walsh received his MB, BCh and MD from the University College Dublin, Ireland. Following his internship, Dr. Walsh went into specialist training in neurology that started with a two year period as a registrar in St. Vincent's Hospital Dublin. Dr. Walsh has relocated to Canada to obtain further training in the subspecialty of movement disorders. He is training under the supervision of Dr. Anthony Lang at the Morton and Gloria Shulman Movement Disorders Research Centre at Toronto Western Hospital.

One Year Award $50,000

People with the most common form of Parkinson's disease typically experience slowness, stiffness, and tremor. But a number of other conditions, known as atypical Parkinson's, can mimic some or all of these features. Identifying atypical Parkinson's can be important for predicting the outcome of treatment.

At Toronto Western Hospital, Dr. Richard Walsh has a unique opportunity to work with people attending the Movement Disorders Centre, where he will study the ability of ultrasound images to identify Parkinson's disease correctly.

"Ultrasounds are cheap, easy, non-invasive and available in any radiology department," says Walsh. But this kind of imaging technology has been used more in Europe than in Canada to investigate movement disorders over the last 10 years.

"What we hope to do is apply it to the population of movement disorder patients attending this hospital, to evaluate and validate it," says Walsh, an MD and neurologist in Ireland who is completing his training in Toronto.

Walsh hopes he can see how ultrasound images correlate with the severity and duration of Parkinson's disease, as well as to distinguish it from related disorders.

Being able to distinguish different forms of Parkinson's is important when recruiting people to clinical trials, and helps predict the likelihood that someone will respond to levodopa, the major drug used to treat the disease.

"If patients knew they had an atypical form of Parkinson's, it could help them and their families plan their care and financial needs more accurately as well," Walsh says.

Currently, there is no reliable biomarker that objectively identifies Parkinson's disease, rather than relying on a description of people's symptoms to make a diagnosis. Walsh hopes the ultrasound images may become that biomarker, to enable more objective diagnoses.

In the movement disorders clinic, Walsh will work with a neurosurgical unit to refer some patients with long-standing Parkinson's disease for deep-brain stimulation surgery to try to reduce their uncontrollable movements, known as dyskinesias. He also hopes to be involved in a study at several centres to examine whether infusing a gel form of levodopa into the small intestine can smooth out people's responses to the drug as an alternative to surgery.

Walsh was drawn to neurology after seeing the dramatic responses some people with Parkinson's had to deep brain stimulation after travelling to the United Kingdom for treatment. Someday, he'd like to see a deep brain stimulation program running in Dublin.

"In the long term, I'd hope to return and share my knowledge accrued here in Canada," Walsh says.

Parkinson Society Canada – Canadian Institutes of Health Research/Institute of Neurosciences, Mental Health and Addiction

Psychosocial Doctoral Award

Assessing sex and stage differences in muscle activity using portable electromyography in Parkinson's disease

Ms. Kaitlyn Roland

Ms. Roland received her BSc in 2006 and MSc in 2008 from the University of Western Ontario, London. She is currently a PhD candidate in Human Kinetics at the University of British Columbia Okanagan working under the supervision of Dr. Gareth Jones.

Year 1 $22,000 Year 2 $29,333 Total Award: $51,333

One of the differences between the way men and women experience Parkinson's disease is that more women develop uncontrollable movements, known as dyskinesias, as a side-effect of the medication they take to treat the illness.

At the University of British Columbia/Okanagan, Kaitlyn Roland studies the sex differences in those involuntary muscle movements as people with Parkinson's perform real-life daily tasks.

Roland compares the responses of men and women by having people go about their usual daily routines at home, while wearing electrodes attached to portable packs the size of Walkmans. These packs, called electromyography devices, measure the electrical impulses people's muscles generate.

"We're measuring the muscle activity during the day to see how Parkinson's disease is influencing different alternations in muscle and nerve function," Roland says.

As they age, women lose more skeletal muscle and lower limb strength relative to men. Roland wants to know if this sex-specific difference is also reflected in the muscle activity patterns of people with Parkinson's. By graphing the electrical impulses from muscles, she hopes to determine how the progression of Parkinson's disease affects women's versus men's ability to remain independent and move around.

If Roland can demonstrate differences in how Parkinson's affects men's and women's muscle movements, her work may help physiotherapists and other rehabilitation specialists design sex-specific programs to strengthen the muscles or address dyskinesias where each sex needs them the most.

Roland's work could also serve as a diagnostic tool, one day helping healthcare professionals find the same muscle activity patterns she charted in people who have not yet been diagnosed with Parkinson's.

Ever since her grandfather Buddy was diagnosed with Parkinson's disease in the mid-1990s, Roland has been trying to improve the lives of people living with this illness. She began volunteering with the Parkinson Society Southwestern Ontario in London during her first year of university, and continued that work after her grandfather died.

"I fell in love with the Parkinson's community in London," she says. "The people who worked at the office were so passionate about what they did, as were all the members and volunteers. It's a great community."

As a certified Yoga instructor, Roland eventually wants to develop a rehabilitation program for movement disorders, based on the neuromuscular information she gleans from her project.

Graduate Student Award

Cystamine: a potential neuroprotective molecule for Parkinson's disease

Ms. Giulia Cisbani

Ms.Cisbani received her BA in 2005 and MSc in 2007 in Industrial and Environmental Biotechnology from the University of Milan in Italy. She completed an MSc in Neurobiology in 2009 and is currently pursuing a PhD in Neurobiology under the supervision of Drs. Francesca Cicchetti and Denis Soulet at Laval University.

Year 1 $15,000* Year 2 $15,000 Total Award $30,000

Many researchers are trying to understand the intricate mechanisms involved in the death of dopamine-producing brain cells, so they can develop new drugs that could treat or cure Parkinson's disease. But what if a substance already exists that could protect these critical neurons?

At Laval University, Giulia Cisbani is exploring the possible protective effects of a molecule called cystamine. Cystamine is an amine, a combination of two amino acids that appears to have beneficial effects on the brain. It increases the levels of other molecules, called neurotropic factors, which support the survival of brain cells.

Cisbani, a PhD student in neurobiology, is studying the effects of cystamine on the brains of mice with Parkinson-like symptoms, to understand how this protective effect works.

Cystamine has already been approved to treat cystinosis, a metabolic disease that can affect the kidneys, eyes, muscles, pancreas and brain.

If this basic research demonstrates that cystamine can protect neurons that currently die in people with Parkinson's, researchers can move on to clinical trials. If the clinical trials are promising, getting cystamine to people with Parkinson's would be much easier than starting from scratch to develop a new drug.

"That's why it's of great interest, because it is going to be very easy to get for patients," Cisbani says.

Cisbani, whose parents are both doctors, has been interested in science for as long as she can remember. She opted for research over medicine, in part because she has watched a family friend suffer with Parkinson's disease.

"It was really sad not to be able to help. That affected me a lot," she says. "It's a great opportunity for me to participate in research in Parkinson's."

Cisbani, who grew up in Fermo, Italy, chose to study under supervisor Francesca Cicchetti at Laval because she knew Canada "was very good in researching neurodegenerative diseases," she says.

"I thought it was a great opportunity to join this lab and continue this research here."

*Year 1 of this award is being funded through an educational grant from Novartis Pharmaceuticals Canada.

PSC/FRSQ Partnership Award

Graduate Student Award*

The roles of parkin and PINK1 in mitochondrial-derived vesicle biogenesis and mitochondrial quality control

Mr. Gian-Luca McLelland

Mr. McLelland completed his BSc in Biochemistry at McGill University in 2009. He is currently a Master's student in the Integrated Program in Neuroscience at McGill University, training under the supervision of Dr. Edward Fon. His area of focus is mitochondrial dysfunction and its association with Parkinson's disease.

Year 1 $20,000 Year 2 $20,000 Total Award $40,000

Researchers are increasingly focused on mitochondria, the parts of a cell that are responsible for generating its energy, as a factor in Parkinson's disease. At the Montreal Neurological Institute and Hospital, graduate student Gian-Luca McLelland is zeroing in on an even more distinct part of mitochondria.

"What we are investigating is the involvement of mitochondria and how they interact with different genes linked to Parkinson's disease," says McLelland.

Specifically, McLelland is examining the way small parts of some mitochondria interact with these genes. These small pieces of mitochondria, known as mitochondria-derived vesicles, or MDVs, break off and can travel between the rest of the mitochondria and other parts of the cell.

McLelland is collaborating with Heidi McBride of the University of Ottawa's Heart Institute. They believe that these vesicles are being used to transport proteins. Parkin, one of several proteins linked to Parkinson's disease, appears to be able to stimulate the production of these vesicles.

McLelland believes parkin and mitochondria-derived vesicles work together in a process that occurs in response to stress on the cells. It is designed to keep the mitochondria healthy. In people who do not have the parkin protein, this health-promoting process would not occur, possibly causing Parkinson's disease.

"This generation of MDVs is keeping the mitochondria from becoming damaged. Parkin is regulating the process," McLelland says.

If McLelland can decipher the way this particular molecular pathway works, he would further the search for a way to alleviate the symptoms or halt the progression of Parkinson's.

"It could eventually lead to a drug target," he says.

McLelland enjoys solving the small problems that, when added up, lead to the solution to a big problem. He's convinced that research into Parkinson's will eventually find that solution, and he is excited by new developments in the field.

"It's interesting to be on the cutting edge of things," he says.

*Funding of this award is being shared with the Fonds de la recherche en santé du Québec (FRSQ) through a partnership to increase Parkinson's research in Quebec.

Graduate Student Award

Investigating the neurological mechanisms implicated in the development of motor dysfunction in Parkinson's disease

Mr. Nicolas Morin

Mr. Morin received his BPharm in 2006 and his MSc in Pharmacology in 2009 from Laval University. He is currently pursuing his PhD at the Centre de recherche en endocrinologie moléculaire et oncologique et génomique, Centre Hospitalier Universitaire de Québec (CHUQ), training under the supervision of Dr. Thérèse Di Paolo.

Year 1 $15,000 Year 2 $15,000 Total award: $30,000

If researchers could find a way to prevent the uncontrollable movements known as dyskinesias that are a common side-effect of the levodopa medication used to treat Parkinson's, they could vastly improve the quality of life of people with the disease.

At Laval University, PhD student Nicolas Morin is working on doing just that, by looking for new molecules that could block a family of protein molecules that help to form connections among nerve cells.

"Because levodopa is the most commonly used and most effective treatment, we'd like to see if it's possible to add these antagonists (synthetic chemicals) to reduce the levodopa dosage," says Morin.

Reducing the dosage will probably reduce and prevent the development of dyskinesias that people with Parkinson's experience, but the researchers need to make sure that doing so won't affect people's motor control.

Using animal models, Morin will observe motor behaviour and also try to identify the pathways in the brain that are involved when they block these particular proteins, called glutamate receptor subtypes. He has already observed the chemical antagonists' ability to reduce dyskinesias for short periods of time, but is now looking at chronic treatment.

"By giving levodopa with this other molecule, you can prevent the dyskinesias," he says. Morin, who is already a pharmacist, is taking his graduate degree in the field to learn more about Parkinson's disease. In addition to the many people with Parkinson's whom he works with at the hospital, Morin has seen the effects of the disease up close because his girlfriend's grandmother has Parkinson's.

"Right now, after 5 to 10 years of treatment, every patient (treated with levodopa medication) has dyskinesias," says Morin. "If we could delay it even for 15-20 years, it would be better."

Graduate Student Award

The role of paraoxonas-2 in protective function of DJ-1 in Parkinson's disease

Mr. Mohammad Parsanejad

Mr. Parsanejad completed his BSc with a focus in cell-molecular biology in 2004 at the Shiraz University in Shiraz, Iran. Mr. Parsanejad is currently pursuing his PhD in neuroscience under the supervision of Dr. David Park in the Department of Cellular and Molecular Medicine at the University of Ottawa. Mr. Parsanejad is interested in biochemical and molecular mechanisms underlying neuronal death and neurological disorders.

Year 1 $15,000 Year 2 $15,000 Total award: $30,000

Each time a researcher pinpoints the proteins and enzymes involved in one of the biochemical pathways in the brain that is linked to Parkinson's disease, the global research community gets closer to identifying the causes and potential treatments of this illness.

At the University of Ottawa, PhD student Mohammad Parsanejad is investigating one such pathway. He's concentrating on DJ-1, a gene which, when mutated, can cause Parkinson's disease.

Parsanejad knows that biochemical pathways consist of a series of proteins that work together. Biochemical messages in cells, such as the messages that eventually signal cell death, start from one protein and work their way down a chain to another. His research is concentrating on the biochemical pathway between DJ-1 and another protein, called paraoxonas-2 (PON-2).

PON-2 appears to play a protective role in cells, and Parsanejad believes it should be able to protect neurons against neurotoxins that can cause Parkinson's disease. But when DJ-1 is mutated and can not modify PON-2, DJ-1 reduces PON-2's protective function – and the brain cells die.

If Parsanejad's research can confirm this relationship between DJ-1 and PON-2, it may open the door to discovering a way to raise the levels of PON-2 in dopamine-producing cells. That could lead the way to a new drug target.

"If there is anything that can induce the PON-2 gene to increase levels of PON-2 … then perhaps we can protect cells against the progression of this disease," Parsanejad says.

Parsanejad was just 4 or 5 years old when he began demonstrating the scientific curiosity that motivates his current work on the brain. He began asking what happened before he was born, and what caused life, including the lives of the first animals.

His father, who is a doctor in Parsanejad's native country of Iran, could answer all of Parsanejad's early questions. But in the field of neuroscience, many of the answers to Parsanejad's most recent questions still await discovery.

"Parkinson's disease damages most aspects of people, from movement to mood and social life," he says. "I believe any kind of improvement toward treatment of this disease is extremely valuable. That's why I decided on neuroscience."

Michael Kingdon Estate

Graduate Student Award

Non-motor language and communications in Parkinson's disease and the impact on quality of life for individuals with Parkinson's and family care partners

Ms. Angela South

Ms. South received her BA and MA in Speech Pathology from the University of Tennessee. She was a Speech Language Pathologist at the London Health Sciences Centre in London, Ontario until 2009 when she left her position to pursue her PhD in Health and Rehabilitation Sciences and Communication Sciences and Disorders. She is currently a doctoral student at the University of Western Ontario, training under the supervision of Drs. Mandar Jog and J.B Orange.

Year 1 $15,000 Year 2 $15,000 Total award: $30,000

People with Parkinson's disease often have trouble communicating. But they don't always know their struggles are connected to the disease.

At the University of Western Ontario, Angela South is studying the reasons for these communication challenges and the impact they have on people's lives.

South, a speech pathologist and PhD student in neuroscience, wants to help healthcare providers understand that the cognitive changes Parkinson's disease cause are connected to language function.

Often, South's patients report difficulty choosing the right word or following conversations. Those problems may precede the tremors, stiffness or other symptoms of motor function that lead to a diagnosis of Parkinson's.

But many healthcare professionals are unaware those problems are linked to Parkinson's disease. They may tell their patients the problems are unconnected, leaving people without the counselling and supports they need to make sense of what's happening to them.

By quantifying the communication problems that people with Parkinson's disease experience, South hopes to validate their experience and educate care providers.

"We're hoping that … we can help professionals in the community know how to recognize the problem and how to develop strategies or treatment programs to help the problem," South says.

For example, South advises the families she works with to adapt their communication style. She gets them to slow their conversations down, pause often, and check with the people with Parkinson's to see if they'd like to add anything.

"It's teaching those care providers to look for verbal and non-verbal signs and make room in the conversation for the person with Parkinson's," she says.

South also tells people to shorten the length of their sentences, or to use simpler grammar or syntax. She helps them learn to select environments with fewer distractions, and to do simple things like turn a television or radio off before starting a conversation.

Those practical suggestions are one of the ways South helps people live with Parkinson's disease.

"Part of living is communicating. It's a huge part," she says. "When communication breaks down it affects everything – relationships with family, relationships with partners, and sense of identity."

Her passion for helping people with Parkinson's disease live productively is one of the reasons South turned to research despite a rewarding clinical career.

"Joining clinical knowledge and research expertise translates, I hope, into someone who can truly understand and make a difference," she says.

The Garden Centre Group Co-op

New Investigator Award

Understanding impulse control disorders in Parkinson's disease

Dr. Stephanie Borgland

Dr. Borgland is currently an Assistant Professor in the Department of Anesthesiology, Pharmacology & Therapeutics at the University of British Columbia. She received her PhD in Pharmacology/ Neuroscience from the University of Sydney, Australia in 2002 and then went on to complete her post-doctoral training at the University of California, San Francisco ending in 2006.

Year 1 $45,000 Year 2 $45,000 Total Award: $90,000

University of British Columbia professor Dr. Stephanie Borgland has long been interested in investigating motivation and impulse control and the psychological aspects associated with these problems.

Impulse control problems such as gambling, hyper-sexuality and other addictive behaviours are among the most disturbing side-effects that can occur when people with Parkinson's disease take drugs that activate dopamine receptors in their brain cells.

"Drug addiction and these other impulse control disorders are really devastating disorders," says Borgland, who is an electrophysiologist and Assistant Professor at the University of British Columbia. "People are aware they have them, and they would like to change, but for some reason they just can't do it."

Dr. Borgland is specifically investigating the role that dopamine plays in the orbitofrontal cortex, a region of the brain involved in impulse control. Dopamine neurons located in a group of neurons at the centre of the brain, known as the ventral tegmental area, communicate with the orbitofrontal cortex, and can release dopamine into this region. Researchers believe dopamine in that region regulates impulsive behaviours.

Dopamine neurons located in this area, part of the midbrain, are relatively unspared by Parkinson's disease. But when between 8-10 percent of people with Parkinson's take drugs to treat motor control problems, those drugs affect the dopamine release in the orbitofrontal cortex. By altering the way the neurons in this area communicate, that may cause impulse control and addiction problems.

Before researchers can adapt existing drugs or design new ones, they need to understand more about how the dopamine-producing neurons in this part of the brain regulate behaviours.

"The research that I'm doing is setting out to understand more about the neurobiological mechanisms underlying these impulse control disorders," says Borgland.

Dr. Borgland was drawn to UBC after a post-doctoral fellowship at the University of California in San Francisco because of the group of researchers there involved in dopamine research.

"It's an amazing academic environment for me to be in, as a lot of people share my interests," she says.

The results of the UBC researchers' work will, they hope, translate into better therapies that could have applications for Parkinson's disease and other problems, including schizophrenia and learning and memory disorders.

Parkinson Society Canada – Canadian Institutes of Health Research/Institute of Neurosciences, Mental Health and Addiction

Psychosocial Research Grant

Improving detection and management of non-motor features of Parkinson's Disease – Development of a knowledge translation outreach strategy

Year 1 $49,454 Year 2 $49,454 Total Award: $98,908

Dr. Ron Postuma

Dr. Postuma is an Assistant Professor in the Department of Neurology at McGill University and a staff Neurologist at Montreal General Hospital. He obtained his MD in 1995 from the University of Manitoba and completed his Neurology Residency at McGill University in 2002. Dr. Postuma is a past recipient of a PSC Clinical Research Fellowship and trained under the supervision of Dr. Anthony Lang at the Toronto Western Hospital, Movement Disorders Centre.

People with Parkinson's disease often experience a wide variety of symptoms that they may not know are related to the illness that is causing them to shake or that is disrupting other aspects of their motor control.

Because people are unaware that the anxiety, depression, hallucinations, lightheadedness, insomnia, constipation, dementia or impulse control issues they are experiencing are related to Parkinson's, they may not mention them to their doctor. Many doctors may not understand the relationship either, or how to treat the symptoms. That's why Dr. Ron Postuma is testing aids to help patients and doctors detect and treat the non-motor symptoms of Parkinson's disease.

"On average, patients have not discussed half of their non-motor symptoms with a physician," says Postuma, a neurologist and movement disorders specialist, as well as an assistant professor at McGill University in Montreal.

"Most of them are treatable. That's why it's so important that they be detected."

As a first step, Postuma is testing the reliability of a screening questionnaire to help people identify their symptoms. After having 60 patients complete the questionnaire, he is following up with in-depth evaluations to see if it caught all the non-motor symptoms people are experiencing.

In addition, Postuma is developing a patients' guide and a physicians' guide that describe these symptoms, help people recognize them and advise doctors about how to treat the problems.

Finally, with the help of Parkinson Society Quebec, Postuma is going to have a wider group of people, who have filled out the questionnaires, take them to their doctor. He and his colleagues will have contacted those same doctors to make sure they have a physicians' guide in hand. They will then evaluate what difference the guide and questionnaire made in helping people with the disease and their doctors detect non-motor manifestations of the disease.

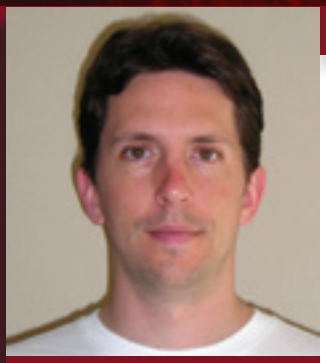
In the future, if this project proves successful at increasing detection and treatment, Postuma would like to see his questionnaires and guides implemented on a national level.

Although the neurologist began his work on neuro-degenerative diseases with Alzheimer's patients, he switched to working with people with Parkinson's because he found it more encouraging, he says.

"People really do get a lot better after they see you," Postuma says. "I like doing practical research. That way I know I'm making a difference in the end."

Basic Research Fellowship

Mitochondrial Dysfunction in the Etiology of Parkinson's disease



Dr. Jonathon Burman

Dr. Burman obtained his BSc in 2001 from the University of Western Ontario and recently completed his PhD in neurosciences at the Montreal Neurological Institute. Dr. Burman will continue with his studies and will undergo post-doctoral training at the University of Washington under the supervision of Dr. Leo Pallanck.

Year 1 $40,000 Year 2 $40,000 Total Award: $80,000

To create more effective treatments for people with Parkinson's disease, researchers need to understand exactly how the disease works, down to the finest detail.

That's why Jonathon Burman, a 33-year-old post-doctoral fellow in neuroscience at the University of Washington, is exploring the role that two particular proteins play in interacting with the mitochondria in dopamine-producing brain cells.

"You need to know what's going wrong at a mechanistic level before you can really find a long-lasting cure," says Burman.

Working in the laboratory of Dr. Leo Pallanck, Burman is studying the proteins known as PINK1 and parkin. Damaged copies of these proteins have been genetically linked to early-onset Parkinson's disease. Using the fruit fly model system as a subject, Burman is investigating how PINK1 and parkin interact with mitochondria, the energy powerhouses of cells.

He plans to test a theory that PINK1 and parkin, when working properly, help to keep brain cells healthy by being part of the machinery that removes unhealthy or damaged mitochondria from the cells, clearing the way for healthier mitochondria to thrive.

If the proteins are themselves damaged, however, as is the case in people with early-onset or familial Parkinson's disease, they can't perform their task of clearing away dysfunctional mitochondria. That, in turn, somehow causes the neurons that produce dopamine to die.

"The goal of this type of research is really to look at why these cells are dying and to stop them from dying," Burman says.

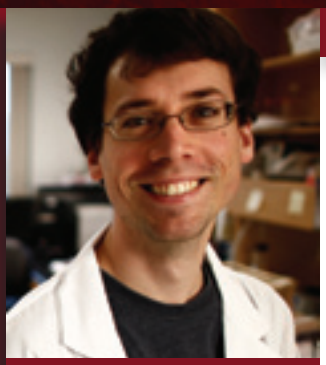
Eventually, these proteins and the mechanism involved in having them attach to mitochondria could be the target for new drug therapy.

Long interested in how science can explain the complex nature of the world, Burman was drawn to the world of Parkinson's research when he studied with a leader in the field, Professor Robert Edwards, in San Francisco.

During that time his grandmother, Jeanine Rosen, was diagnosed with Parkinson's disease. Before his grandmother died, at 83, he often talked to her about what he was learning and discovering.

"With research, there are lots of ups and downs, and you need time," Burman says. "In that way, her memory continues to inspire me to stay the course."

Neuronal cell death/Autophagy



Dr. Marc Germain

Dr. Germain is presently a post-doctoral fellow at the University of Ottawa in the Department of Cellular & Molecular Medicine training under the supervision of Dr. Ruth Slack. Prior to his move to Ottawa, he was a post-doctoral student at the University of British Columbia. Dr. Germain received his PhD in Biochemistry from McGill University in 2004 and his Masters in Molecular and Cellular Biology from Laval University in 1999.

Year 1 $50,000 Year 2 $50,000 Total Award: $100,000

Marc Germain has always liked finding out how things work. That's why the biochemist has turned his attention to the genes and proteins involved in the death of the dopamine-producing cells that are central to Parkinson's disease.

At the University of Ottawa lab where Germain is conducting his research as a post-doctoral fellow, he is focused on a protein known as MCL-1, which helps to regulate the process of autophagy. Autophagy, which is a naturally occurring process, allows cells to recycle their components and generate energy during periods of starvation. However, autophagy can also result in the death of cells when they are under prolonged stress.

"There have recently been several links between autophagy and Parkinson's disease," Germain says.

Researchers do not yet completely understand the role that MCL-1 and autophagy play in Parkinson's disease – that's what Germain is investigating. One theory is the proteins that aggregate in the dopamine-producing neurons cause them to die, and the autophagy process is somehow blocked. In other words, explains Germain, blocking autophagy means the cells "can't get the garbage out" – the garbage being the clumped proteins.

Alternatively, damaged or mutated genes may be failing to regulate the autophagy process so that cells are eating themselves and dying that way.

Using mice with MCL-1 and other genes knocked out will enable Germain to begin answering the questions about how the autophagy and other forms of cell death affect the dopamine-producing neurons, at the molecular level.

Originally, Germain was working in the cancer field, studying ways to turn on a second MCL-1-regulated process, called apoptosis (cell suicide), in order to kill cancer cells. He was drawn to Parkinson's disease because of the critical mass of research involved in trying to understand the neuroscience and underlying mechanisms that cause the degenerative illness. The complexity of the problem, and the quality of other researchers at the University of Ottawa, drew him there.

Germain hopes his basic research will help to illuminate the reasons that Parkinson's disease occurs, and show a pathway for future treatment.

"Eventually, if we show that this process of autophagy is really important, that could provide new drug targets for Parkinson's disease," says Germain.

Basic Research Fellowship

The influence of 5HT1A and 5HT2A serotoninergic receptors in the generation of psychosis in Parkinson's Disease

Dr. Philippe Huot

Dr. Huot is currently a Movement Disorders Fellow pursuing his PhD at the Toronto Western Research Institute under the supervision of Drs. Jonathan Brotchie and Susan Fox. He obtained his FRCPC in Neurology in 2008, an MSc in Neurobiology in 2006 and his MD in 2003 all from Laval University, Quebec.

Year 1 $50,000 Year 2 $50,000 Total Award: $100,000

One of the most difficult aspects of treating people with Parkinson's disease is the disturbing level of side-effects that accompany the only long-term drug therapy currently available for them. Among those side-effects are vivid visual hallucinations that up to 60 percent of people experience.

"Those hallucinations appear to result from an interaction between the administration of dopamine drugs and the effects on the brain of advanced Parkinson's disease," says Dr. Philippe Huot, a neurologist and PhD candidate in neurobiology at Toronto Western Hospital.

"The problem is that it's hard to control the hallucinations without changing the drug regimens people take," says Huot. Stopping or reducing Levodopa therapy can alleviate the hallucinations – but then the patient's other neurological symptoms are untreated.

That's why Huot is exploring the involvement of serotonin Type 2A receptors in the brains of people who are experiencing these hallucinations. He hopes that by better understanding the role these serotonin receptors play in Parkinson's disease, he will eventually provide an avenue for new compound drugs that will act as tools against the debilitating effects of the illness.

"These symptoms can be very debilitating for the patients," says Huot. "It impairs their quality of life, which is already impaired by the disease itself."

Huot, who treated Parkinson's patients during his neurology residency, is drawn to research because he wants to give larger numbers of patients hope that there is a better treatment on the horizon, he says. He was first inspired to work in the area after studying with Dr. André Parent, a neuroanatomist at Laval University who was studying the basal ganglia.

"I was very interested in how so many aspects of behaviour can be regulated by very small structures in the brain," says Huot. "When their functioning is impaired, it can lead to very serious diseases like Parkinson's or Huntington's chorea."

During his residency, Huot was frustrated by the number of treatments available for people with Parkinson's disease that become limited, eventually, by the severity of their side effects. He hopes a part-time clinical fellowship in movement disorders, as well as his research, will allow him to help people with Parkinson's in both the short-term and the long-term.

"It's important for me to help the patients directly, not just through a long-term perspective," Huot says.

Clinical Research Fellowship

Maladaptive neuroplasticity in Parkinson's disease

Dr. Michael Sidel

Dr. Sidel is currently a Clinical fellow training at the Lady Davis Institute for Medical Research at the Sir Mortimer B. Davis – Jewish General Hospital in Montreal under the supervision of Drs. Alexandre Thiel, Calvin Melmed and Anne-Louise Lafontaine. He received his Doctor of Medicine and Master of Surgery (MD.CM) from McGill University in 2004 and recently completed his Neurology Residency in May 2009.

Year 1 $50,000 Year 2 $50,000 Total Award: $100,000

Dr. Michael Sidel hopes that something as simple and non-invasive as a powerful magnet will help researchers find ways to prevent and treat the uncontrollable movements that affect some people with Parkinson's disease.

That's why Sidel will spend the majority of his clinical research fellowship at Montreal's Jewish General Hospital working with another neurologist who specializes in a new technology that could eventually open up another area for Parkinson's treatment.

Dr. Alexander Thiel, with whom Sidel will be training, uses a powerful electro-magnet to manipulate patients' brains without even touching them, a technique called transcranial magnetic stimulation. The magnet is positioned above a patient's skull. Currently, Thiel is using the magnet to determine what areas of people's brains are activated as they begin recovering from strokes.

Sidel will work with him to use the magnet to send rapid electrical pulses to the brains of people with Parkinson's, to determine which connections and passageways in the brain are involved when they experience dyskinesias – the uncontrollable movements that are often side-effects to drugs treating the disease.

"We're trying to understand what brain pathways are actually involved in the creation of these things," says Sidel. "No one's ever looked at it quite in this way before."

In addition to the magnetic tools and experience that Thiel has brought to Canada from Germany, Sidel will also have access to imaging tools, like the hospital's high-resolution PET scanner. Combining the detailed images of people's brains that the PET scanner will provide with the electro-magnetic stimulation will provide Sidel with a map showing where neurons are activated or inhibited in the brain.

"We know a lot about the circuits that are involved as we generate movement, but we don't understand how people with Parkinson's disease generate these movements and how they are perpetuated," Sidel says.

Finding the specific pathways involved would allow researchers to develop drugs or new surgical interventions to prevent or treat the dyskinesia, or to develop new drugs that would avoid these side-effects.

Although 80 percent of Sidel's time during the fellowship will be spent on research, he's glad that the other 20 percent will involve seeing patients.

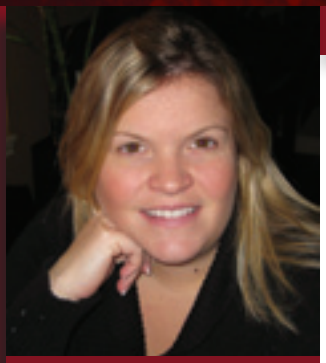
"What drew me to medicine was patient interaction and patient diagnosis, not sitting in front of a computer all day," he says.

Parkinson Society Canada – Canadian Institutes of Health Research/Institute of Neurosciences, Mental Health and Addiction

Psychosocial Doctoral Award

Awareness of deficit in Parkinson's disease – Understanding patient reality

Year 1 $22,000 Year 2 $22,000 Total Award: $44,000



Ms. Christine Cullion-Hicks

Ms. Cullion-Hicks is currently a PhD student training under the supervision of Drs. Andrew Johnson and Linda Miller in the Faculty of Health Rehabilitation Sciences at the University of Western Ontario. She received her Masters degree in Counselling Psychology with a focus on the diagnosis of children with developmental disabilities and high-risk youth populations, from the Adler School of Professional Psychology in Toronto in 2006, and an Honours BA in Psychology from the University of Guelph in 2002.

Christine Cullion-Hicks believes that professionals treating people with Parkinson's disease are too focused on the way the symptoms of the disease restrict their patients' lives.

Instead, the University of Western Ontario graduate student in the School of Health and Rehabilitation Sciences thinks professionals need to consider whether people with Parkinson's feel as disabled as the textbooks say they should.

"People with Parkinson's can exceed the expectations that the diagnosis puts on them," Cullion-Hicks says.

That's why her research will try to identify the difference between the neurological, cognitive, functional, and biomechanical deficits that Parkinson's disease results in, and the way people with Parkinson's actually perceive those deficits.

For example, although people with Parkinson's may have a slow or halting gait, that deficit or disability might be perceived as more restrictive by a doctor or physiotherapist than by the person experiencing it, who might simply attribute their slowness to age.

That perception can, in turn, alter the way a person deals with their reality. Someone who accepts the medical model of the severity of their symptoms might find them more restrictive than someone who takes their symptoms in stride.

"I think people still believe that they are not as sick as what the doctor says," Cullion-Hicks explains. "I want to focus on the individual's voice versus the professional's voice and look at any discrepancies in how they're actually experiencing the deficit."

Cullion-Hicks' research will examine whether people with Parkinson's are living within the confines of their diagnosis, or not.

She will see about 50 people in her London, Ontario laboratory to measure their gait, the way they can perform activities of daily living, such as self-care, and their cognitive abilities. She will also spend time with the individuals in her study to talk to them and their caregivers, assessing the way they feel about their abilities, rather than just using a standard questionnaire that is one of the common tools health care professionals use to arrive at a description of people's deficits.

"That method may be too restrictive," Cullion-Hicks says. "We need to take time to talk to patients about what they actually feel."

Cullion-Hicks expects that her research will find that people consider themselves much less restricted than do the professionals. She hopes her findings will help improve the assessment, treatment and counselling that people with Parkinson's disease receive.

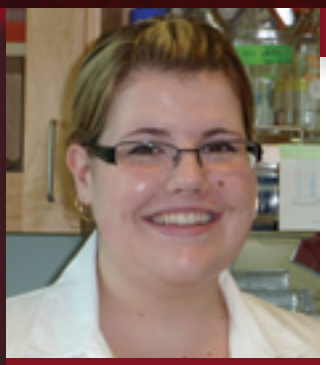
Cullion-Hicks, whose background is in psychology, has always been interested in the psychosocial domain of illness – how it affects the people experiencing it and their caregivers and family members. She brings that background to this project.

"People's reality is what's really important to them, and what they believe they can do is way more important than what the health professionals told them they can do," she says.

Harrison McCain Foundation

Graduate Student Award

Understanding the role of DJ-1 in Parkinson's disease: Role of VDAC1



Ms. Sarah Hewitt

Ms. Hewitt obtained her BSc, Honours in Biochemistry at the University of Ottawa and is currently a Master of Science student in Neuroscience. As the recipient of a Graduate Student Award, Ms. Hewitt is training under the supervision of Dr. David Park.

Year 1 $15,000 Year 2 $15,000 Total Award: $30,000

Sarah Hewitt is a self-proclaimed science geek. As a child, she watched Popular Mechanics for Kids; as an adult, she is trying to decipher the genetic process involved in familial forms of Parkinson's disease.

The research that Hewitt conducts with a team at the University of Ottawa is a natural outgrowth of her childhood curiosity about how things work – in particular, the brain.

"It's the regulator of your entire body and the thing that defines who you are. I just find it really cool," she says.

Hewitt is exploring the relationship between a protein known as DJ-1, which has been linked to familial Parkinson's disease, and a protein called VDAC-1. She is pursuing a theory that DJ-1 plays a protective role in reducing cell death, particularly in certain dopamine-producing cells in the brain, the area most severely affected in Parkinson's disease.

In healthy people, DJ-1 appears to affect the mitochondria, the structures inside cells that convert energy, to help protect neurons and reduce cell death. People who have mutations in DJ-1 lose its protection. Mitochondria are also responsible for many other intricate processes such as the regulation of cell death. VDAC-1, a channel that sits on the outside of the mitochondria, appears to be an activating switch for cell death. Hewitt hopes to connect the dots between loss of DJ-1 and increased cell death through VDAC-1.

"The whole point of my research is to see if this interaction between DJ-1 and VDAC-1 has any merit," says Hewitt. "What I hope to find is an explanation of how DJ-1 protects the cell and its loss can in turn lead to Parkinson's disease."

Hewitt's results may suggest a new drug target or treatment for Parkinson's disease, or even the ability to prevent it. If researchers can determine how cell death occurs and then prevent that death, using targeted gene therapy, it would be a major advance.

Currently, about 10 percent of people who have Parkinson's disease have the familial form. Even if stem cell therapy were able to generate new cells in the affected region of the brain, people with mutations in DJ-1 would still eventually experience the degeneration of those new stem cells, without this gene's protection.

Hewitt, who hopes to enter a PhD program in neuroscience, did not know any people with Parkinson's disease when she began her studies. But she has been inspired by Shelby Hayter, a woman with Parkinson's who works with scientists to educate school children about the disease and help them participate in fund-raising for research directed at a cure. Hewitt has helped Hayter demonstrate projects for students in the University of Ottawa lab.

"The more people you can recruit to research, the better," Hewitt says.

Graduate Student Award

Effect of dopaminergic medication on a finger-moving task in Parkinson's patients: an fMRI study

Year 1 $15,000 Year 2 $15,000 Total Award: $30,000

Ms. Kristina Martinu

Ms. Martinu obtained her BSc in Physiology from McGill University in 2006. She is currently pursuing her PhD, training under the supervision of Dr. Oury Monchi at the University of Montreal and Research Centre, Institut Universitaire de Gériatrie de Montréal.

One of the persistently perplexing challenges of treating people with Parkinson's disease is that the medication used to restore their mobility does not usually improve their cognitive symptoms.

Researchers are not sure why the drugs used to mimic the effects of dopamine affect only certain areas of the brain damaged by Parkinson's disease. But at the University of Montreal, PhD student Kristina Martinu is conducting research to try to find out more about how the brain circuitry affecting motor function responds to the medication.

Martinu is using magnetic resonance imaging to scan the brains of people with Parkinson's disease as they perform three different tasks, involving pressing coloured buttons in different sequences with their fingers.

By contrasting the brain scans as people with Parkinson's disease press buttons continuously, then press buttons as directed, and finally press buttons in a self-generated order, Martinu hopes to understand how externally triggered and self-initiated movements are processed differently in the brain of patients compared with those of participants who do not have the disease.

"We're also looking at the effect of medication on these tasks," Martinu says.

Finally, Martinu will also be trying to assess how different areas of the brain are activated by people whose Parkinson's disease affects one side of their body more than the other.

The eventual goal of the research is to see if researchers can tailor medication differently so that it affects one area of the brain more than another. The results of Martinu's analysis of the brain scans she collects might also be able to help researchers position electrodes as they conduct deep brain stimulation.

"If we can understand more about what the medication does and how it changes these (brain) activation patterns, we might be able to target the medication better to certain things," Martinu says.

Martinu, who is a physiologist, is intrigued by Parkinson's disease because it enables her to work directly with patients and try to make a difference in their lives.

"I enjoy the interaction with the patients," she says.


The Donald Calne Lectureship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