



## EXECUTIVE SUMMARY

### INTRODUCTION

Future health policy, funding and integration of chiropractic services into mainstream healthcare will rely on the extent of empirical evidence supporting the physiologic benefits of chiropractic intervention. At the root of this challenge lies the fact that we are still unable to adequately characterize the chiropractic effect from a fundamental scientific perspective. According to the Report of the Task Force on Chiropractic Research in Canada, “Researchers and their work will play an important role towards the acceptance of chiropractic”, however, the chiropractic research infrastructure, financial resources and roster of full-time chiropractic researchers is currently inadequate to produce the requisite quality and volume of research to advance this cause.

### **BENEFITS OF THE UNIVERSITY OF GUELPH – CCRF PROFESSORSHIP IN SPINE MECHANICS AND NEUROPHYSIOLOGY**

The University of Guelph - CCRF Professorship in Spine Mechanics and Neurophysiology was established on September 1, 2008 through the financial support of the Ontario Chiropractic Association (OCA), Canadian Chiropractic Research Foundation (CCRF) and the University of Guelph. The CCRF University Professorship initiative is an important strategic undertaking that will facilitate the acceptance and integration of chiropractic services into mainstream healthcare by facilitating the advancement of the chiropractic research agenda. The investment into the University of Guelph-CCRF Professorship provides significant immediate, short-term and long-term payoffs to the chiropractic profession:

- Provides immediate access to over \$1 million in much needed research infrastructure for chiropractic research, including state-of-the-art biomechanics and neurophysiology laboratory facilities, allowing chiropractic researchers to conduct high quality research (randomized controlled trials) publishable in high profile peer-reviewed journals.
- Introduces increased access to a larger pool of funding to support chiropractic research.
- Provides opportunities for enhanced interprofessional and interdisciplinary collaborations between chiropractors and other health professionals and researchers.
- Enhances the image and credibility of the chiropractic profession by linking chiropractic research to renowned scientists and respected institutions of higher learning. It also provides opportunities for chiropractic researchers to demonstrate their expertise in academia and research, enhancing the credibility of chiropractors and the profession.
- Provides a vehicle to train future chiropractic researchers in the field of biomechanics and neurophysiology. Increasing numbers of chiropractic researchers are much needed in these important fundamental disciplines to advance our long-term research agenda.



## **RESEARCH GOALS**

My primary research interest focuses on the study of the neurophysiologic mechanisms of central sensitization. Central sensitization is a neuroadaptive response which has been linked to the pathophysiology of an increasing number of musculoskeletal (somatic) and non-musculoskeletal (visceral) conditions. My research aims to characterize the fundamental physiologic effects and benefits of chiropractic treatment by investigating the neurophysiologic impact of spinal manipulative therapy (SMT) on central sensitization. Owing to the emerging role of central sensitization in both somatic and visceral pathologies, this area of research is essential to establishing the importance and value of chiropractic treatment in the management of both chronic musculoskeletal (myofascial) pain as well as preventive wellness care. This research will provide the necessary empirical foundation to validate the integration of chiropractic services into mainstream healthcare service delivery.

## **CURRENT RESEARCH ACTIVITIES**

I have established an independent and growing research program within the Department of Human Health and Nutritional Science, University of Guelph. I am currently lead investigator on seven (7) Guelph Ethics Board approved projects, involving multidisciplinary collaborations from distinguished research institutions. I currently have eight (8) publications and three (3) manuscripts in final stages of preparation, including manuscripts featured in high profile science journals such as Pain, Journal of Pain, Journal of Rehabilitation Medicine and Clinical Rehabilitation. I also have one invited review published in Current Pain and Headache Reports.

## **ACADEMIC ACTIVITIES**

My teaching responsibilities include teaching 4<sup>th</sup> year “Health and Injury Biomechanics” in the Human Kinetics program. I supervise graduate and undergraduate student projects as well as one thesis Masters student. I will be accepting two coursework Masters students this fall. I have also conducted a number of invited presentations to a variety of institutions including the Massachusetts Institute of Technology, University of Guelph, Manitoba Chiropractic Association, Canadian Chiropractic Association and Canadian Institute of Health Research Workshop to Advance Chiropractic Research. I have contributed to several conferences including the World Federation of Chiropractic, Canadian Society for Life Science Research (CSLSR), Technological Advances in Science, Medicine and Engineering (TASME) and Neuroscience Day at the University of Guelph. I have also contributed my expertise as a peer reviewer for Canadian Institutes of Health Research and as a reviewer for several prominent journals including Archives of Physical Medicine, Journal of Musculoskeletal Pain, Central European Journal of Medicine and Journal of the Canadian Chiropractic Association. The CCRF Professorship has also provided positive exposure to chiropractic in a number of ways including an article published in the University of Guelph newspaper featuring chiropractic research and the CCRF Professorship initiative. In addition, I have conducted a number of guest lectures and was the subject of an article featuring my research in the Fibromyalgia Network publication, which is distributed worldwide to its membership.



## **FUTURE GOALS**

My 5-year objective as CCRF Professor in Spine Mechanics and Neurophysiology at the University of Guelph is to enhance and consolidate the body of basic science characterizing the therapeutic effects of chiropractic treatment. To this extent, my objective is to specifically explore the physiologic effects of spinal manipulation on central sensitization. This area of research is foundational to the validation of chiropractic treatment for the treatment and management of pathologies of both musculoskeletal and non-musculoskeletal (visceral) origin. This research will provide the scientific basis for integration of chiropractic services into mainstream healthcare delivery.

In order to advance this agenda, more chiropractic researchers specializing in the fields of biomechanics and neurophysiology are needed. The University of Guelph - CCRF Professorship provides an avenue for mentorship of future chiropractic researchers at the graduate level to assure the long-term viability of chiropractic research.



**PROGRESS REPORT**  
**CCRF PROFESSORSHIP IN SPINE MECHANICS AND NEUROPHYSIOLOGY**  
**UNIVERSITY OF GUELPH, GUELPH, ONTARIO**  
**DR JOHN Z. SRBELY, DC, PHD**

## **INTRODUCTION**

The University of Guelph - CCRF Professorship in Spine Mechanics and Neurophysiology was established on September 1, 2008. This position resides within the Department of Human Health and Nutritional Science (HHNS), College of Biological Sciences, and was made possible by the generous support of the Ontario Chiropractic Association (OCA), Canadian Chiropractic Research Foundation (CCRF) and the University of Guelph. My current rank in HHNS is Assistant Professor and distribution of effort (DOE) within the department is allocated to 70% research, 20% teaching and 10% Service.

The CCRF University Professorship initiative is vital to the evolution of the chiropractic profession. Future health policy, funding of both chiropractic research and services and integration of chiropractic into mainstream health services will depend on the quality of empirical evidence supporting the physiologic effects of chiropractic intervention. However, the current infrastructure and financial resources remain inadequate for chiropractic to generate the quality and volume of research needed to advance this cause. Adding to this challenge is the fact that less than one percent of chiropractors are currently engaged in full-time research at institutions of higher learning.

In the wake of these deficiencies, chiropractic continues to be marginalized with respect to government funding and public utilization. Central to this challenge is the fact that we are still unable to explain our clinical effect from a basic scientific perspective and, consequently, chiropractic care is often sought as a last resort by patients and health professionals, alike. In order to increase the profile and credibility of chiropractic to mainstream health care, we must demonstrate the value of chiropractic services to patients, clinicians and other stakeholders by characterizing the chiropractic effect on a fundamental physiologic level, using the jargon of basic science. For this reason, the Report of the Task Force on Chiropractic Research in Canada is appropriate in concluding that "Researchers and their work will play an important role towards the acceptance of chiropractic".



## RESEARCH GOALS

### OVERALL RESEARCH GOALS

My overall research initiatives revolve around the study of the neurophysiologic mechanisms of central sensitization and pain. Central sensitization is a fundamental neuroadaptive response that has been linked to an increasing number of pathologies, both somatic and visceral. One of my primary interests is exploring the role of central sensitization in the clinical manifestation of chronic and myofascial pain, as well as its role in the clinical expression of somatovisceral diseases. I am also exploring the mechanisms of modulation of central sensitization with therapeutic applications such as manual therapy and other modalities including acupuncture and therapeutic ultrasound.

### GOALS as CCRF PROFESSOR

My primary goal as CCRF Chair in Spine Mechanics and Neurophysiology at the University of Guelph is to elucidate the physiologic mechanisms of chiropractic spinal manipulative therapy (SMT). The specific purpose of this research is to characterize SMT in basic physiologic terms in order to establish a contemporary scientific paradigm for chiropractic medicine.

The primary hypothesis guiding this research is that SMT achieves its physiologic effects by modulating central sensitization. Under this hypothesis, I am currently pursuing two primary research threads:

1. Investigate the physiologic mechanisms of SMT in the treatment and management of pain (chronic, myofascial). Chronic and myofascial pain have been linked to central sensitization. Modulation of central sensitization via SMT will provide evidence that SMT may play an important role in the ongoing treatment and management of chronic and myofascial pain. Owing to aging demographics, the incidence of chronic and myofascial pain is accelerating and becoming one of health care's greatest fiscal challenges. This research will validate the importance of integrating conservative interventions, such as chiropractic, into mainstream health services.
2. Investigate the physiologic mechanisms of therapeutic interventions, such as SMT, in the treatment and management of non-musculoskeletal (visceral) conditions. I have demonstrated through initial studies that somatovisceral responses are mediated by changes in central sensitization. Accordingly, therapeutic interventions, such as SMT, which modulate central sensitization, may have important contributions towards the management of this group of pathologies, which includes common conditions such as Functional Gastrointestinal Disorders (FGID), Irritable Bowel Syndrome, dyspepsia and gastritis. This line of research will provide the scientific basis and rationale for inclusion of chiropractic services in wellness and preventive programs.



Enhancing the contemporary chiropractic scientific paradigm will reinforce the credibility of the profession and demonstrate the value of chiropractic services to all stakeholders in the mainstream health care delivery system, for both musculoskeletal and wellness/preventive initiatives.

## CURRENT RESEARCH ACTIVITIES

I have established an independent and growing research program at the University of Guelph, which currently includes eight University of Guelph Ethics approved projects in various stages of progress:

- **\*Srbely, Dickey: Central Sensitization Evoked Segmental Changes in Dermatomal Temperature.**

This study is complete and the manuscript is currently in its final review by authors. This study demonstrated that central sensitization evokes visceral responses (ie., temperature change) in segmental patterns. We hypothesize that central sensitization is the underlying physiologic mechanism for the somatovisceral response in humans.

- **\*Srbely, Vernon, Lee: Spinal Manipulation Evokes Segmental Antinociceptive Effects.**

We are in the final stages of data collection for this study; preliminary data demonstrates that SMT evokes antinociceptive effects that follow segmental patterns. Our hypothesis states that the physiologic effects of SMT are mediated via modulation of central sensitization. Follow up to this study will examine the effect of SMT on experimentally sensitized segments to determine a causal relationship between central sensitization and SMT. The results of these studies, when coupled with the above study by Srbely and Dickey, provide a basic foundation for the use of SMT in the treatment and/or management of all conditions linked to central sensitization, including chronic and myofascial pain, osteoarthritis and visceral (non-msk) disease.

- **\*Srbely, Zettel: Central Sensitization Modulates Balance**

Data collection for this study is complete. Manuscript is being written up and anticipated submission is in September 2010. This study demonstrated that central sensitization modulates balance in young healthy humans, which may be an important underlying mechanism in balance changes observed post injury, such as whiplash. Follow up to this study will investigate whether therapeutic interventions (SMT, ultrasound, dry needle therapy) can therapeutically modulate this mechanism.

- **\*Srbely, Bent: Central Sensitization Modulates Motoneurone Excitability**

This study is funded by the Canadian Arthritis Network and is Phase I of a two-phased project evaluating the effects of central sensitization on motoneurone excitability in osteoarthritis as well as the impact of therapeutic ultrasound on motoneurone excitability. The results of this study, when coupled with the results from the Srbely, Vernon, Lee thread above, will provide scientific rationale for the use of SMT in the management of pain and dysfunction in osteoarthritis.



- **\*Srbely, Triano: Trigger Point Stimulation Evokes Morphologic Changes in Segmentally Related Myofascial Trigger Points.**

Data collection is complete for this pilot study. Preliminary results demonstrate changes in trigger point morphology (size, shape) and stiffness properties after stimulation of segmentally related trigger points after dry needle therapy. These findings, when coupled with the Srbely and Bent study, suggest that trigger point stimulation evokes segmental physiologic changes in motoneurone excitability, which is important in the enhancement of current and/or novel therapeutic applications.

- **\*Srbely, Bandukwala, Dickey: Ultrasound Stimulation of Myofascial Trigger Points Evokes Segmental Changes in Skin Temperature.**

Data collection is ongoing. This study is follow up to the Srbely and Dickey study, which investigated segmental changes in skin temperature, and aims to explore the effects of therapeutic ultrasound on skin temperature. The results of this study will provide insight into therapeutic approaches amenable to the treatment of visceral (non-msk) disease.

- **\*Srbely, Murphy, Bush: Does Central Sensitization Modulate Somatosensory Evoked Potentials in Humans?**

We are in the initial stages of data collection for this pilot study, whose purpose is to investigate ways of quantifying changes in central sensitization. Currently there is no acceptable method for quantifying central sensitization. Quantifying sensitization is important because it will allow us to better assess changes in central excitability, both clinically and experimentally, to improve the diagnosis and treatment of a broad spectrum of pathologies.

- **Budgell, Injeyan, Srbely, Bent: Spinal Manipulation Modulates Sympathetic Activity in Segmental Patterns.**

This study is in the application stage for Ethics Approval. It is an important study for chiropractic because it will objectively quantify the sympathetic effects of spinal manipulation using single fiber recordings (microneurography). This is a seminal study in the thread investigating the importance of spinal manipulation in the treatment of non-msk conditions and will contribute to the scientific rationale justifying the use of SMT in wellness/preventive healthcare initiatives.

**\*denotes Randomized Controlled Trial (RCT)**

Through my evolving research program, I have developed several interdisciplinary collaborations with renowned scientists in world-class institutions, including:

- Dr John Bush, PhD at MIT (Boston, MA)
- Dr Jim Dickey, PhD (University of Western Ontario)
- Dr Leah Bent, PhD (University of Guelph)
- Dr John Zettel, PhD (University of Guelph)
- Dr Stephen Miller PhD (University of Guelph)
- Dr John Triano, DC PhD (CMCC, McMaster University)
- Dr Bernadette Murphy, DC PhD (UOIT)



- Dr Howard Vernon, DC PhD (CMCC)
- Dr Kelly Ainsworth, DC, MD and Dr Srinivasan Harish, MD (Radiology, McMaster University)
- Dr Matthew Weisbrod, MD, CCFP (Family Physician)

## PUBLICATIONS

The state of the art research facilities at the University of Guelph has enabled me to conduct high quality research (randomized controlled trials) which is already published in leading international peer reviewed journals such as Clinical Rehabilitation, Pain, Journal of Pain, Journal of Rehabilitation Medicine:

### PUBLISHED MANUSCRIPTS IN PEER REVIEWED JOURNALS:

**Srbely JZ.** Chiropractic Science: A Contemporary Neurophysiologic Paradigm, J Can Chiropr Assoc. 2010;54(3). Journal of Canadian Chiropractic Association (JCCA) is the official journal of the Canadian Chiropractic Association. It is the preeminent international chiropractic research publication with the latest research and advances in chiropractic/rehabilitation science.

**\*Srbely JZ, Dickey JP, Bent LR, Lee D.** Capsaicin Induced Central Sensitization Evokes Segmental Changes in Trigger Point Sensitivity In Humans. J Pain. 2010 Jul;11(7):636-643. J Pain. 2009 Dec 14 [Epub ahead of print]. *Journal of Pain's 5-year Impact Factor (3.893) ranks 23<sup>rd</sup> (out of 147, 85<sup>th</sup> percentile) in the "Clinical Neurology" category.*

**\*Srbely JZ, Dickey JP, Lee D, Lowerison M.** Dry Needle Stimulation of Myofascial Trigger Points Evokes Segmental Antinociceptive Effects: A Double-Blind Randomized Controlled Study. J Rehabil Med. 2010 May;42(5):463-8. *Journal of Rehabilitation Medicine's 5-year Impact Factor (3.087) is ranked 3<sup>rd</sup> (out of 28, 90<sup>th</sup> percentile) in the "Rehabilitation" category.*

**\*Srbely JZ, Dickey JP, Lowerison M, Edwards MA, Nolet PS, Wong LL.** Stimulation of Myofascial Trigger Points with Ultrasound Induces Segmental Antinociceptive Effects: A Randomized Controlled Study. Pain. 2008 Oct 15;139(2):260-6. *Pain's Impact Factor (6.030) is ranked 1<sup>st</sup> (out of 22, 99<sup>th</sup> percentile) in "Anaesthesiology" category, 8<sup>th</sup> (out of 147, 95<sup>th</sup> percentile) in "Clinical Neurology".*

**Srbely JZ.** Ultrasound in the management of osteoarthritis: Part 1 - A Review of the Current Literature. JCCA J Can Chiropr Assoc. 2008 Mar ;52 (1):30-7 *Journal of Canadian Chiropractic Association (JCCA) is the official journal of the Canadian Chiropractic Association. It is the preeminent international chiropractic research publication with the latest research and advances in chiropractic/rehabilitation science.*

**\*Srbely JZ, Dickey JP.** Randomized controlled study of the antinociceptive effect of ultrasound on trigger point sensitivity: novel applications in myofascial therapy? Clin Rehabil. 2007 May;21(5):411-7. *Clin Rehabil. 2007 May;21(5):411-7. Clinical Rehabilitation's 5-year Impact Factor (2.520) ranks 7<sup>th</sup> (out of 28, 75<sup>th</sup> percentile) in the "Rehabilitation" category.*





**\*Srbely J, Dickey JP.** Stimulation of Myofascial Trigger Points Causes Systematic Physiologic Effects. *J Can Chiropr Assoc.* 2005 Jun;49(2):75. *Journal of Canadian Chiropractic Association (JCCA) is the official journal of the Canadian Chiropractic Association. It is the preeminent international chiropractic research publication with the latest research and advances in chiropractic/rehabilitation science.*

## INVITED REVIEW

**Srbely JZ.** New Insights into the Treatment of Myofascial Pain. *Current Pain and Headache Reports*, Vol. 14, Issue 5. Jul 7. [Epub ahead of print] *Current Pain and Headache Reports' target audience is clinicians. The spotlight of this review is to highlight my novel hypothesis and research on central sensitization and therapeutic ultrasound, as it applies to the clinical management of soft tissue/myofascial pain and joint function.*

## MANUSCRIPTS IN PREPARATION

**\*Srbely JZ, Dickey JP, Montaholi Y, Miller S, Lowerison M.** Central Sensitization Evokes Segmental Changes in Skin Temperature in Young Healthy Humans. *This manuscript is complete and is awaiting final revision from all authors before submission. Target journal is the Journal of Physiology.*

**\*Srbely JZ, Dickey JP, Montaholi Y, Miller S, Bandukwala S, Lowerison M.** Trigger Point Stimulation with Therapeutic Ultrasound Modulates Skin Temperature in Segmental Patterns. *Manuscript is in final stages of preparation. Target Journal is Journal of Physiology.*

**\*Srbely JZ, Zettel J.** Central Sensitization Modulates Quiet Standing Balance. *Manuscript is in final stages of preparation. Target Journal is Balance and Posture.*

**\*denotes Randomized Controlled Trial (RCT)**

## ACADEMIC ACTIVITIES

In my capacity as Assistant Professor and CCRF Chair, I have integrated into the academic and research culture through extensive teaching and academic service:

## TEACHING

My responsibilities include teaching a 4<sup>th</sup> year level Human Kinetics course entitled "Health and Injury Biomechanics". I designed this course from scratch and aimed to cover topics including tissue mechanics, functional anatomy and physiology, principles of rehabilitation and clinical assessment of



injury. This course has received exceptional reviews from students with course evaluations of 4.22 (Winter 2009) and 4.62 (Winter 2010) out of a maximum 5 rating.

My teaching responsibilities also include acting as faculty supervisor to undergraduate and graduate student research projects; to date I have supervised 18 students in this capacity. I currently supervise one thesis Masters student (commenced September 2009) and am taking on two coursework Masters students (commencing September 2010) this fall.

My successful teaching profile to date emphasizes that chiropractic researchers are experts and leaders in the field of neuromusculoskeletal medicine. This success also provides evidence that chiropractic researchers can play an important role within institutions of higher learning; this brings significant exposure and credibility to the profession.

I have included my complete teaching profile in Table 1.

## **INVITED TALKS**

May 2010: Canadian Chiropractic Association/Canadian Chiropractic Research Foundation Annual General Meeting. Topic: "A contemporary, evidence-based neurophysiologic paradigm for therapeutic manual interventions." Toronto, Ontario.

November 2009: Manitoba Chiropractic Association Annual General Meeting: Keynote Speaker. Talk entitled "Biomechanical and Neurophysiologic Mechanisms of Central Sensitization: Diagnostic and Therapeutic Implications in Health and Disease.", Winnipeg, Manitoba.

November 2009: Department of Human Health and Nutritional Science Seminar Series. Presented talk entitled "Myofascial Trigger Points: Therapeutic Implications in the Treatment of Musculoskeletal Pain and Joint Dysfunction.", Guelph, Ontario.

September 2009: University of Guelph "Make Your Mark in Research." Presented an overview of my clinical experience and how this has translated into a career in research. Guelph, Ontario.

October 2009: CIHR Workshop to Enhance the Chiropractic Research Agenda. Montreal, PQ. Presented my research initiatives to CIHR Workshop. This Workshop was funded by CIHR (Oct 1 and 2, 2009).

April 2009. World Federation of Chiropractic Biennial Conference. Presented my research plan and activities as "Canadian Chiropractic Research Foundation Chair in Spine Mechanics and Neurophysiology. , Montreal, PQ

October 2008. Presented a talk entitled "Neurophysiology of Pain". Massachusetts Institute of Technology (MIT), Boston, MA. Department of Mathematics, Contact: Dr John W Bush, PhD

November, 2007. "Neurophysiologic Mechanisms of Myofascial Trigger Points, "Department of Human Health and Nutritional Science Talk Series, University of Guelph



## **CONFERENCE PRESENTATIONS**

April 2009: Srbely JZ, Dickey JP, Bent LR, Lee D. Capsaicin Induced Central Sensitization Evokes Segmental Changes in Trigger Point Sensitivity In Humans. Presented abstract to World Federation of Chiropractic Biennial International Conference, Montreal, PQ.

### **Poster Presentation**

August 2010: Canadian Society for Life Science Research (CSLSR). "Central Sensitization Reduces Activation Thresholds of Motoneurons." McGill University, Montreal, Quebec.

July 2010: Technological Advances in Science, Medicine and Engineering. "Central Sensitization Evokes Changes in Activation Threshold of Motoneurons." Hospital for Sick Children, Toronto, Ontario.

April 2010: Neuroscience Day (Biomedical Science). "Effects of Ultrasound on Pain and Function in Osteoarthritis" University of Guelph, Guelph, Ontario.

## **SERVICE**

### **Peer Reviewer**

March 2010: External Peer Reviewer (Randomized Controlled Trials 2), Canadian Institute of Health Research (CIHR)

### **Journal Reviewer**

July 2010: Central European Journal of Medicine: Manuscript Number: CEJMED-D-10-00037

January 2010: Archives of Physical Medicine and Rehabilitation: Manuscript Number: ARCHIVES-PMR-D-10-00422 "

December 2009: Journal of Musculoskeletal Pain: Manuscript ID: WJMP-2009-0023

June, 2009. Journal of the Canadian Chiropractic Association. "Chiropractic effectiveness at co-managing the symptoms associated with upper motor neuron lesion diseases: An annotated bibliography and rating of the literature."

May, 2009. Journal of the Canadian Chiropractic Association. "Psoas Major: A Case Report."

January, 2009. Journal of the Canadian Chiropractic Association. "Chiropractic Care of a Student Athlete with Lumbar Disc Protrusion and Spina Bifida Occulta"

March, 2008: Journal of Musculoskeletal Pain. Manuscript No. JMP071151



## **BENEFITS AND PAYOFF OF THE CCRF PROFESSORSHIP**

The investment into the CCRF Chair at the University of Guelph has provided me with an immediate opportunity to establish a high profile research program within a state-of-the-art university facility. In addition, it opens up many immediate, short term and long term opportunities/payoffs for the chiropractic profession. The most important of these benefits is to facilitate and enable the production of world class research by providing instant access to over \$1M in world class research infrastructure, opening the door for chiropractic researchers to pursue further research grant support, facilitating interprofessional collaborations and enhancing the profile and credibility of chiropractic science within institutions of higher learning.

### **RESEARCH FACILITIES**

The CCRF Research Chair at the University of Guelph has provided immediate access to over \$1 million in much needed state-of-the-art laboratory infrastructure for chiropractic research, including two biomechanics labs (John Zettel, Lori Vallis) and one neurophysiology lab (Leah Bent). The biomechanics facility includes a unique six-degrees of freedom robot employable in a wide range of biomechanical applications and spinal research. The biomechanics facility also includes Optotrak kinematic data acquisition system for 3-D analysis of human movement and accelerometry and force transducers for the quantification of human movement. The neurophysiology lab is headed by Dr Leah Bent, one of few researchers in Canada who are trained in the technique of microneurography. Microneurography is a technique used to record signals from neurons by inserting microelectrodes directly into peripheral nerves, allowing us to collect high-quality data on in-vivo human subjects. Her state-of-the-art laboratory facility includes:

- electrically shielded room to ensure the highest quality nerve recordings (noise reduction)
- CED data acquisition hardware, data acquisition software (Spike and Signal)
- two ISO 80 amplifiers for afferent/efferent recordings
- Bortec 8 Channel EMG analysis system
- Grass S88X nerve and muscle stimulator
- PCs for data collection/analysis

The neurophysiology lab is also expanding its capacity to perform evoked potentials (SEP) and transcranial magnetic stimulation (TMS), further broadening the potential for high-level research and inter-disciplinary and inter-institutional collaboration. The University of Guelph research environment allows chiropractic researchers like myself the opportunity to produce high quality research (randomized controlled trials) worthy of publication in high profile peer reviewed journals; this is essential to increasing the exposure and credibility of chiropractic research.

### **FUNDING**

An extremely important benefit to the CCRF Professorship initiative is enabling chiropractic researchers to pursue and access alternate sources of research support, otherwise inaccessible outside the



university setting. To this extent, I have secured a prestigious peer-reviewed grant as a Principal Investigator from the Canadian Arthritis Network (CAN), Network of Centres of Excellence (Government of Canada) in the amount of \$48,100 to investigate the mechanisms of pain in osteoarthritis. This grant supports my research and provides support for one Masters student until September 2011.

In addition, I am currently the only chiropractic researcher (DC, PhD) holding the distinction of “Canadian Arthritis Network Investigator”. This honour, which is given to approximately 150 of Canada's leading researchers in arthritis, includes internationally-renowned scientists and specialists from a variety of disciplines (genetics, rheumatology, biomechanics, neuroscience, biochemistry). This accomplishment underscores the expertise of chiropractic researchers, enhances the profile of chiropractic science at the highest levels of research and promotes interdisciplinary awareness and collaboration.

I have also secured funding through our department for an Undergraduate Research Assistant. This peer-reviewed award totalled \$6000 and provided me with support for an undergraduate research assistant during the Summer 2010 semester (May-Aug 2010). This funding support significantly leveraged my research productivity.

## **RESEARCH COLLABORATION**

As a direct result of the CCRF Professorship, I have fostered high profile interdisciplinary research collaborations with renowned institutions and world class researchers (listed in “Current Research Activities”), providing vital exposure and credibility to our research agenda.

One of the most exciting and significant collaborations is one with internationally recognized Dr John Bush at the Massachusetts Institute of Technology (MIT), in Boston, MA. Dr Bush is a full professor in the Department of Applied Mathematics at the Massachusetts Institute of Technology at MIT. MIT is a world renowned research and academic institution which is ranked 1st internationally in the fields of Technology and Natural Sciences by the 2009 Times Higher Education-QS World University Rankings. Dr Bush’s work is internationally acclaimed and his research has been twice featured on the cover of the preeminent journal “Nature”. In October of 2008, I was invited to speak at MIT on my work in the field of pain. Since then, Dr Bush and I have initiated a formal collaboration in the study of pain and its physiologic mechanisms, and how therapeutic interventions such as SMT may modulate pain on a biophysical level. This initiative provides significant exposure and credibility to chiropractic research and provides immediate access to the research environment and research infrastructure of one of the world’s leading academic and research institutions. We have already produced one paper (not yet submitted) and recently embarked on a study with Dr Bernadette Murphy (OUIT) to investigate the electrophysiologic properties of nerve propagation.

Linking chiropractic research with internationally renowned and respected institutions such as MIT is invaluable to the credibility, exposure and perceived value of chiropractic research. Fostering and nurturing relationships such as these is essential to our long-term research mandate as it exposes chiropractic research to the top minds and institutions in science, increasing the potential for high impact, high-profile research validating our importance to mainstream healthcare. These types of



relationships are made possible with the support of the CCRF Professorship initiative and bring tremendous immediate and long-term returns to the profession.

## **CHIROPRACTIC EXPOSURE in the UNIVERSITY SETTING**

In my role as Assistant Professor and CCRF Chair at the University of Guelph, I have had the opportunity to enhance the profile of chiropractic within the university setting:

- April, 2010: Fibromyalgia Network published an article on my recent research in the field of pain and the implications to fibromyalgia syndrome. I was one of two researchers in the field to be interviewed for this article. This publication is sent out worldwide to the Network's membership, validating the expertise of chiropractic researchers.
- March 25, 2009: The University of Guelph's school newspaper, "at Guelph", featured me in an article reporting on the Guelph-CCRF Research Chair initiative and the advancement of chiropractic science. This article provided significant exposure to chiropractic and shed very positive light on our research initiatives.
- I was one of several faculty members in the University of Guelph invited to speak at the 2009 "Make Your Mark in Research" lecture series during Orientation Week. The purpose of this lecture series was to target a cross-section of Guelph faculty members from unique and/or interesting backgrounds to speak to first year students about career opportunities and research. I spoke about my career as a chiropractor and how this experience led me into research.
- My clinical experience as a chiropractor and related research interests has attracted great attention from students within the Human Kinetics program at U Guelph. Several students I taught during the Winter 2009 and Winter 2010 sessions have since pursued chiropractic as a career. I have incorporated my chiropractic clinical experience into my course with great success.
- I have conducted two invited presentations within the U of Guelph Department of Human Health and Nutritional Science Lecture Series discussing my research goals and initiatives as a chiropractic clinician/researcher.
- I have managed to incorporate chiropractic research in the formal 2010 Department of Human Health and Nutritional Science Strategic Plan. This document specifically outlines priority areas of research interests and ongoing collaboration for our department and now lists chiropractic research as one such area. This provides tremendous exposure and credibility to our research initiatives and demonstrates that our research is valuable and relevant to institutions of higher learning.
- In collaboration with Dr Jay Triano, I am initiating discussions with our department (HHNS) to establish a joint Masters program with Canadian Memorial Chiropractic College (CMCC). This is important to advancing the research initiatives of chiropractic as it would improve accessibility of chiropractors to university-based graduate programs and enhance our research presence in the vital disciplines of



biomechanics and neurophysiology. This affiliation would also provide significant credibility to CMCC and the profession and lay the foundation for future educational and/or research affiliations.

## OTHER BENEFITS

- Exposing chiropractic to the daily university setting and culture allows and facilitates open communication and interdisciplinary/interprofessional cooperation. I have had the opportunity to engage in many informal discussions with my academic colleagues and peers about chiropractic. These discussions have served to increase awareness and understanding of the benefits of chiropractic as well as the challenges we face as a growing profession. Ongoing interactions such as these nurture positive interprofessional rapport between chiropractors and other healthcare and research professionals.
- The CCRF Research Chair at the University of Guelph provides a vehicle to train future chiropractic researchers in the disciplines of biomechanics and neurophysiology. Chiropractic research is significantly underserved in these areas, which are essential to the evolution and long-term growth of chiropractic science.

## FUTURE GOALS AND OBJECTIVES

One of my primary immediate career goals is to transition into a full time university-based research position, enabling me to concentrate full-time on enhancing the important foundation that I have laid over the past two years at the University of Guelph. During my tenure as CCRF Research Chair, I have established a vibrant research program which continues to expand, the fruits of which are now evident by increasing publications in high profile journals and an expanding undergraduate and/or graduate student training program. I have also established my credibility and profile within the Department of Human Health and Nutritional Science, where my colleagues have embraced my research, as evidenced by the growing interprofessional collaborations that I have been able to quickly establish. My students have expressed their regard for me as a teacher and my unique knowledge and expertise as a chiropractic researcher. I will continue to build on this foundation and pursue several key areas of research over the next 5-years, which will serve to enhance the foundation of basic science substantiating the importance and increased utilization of chiropractic services in mainstream healthcare. These areas will continue to:

1. Investigate the neurophysiologic mechanisms and role of central sensitization in the clinical expression of pain and pathology. These neural mechanisms form the physiologic basis to justifying the effects of therapeutic modalities in pain management, especially in the growing field of chronic myofascial pain. I will continue to facilitate this research through multi-site (MIT, Guelph, U Western Ontario, McMaster, CMCC, OUIT) interdisciplinary research.
2. Explore the physiologic impact of therapeutic interventions, such as SMT, on central sensitization. This is an important topic of research that will form a major pillar in the scientific storyline of chiropractic. Modulating the mechanisms of central sensitization has immense implications in both **pain management** as well as **health promotion (wellness)**.



3. Focus on RCT study designs to capture high quality data on a cellular and/or electrophysiologic level, using highly specialized recording techniques such as microneurography, a technique unique to our neurophysiology facility at the University of Guelph.
4. Strive to increase the research presence of chiropractic in biomechanics and neurophysiology by continuing to develop intra, inter and trans-disciplinary research collaborations. This is a significantly underserved area of research in our profession, yet increasing our research productivity in these disciplines is a priority to the long term credibility and acceptance of chiropractic into mainstream healthcare.
5. Develop an experimental technique/protocol to quantify central sensitization which will provide researchers and clinicians better tools to assess/monitor pain and treatment outcomes both in the lab and the clinic.





**Table 1: Teaching Record at University of Guelph**

Semester	Course # and Title	# Registered Students	# Lectures/ labs presented	# instructors
Fall 2008	HK*4230 Advanced Study in Human Biology and Nutritional Sciences; Student: Cameron Lawrie	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1
Winter 2009	HK4610: Health and Injury Biomechanics	75	24 Lectures @ 1.5 hrs/lecture; 4 labs x 6 groups = 24 lab sessions @2 hours/lab. Total hours = 84 hours	1 instructor (John Srebely); 1 TA (Erik Prout)
	HK*4360: Research in Human Biology and Nutritional Sciences; Student: Natasha Brancier	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1
Summer 2009	HK*4230: Advanced Study in Human Biology and Nutritional Sciences; Student: Jordan Sampson	1	Approx. 5 hours Individual teaching and discussion	1
	KIN*555: Independent Study; Student: Ryan Frane (University of Western Ontario)	1	Approx. 2 hours of Individual teaching and discussion	2 (co-advisors: Jim Dickey, John Srebely)
Fall 2009	HK4360: Research in Human Biology and Nutritional Science; Student: Amber Garrett	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1
	HK4360: Research in Human Biology and Nutritional Science; Student: Andrew Crosby	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1
	HK4360: Research in Human Biology and Nutritional Science; Student: Jordan Sampson	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1

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	NEUR4450: Research in Neurosciences; Student: Kelly Pedersen	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1
	HK4230: Advanced Study in Human Biology and Nutritional Sciences; Student: Nicole Harada	1	Approx. 5 hours of Individual (1 on 1) teaching and discussion	1
	HK4230: Advanced Study in Human Biology and Nutritional Sciences; Student: Katherine Randall	1	Approx. 5 hours of Individual (1 on 1) teaching and discussion	1
	HK4230: Advanced Study in Human Biology and Nutritional Sciences; Student: Roberto Mirota	1	Approx. 5 hours of Individual (1 on 1) teaching and discussion	1
	HK4371: Research in Human Biology and Nutritional Science; Student: Katherine Randall	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1
	HK4371: Research in Human Biology and Nutritional Science; Student: Antik Dey	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1
	HK4371: Research in Human Biology and Nutritional Science; Student: Cale Templeton	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1
	NEUR6000: Principles of Neuroscience	18	1 @ 3 hour lecture: approx. 10 hours of prep time	1
Winter 2010	HK4610: Health and Injury Biomechanics	72	36 Lectures @ 1 hrs/lecture; 4 labs x 3 groups = 12 lab sessions @ 2 hours/lab. Total hours = 84 hours	1 instructor (John Srbely); 1 TA- Gaayathiri Jegatheeswaran
	HHNS6920: Applied Research Techniques; Student: Shazeen Bandukwala <sup>†</sup> <sup>†</sup> Co-authorship	1	Approx. 20 hours of Individual (1 on 1) teaching and discussion	1



Summer 2010	HK4360: Research in human biology and Nutritional sciences; Student: Alex Mason	1	Approx. 10 hours of Individual (1 on 1) teaching and discussion	1
	HHNS*6920 Applied Research Techniques and Processes; Student: Lisa Maddelena	1	Approx. 30 hours of Individual (1 on 1) teaching and discussion	1