The balming influence of chronic pain research

Dr Mathieu Piché is improving and developing treatments to relieve and alleviate chronic pain. Below, he discusses how he arrived at this point, highlights the scale of the problem and identifies ongoing challenges faced by those in his profession.

When and why did you start researching chronic pain and what do you consider to be the most interesting aspects of this area?

At the beginning of my graduate studies, I was interested in neural plasticity in sensory systems in general. Neural plasticity is a set of mechanisms that allow the nervous system to be modified to provide improved or alternative functions. I went on to study plasticity of the visual system in animal models in blindness but, because of my training in chiropractic care and my experience with patients with chronic pain, became interested in the plasticity of neural processes underlying pain perception and regulation.

There are many similarities between the neural plasticity mechanisms of blindness and chronic pain but, in the case of chronic pain, the mechanisms are pathological and contribute to maintaining chronic pain, whereas in blindness they allow enhanced function in auditory and somatosensory systems. Thus, I am dedicated to investigating the neural processes of physiological and pathological pain regulation mechanisms to improve current interventions and develop new ones.

What are the implications of chronic pain at the population level?

Chronic pain is a silent epidemic and its impact is huge. In Canada, for example, over one-fifth of the adult population is affected, leading to high costs of several billion dollars each year. This includes medical costs, insurance coverage, social programmes, loss of productivity and loss of tax income for the state.

Most importantly, chronic pain has a devastating effect on the individual. Over half of patients do not receive adequate pain relief, which obviously affects their quality of life and interpersonal relationships. Patients also have increased depressive symptoms and a higher risk of committing suicide. In addition, patients with chronic pain are more prone to losing their job and have less professional responsibilities. It is estimated that the personal cost for a person living with chronic pain is over CAD 1,000 per month.

Briefly, can you tell us the key issues your research is seeking to address?

We are investigating four main areas, from more fundamental to more clinically orientated questions. We want to understand the neural mechanisms of non-pharmacological analgesic interventions; understand the dysfunction of pain modulation mechanisms in patients with chronic pain; make better use of existing non-pharmacological interventions; and develop new approaches to treating pain.

Have you encountered any challenges in your research?

Pain research in general provides several challenges. In studies involving patients with chronic pain, the recruitment of participants is the most difficult aspect. We need very good collaborators who can refer patients, but these collaborators must see a large number of patients in order to recruit a sufficiently large sample to complete a study. Moreover, we always face heterogeneity in the recruited sample, in terms of clinical presentation, symptom severity and comorbidities.

How have you overcome these?

Addressing these issues is not a trivial task and solutions are always imperfect, one way is to be relatively strict in terms of selection criteria or study a subgroup of the disease. The disadvantage of this, however, is that the results are not applicable to all patients, only the specific subgroup. Another thing that we can do is to take the variability and some confounding factors into account in our analyses. This partially solves the problem, but it would be ideal if we could avoid such factors which, unfortunately, is simply not possible.

Finally, what is the research landscape currently like in this area?

Pain research is funded by most funding agencies in Canada. However, considering its impacts, more research is needed at all levels, including basic research to better understand pain mechanisms and clinical research to improve our ability to relieve pain in all patients. Unfortunately, the economic climate makes it extremely challenging to obtain sustained funding to conduct any research, including pain research, so even the short-term is precarious work.

Increasing awareness for the general public and funding agencies might help to increase pain research, but several other health-related research interests – like cancer and mental disorders – also need increased funding. Thus, it is a constant challenge to address all of these needs all of the time.
One particular mechanism the researchers are interested in is the alteration of pain regulation working to improve the lives of people around the globe. Led by Dr Mathieu Piché, the team’s research through non-pharmacological interventions is developing interventions that could help manage, or even treat, a range of chronic pain conditions.

PAIN IS ONE of the most significant global burdens. Estimates suggest around 20 per cent of adults around the world experience pain in some form, be it acute, intermittent, chronic or a combination of all three. It has been reported that 10 per cent of adults are newly diagnosed with chronic pain each year, yet this problem is still largely misunderstood, not least because of the multitude of ways in which pain can manifest itself and the plethora of potential underlying causes.

Characterised by its indiscriminate nature, pain is capable of affecting anybody, irrespective of their age, race, gender or location. It is difficult to overstate the far-reaching and devastating effects of experiencing chronic pain; the financial burden it places on a society’s healthcare system is one thing, but the depression, inability to work and disruption to relationships for an individual serve as arguably more pressing reasons to address this global health problem.

The four main causes of pain are cancer, spinal problems, osteo- and rheumatoid arthritis and the results of operations and injuries. While the sensation of pain can be largely identified by the vast majority of people, the specific reasons for its onset in an individual are far less uniform. In short, it is impossible to find a means to relieve or alleviate pain that is universally applicable; one size does not fit all.

However, certain consequences of chronic pain are common, irrespective of the underlying causes. Now, a team of researchers at the Université du Québec à Trois-Rivières is developing interventions that could help manage, or even treat, a range of chronic pain conditions.

Piché and his group focus their attention on working memory because of the way it can block pain perception. "If you have a pounding headache that captures your attention resources, you may still be able to accomplish a task because your working memory allows you to block headache information for the duration of a task in order to focus your attention on the completion of the task," he explains. "However, in patients with chronic pain, this ability is decreased. It is therefore of interest to find ways of improving working memory, such as through stimulating the brain electrically or with a focal magnetic field.”

The second intervention is counter-stimulation, which triggers inhibition of pain by diffuse noxious inhibitory controls (DNIC). It is known that DNIC provide analgesia by blocking pain within the spinal cord through messages sent by the brain and are triggered by a second pain (counter-stimulation), demonstrating the effect of the pain inhibiting pain mechanism.

Pain affects a staggering number of people around the world. Now, a team of researchers from the Université du Québec à Trois-Rivières is developing interventions that could help manage, or even treat, a range of chronic pain conditions.
However, for patients with a range of chronic pain conditions this mechanism is altered. "We observed that in patients with irritable bowel syndrome, counter-stimulation is unable to produce analgesic effects," explains Piché. "We are now trying to develop new treatments to enhance these mechanisms to manage chronic pain."

The team’s investigations into working memory also include a focus on a specific brain region called the dorsolateral prefrontal cortex; the researchers are continuing attempts to enhance its function with transcranial direct current stimulation and transcranial magnetic stimulation. Achieving this could lead to an improvement of inhibition of pain through this particular mechanism.

THE NATURE OF PAIN
Although Piché and his team’s research primarily concerns the spine, the potential applications are far wider and, while much of their work focuses on developing new approaches to pain inhibition, they still devote time to improving existing treatments. As such, the findings from their approaches will be used to determine factors that increase the efficacy of spinal manipulation and chiropractic treatments in general. To this end, Piché and his team founded a practice-based research network in Québec, the RQRCC, allowing large-scale studies on these factors. These factors may include patients’ expectations, psychological factors or subtypes of pathological conditions that may respond more or less to the intervention,” says Piché.

An important consideration when thinking about the devastating global impact of chronic pain is its nature; by definition it is a subjective experience that can therefore only be ‘seen’ through its physical manifestations. In many ways, it can be thought of as a silent condition, one that is rarely dormant but inconspicuous to all but the individual experiencing it. However, what is clearly visible is the need for improved efficacy of treatment for pain, the ultimate goal of Piché and his team.

OBJECTIVES
To understand the mechanisms of pain and its regulation by non-pharmacological interventions.

COLLABORATORS
Pierre Rainville, PhD; Mathieu Roy, PhD, Institut Universitaire de Gériatrie de l’Université de Montréal, Canada
Isabelle Blanchette, PhD; Gilles Bronchti, PhD; André Bussières, PhD; Martin Descarréaux, PhD; Maria-Gazia Martinelli, PhD; Hugues Leblond, PhD; Johanne Martel, DC; Patrice Normandeau, DC; Djamel Ramla, PhD, Université du Québec à Trois-Rivières, Canada
Stéphanie Cormier, PhD, Université du Québec en Outaouais, Canada
Harumi Hotta, PhD; Sae Uchida, PhD; Nobuhiro Watanabe, PhD, Tokyo Metropolitan Institute of Gerontology, Japan

FUNDING
Conseil de Recherches en Sciences Naturelles et Génie (CRSNG) du Canada • Fondation Canadienne pour l'Innovation (FCI) • Fonds de Recherche du Québec en Santé (FRSQ) • Fondation de Recherche en Chiropratique du Québec (FRCQ) • Université du Québec à Trois-Rivières (UQTR)

CONTACT
Dr Mathieu Piché, DC, PhD
Université du Québec à Trois-Rivières
Department of Chiropractic, 3351 Boulevard des Forges
Trois-Rivières, Québec, G9A 5H7, Canada
T +1 819 376 5011 x 3998
E mathieu.piche@uqtr.ca

www.uqtr.ca/cognac

DR MATHIEU PICHÉ earned his undergraduate degree in chiropractic at Université du Québec à Trois-Rivières in 2002. He then obtained a Masters in Cell Biophysics and Biology and a PhD in Neuroscience. Later on, he completed his postdoctoral training in neurophysiology at the Tokyo Metropolitan Institute of Gerontology. Piché is now Full Professor in the Department of Chiropractic at the Université du Québec à Trois-Rivières.

COGNAC RESEARCH GROUP
Co-directed by Professor Isabelle Blanchette and Dr Mathieu Piché, the research group on Cognition, Neuroscience, Affect and Behaviour (CogNAC) at the Université du Québec à Trois-Rivières includes 11 professors from four departments. The team works on various themes related to brain and spinal cord research, from functional neuroanatomy and single cell recordings to behaviour in animals and humans of all ages, including babies and older people.

CONTACT
E mathieu.piche@uqtr.ca