SUPRASPINAL MECHANISMS CONTRIBUTING TO CHRONIC PAIN

Chair: Laura S. Stone, PhD, Associate Professor, McGill University, Alan Edwards Centre for Research on Pain, Faculty of Dentistry

Speakers:

- **David A. Seminowicz**, PhD, Assistant Professor, Department of Neural & Pain Sciences, University of Maryland School of Dentistry
- **Marco Martina**, PhD, MD, Associate Professor, Department of Physiology, Northwestern University School of Medicine
- **Laura S. Stone**, PhD, Associate Professor, McGill University, Alan Edwards Centre for Research on Pain, Faculty of Dentistry

Symposium Abstract:

Changes in brain structure and cortical function have been reported in many chronic pain conditions. Affected brain regions may include the prefrontal cortex, the amygdala and the nucleus accumbens; regions that are associated with pain-related co-morbidities such as depression, anxiety and impaired emotional decision-making ability. While much has been learned at the level of the dorsal root ganglia and the spinal cord, to date very little is known about mechanisms underlying pain-related structural and functional brain abnormalities. The goal of this session is to highlight recent work investigating pain-related neuroplasticity at the systems, cellular and molecular levels in supraspinal structures. Dr. Seminowicz will begin the session by providing a broad overview of current research in neuroplasticity in supraspinal structures in chronic pain followed by a discussion of how rodent neuroimaging studies can supplement the findings from human neuroimaging studies. Dr. Martina will address the involvement of the limbic system in chronic pain and focus on the prefrontal cortex and the nucleus accumbens. Dr. Stone will discuss the role of epigenetic regulation of gene expression in supraspinal structures in chronic pain. Speakers will ensure that each presentation is accessible to individuals from a wide range of backgrounds and expertise. 30 minutes will be reserved for an interactive question and answer period will follow the presentations.

Learning Objectives:

1. Discuss the recent developments and theories in brain imaging of chronic pain.
2. Examine changes in synaptic transmission in supraspinal structures associated with chronic pain.
3. Review the emerging field of pain neuroepigenetics and the role of epigenetics in chronic pain.

**Functional MRI studies in rodents to uncover the brain circuitry of chronic pain**

David A. Seminowicz, PhD, Assistant Professor, Department of Neural & Pain Sciences, University of Maryland School of Dentistry

With decades’ worth of results from human neuroimaging studies, the picture of how chronic pain changes brain function and structure is coming into focus. By adding MRI studies using...
rodent models of chronic pain, we are able to further understand how circuits change over time and – using invasive techniques – the involvement of specific brain regions. This talk will cover recent rodent fMRI studies on various models of chronic pain, highlighting common and unique circuitry across conditions, and relating the findings back to human studies.

**The involvement of the limbic system in chronic pain**
Marco Martina, PhD, MD, Associate Professor, Department of Physiology, Northwestern University School of Medicine

While acute pain clearly originates in the periphery, the origin of chronic pain is more complex. Increasing amounts of data point to the involvement of the limbic system as a key element in the generation of chronic pain. Data will be presented supporting the idea that multiple components of the limbic system, including the prefrontal cortex, the nucleus accumbens and the hippocampus, undergo important functional and morphological reorganization in animal models of neuropathic pain. The potential therapeutic implications of these findings will be discussed.

**Epigenetic regulation of supraspinal neuroplasticity in chronic pain.**
Laura S. Stone, PhD, Associate Professor, McGill University, Alan Edwards Centre for Research on Pain, Faculty of Dentistry

Long-term programming of gene expression is dynamically regulated by modifications to the DNA collectively referred to as epigenetic modifications. The emerging field of pain epigenetics will first be introduced. Recent evidence suggesting that epigenetic mechanisms are involved in pain-related neuroplasticity in the prefrontal cortex will be presented. Finally, the broader implications of epigenetic regulation in the treatment of chronic pain research will be discussed.