

Robert Paul Bonin, Ph.D.

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CURRENT APPOINTMENT

Catherine Bushnell Postdoctoral Fellow in Pain Research

Cellular and Molecular Neuroscience Unit
Centre de recherche de l'Institut universitaire en santé mentale de Québec

Theme 1: Synaptic plasticity contributing to the development and maintenance of pain pathology

Theme 2: Development of novel optogenetic and behavioural approaches for pain research

Key research methods: Electrophysiology, optogenetics, behaviour

EDUCATION AND TRAINING

Postdoctoral Fellow

Jan 2011 – Present

Centre de recherche de l'Institut universitaire en santé mentale de Québec, QC
Supervisor: Dr. Yves De Koninck

Ph.D., Physiology (Collaborative Program in Neuroscience)

Sept 2004 – Dec 2010

University of Toronto, Toronto, ON
Thesis: “*Role of tonic GABAergic inhibition in hippocampal memory formation and nociception*”. Supervisor: Dr. Beverley A. Orser

B.Sc. (Hon), Biology and Pharmacology Co-op Program

Sept 1999 – Apr 2004

McMaster University, Hamilton, ON
Thesis: “*Gastric acid secretion in Flinder’s Sensitive Line rats: an animal model of depression*”. Supervisor: Dr. Richard Hunt

HONOURS AND SCHOLARLY AWARDS

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| Catherine Bushnell Postdoctoral Fellowship in Pain Research (\$90,000) | 2013-2015 |
| International Association for the Study of Pain Travel Grant (\$1200) | 2014 |
| Prize for best oral presentation (postdoc), Neuroscience rounds, CHU de Québec (\$100) | 2014 |
| Prize for best presentation at 7e Journée de la recherche en neurosciences et santé Mentale, Laval University. (\$150) | 2013 |
| Québec Network of Junior Pain Investigators Travel Grant (\$1,000) | 2013 |
| FRQS Postdoctoral Fellowship (\$90,000) | 2011-2013 |
| Québec Network of Junior Pain Investigators Travel Grant (\$1,000) | 2012 |
| Federation of European Neuroscience Societies Travel Grant (750€) | 2012 |
| International Association for the Study of Pain Travel Grant (\$900) | 2010 |
| University of Toronto Neuroscience Program Travel Award (\$500) | 2010 |
| A.C. Bryan Award for best presentation at the University of Toronto Shields’ Day lecture series. | 2009 |

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| University of Toronto Open Fellowship (\$1,600) | 2008 |
| University of Toronto Neuroscience Program Travel Award (\$500) | 2008 |
| NSERC PGS Doctoral Award (\$63,000) | 2007-2010 |
| University of Toronto Open Fellowship (\$2,000) | 2007 |
| Frist-Jus Annual Memorial Award in Neuropsychopharmacology (\$3,000) | 2007 |
| Peterborough K.M. Hunter Scholarship (\$20,000) | 2006-2007 |
| University of Toronto Open Fellowship (\$2,000) | 2006 |
| NSERC PGS Master's Award (\$17,300) | 2005-2006 |
| OGS Master's Award (Declined; \$15,000) | 2005-2006 |
| University of Toronto Open Fellowship (\$2,262) | 2005 |
| University of Toronto Open Fellowship (\$1,495) | 2004 |

PEER-REVIEWED PUBLICATIONS

Bonin RP & De Koninck Y (2014). A spinal analogue of memory reconsolidation enables reversal of hyperalgesia. *Nature Neuroscience*; 17: 1043-1045.

Bonin RP, Bories C & De Koninck Y (2014). A simplified up-down method (SUDO) for measuring mechanical nociception in rodents using von Frey filaments. *Molecular Pain*; 10: 26. Listed as a Highly Accessed article within 30 days of publication.

Bonin RP & De Koninck Y (2013). Restoring ionotropic inhibition as an analgesic strategy. *Neuroscience Letters*; 557: 43-51.

Gagnon M, Bergeron MJ, Lavertu G, Castonguay A, Tripathy S, **Bonin RP**, Perez-Sanchez J, Boudreau D, Wang B, Dumas L, Valade I, Bachand K, Jacob-Wagner M, Tardif C, Kianicka I, Isenring P, Attardo G, Coull JAM & De Koninck Y (2013). Chloride extrusion enhancers as novel therapeutics for neurological diseases. *Nature Medicine*; 19: 1524-1528.

Daou I, Tuttle A, Longo G, Wieskopf J, **Bonin RP**, Ase A, Wood J, De Koninck Y, Ribeiro-da-Silva A, Mogil J & Seguela P (2013). Remote optogenetic activation and sensitization of pain pathways in freely moving mice. *Journal of Neuroscience*; 33: 18631-18640.

Clarke H, Wijeyesundera DN, **Bonin RP**, Orser B, Englesakis M, Katz J (2013). Pregabalin effective for the prevention of chronic postsurgical pain: really? Reply. *Anesthesia and Analgesia*; 116:508-509.

Bonin RP, Zurek AA, Yu J, Bayliss DA & Orser BA (2013). Hyperpolarization-activated current (I_h) is reduced in hippocampal neurons from mice lacking $\alpha 5$ GABA_A receptors. *PLoS One*; 8: e58679.

Clarke HA, **Bonin RP**, Orser BA, Englesakis M & Katz J (2012). The prevention of chronic postsurgical pain using gabapentin: A systematic review. *Anesthesia and Analgesia*; 115: 428-442.

Bonin RP, Labrakakis C, Eng DG, Whissel PD, De Koninck Y & Orser BA (2011). δ GABA_A receptors regulate acute nociception. *Pain*; 152: 1317-1326.

Martin LJ, Zurek AA, **Bonin RP**, Oh GH, Kim JH, Mount H & Orser BA (2011). The memory-blocking properties of ethanol are not mediated by $\alpha 5$ subunit-containing γ -aminobutyric acid type A receptors. *Behavioural Brain Research*. 217: 379-385.

Martin LJ, **Bonin RP** & Orser BA (2009). The physiological properties and therapeutic potential of $\alpha 5$ -GABA_A receptors. *Biochemical Society Transactions*; 37: 1334-1337.

Bonin RP & Orser BA (2008). GABA_A receptor subtypes underlying general anesthesia. *Pharmacology, Biochemistry and Behavior*; 90: 105-112.

Bonin RP, Martin LJ, MacDonald JF & Orser BA (2007). $\alpha 5$ GABA_A receptors regulate the intrinsic excitability of mouse hippocampal pyramidal neurons. *Journal of Neurophysiology*; 98: 2244-2254.

Carascos VB, **Bonin RP**, Newell JG, Czerwinska E, MacDonald JF & Orser BA (2007). Insulin increases the function of glycine receptors by increasing the potency of glycine. *Molecular Pharmacology*; 71:1277-1287.

Cheng VY*, **Bonin RP***, Chiu MW, Newell JG, MacDonald JF & Orser BA (2006). Gabapentin increases a tonic inhibitory conductance in hippocampal pyramidal neurons. *Anesthesiology*; 105: 325-333. **The first two authors contributed equally to this report*

Sager M, Padol I, Khan W, **Bonin RP**, Blennerhasset PA & Hunt RH (2004). Establishment of T_H2 immune response based gerbil model of enteric infection. *Scandinavian Journal of Gastroenterology*; 39: 668-673.

BOOK CHAPTERS

Bonin RP & Orser BA. "Cellular and molecular effects of general anesthesia in the brain". In Neuroscientific Foundations of Anesthesiology, eds. Mashour GA & Lydic R. Oxford University Press, 17-32, 2011.

ABSTRACTS AND CONFERENCE PROCEEDINGS

Bonin RP & De Koninck Y (2014). A spinal analogue of reconsolidation enables reversal of hyperalgesia. Can. Assoc. Neurosci. #2-I-188; IASP #3270; Soc. for Neurosci. #242. **IASP Travel Grant*

Perez-Sanchez J, **Bonin RP**, Lorenzo LE, Labrakakis C, Bridgwater EM, Orser BA, De Koninck Y (2014). $\alpha 5$ GABA-A receptors in the superficial dorsal horn regulate central sensitization. Soc. for Neurosci. #627.

Bonin RP, Bories C & De Koninck Y (2014). A simplified up-down method (SUDO) for measuring mechanical nociception in rodents using von Frey filaments. Can. Assoc. for Neurosci. 1-D-111.

Yu J, **Bonin RP** & Orser BA (2014). δ GABA_A receptors: A novel target for gabapentin actions. Canadian Association for Neuroscience 2-B-63.

Bonin RP & De Koninck Y (2013). A spinal analogue of reconsolidation enables reversal of hyperalgesia. Poster at 7^e Journée de la recherche en neurosciences et santé mentale, U. Laval. **Best presentation award*.

Bonin RP, Desrochers-Couture M & De Koninck Y (2013). Development of an epidural optic fiber for the optogenetic study of spinal sensory processing. 7^e Journée de la recherche en neurosciences et santé mentale, Université Laval.

Bonin RP & De Koninck Y (2013). A simplified method for von Frey testing in mice. Society for Neuroscience #369.03. **QNJPI travel award*

Yu J, **Bonin RP** & Orser BA (2013). δ GABA_A receptors contribute to the anxiolytic and ataxic, but not anti-nociceptive properties of gabapentin. Society for Neuroscience #421.20.

Daou I, Tuttle A, Longo G, Wieskopf J, **Bonin RP**, Ase A, Wood J, De Koninck Y, Ribeiro-da-Silva A, Mogil J & Seguela P (2013). Optogenetic activation and sensitization of pain pathways in freely moving mice. Canadian Association for Neuroscience #3-D-109.

Yu J, **Bonin RP**, Zurek AA, Bayliss D & Orser BA (2013). Hyperpolarization-activated current (I_h) is reduced in hippocampal neurons from mice lacking $\alpha 5$ GABA_A receptors. Canadian Association for Neuroscience #2-B-47.

Bonin RP & De Koninck Y (2012). Gap junctions regulate the strength and plasticity of afferent input to the superficial spinal cord dorsal horn. Canadian Association for Neuroscience #3-B-2 and Federation of European Neuroscience Societies #D49. **FENS travel award, QNJPI travel award*

Gagnon M, Bergeron MJ, **Bonin RP**, Bachand K, Vandal K, Jacob-Wagner M, Isenring P, Attardo G, Coull JA & De Koninck Y (2012). Small molecule KCC2 activators as novel therapeutic agents for neuropathic pain. Canadian Association for Neuroscience #1-G-86. Society for Neuroscience #472.02.

Bonin RP, Labrakakis C, Whissel P, De Koninck Y & Orser BA (2010). δ subunit-containing GABA_ARs regulate neuronal excitability and nociception in mice. International Association for the Study of Pain abstract. **IASP travel award*

Bonin RP, Labrakakis C, De Koninck Y & Orser (2010). Spinal dorsal horn δ subunit-containing GABA_ARs regulate acute nociception and central sensitization in mice. Canadian Association of Neuroscience #B-D2082 and Mechanisms of Anesthesia Conference #3014. **U. Toronto travel award*

Bonin RP, Liu H-N, Eng DG, Robertson J & Orser BA (2009). Spinal δ GABA-A receptors are novel targets for analgesia. American Society of Anesthesiology #A100.

Bonin RP, Liu H-N, Eng DG, Robertson J & Orser BA (2009). δ GABA-A receptors regulate the excitability of spinal neurons and nociception. Oral presentation at the U. Toronto Shields' Day lecture series abstract #D6. **A.C. Bryan Award for best presentation*

Bonin RP, Eng DG, MacDonald JF & Orser BA (2008). δ GABA_A receptors generate a tonic inhibitory conductance in spinal cord neurons and modify nociception. Society for Neuroscience #771.5 and oral presentation at International Union of Basic and Clinical Pharmacology, Neuropharmacology: Ligand Gated Ion Channels conference #S1. **U. Toronto travel award*

Bonin RP, Eng DG, MacDonald JF & Orser BA (2008). Analgesia mediated by a tonic GABAergic conductance in murine spinal neurons. Canadian Association of Neuroscience.

Orser BA, Martin LJ, Cheng VY & **Bonin RP** (2006). Role of extrasynaptic GABA in the hippocampus. European Neuropsychopharmacology; 16 Suppl 4: S198.

Bonin RP, Chiu MW, Cheng VY, Rauw GA, Baker GB, Macdonald JF & Orser BA (2006). Gabapentin increases a tonic inhibitory conductance in cultured hippocampal neurons. Society for Neuroscience #49.12.

Martin LJ, **Bonin RP**, OH G & Orser BA (2006). $\alpha 5$ GABA_ARs are not required for memory impairment by ethanol in mice. Canadian Anesthesiologists' Society abstract.

Eng D, **Bonin RP** & Orser BA (2006). A tonic inhibitory conductance in murine spinal neurons: a novel site for anesthetics? Canadian Anesthesiologists' Society abstract.

Bonin RP, Wafford KA, MacDonald JF & Orser BA (2005). Regulation of neuronal excitability and sensitivity to GABA by $\alpha 5$ subunit-containing GABA_A receptors. Society for Neuroscience #955.13.

Padol IT, Wang C-C, **Bonin RP**, Tougas G & Hunt RH (2005) *In vitro* and *in vivo* insight into the physiology of acid secretion in relation to cholinergic hypersensitivity: introducing a new animal model for studying gastric disease and functional disorders. Canadian Journal of Gastroenterology; 19 Suppl C: R.0327

Bonin RP, Padol I, Tougas G & Hunt RH (2003). Gastric acid secretion in the isolated stomach of Flinders Line rats. Digestive Disease Week abstract, McMaster University.

RESEARCH HIGHLIGHTS IN THE MEDIA

“**Pain Reconsolidation**” (Bonin RP & De Koninck Y. *Nat. Neurosci.* 2014; 17: 1043) featured in:

- PBS Nova Next article: “*Teaching the Nervous System to Forget Chronic Pain*” (13 Aug 2014)
- CBC Radio-Canada article: “*Nouvel espoir pour les patients atteints de douleur chronique*” (9 Jul 2014)
- Audio segment in *Nature* NeuroPod podcast: “Erasing the Pain” (July 2014)
- Research highlight in *Nature Reviews Neuroscience*: “Reversing Hyperalgesia” (2014; 15:495)
- Highlighted article in MedicalXpress, ScienceDaily and numerous other scientific outlets
- Discussed in Pain Research Forum; Faculty 1000.
- Altmetric score of 66 (as of 01 Sept 2014) places article in 97th percentile of similarly tracked articles.

SCIENTIFIC COMMUNICATION AND SCHOLARLY ACTIVITIES

2014 – Development of an epidural optic fiber for the optogenetic study of spinal sensory processing. Neurophysics Annual Meeting and Retreat, Québec.

2014 – Painful memories: Parallels between memory and chronic pain suggest new possibilities for chronic pain treatment. Neuroscience axis research rounds, CHUL; U. Laval. ***Best presentation award.**

2013 – A spinal analogue of reconsolidation enables reversal of hyperalgesia. Oral presentation at 7^e Journée de la recherche en neurosciences et santé mentale, Université Laval.

2013 – Painful memories: Parallels between memory and chronic pain suggest new possibilities for chronic pain treatment. Invited speaker to Québec chapter of the Canadian Association for Laboratory Animal Science (CALAS).

2011 – The regulation of acute nociception and sensitization by spinal tonic inhibition. Québec Network of Junior Pain Investigators (QNJPI) annual meeting.

2006 – present: Member of Society for Neuroscience

2008 – present: Member of Canadian Association for Neuroscience

2010 – present: Member of International Association for Study of Pain

2010 – present: Member of Québec Network of Junior Pain Investigators (QNJPI)

Invited reviewer for: Pain, PLoS One.

TRAINING OF HIGHLY QUALIFIED PERSONNEL

| <u>STUDENT</u> | <u>CAPACITY</u> | <u>PERIOD</u> |
|--|---|---------------|
| Zak Doric B.Sc. Neuroscience McGill University | Undergraduate summer project, principal supervisor Establishment of an <i>in vitro</i> model of hyperalgesia Laval University | 2014 |
| Marie-Eve Boulanger B.Sc. Physics Laval University | Undergraduate summer project, principal supervisor Optogenetic modulation of pain sensitization Laval University | 2014 |
| Mireille Desrochers-Couture B.Sc. Psychology Laval University | Independent project, principal supervisor Epidural optic fibers for optogenetic manipulation of nociception Laval University | 2013-2014 |
| Anne-Marie Roy B.Sc. Physics Laval University | Undergraduate NSERC fellowship, principal supervisor Development of epidural optic fibers for chronic implantation Laval University | 2012 |
| Erica Bridgwater B.Sc. Nursing U. Waterloo | Undergraduate NSERC fellowship, principal supervisor Tonic inhibitory control of nociception University of Toronto | 2010 |
| Agnieszka A. Zurek B.Sc. Neuroscience U. Toronto | Independent project, co-supervisor Circadian modulation of place cell activity University of Toronto | 2007 |

TEACHING EXPERIENCE

| <u>COURSE AND CAPACITY</u> | <u>INSTITUTION</u> | <u>PERIOD</u> |
|---|-----------------------|---------------|
| Neurophotonics Summer School Lab Instructor, <i>in vivo</i> Optogenetics | Laval University | 2014 |
| Mammalian Physiology Laboratory (PSL 372H) Lab Instructor and teaching assistant | University of Toronto | 2008-2010 |
| Advanced Physiology (PSL 303Y) Tutorial instructor and teaching assistant | University of Toronto | 2007-2008 |
| Human Physiology (PSL 302Y) Tutorial instructor and teaching assistant | University of Toronto | 2006-2007 |
| Organic Chemistry I (Chem 20A3) Lab Instructor and teaching assistant | McMaster University | 2003-2004 |
| Introductory Chemistry II (Chem 1AA3) Lab Instructor and teaching assistant | McMaster University | 2002-2003 |
| Introductory Chemistry I (Chem 10A3) Lab Instructor and teaching assistant | McMaster University | 2002-2003 |