

## MASTER'S THESIS

### Treatment of neuropathic pain: by Chinese scorpion (*Buthus martensii* Karsch)

Wong, Shing Chau

*Date of Award:*  
2011

[Link to publication](#)

#### General rights

Copyright and intellectual property rights for the publications made accessible in HKBU Scholars are retained by the authors and/or other copyright owners. In addition to the restrictions prescribed by the Copyright Ordinance of Hong Kong, all users and readers must also observe the following terms of use:

- Users may download and print one copy of any publication from HKBU Scholars for the purpose of private study or research
- Users cannot further distribute the material or use it for any profit-making activity or commercial gain
- To share publications in HKBU Scholars with others, users are welcome to freely distribute the permanent URL assigned to the publication

**Treatment of Neuropathic Pain**

**by**

**Chinese Scorpion (*Buthus martensii* Karsch)**

**WONG Shing Chau**

**A thesis submitted in partial fulfilment of the requirements**

**for the degree of**

**Master of Philosophy**

**Principal Supervisor: Dr. ZHANG Hongqi**

**Hong Kong Baptist University**

**September 2011**

## ABSTRACT

**Background:** Chinese Scorpion (*Buthus martensii* Karsch, Bmk) has long been used for the treatment of various nervous system diseases such as apoplexy, epilepsy, facial paralysis and chronic pains. However, its analgesic effect and underlying mechanisms remain to be delineated. The current study aims at studying the potential analgesic effect of Bmk and its mechanism in a rat model of neuropathic pain. **Methods:** One week after L5 spinal nerve ligation (SNL), rats were fed daily for 21 days with either the extract of Bmk or distilled water as a control. Behavioral tests on mechanical and cold hypersensitivity were performed regularly by applying electronic von Frey filament and 100% acetone respectively to the ipsilateral hind-paws of the rats. L4/L5 dorsal root ganglia (DRG) samples were collected at the end of experiment for the assessment of the level of sodium channels by RT-PCR and immunohistochemistry. **Results:** Comparing with the control group, Bmk treatment significantly improved the paw withdrawal behavior of the SNL rats to tactile but not to cold stimulus. The level of Na<sub>v</sub> 1.8 was found changed in the L5 DRG of the Bmk-treated rats. **Conclusion:** The whole Bmk extract could significantly alleviated the mechanical hypersensitivity in neuropathic SNL rats in a time- and dose-dependent manner, and this effect could be intricately related to changes in voltage gated sodium channels (VGSCs), in particular Na<sub>v</sub>1.8 in DRG neurons. The mechanism behind this Bmk analgesic effect could be a combination of the VGSCs regulating peptides and other possible active components contained in the agent.

# TABLE OF CONTENT

DECLARATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
TABLE OF CONTENT	v
LIST OF FIGURES AND TABLES	viii
ABBREVIATIONS	xii
CHAPTER 1 Introduction	1
1.1 Neuropathic Pain	1
1.1.1 Definition.	1
1.1.2 Epidemiology and classification.	2
1.1.3 Mechanisms of neuropathic pain.	4
1.2 Treatment of Neuropathic Pain and Current Predicament	7
1.2.1 Antidepressants.	8
1.2.2 Anticonvulsants.	9
1.2.3 Topical anesthetics.	9
1.3 Potential of TCM in Management of Neuropathic Pain	11
1.4 <i>Buthus martensii</i> Karsch as a Potential Treatment Agent	13
1.5 Animal Models of Neuropathic Pain	15
1.5.1 The partial sciatic nerve ligation model.	18
1.5.2 The chronic constriction injury model.	18
1.5.3 The spared nerve injury model.	18
1.5.4 The spinal nerve ligation or transection model.	19

1.6 Rationale	20
CHAPTER 2 Materials and Methods	22
2.1 Animals	22
2.2 Grouping	22
2.3 SNL Surgery	23
2.4 Behavioral Tests	25
2.4.1 Mechanical hypersensitivity.	26
2.4.2 Thermal hypersensitivity.	27
2.5 Drug and Treatment	29
2.6 mRNA Expression of VGSCs	30
2.6.1 RNA isolation.	30
2.6.2 cDNA sythesis and RT-PCR.	31
2.7 Protein Expression of VGSCs by Immunohistochemistry	31
2.7.1 Tissue preparation and sectioning.	31
2.7.2 Immunofluorescence staining protocol.	32
2.7.3 Image acquisition and analysis.	32
2.8 Statistical Analysis	33
CHAPTER 3 Results	34
3.1 Dose-response of Bmk on Neuropathic Pain	34
3.1.1 Change in average body weight of the rat.	34
3.1.2 Response of SNL rats at different doses of Bmk.	37
3.2 Effect of Bmk on Neuropathic Hypersensitivity Following SNL	40
3.2.1 Mechanical hypersensitivity.	40

3.2.2 Thermal hypersensitivity.	43
3.3 Altered Expression of VGSCs mRNA and Protein Distribution after Bmk Treatment	47
3.3.1 Change of VGSCs mRNA level in ipsilateral L4/L5 DRG.	47
3.3.2 Expression and distribution of Na <sub>v</sub> 1.8 protein in ipsilateral L5 DRG.	53
CHAPTER 4 Discussion and conclusion	59
4.1 On VGSCs	59
4.2 Behavior Tests	62
4.3 The Therapeutic Effect of Bmk	63
4.4 Mechanisms of Bmk on Neuropathic pain	65
4.5 Conclusion	66
CITATIONS AND REFERENCES	67
CURRICULUM VITAE	83