

## TABLE OF CONTENT

Title Page .....	i
Assertion Page .....	ii
Statement.....	iii
Acknowledgement .....	iv
Table of Content .....	vii
List of Figures .....	x
List of Tables .....	xiv
List of Formulas .....	xv
List of Acronyms .....	xvi
List of Appendices .....	xix
Abstract.....	xxi
<b>I. INTRODUCTION .....</b>	<b>1</b>
A. Background .....	1
B. Problems.....	5
C. Novelty .....	5
D. Objective .....	6
E. Outcomes.....	6
<b>II. LITERATURE REVIEW AND THEORETICAL BACKGROUND .....</b>	<b>7</b>
A. Literature Review.....	7
1. Peripheral nervous system.....	7
2. Peripheral nerve injury and degeneration.....	16
3. Peripheral nerve regeneration and engineering .....	19
4. Gelatin .....	25
5. Carbonated apatite (CHA).....	28
6. Pheochromocytoma 12 (PC12) cells .....	30
7. Wistar rat as animal model to study peripheral nerve regeneration .....	32
B. Theoretical Background .....	34
C. Theoretical Framework .....	36
D. Conceptual Framework .....	37
E. Hypothesis .....	38
<b>III. MATERIAL AND METHOD .....</b>	<b>39</b>
A. Design .....	39
B. Subjects .....	39
C. Location.....	41
D. Variable.....	42
E. Operational Definition.....	43
F. Materials and Equipment.....	47

G. Procedures .....	50
1. Peripheral nerve devices preparation.....	50
a. Gelatin membrane (CHA-00) preparation .....	50
b. Carbonated apatite incorporated gelatin (CHA-05) membrane preparation .....	51
2. Peripheral nerve devices characterization .....	52
a. FT-IR spectroscopy analysis .....	52
b. SEM micrograph analysis .....	52
c. Glucose permeation test .....	52
d. Air-water contact angle evaluation .....	54
e. Analysis of swelling index .....	55
f. Evaluation of degradability rate .....	56
g. Mechanical strength .....	57
h. Calcium concentration .....	57
3. Cell culture study.....	57
a. PC12 culture preparation.....	57
b. Cell seeding.....	58
c. Calcium concentration in culture medium .....	59
d. Neurogenic activity of PC12 cell.....	59
4. Animal experiment .....	62
a. Surgery .....	64
b. Autotomy score .....	65
c. Nociceptive withdrawal response test.....	66
d. Walking track analysis .....	67
e. Histological study.....	68
H. Research Procedure Scheme .....	71
I. Data Analysis.....	72
4. RESULT AND DISCUSSION .....	73
A. Result .....	73
1. Characterization of CHA-00 and CHA-05 membrane .....	73
a. FT-IR spectroscopy .....	73
b. SEM micrograph.....	74
c. Glucose permeation.....	75
d. Air-water contact angle.....	76
e. Swelling index.....	78
f. Degradation evaluation.....	79
g. Mechanical strength .....	80
h. Calcium concentration in PBS .....	81
2. Cell culture study.....	82

a. Calcium concentration in cell culture medium .....	82
b. Neurogenic activity .....	83
3. Animal experiment .....	88
a. Body weight of the rats .....	88
b. Autotomy score .....	89
b. Nociceptive withdrawal response test.....	90
c. Walking track analysis .....	91
d. Histology study .....	93
B. Discussion .....	97
5. CONCLUSION AND RECOMMENDATIONS .....	105
A. Conclusion .....	105
B. Recommendations .....	106
SUMMARY .....	107
REFERENCES .....	137
APPENDICES .....	167