

Index

1. General introduction	1
1.1. Previous experience and thesis structure.....	3
1.2. Target population	5
1.3. Nervous system.....	6
1.4. Nervous system injuries.....	10
1.5. Nervous tissue engineering.....	14
1.6. Hyaluronic acid	19
1.7. Silk fibroin	23
1.8. Polylactic acid.....	26
1.9. Cell therapy in the nervous system	28
1.10. Electrical stimulation in the nervous system.....	30
1.11. Polypyrrole	36
1.12. Gold	37
1.13. Gene delivery methods. Gene transfer by electroporation.	39
1.14. References.....	43
2. Objectives	55
3. Paper 1: Novel tissue-engineered multimodular hyaluronic acid-polylactic acid conduits for the regeneration of sciatic nerve defect.....	61
3.1. Abstract.....	65
3.2. Introduction.....	65

3.3. Experimental section	70
3.4. Results and discussion	78
3.5. Conclusions.....	97
3.6. Authorship contribution statement	98
3.7. Conflicts of interest.....	98
3.8. Acknowledgements	98
3.9. References.....	98
3.10. Supporting information.....	103
4. Paper 2: Conduits based on the combination of hyaluronic acid and silk fibroin: characterization, <i>in vitro</i> studies and <i>in vivo</i> biocompatibility	105
4.1. Abstract.....	109
4.2. Introduction.....	109
4.3. Experimental section	112
4.4. Results and discussion	123
4.5. Conclusions.....	144
4.6. Authorship contribution statement	145
4.7. Conflicts of interest.....	145
4.8. Acknowledgements	145
4.9. References.....	146
5. Paper 3: Solid polymer electrolytes based on polylactic acid nanofiber mats coated with polypyrrole	151
5.1. Abstract.....	155

5.2. Introduction.....	155
5.3. Experimental section	159
5.4. Results and discussion	164
5.5. Conclusions.....	187
5.6. Authorship contribution statement.....	188
5.7. Conflicts of interest.....	189
5.8. Acknowledgements	189
5.9. References.....	189
5.10. Supporting information.....	195
5.11. Addendum	201
6. Paper 4: Axonal extension from dorsal root ganglia on fibrillar and highly aligned poly (lactic acid)-polypyrrole substrates obtained by two different techniques: electrospun nanofibres and extruded microfibres	205
6.1. Abstract.....	209
6.2. Introduction.....	209
6.3. Experimental section	213
6.4. Results and discussion	224
6.5. Conclusions.....	234
6.6. Authorship contribution statement	235
6.7. Conflicts of interest.....	235
6.8. Acknowledgements	235
6.9. References.....	236

6.10. Supporting information.....	239
7. Paper 5: Electrical stimulation increases axonal growth from dorsal root ganglia co-cultured with Schwann cells in highly aligned PLA-PPy-Au microfiber substrates.....	241
7.1. Abstract.....	245
7.2. Introduction.....	245
7.3. Results and discussion	248
7.4. Experimental section	269
7.5. Conclusions.....	280
7.6. Author contribution statement	280
7.7. Conflicts of interest.....	280
7.8. Acknowledgements	281
7.9. References.....	281
7.10. Supporting information.....	287
8. Paper 6: BDNF-gene transfected Schwann cell-assisted axonal extension and sprouting on new PLA-PPy microfiber substrates	291
8.1. Abstract.....	295
8.2. Introduction.....	295
8.3. Experimental section	301
8.4. Results and discussion	311
8.5. Conclusions.....	325
8.6. Author contribution statement	326

8.7. Conflicts of interest.....	326
8.8. Acknowledgements	326
8.9. References.....	327
8.10. Supporting information.....	331
9. General discussion	333
9.1. Dimensional adaptation of the nerve guidance conduits.....	335
9.2. Application in rabbit sciatic nerve injury model	338
9.3. Upgrading developments.....	339
9.4. Incorporation of silk fibroin	340
9.5. Electroconductive substrates	340
9.6. Electrical stimulation of SCs and DRG	344
9.7. Neurotrophic factors.....	348
9.8. Incorporation of the improvement development into the multimodular device.....	349
9.9. References.....	351
10. Conclusions	357
11. Future perspective	363
12. Contributions	369