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**Figure 6.30** Scanning electron micrographs of 3T3 fibroblasts after 3 days culture on CSN1 (a1), CSN2 (b1), AFCSN1 (a2), AFCSN2 (b2), HFCSN1 (a3) and HFCSN2 (b3) [Scale bar=20  $\mu\text{m}$ ]. Insets of (a1-b3) show magnified image of green circled region [Scale bar=10  $\mu\text{m}$ ]. Red and yellow arrows indicate the direction of cell alignment and filopodia/lamellipodia like extensions, respectively. 273

**Figure 6.31** Immunolabelling of beta (III) tubulin in differentiated PC12 cells with DAPI stained nuclei after 7 days of culture on the non-functionalized blended MEH-PPV:PCL electrospun meshes (SEN1, SEN2, SEN3 and SEN4), APTES functionalized blended MEH-PPV:PCL electrospun meshes (AFSEN1, AFSEN2, AFSEN3 and AFSEN4), 1,6-Hexanediamine functionalized blended MEH-PPV:PCL electrospun meshes (HFSEN1, HFSEN2, HFSEN3 and HFSEN4), and collagen coated blended MEH-PPV:PCL electrospun meshes (CSEN1, CSEN2, CSEN3 and CSEN4). White arrows show neuronal cell bodies with at least one neurite formed. Red arrows represent neurons with long branched neurites and/or growth cones. Inset of SEN1 shows confocal images of stained PC12 cells cultured on collagen-coated cover slip for 7 days. 275

**Figure 6.32** Immunolabelling of beta (III) tubulin in differentiated PC12 cells with DAPI stained nuclei after 7 days of culture on non-functionalized core-sheath electrospun meshes (CSN1 & CSN2), APTES functionalized core-sheath electrospun meshes (AFCSN1 & AFCSN2), 1,6- 276



Hexanediamine functionalized core-sheath electrospun meshes (HFCSN1 & HFCSN2) and collagen coated core-sheath electrospun meshes (CCSN1 & CCSN2). White arrows show neuronal cell bodies with at least one neurite formed. Red arrows represent neurons with long branched neurites and/or growth cones.

- Figure 6.33** Quantitative analysis of formation and outgrowth in terms of (a) percentage of neurite-bearing cells and (b) neurite length per cell on the non-functionalized, APTES functionalized, 1,6-Hexanediamine functionalized and collagen coated blended MEH-PPV:PCL electrospun meshes along with collagen-coated glass.\* and # indicate statistically significant difference from the non-functionalized electrospun meshes at  $p \leq 0.01$  and  $p \leq 0.05$ , respectively. 277
- Figure 6.34** Quantitative analysis of neurite formation and outgrowth in terms of (a) percentage of neurite-bearing cells and (b) neurite length per cell on the non-functionalized, APTES functionalized, 1,6-Hexanediamine functionalized and collagen coated core-sheath MEH-PPV:PCL electrospun meshes along with collagen-coated glass.\* and # indicate statistically significant difference from the non-functionalized electrospun meshes at  $p \leq 0.01$  and  $p \leq 0.05$ , respectively. 277
- Figure 6.35** Scanning electron micrographs of PC12 cells after 7 days cultured on SEN1 (a1), SEN2 (b1), SEN3 (c1), SEN4 (d1), AFSEN1 (a2), AFSEN2 (b2), AFSEN3 (c2), AFSEN4 (d2), HFSEN1 (a3), HFSEN2 (b3), HFSEN3 (c3), HFSEN4 (d3), CSEN1 (a4), CSEN2 (b4), CSEN3 (c4) and CSEN4 (d4). Red arrows show neurite projections on different electrospun meshes. Scale bar = 5  $\mu\text{m}$ . 281
- Figure 6.36** Scanning electron micrographs of PC12 cells after 7 282

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- Figure 6.37** (a) Schematic illustration of the electrical stimulation experiment using a custom made electrical stimulation set up ; (b) photograph of self made cell culture plate with different electrospun MEH-PPV:PCL meshes (orange colour) fixed on it for electrical stimulation experiment; (c) photograph of the electrical stimulation experiment in situ. 283
- Figure 6.38** Confocal images with phase contrast overlay of beta (III) tubulin immunostained PC12 cells cultured for 7 days on the various blended electrospun meshes under no electrical stimulation (a1-AFSEN1, b1-AFSEN2, c1-AFSEN3, d1-AFSEN4, e1-HFSEN1, f1-HFSEN2, g1-HFSEN3, h1-HFSEN4, i1-CSEN1, j1-CSEN2, k1-CSEN3 and l1-CSEN4) and under electrical stimulation of 500 mV/cm for 2h/day (a2-AFSEN1, b2-AFSEN2, c2-AFSEN3, d2-AFSEN4, e2-HFSEN1, f2-HFSEN2, g2-HFSEN3, h2-HFSEN4, i2-CSEN1, j2-CSEN2, k2-CSEN3 and l2-CSEN4) [Scale bar = 75  $\mu\text{m}$ ]. 284
- Figure 6.39** Confocal images with phase contrast overlay of beta (III) tubulin immunostained PC12 cells cultured for 7 days on the various core-sheath electrospun meshes under no electrical stimulation (a1-AFCSN1, b1-ACSN2, c1-HFCSN1, d1-HFCSN2, e1-CCSN1, f1-CCSN2) and under electrical stimulation of 500 mV/cm for 2h/day (a2-AFCSN1, b2-AFCSN2, c2-HFCSN1, d2-HFCSN2, e2-CCSN1, f2-CCSN2) [Scale bar = 75  $\mu\text{m}$ ]. 285
- Figure 6.40** (a) Percentage of neurite bearing cells, (b) Neurite per cell, (c) Neurite length per cell and (d) Median neurite 286

length of differentiated PC12 cells on the various blended MEH-PPV:PCL electrospun meshes without electrical stimulation and with electrical stimulation. Data were Mean  $\pm$  S.D. \* and # indicate statistical significance difference from unstimulated PC12 cells at  $p \leq 0.01$  and  $p \leq 0.05$ , respectively.

**Figure 6.41** (a) Percentage of neurite bearing cells, (b) Neurite per cell, (c) Neurite length per cell and (d) Median neurite length of differentiated PC12 cells on the various core-sheath MEH-PPV:PCL electrospun meshes above without electrical stimulation and with electrical stimulation. Data were Mean  $\pm$  S.D. \* and # indicate statistical significance difference from unstimulated PC12 cells at  $p \leq 0.01$  and  $p \leq 0.05$ , respectively. 287

**Figure 6.42** Current signal recorded (upto 400 s) during electrical stimulation of PC12 cells through various blended MEH-PPV:PCL electrospun meshes and core-sheath MEH-PPV:PCL electrospun meshes under a constant potential of 500 mV/cm for 2 h, applied in chronoamperometric technique in pulsed mode (pulse duration 1 ms). 291

## List of abbreviations

<b>Abbreviation</b>	<b>Meanings</b>
0D	Zero dimensional
1D	One dimensional
2D	Two dimensional
3D	Three dimensional
3T3	3-day transfer, inoculum $3 \times 10^5$ cells
AAO	Anodic aluminum oxide
AB	Acid base
Ag	Argentum (Silver)
AO	Acridine orange
Ar	Argon
Au	Aurum (Gold)
APS	Ammonium peroxydisulfate
APTES	(3-Aminopropyl)triethoxysilane
AFCSN1	(3-Aminopropyl)triethoxysilane functionalized core-sheath nanofibers: 0.6 mL/h
AFCSN2	(3-Aminopropyl)triethoxysilane functionalized core-sheath nanofibers: 1 mL/h
AFSEN1	(3-Aminopropyl)triethoxysilane functionalized solid electrospun nanofibers:20:80 (v/v)
AFSEN2	(3-Aminopropyl)triethoxysilane functionalized solid electrospun nanofibers:40:60 (v/v)
AFSEN3	(3-Aminopropyl)triethoxysilane functionalized solid electrospun nanofibers:50:50 (v/v)
AFSEN4	(3-Aminopropyl)triethoxysilane functionalized solid electrospun nanofibers:60:40 (v/v)
BDNF	Brain-derived neurotrophic factor
BOC	<i>tert</i> -butyloxycarbonyl
BSEs	Back scattered electrons
CHO	Aldehyde

CCD	Charge coupled detector
Ch	Chitosan
cm	Centimetre
CO <sub>2</sub>	Carbon dioxide
CNT	Carbon nanotubes
CSA	Camphor sulfonic acid
COOH	Carboxyl
CP	Conducting polymer
CSN1	Core-sheath nanofibers: 0.6 mL/h
CSN2	Core-sheath nanofibers: 1 mL/h
DAPI	4',6-Diamidino-2-Phenylindole
DB-PPV	2,3-dibutoxy-1,4-poly(phenylenevinylene)
DC (dc)	Direct current
DO-PPV	2,5-dioctyloxy-1,4-poly(phenylenevinylene)
DPPH	1,1-diphenyl-2-picrylhydrazyl
DNA	Deoxyribonucleic acid
DRG	Dorsal root ganglion
EB	Emeraldine base
ES	Emeraldine salt
EtBr	Ethidium bromide
ECM	Extracellular matrix
eV	Electron volt
FeCl <sub>3</sub>	Ferric chloride
FWHM	Full width at half maxima
FT-IR	Fourier transform infrared spectroscopy
HOMO	Highest occupied molecular orbital
HFCSN1	1,6-Hexanediamine functionalized core-sheath nanofibers: 0.6 mL/h
HFCSN2	1,6-Hexanediamine functionalized core-sheath nanofibers: 1 mL/h
HFSEN1	1,6-Hexanediamine functionalized solid electrospun nanofibers:20:80 (v/v)
HFSEN2	1,6-Hexanediamine functionalized solid electrospun

	nanofibers:40:60 (v/v)
HFSEN3	1,6-Hexanediamine functionalized solid electrospun nanofibers:50:50 (v/v)
HFSEN4	1,6-Hexanediamine functionalized solid electrospun nanofibers:60:40 (v/v)
H <sub>2</sub> O	Dihydrogen monoxide (Water)
HCl	Hydrochloric acid
Hz	Hertz
ICPs	Intrinsically conducting polymers
IUPAC	International Union of Pure and Applied Chemistry
LUMO	Lowest unoccupied molecular orbital
LEB	Leucoemeraldine
MDMO-PPV	Poly[2-methoxy-5-(3',7'-dimethyloctyloxy)-1,4-phenylenevinylene]
MDA-MB-231	M.D. Anderson Metastatic Breast adenocarcinoma
MEH-PPV	Poly[2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene]
MnO <sub>2</sub>	Manganese dioxide
MO-FeCl <sub>3</sub>	Methyl orange-ferric chloride
MTS	3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium, inner salt)
NH <sub>2</sub>	Amine
N <sub>2</sub>	Nitrogen
NA	Nigraniline
NH <sub>3</sub>	Ammonia
NHS	N-hydroxysuccinimide
NIH 3T3	National Institutes of Health
NGF	Nerve growth factor
NMR	Nuclear Magnetic Resonance
NMP	N-methyl pyrrolidone
NT-3	Neurotrophins-3
OH	Hydroxyl
O <sub>2</sub>	Oxygen
O-I	Organic in inorganic

O-O	Organic in organic
PA	Polyacetylene
PADPA	<i>p</i> -aminodiphenylamine
PAni	Polyaniline
PCL	Polycaprolactone
PC12	Pheochromocytoma
PDLLA	Poly-D,L-lactide
PE	Poly(ethylene)
PEB	Protoemeradine
PEDOT	Poly (3,4-ethylenedioxythiophene)
PEG	Poly(ethylene glycol)
PEO	Polyethylene oxide
PHEMA	Polyhydroxyethylmethacrylate
PLA	Poly(lactic acid)
PLGA	Poly(lactic-co-glycolic acid)
PLLA	Poly(L-lactide)
PMAA	Poly(methacrylic acid)
PMAS	Poly(2-methoxyaniline-5-sulfonate)
PMMA	Poly (methyl methacrylate)
PNB	Pernigraniline
PP	Polypropylene
PPP	Poly( <i>p</i> -phenylene)
PS	Polystyrene
PPy	Polypyrrole
PPV	Poly( <i>p</i> -phenylene vinylene)
Pt	Platinum
PT	Polythiophene
PTM	Particle track-etched membranes
PU	Poly(urethane)
PVA	Polyvinyl alcohol
P3MT	Poly(3-methylthiophene)
PVC	Polyvinyl chloride
PET	Polyethylene terephthalate

PTFE	Polytetrafluoroethylene
PVDF	Polyvinylidene fluoride
RBC	Red blood corpuscles
RGC	Retinal ganglion cell
RGD	Arginylglycylaspartic acid (Arg-Gly-Asp)
RNA	Ribonucleic acid
SAM	Self-assembled monolayer
SPR	Surface plasmon resonance
SEM	Scanning electron microscopy
SEN1	Solid electrospun nanofibers:20:80 (v/v)
SEN2	Solid electrospun nanofibers:40:60 (v/v)
SEN3	Solid electrospun nanofibers:50:50 (v/v)
SEN4	Solid electrospun nanofibers:60:40 (v/v)
SEs	Secondary electrons
Si	Silicon
SO <sub>2</sub>	Sulfur dioxide
TEM	Transmission electron microscopy
UV-Vis	Ultra violet visible spectroscopy
V <sub>2</sub> O <sub>5</sub>	Vanadium pentoxide
XPS	X-ray photoelectron spectroscopy
XRD	X-ray diffraction