

1	Motivation.....	1
2	Introduction.....	5
2.1.1	Invertebrate neuronal networks	6
2.1.2	Cricket cercal sensory system.....	7
2.1.3	Morphology of invertebrate neurons <i>in vivo</i> and <i>in vitro</i>	10
2.1.4	Primary cell culture.....	11
2.1.5	Neurogenesis: adhesion molecules and neurotrophic factors.....	11
2.1.6	Network development	13
2.1.7	Cellular patterning.....	15
2.1.8	Outline	19
3	Materials and Methods.....	21
3.1	Primary neuronal cell culture of cricket neurons	21
3.1.1	Animals.....	21
3.1.2	Procedure of cell culture.....	22
3.2	Surface coatings for primary cell culture.....	23
3.2.1	Uniformly conA-coated surfaces.....	23
3.2.2	Surface coatings with star PEG / conA grid pattern	24
3.3	Microcontact Printing.....	26
3.4	Parylene /star PEG patterning on microelectronic devices for extracellular recordings	28
3.4.1	Microelectronic devices.....	28
3.4.2	Parylene stencil production.....	29
3.4.3	Plasma assisted removal of star PEG with parylene stencils	29
3.5	Surface characterization.....	31
3.5.1	Ellipsometry	31
3.5.2	Atomic force microscopy	32
3.5.3	Scanning electron microscope	35
	SEM measurements	35

Cell Fixation for SEM.....	37
Critical point drying.....	37
3.6 Data evaluation of morphological type distribution and statistical analysis	38
3.7 Electrophysiology.....	39
3.7.1 Voltage clamp experiments.....	41
3.7.2 Current clamp experiments.....	42
3.7.3 Paired patch- clamp recordings.....	43
4 Ultrathin coatings with reactivity change by time enable functional <i>in vitro</i> networks of insect neurons	45
5 Surface growth restriction in insect neuronal cell culture promotes <i>in vivo</i>-like phenotypes	61
6 Inverse patterning of cell-aversive Star PEG for building neuronal networks on microelectronic devices.....	83
7 Discussion	98
8 Summary	102
9 Zusammenfassung	104