CULTURING NEURONAL CELLS ON THREE-DIMENSIONAL SILICON MICROSTRUCTURES

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Three-dimensional multi-microelectrode arrays are fabricated with the objective of guiding the growth of neuronal cell axons along determined cavities and monitoring their behaviour during cell development. We present here the processing sequence used in the fabrication of such arrays and preliminary results on dissociated cell culture.

The microstructures are basically an array of four wells (to place cell soma) connected by cavities to guide axon growth. Four sizes were chosen for each structure depth, and they were designed into a chip including gold microelectrodes in the wells to stimulate cells or to record extracellular field potentials. Structures were fabricated with depths from 11 to 48 µm using KOH etch; metal definition was made by means of "lift-off" technique.

Neuronal cells are extracted from the cerebral and bucal ganglia of the snail *Helix aspersa*. The structure (cavities and wells) was three dimensional in order to give mechanical support for the biological culture and to promote directional axon growth. We analysed the relative biocompatibility with respect to the material utilized (as silicon oxide and photoresist, for example) and the behaviour of soma and axon depending on the substrate and as a function of time period in culture. Furthermore, an improved second version of microstructures is being fabricated including resistors and diodes for temperature control.