P7.04.

Thousand-channel electrode system to investigate thalamocortical interactions

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A novel two dimensional silicon-based electrode array was developed in the framework of the NeuroProbes EU project. The electrode array is equipped with electronic depth control system in order to select up to 32 active recording sites from the more than two thousand possible electrode channels without moving the array. The array consists of four shanks forming a comb-like structure. Each shank is 8 mm long and contains a total of 513 electrodes separated by 40 micrometer in two rows. The electrodes can be electronically switched to the eight output lines in 2×2 groups like in a tetrode configuration. As a result, any combination of two tetrodes can be selected on each shank. The complete system consists of the electrode array, switching matrix, front-end electronics, conditioning, multiplexing and interface electronics and the control software. The electrode array was tested in acute experiments. Adult rats under ketamine/xylazine anesthesia were used. The electrode array was implanted into the cortex and the underlying thalamus. We were able to record good quality local field potential and multiunit activity with the aid of the system, simultaneously from the the primary somatosensory cortex and from different nuclei of the thalamus. The analysis of the simultaneously recorded cortical and thalamic signals may give us a powerful tool to reveal more information about the intricate relationship of cortical and thalamic activity.