



CyberRat

A Brain-Chip Interface for High-resolution Bi-directional Communication

We intend to create an innovative interface between a semiconductor chip or an ensemble of semiconductor chips and the brain of a living rat. Small CMOS chips featuring stimulation and recording sites integrated at high-density (1000 elements spaced only 5-10 micrometers) will be implanted in several brain areas, either independently or simultaneously, thus obtaining an unprecedented control of neuronal activity in the mammalian brain. Thanks to high-density integration, functional electrical imaging and stimulation of neuronal networks within the brain cortex and deep nuclei will be performed at a spatial resolution close to the single neuron and at a temporal resolution of a few tens of microseconds. Obtaining such high spatiotemporal resolution will enable for the first time to explore and control brain information processing with unprecedented detail. The project will focus on sensory-motor circuits regulating coordinated voluntary movement. By exploring interfacing with the main cortical and nuclear structures of the brain, the choice of this neurobiological context ensures that the approach will have a general applicability to several other brain circuits such as those underlying vision, hearing and attention.

February, 12th 2008 – Project presentation
Institute of Physiology, Aula Magna
Via Marzolo 3

Programme

- h 9:15** **Workplan and Consortium in brief**
Prof. S. Vassanelli, Dept. of Human Anatomy and Physiology, University of Padua
- h 9:25** **Fundamentals of brain-chip interfacing**
Prof. P. Fromherz, Dept. Membrane and Neurophysics, Max-Planck Institut for Biochemistry, Martinsried, Germany
- h 9:45** **Development of semiconductor chips for brain-chip interfacing**
Prof. P. Fromherz
Dr. R. Thewes, Dept. Membrane and Neurophysics, Max-Planck Institut for Biochemistry, Martinsried, Germany
Dr. S. Spiga, CNR-INFM (MDM Lab.), Agrate Brianza – Milano, Italy
- h 10:15** **Brain-chip interfacing by chip implantation “in vivo”: state of the art and new implementations within the CyberRat project**
Prof. S. Vassanelli
- h 10:35** **Investigating information processing within cerebellar neuronal networks: state of the art and perspectives**
Prof. E. D'Angelo, Institute of Physiology, University of Pavia, Italy
- h 10:55** **Measuring neuronal networks “in vivo” with microwires: a comparison with the CyberRat approach**
Prof. D. Cohen, Bar-Ilan University, Ramat Gan, Israel