

## 6. Electrochemistry at living systems

Electrical and electrochemical processes are essential to living systems, allowing for instance the transmission of neuronal information or the chemical energy production of ATP by mitochondria. These processes have been identified since decades and even centuries, when thinking about the seminal works of Galvani. Recently, electrical and electrochemical methods have been developed on purpose to analyze metabolic activities of, or interact with living organisms.

Electrochemical analyses of biomolecules by cyclic voltametry or by amperometry were initially conducted *in vivo*, within the brain tissue, then on isolated cells and recently at the intracellular level. This top-down evolution has been correlated with the development of electrodes and sensors of decreasing dimensions (millimetric size initially, of micrometric size since the 80-90s' period and of nanometric dimension over the last decade).

Besides this quite recent and huge development of *in vivo* electrochemistry, the use of electrical fields applied by or simply detected with electrodes on living tissues has also encountered a large success within different scientific communities. After being established on isolated cells, electropermeabilization of chemical or biological species (DNA electrotransfer) is currently used for clinical applications, for instance in cancer treatment. Otherwise, *in vivo* electrostimulation based on electrode arrays constitute a rapidly growing research field because of its interest for neurobiological and medical issues, such like the development of retina implants.