Workshop on Scanning Probe Nanotechnology

Experimental Physics Department - University of Torino, Italy
16-17 December 2002

The Artificial Hand Project

***Lars Wallman**, Department of electrical measurements, Lund University, Sweden*
lars.wallman@elmat.lth.se

Abstract

A goal in design of prostheses for replacement of limbs is to create a neural interface. This would ultimately enable transfer of signals for control of motor functions of the prosthesis. In principal, one way would be to integrate a silicon sieve electrode into the peripheral nervous system. Neural activity is recorded by the sieve electrode; an artificial neural network (ANN) interprets the signal pattern and controls the prostheses. In case of an amputation the sieve electrode is implanted in the nerve immediately proximal to the amputation site and the nerve fibres will regenerate through the via holes in the sieve electrode.

To achieve a good neural interface it is important to have good neural regeneration through the sieve electrode and also that the implanted structure creates as low tissue reaction as possible. It is also important to have a good electrode material that has a high recording capability.

I will discuss porous silicon as both a good candidate as electrode material and also its biocompatibility. Implants of porous and planar silicon, oxidised (porous) titanium and polished (planar) titanium have been implanted in soft tissue and the capsule formation over time has been studied.

I will also present our studies on how the geometric design of the sieve electrode influenced the performance of the regenerated nerve. By optimizing the via hole size and the transparency of the sieve the possibility of a proper regeneration is enhanced.

Finally I will discuss the artificial hand project in a wider view, how the signal pattern from the neural system can be interpreted to control an artificial hand.