Motivazione e campo di applicazione

Osteoporosis is a systemic skeletal disorder characterized by low bone mass and altered bone microarchitecture, leading to an increase in bone fragility and fracture risk. With the increase in aging populations, osteoporosis is becoming a global health and economic problem. Monitoring the interactions of diseased bone tissues with drugs is fundamental for osteoporosis drug development and screening.

Obiettivi generali e principali attività

This project aims to develop an innovative three-dimensional (3D) in vitro model of physio-pathological bone tissue for osteoporosis drug screening. The 3D in vitro system will better mimic the in vivo microenvironment of bone architecture and enable in situ monitoring of bone cell response to drugs in real time. 3D carbon microelectrodes will be designed and used as both scaffold and sensor simultaneously. The 3D microelectrodes will provide: 1) optimal properties to support bone cell adhesion, migration and proliferation, e.g. stiffness, porosity and mass transport and 2) electric conductivity to electrochemically monitor in situ and real time bone cell fate and responses to external stimuli (i.e. alkaline phosphates expression). This will be achieved by novel fabrication techniques for 3D microelectrodes using pyrolysis, where 3D conductive carbon structures are obtained through “burning” polymer templates (e.g. SU-8) at high temperatures in inert atmosphere.

Obiettivi di apprendimento (strumenti tecnici e analitici, metodologie sperimentali)

You will gain knowledge in various scientific areas: Electrodes design and fabrication (cleanroom facilities), Micromilling/Laser ablation/3D Printing, Cell culturing, Electrochemical techniques for surface characterization and cell-based assays, Staining and Microscopy, Data analysis, statistics and critical evaluation of the results. Moreover the student will get experience on summarizing and presenting scientific results.