



NANOBIOELECTRONICS & BIOSENSORS

Led by ICREA Prof. Arben Merkoçi, the Nanobioelectronics & Biosensors Group aims to integrate nanotechnology methods, tools and materials into low cost, user friendly and efficient sensors and biosensors with application in fields such as diagnostics, food analysis, environment monitoring and other industries. The applications will take advantage of the unique properties of nanoparticles, nanotubes, nanochannels and other nanomaterials.

BACKGROUND

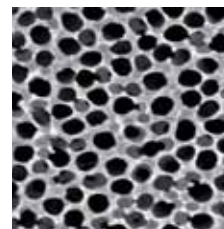
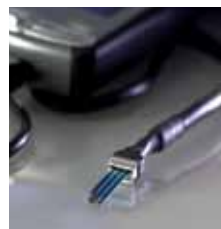
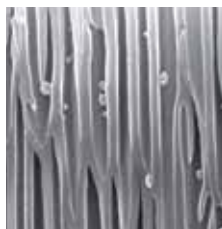
The need for low-cost, effective and accurate sensors has exploded in recent decades, with applications ranging from home-testing of diseases to environmental monitoring of pollutants. Many nanomaterials, especially carbon nanotubes, quantum dots and various forms of nanoparticles have unique properties that make them ideally suited to act as the core sensing medium in small-scale, cheap devices.

The focus of the Group's research activity is to improve the performance (sensitivity, selectivity, response range, etc) for various kinds of biosensors, especially for applications in the food, environmental and medical industries.

RESEARCH ACTIVITIES INCLUDE:

Design, preparation and characterization of nanomaterials for sensing and biosensing applications. Using various methods to produce nanostructures such as quantum dots, core shell nanoparticles and nanocrystals, then characterising them via TEM, AFM, z-Potential, UV-Vis absorption spectroscopy as well as electrochemical methods in order to determine their potential for applications in sensing and biosensing.

Electrochemical sensors based on nanostructured materials for environmental monitoring and other industrial applications. Studying the ability of nanomaterials (i.e. carbon nanotubes, nanoparticles, etc) to be immobilised onto electrodic transducing platforms so as to generate a high-conductive surface area interface that enables the sensitive / catalytic detection of ionic, molecular and biomolecular analytes.



Nanoparticle based electrochemical detection systems for DNA, protein and cell detection, focussed on user-friendly diagnostics, security and quality control applications. Developing applied biosensors, using nanoparticles in general and quantum dots particularly to achieve sensors that are more stable and cost effective than current techniques and offer more flexibility, faster binding kinetics (similar to those in a homogeneous solution), high sensitivity and high-reaction rates for many types of multiplexed assays, ranging from immunoassays to DNA analysis.

Fast and low cost sensing devices for heavy metals and other compounds for

environmental and industrial applications. Manufacturing smaller-scale detection devices with improved detection capability and based on free-mercury materials to be used as a water monitoring tool, enabling automatic control of heavy metal levels in seas, rivers, lakes and wastewaters.

Lab-on-a-chip systems with interest for in-field screening of analytes and other applications. Creating and characterising portable bioanalytical systems where nanoparticles and carbon nanotubes, bringing special advantages, are involved, in order to perform "point-of-care" analysis of analytes with clinical, environmental and food industry applications.



ICREA PROF. ARBEN MERKOÇI
GROUP LEADER

Prof Arben Merkoçi studied industrial chemistry at the University of Tirana (Albania) and obtained his PhD at the same university working on the field of ion selective electrodes. From 1992 he has undertaken research as postdoctoral fellow and research professor at Polytechnic University of Budapest (Hungary), University of Ioannina (Greece), Università degli Studi di Padua (Italy), Universitat Politècnica de Catalunya (Spain), Universitat

Autònoma de Barcelona (Spain) and New Mexico State University (USA). He is currently ICREA Research Professor and head of the Nanobioelectronics & Biosensors Group at the Catalan Institute of Nanotechnology (ICN) in Barcelona, Spain, researching the integration of biological molecules (DNA, antibodies, cells and enzymes) and other species with micro- and nanostructures with interest for the design of novel sensors and biosensors.