DNA's hybridization detection based on DNA mediated charge transport.

Rosa Letizia Zaffino[1,3], Dr.Mònica Mir[1,2] and Prof. Josep Samitier[1,2,3]
[1]Nanobioengineering group, Institute for Bioengineering of Catalonia (IBEC), Baldiri Reixac 10-12, 08028 Barcelona, Spain
[2]Centro de Investigación Biomédica en Red en Bioingeniería, Biomateriales y Nanomedicina (CIBER-BBN), Spain.
[3]Department of Electronics, University of Barcelona, c/ Martí i Franquès 1, 08028 Barcelona, Spain.
rlzaffino@ibec.pcb.ub.es

Abstract
The genomic era is now at hand since sequencing genes, a process which once required the efforts of large investigation teams during a long time, is now achievable in few hours by means of DNA chip microarrays. Although this, wide-scale applications of DNA sequencing, ranging from the emerging field of molecular diagnostic to forensic and security purposes, demands for faster and easier methods. The existing ones, mainly optical and mass read-out techniques, not only usually need for a labeling and/or a PCR step, but indeed they involve costly and sophisticated equipment.

Biosensors based on electrochemical detection methods represent the most promising platform to achieve this challenging target. Electrochemical methods are sensitive, affordable, selective and scalable in such a way that they offer the possibility to direct couple the molecular recognition event to the physical signal transducer, thus giving rise to a direct electrical read-out, which is often also a real-time one.

We propose a novel concept of DNA biosensing which exploits the advantages of nano-scale devices, scaling down the sensor size to a molecular level. In this platform, the DNA is part of the electrical circuit, closed due to the specific interaction with the target in a switch on/off fashion. The read out of this system is based on DNA mediated charge transport as sensing principle. Enhancing the efficiency of the interaction between the target and the recognition layer, this nano-device opens to the possibility of DNA detection in a label-PCR free fashion. Gold nano-electrodes, properly adjusted to the persistence length of DNA, thus assuring for an optimal stability of the molecule against environment induced perturbations, are here employed within a high sensitive electrometer. Conceptually simple, our scheme is also versatile to the study of electronic transport along the DNA molecule, and useful to get insight in to the questioned subject of DNA conductivity.

Figures

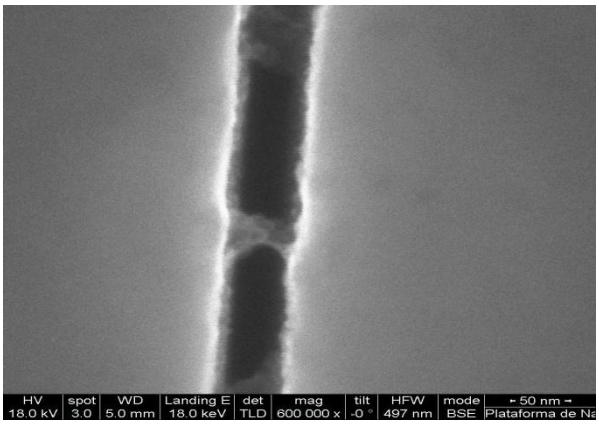

Fig.1 DNA's bridges connections between gold nano-electrodes.