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Maintaining biomolecules' native conformation upon surface immobilization and extracting their size and shape: a study employing the QCM-D biosensor

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Studying bio-molecular conformation is of extremely great importance in the fields of biology and nano-biotechnology. The ability to maintain and study the biomolecule's native conformation is crucial, as the latter is directly related to the molecule's properties and functions. For this purpose, in this work we used anchors for immobilizing different biomolecules on an acoustic biosensor surface via single-point attachment. The biosensor response provides information directly related to the geometrical features of the probed molecule. More precisely, we used the Quartz Crystal Microbalance with Dissipation monitoring (QCM-D) technique; as an acoustic wave propagates through a medium containing the molecules of interest, any change occurring in its characteristics, such as the propagation frequency (F) and the energy dissipation (D), can be linked to changes in the concentration and/or the conformation of the biomolecules bound on the surface. The scientific principle behind the new approach described here is that the acoustic ratio (ΔD/ΔF) is a measure of the hydrodynamic volume of the attached entity, mathematically expressed by its intrinsic viscosity [η]. We have already used this approach for diagnostic purposes, including detection of SNPs or targets of different lengths in real samples. Here, we expand this methodology by specifically attaching discrete biomolecules on the biosensor surface using DNA molecules as single point and variable length anchors. The native conformation of the biomolecules is thus maintained and their conformation, i.e. shape and length, is correctly predicted through acoustic measurements.

Biography

Dimitra Milioni obtained her Diploma in Applied Physics at NTUA, Athens, Greece. She completed her MSc in Molecular and Cellular Biophysics at Pierre et Marie Curie University (Paris VI, France) and PhD in Biophysics at the same University in 2012. After spending some months as Visiting Researcher in Molecular Modeling and Drug Design Laboratory, she is a Post-doctoral Researcher in Biosensors Lab at Institute of Molecular Biology and Biotechnology, Foundation for Research and Technology-Hellas-IMBB-FORTH, Greece. Her scientific interests focus on "Biosensors, plasma membrane and model membranes as well as on their interaction with other biomolecules (biocompatible polymers, pore-forming toxins and antimicrobial peptides) and drug delivery".

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