Label-free protein electronic detection with an electrolyte-gated organic field-effect transistor-based immunosensor

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Organic bio-electronics represents one of the most exciting directions in printable electronics, promising to deliver new technologies for healthcare and human well-being. Among the others, organic field-effect transistors have been proven to work as highly performing sensors. Selectivity is achieved by integrating a layer of functional biological recognition elements, directly coupled with an electronic interface. The devices were shown to reach detection limits down to the picomolar (10^{-12} M) range with highly repeatable responses (within few percentage of standard deviation) even for hundreds of reiterated measurements.

In this lecture recent developments in the field of organic and printable electronics implemented to probe biological interfaces will be discussed highlighting the importance of the interplay among disciplines such as organic electronics, analytical chemistry and biochemistry to reach a comprehensive understanding of the underpinning phenomena. It will also be shown that applications can lead to label-free electronic biosensors with unprecedented detection limits and selectivity. Notably, the extremely good sensing performance level can be rationalized by quantifying electrostatic and capacitance contributions characterizing the surface confined biological recognition elements interacting with their affinity ligands. Examples of the detection of clinical relevant biomarkers will be provided too.

Selected bibliography

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