INTERNATIONAL SOLVAY INSTITUTES BRUSSELS

Solvay Colloquium

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Organic bio-electronics for ultra-sensitive bio-markers detection

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.[1] Selectivity is achieved by integrating a layer of functional biological recognition elements, directly coupled with an electronic interface.[1-4] The devices were shown to reach detection limits down to the picomolar (10^{-12} M) range[3,4] with highly repeatable responses (within few percentage of standard deviation) even for 10^4 reiterated measurements in sea water.[5] Moreover, femtomolar (10^{-15} M, fM) detections were achieved with a graphene based FET modified with human olfactory receptors 2AG1.[6]

In this lecture the field of organic and printable electronics implemented to probe biological interfaces will be reviewed discussing the importance of the interplay among disciplines such as organic electronics, analytical chemistry and biochemistry to reach a comprehensive understanding of the 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:

1 Manoli, K.; Magliulo, M.; Mulla, M.Y.; Singh, M.; Sabbatini, L.; Palazzo, G.; Torsi L. Angewandte Chemie International Edition 54:2-17 **2015**.

2 Casalini, S.; Dumitru, A.C.; Leonardi, F.; Bortolotti, C.A.; Herruzo, E.T.; Campana, A.; de Oliveira, R.F.; Cramer, T.; Garcia, R.; Biscarini, F. ACS Nano 9:5051-5062 **2015**.

3 Macchia, E.; Alberga, D.; Manoli, K.; Mangiatordi, G.F.; Magliulo, M.; Palazzo, G.; Giordano, F.; Lattanzi, G.; Torsi, L. Scientific Reports 6:28085 **2016**.

4 Mulla, M.Y.; Tuccori, E.; Magliulo, M.; Lattanzi, G.; Palazzo, G.; Persaud, K.; Torsi, L. Nature Communications 6:6010 **2015**.

5 Roberts, M.E.; Mannsfeld, S.C.B.; Queraltó, N.; Reese, C.; Locklin, J.; Knoll, W.; Bao, Z. Proceedings of the National Academy of Science of USA 105:12134-9 **2008**.

6 Park, S.J.; Kwon, O.S.; Lee, S.H.; Song, H. S.; Park, T. H.; Jang, J. "Nano Letters 12:5082-5090 **2012**.

Tuesday 7 February 2017 at 4.00 P.M.

COFFEE AND TEA WILL BE SERVED AT 3.45 P.M. IN FRONT OF THE SOLVAY ROOM

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