Graphene biosensor with fusion protein receptor modules

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Health care and well-being are becoming more and more important as the fraction of the elderly of the population is constantly increasing. This calls for easy-to-use appliances to monitor the physical condition preferably at home on daily or weekly basis with minimum requirements in sample preparation and with connectivity via internet or mobile phone.

Most of the biological molecules carry charge providing a route to label-free and fast sensing. We have developed a sensor concept based on graphene field effect transistor and fusion protein receptor modules [1], shown schematically in Figure 1. The sensor can be sensitised to various analytes, allowing use of pre-fabricated sensor chips and/or changing the receptor modules in-situ for reprogramming of the device. Relatively standard microfabrication processes are used in the fabrication and the sensors can also be manufactured on flexible substrates. The response is fast and detection of concentrations down to femtomolar range has been demonstrated. In this talk we will discuss the potential and challenges of this label-free biosensor approach.

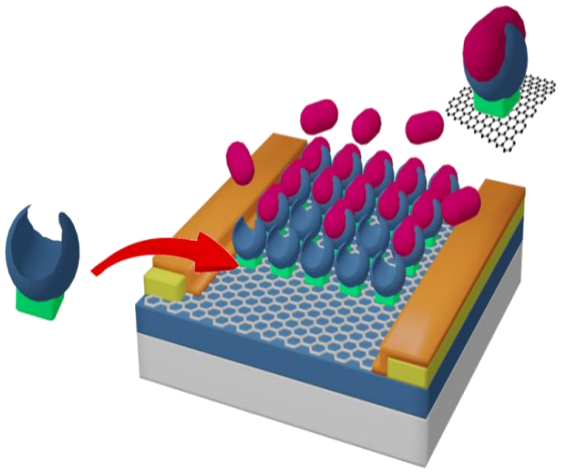

Figure 1. *GFET biosensor shown schematically. The receptor modules form a dense monolayer on the graphene channel. The receptors selectively bind the desired analyte from the sample and the charge of the analyte molecules is detected by the highly charge-sensitive graphene FET.*

[1] Miika Soikkeli, Katri Kurppa, Markku Kainlauri, Sanna Arpiainen, Arja Paananen, David Gunnarsson, Jussi J. Joensuu, Päivi Laaksonen, Mika Prunnila, Markus B. Linder, Jouni Ahopelto, Graphene biosensor programming with genetically engineered fusion protein monolayers, ACS Appl. Mater. Interfaces **8** (2016) pp 8257–8264.