A Highly Multiplexed Protein Sensing Platform in Nanopores

Jasmine. Y. Y Sze, Aleksandar. P. Ivanov, Anthony E.G. Cass, Joshua. B. Edel

Department of Chemistry, Imperial College London, London SW7 2AZ

Email: jasmine.sze03@imperial.ac.uk

Nanopore sensors are single-molecule electrochemical devices in which the detection method relies on the modulations of ionic current as molecules pass through the pore under the influence of an applied potential. These current modulations are generally depend on the volume, charge and conformation of a single molecule in the pore. Nanopores have been proven to be a promising tool for the detection of different biological components as they have a low detection volume, label free quantification and the possibility to detect rare molecules which normally masked by an ensemble averaging. Fine tuning the size of the nanopores[1,2] in combination with high bandwidth amplifier allowed efficient detection of nanoscale biological molecules however, challenges remain especially for detection of proteins due to its heterogeneous charge on the surface and fast translocation speed. Direct detection of proteins which often require high nM to μM concentration to be able to observed a fraction of events and there's possibility high concentrations proteins will block the pore, aggregation or protein crowding which making it harder to differentiate the signals between different analytes.

We demonstrate here aptamers can easily enhance the selectivity and specificity by integrating them onto the nanopore platform, this will allow parallel protein molecules to be screened. This platform in particular will improve and enhance the performance of nanopore technology such as selectivity and specificity.

References:

1. J.Y.Y. Sze, S. Kumar, A. P. Ivanov, S.H. Oh and J.B. Edel. Fine tuning of nanopipettes using atomic layer deposition for single molecule sensing. *Analyst*, **2015**, 140, 4828-4834.
2. C.R. Crick*, J. Y.Y. Sze*, M. Rosillo-Lopez, C. G. Salzmann and J. B.Edel. Selectively Sized Graphene- Based Nanopores for in-situ Single Molecule Sensing. *ACS. Applied Materials & Interface*, **2015**, 18188-18194. (* co-first author)