Selective single molecule sensing of proteins using nanopore and DNA aptamer-functionalised gold nanoparticles

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Nanopore-based single molecule sensors have found increasing importance in applications ranging from gaining a better understanding of biophysical processes to technology driven solutions such as DNA sequencing. However, challenges remain especially in terms of the poor selectivity where specific targets cannot distinguished from the mixture, or alternatively the low signal-to-noise ratio and event rate for the detection of smaller molecules such as small-sized proteins. In this work, we used DNA aptamer-functionalised gold nanoparticles (AuNPs), which act as a molecular carrier through the nanopore sensor, to tackle these technological challenges.[1] There are numerous advantages including: enhanced signal-to-noise ratio, high levels of selectivity, efficient capture from a complex mixture, minimized analyte-sensor surface interactions, and improved event rate. In this work, a lysozyme binding aptamer was attached to a 5 nm AuNP carrier[2] and used for selective detection of lysozyme within a mixture of proteins. We show that AuNP can be distinguished from the protein analyte, by looking into sub-complex molecular information, suggesting that this technology can be used for single molecule analysis of different molecular analytes specifically bound to AuNP.

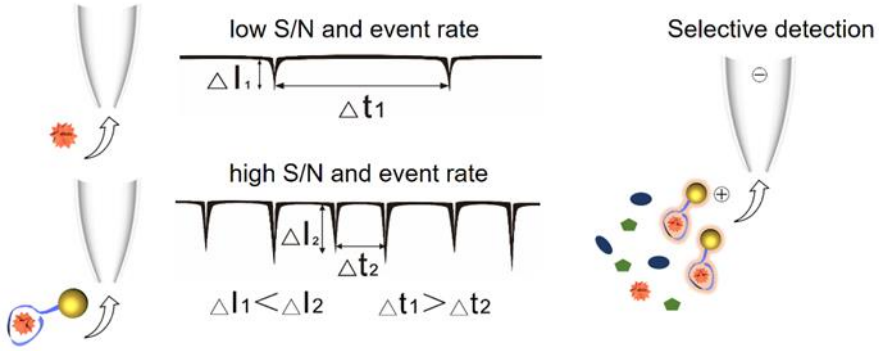

Figure1. Scheme highlighting the enhanced signal-to-noise ratio and event rate by using aptamer-modified AuNPs (left) and selective detection of target proteins in a mixed population (right).

References

[1] X. Lin, A. P. Ivanov and J. B. Edel, *Chemical Science*, 2017, **8**, 3905-3912 (2017)

[2] S. J. Hurst, A. K. Lytton-Jean and C. A. Mirkin, *Analytical Chemistry*, **78**, 8313 (2006)