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Nanopore-Based Single Biomolecule Interface for Single Molecule Electrochemical Sensing

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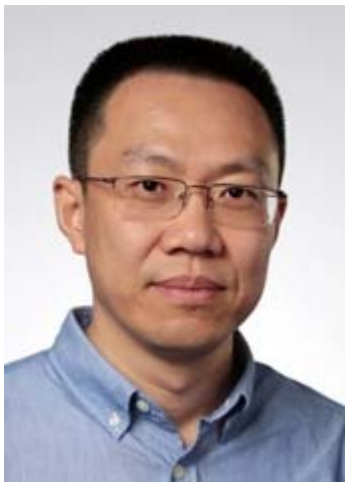
Abstract:

The single molecule measurement has enhanced the precision and depth of our knowledge about living system. The million years of evolution have produced the membrane proteins which acts as a single biomolecule interface for capturing and identifying a single molecule of interests. In our study, we focus on the biological nanopore-based single biomolecule interface for single molecule measurements.[1-3] We outline the design of nanopore-based single biomolecule interface which provides rich heterogeneities and stochastics information about each molecule. Then, we focus on the future areas beyond DNA sequencing including detecting rare species, resolving the hidden intermediates, depicting the spectra for the covalent/non-covalent interactions, tracing the dynamic pathways of single molecule behaviors.[4-7] A concept “single-molecule ionic spectrum” may potentially map the non-covalent interaction at atomic level in future. Since the characteristic interaction determines the sensitivity of nanopore, ideally the frequency analysis of nanopore data could be used not only for DNA sequencing, RNA sequencing, protein sequencing but also all kinds of single molecule detection. As ideally transferring the frequency-energy spectrum from the ionic current into the voice frequency, we illustrate that a nanopore-based single-biomolecule interface likes a tuba. When the single analyte flows into the ‘tuba’, its dynamic interaction with the pore could be modulated by the residue of the pore (‘button’) and the resonance space at the single-molecule interface (‘tuba’). As a result, the beautiful music of a single molecule will be played with a typical rhythm and melody.



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