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Nanopore Kinetic Proofreading of DNA Sequences

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The concept of DNA sequencing using the time dependence of the nanopore ionic current was proposed in 1996 by Kasianowicz, Brandin, Branton, and Deamer (KBBD). The KBBD concept has generated tremendous amount interests in recent decade. In this talk, I will review the current understanding of the DNA "translocation" dynamics and how it can be described by Schrodinger's 1915 paper on first-passage-time distribution function. Schrodinger's distribution function can be used to give a rigorous criterion for achieving nanopore DNA sequencing which turns out to be identical to that of gel electrophoresis used by Sanger in the first-generation Sanger method. A nanopore DNA sequencing technology also requires discrimination of bases with high accuracies. I will describe a solid-state nanopore sandwich structure that can function as a proofreading device capable of discriminating between correct and incorrect hybridization probes with an accuracy rivaling that of high-fidelity DNA polymerases. The latest results from Nanjing will be presented. This work is supported by China 1000-Talent Program at Southeast University, Nanjing, China.