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Probe DNA-Cisplatin Interaction with Solid-State Nanopores[1]

ZHI ZHOU, YING HU, WEI LI, ZHI XU, PENGYE WANG, XUEDONG BAI, XINYAN SHAN, XINGHUA LU, Beijing National Laboratory for Condensed-Matter Physics and Institute of Physics, Chinese Academy of Sciences, NANOPORE COLLABORATION — Understanding the mechanism of DNA-cisplatin interaction is essential for clinical application and novel drug design. As an emerging single-molecule technology, solid-state nanopore has been employed in biomolecule detection and probing DNA-molecule interactions. Herein, we reported a real-time monitoring of DNA-cisplatin interaction by employing solid-state SiN nanopores. The DNA-cisplatin interacting process is clearly classified into three stages by measuring the capture rate of DNA-cisplatin adducts. In the first stage, the negative charged DNA molecules were partially discharged due to the bonding of positive charged cisplatin and forming of mono-adducts. In the second stage, forming of DNA-cisplatin di-adducts with the adjacent bases results in DNA bending and softening. The capture rate increases since the softened bi-adducts experience a lower barrier to thread into the nanopores. In the third stage, complex structures, such as micro-loop, are formed and the DNA-cisplatin adducts are aggregated. The capture rate decreases to zero as the aggregated adduct grows to the size of the pore. The characteristic time of this stage was found to be linear with the diameter of the nanopore and this dynamic process can be described with a second-order reaction model.

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