

# Nanopore Discrimination of Synthetic Digital Polymers for Molecular Data Storage

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## Abstract

The rapid increase in worldwide digital data production is leading to unparalleled demand for conventional storage. Thus, there is a paradigm shift to molecular data storage as an alternative. Sequence-defined synthetic digital polymers are emerging as a molecular data storage medium due to their high information density and chemical robustness. These digital polymers can store, encode, decode, and rewrite information at the molecular level, providing incredible capability. A crucial challenge prevails in developing a quick, robust, and label-free readout on these polymers. These synthetic polymers are only deciphered by using mass spectroscopy. Similarly, biological nanopores possess extremely beneficial prospects as molecular readers with high sensitivity and single-molecule resolution. Here, we investigate 5 different binary encoded synthetic polymers using the aerolysin nanopore as a single-molecule sensing platform. An electrophysiological study determined the molecular discrimination of the tailored polymers based on their blockade distribution and temporal characteristics. Detailed analysis was done based on the dynamics and interactions of the polymers with the nanopore. Our findings also highlight the proof-of-concept potential capability of using a biological nanopore to decode single-bit information stored in sequence-defined synthetic polymers without compromising the information density. Thus, this will lead to the development of extendable readout tools for data information storage technologies.

**Keywords:** Data storage; Synthetic digital polymers; Nanopores; Aerolysin; Single-molecule.