Robust Bio-Secure DNA Based Memory

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Information storage in synthetic DNA oligomers is attractive due to the inherent physical density, stability, and energy efficiency of nucleic acids. Information retention –during writing, storage, and retrieval processes– requires development of efficient encoding/decoding systems. Additionally, potential intrusion of artificial or organic malevolent biologically active molecular machines could potentially cause catastrophic biosecurity concerns. Here we present an improved information storage method that focuses on efficiency and biosecurity.

Herein this paper, we have developed and experimentally tested an algorithm to write data in pool of DNA strands by applying a fountain code (rateless erasure code), a Reed Solomon code, and an oligomer mapping code that ensures Bio-Security. We validated our method through wet-lab experiments and wrote, stored, and fully retrieved 105,360 bits of information. We validated the siosecurity aspects of our method through in-silico experimentation using a BLAST-run to compare our generated oligomers to existing genes documented in the public databases, a Plasmidhawk software analysis to determine our oligomers could not be artificially traced to have originated from another lab, and utilized an open-source software to determine whether our oligomers could have expressed any sequences that potentially originate or empower biologically meaningful functions.

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