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Modeling DNA Separation in Entropic Trap Device ALEX VAUGHN, YONGMEI WANG[1], University of Memphis — DNA electrophoresis in the entropic trap device fabricated by Craighead and coworkers has some interesting properties that allow long chains to be separated; moreover, their results showed that long chains had higher mobility than short chains, a counter-intuitive result. The mechanism by which the device works is not well understood. This study seeks therefore to understand the device's mechanism more thoroughly with a desire to provide the knowledge necessary to optimize the separation of long chains of DNA. The study uses dynamic Monte Carlo simulations on a simple-cubic lattice to model the separation of DNA. The simulation algorithm was first tested by confirming the chain length independence of the electrophoretic mobility of DNA in bulk solution, a well-known experimental fact. When DNA chains are constrained in a slit channel, the electrophoretic mobility is still independent of chain length. If DNA-wall interactions are added to the model, then the mobility decreases with the chain length for short chains and reaches a plateau for long chains. In a channel with entropic traps, the mobility is found to increase with the chain length, consistent with experimental results by Craighead and coworkers. We also found that a better separation was achieved when the trap was made deeper.

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