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Dancing the night away: Improving the persistence of locomotion on the micron scale EMILY W. GEHRELS, W. BENJAMIN ROGERS, Harvard University, ZORANA ZERAVCIC, The Rockefeller University, VINOTHAN N. MANOHARAN, Harvard University — In recent years a range of nano and microscale walkers (motors that are able to move along a preformed track) have been developed. Many of these walkers bind to their tracks using a single binding site at each station along the track. A disadvantage of these systems is that any failure involving a single site becoming unbound leads to the walker falling off of the track and locomotion being prematurely terminated. For this reason, it has been difficult to develop a motor that can reliably take more than a few sequential steps. We present an experimental system of DNA-functionalized colloidal particles which exhibit directed motion along patterned substrates in response to temperature cycling. Many DNA bridges form between each pair of interacting particles, adding redundancy to the binding at each station to realize a system that should be able to consistently take many steps. We take advantage of toehold exchange in the design of the DNA sequences that mediate the colloidal interactions to produce broadened, flat, or even re-entrant binding and unbinding transitions between the particles and substrate. Using this new freedom of design, we devise systems where, by thermal ratcheting, we can externally control the direction of motion and sequence of steps of the colloidal motor.

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