Nanobiodevices integrating molecular motors

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ABSTRACT

Biomolecular motors, such as the motor protein kinesin, are sophisticated biological nanomachines, and are currently unrivaled in their performance as nanoscale engines. The integration of these motors into synthetic devices will permit active transport on the molecular scale, the controlled internal reorganization of advanced materials, and the direct conversion of chemical energy into mechanical work [1, 2].

We investigate the sensing of biological agents as an application for hybrid nanodevices enabled by biomolecular motors. This research is motivated by the ubiquitous use of motor proteins within cells, where motor proteins carry cargo, relay signals, and are even "hijacked" as transporters by viruses invading cells.

We have previously succeeded in loading cargo onto functionalized microtubules, which are propelled on a surface along predefined tracks by kinesin motors [3, 4]. Here we will present recent progress toward real-world applications, which includes an extension in the types of cargo which can be transported, stabilization strategies to minimize environmental effects on device performance, and methods to control the activation of our hybrid devices.

Keywords: biomolecular motors, bionanotechnology, kinesin, microtubules, motor proteins

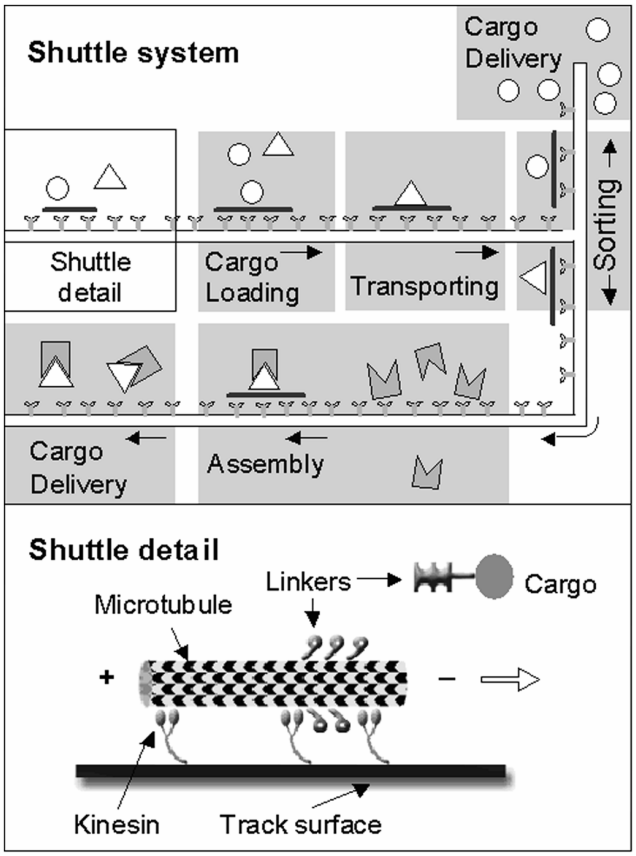

Figure 1: A molecular shuttle system based on biomolecular motors is envisioned to load, transport, sort, and assemble nanoscale building blocks (top). A hybrid design approach utilizes surface-bound kinesin motor proteins to transport functionalized microtubules along fabricated tracks. Reproduced with permission from Nano Letters 2003 Copyright Am. Chem. Soc..

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