

Plain English summary

Kinesin-1 molecular motors use a human-like walking action as they haul cellular cargo along microtubules. The energy for molecular walking comes from the splitting of ATP, a chemical fuel that is dissolved in the solution that bathes the motor. Each molecular step measures just 8 nm, and consumes exactly one ATP molecule.

In this new work, we show that before an ATP fuel molecule binds to the motor, only one head of the motor has its microtubule binding site exposed and available. The microtubule binding site on the second head is blocked. This implies that between steps, only one head of each kinesin molecule is attached to microtubules. We think the other head may park against its partner. Once ATP binds to the partner head, the second head is unblocked, exposing its microtubule binding site and allowing it to bind to the next available binding site along the microtubule.