The microtubule motor kinesin exhibits processive movement, meaning that a single motor can move for many micrometers along a microtubule without falling off. This property may be important in vivo in cases where a small vesicle with only a single kinesin bound must travel long distances on the scale of the cell. One model to account for the processive nature of kinesin is termed the hand-over-hand model. A key feature of this model is that one head should always be attached to the microtubule, which would lessen the chance of the motor falling off the microtubule.

a. To test this model, a single-headed kinesin was prepared and its motile properties examined. If the hand-over-hand model is correct, would you expect the single-headed kinesin to be processive?

b. The figure depicts the landing rate of microtubules on a coverslip coated with either two-headed or one-headed kinesin at different motor densities (landing is defined as interacting with and being moved by motors attached to the glass surface). What can you conclude from this data?

c. Another feature of the hand-over-hand model is that one head, upon binding to the microtubule, promotes the release of the other head from the microtubule. If this hypothesis is correct, what would you expect when a one-headed kinesin molecule bound to a microtubule?