Coordination of Myosin Va Motors Within a Team During Cargo Transport

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Actin-based molecular motor myosin Va (myoVa) is a biological machine involved in intracellular cargo transport, which is essential for normal cellular function. Although a single myoVa is sufficient to transport a cargo in vitro, intracellular cargo such as insulin granules and melanosomes are attached with many motors. It is still poorly understood how multiple motors coordinate to transport cargo through dense actin meshwork. Using Total Internal Reflectance Fluorescence microscopy (TIRF) technique and in vitro motility and gliding assays, the velocities and travel distances (run lengths) of single and multiple myoVa motors were measured. The results showed that the velocity decreased as a function of motor number, which may imply that motors interfere with each other during cargo transport. While the velocity of a single myoVa was measured as 0.63μm/s, this value was reduced by 22% and 46% and 48% at 0.1mg/mL, 0.5mg/mL and 1mg/mL myoVa concentrations respectively. In contrast, the average run length of myoVa was increased with motor numbers. The run length of multiple myoVa motors was several times longer than a single motor suggesting that multiple motors are capable of driving cargo for a long distance which is required for efficient cargo delivery. These results provide a mechanism for how myoVa motors mechanically interact with each other and generate sufficient forces to transport cargo such as insulin granules through a crowded and viscous cellular environment.