Myosin VI: The Motor in your Eyes

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Motors in your eyes? No need to worry there are no tiny electrical motors inside them. However, myosin VI, the "motor" in your eyes, is just as fascinating. Myosin VI is a protein responsible for transporting materials within cells. It consists of two main regions: a head and a tail. The tail rotates, generating torque that propels the entire protein forward. What makes myosin VI unique is the direction in which it moves. Of the nearly 40 known types of myosin, myosin VI is the only one that travels backwards or into the cell along actin filaments [1]. This distinctive movement means it is unique and distinct from all other myosins as can be see in figure 1.

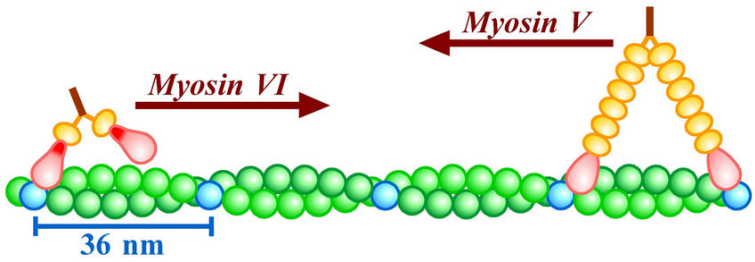

FIG. 1. Example image of myosin VI movement along actin filaments. Image source [2].

So why is myosin VI important in our eyes? To understand this, it helps to know about the RPE, or retinal pigment epithelium. The RPE is the layer of cells that gives the eye much of its color but its function goes far beyond pigmentation [3]. It plays a crucial protective role by degrading photoreceptor outer segment (POS) waste (the part of the eye receptors discarded) before it can accumulate. Without the RPE clearing away this waste, toxic POS byproducts would build up and damage the retina [4]. This is where myosin VI becomes essential: it is speculated that it helps to transport cellular waste along actin filaments, which function like intracellular highways[4].

Myosin VI is not limited to the eye; it is found in many regions throughout the body, which makes research on it significant. In the study discussed in this paper, the experiment followed three main steps. First, small beads roughly a micrometer in diameter were thoroughly washed and inserted into a controlled undisturbed RPE cell with myosin III function disrupted. Next, a 10-minute video of the cells was recorded. The initial frame of the video was colored red, and the final frame was colored green. These two images were then combined to create a composite image. To correct for drift, a plugin was used to shift the red image until immobilized beads attached to the experimental surface appeared yellow [4]. This color overlay made bead displacement easy to detect, since stationary beads would appear yellow while moving beads would not.

Finally, single particle tracking software which tracks the beads position in every frame was used to calculate the mean squared displacement (MSD) of the beads and velocity at different time points. By analyzing this information and comparing it to the random walk model (the idea that movement results from random collisions with surrounding particles), they identified two key measurements α describing how random the motion was and Γ for how fast motion is [4].

Ultimately, the researchers concluded that intracellular trafficking occurred in two distinct modes. The first mode depended on myosin VI moving along actin, producing a more random pattern of motion. The second mode was independent of myosin VI and was instead attributed to other motor proteins, likely kinesin and/or dynein. Similar to Myosin these proteins move along microtubules and use ATP to transport cargo throughout the cell [5]. "This work has identified a tractable cell system for future work that will explore whether myosin VI's unique behavior in vitro has implications for its trafficking behavior within a cellular environment"[4]. This understanding of myosin behavior

allows better prevention for diseases such as age-related macular degeneration. It also paves a path for future research and understanding of myosin VI.

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