TRPV4 shows TRPP2 the moves

You’d think that something as dramatic as a bending cilia would be easy to sense, especially if your own activity depended on it. But the ion channel TRPP2 is oblivious to the cilia movement that activates it, and depends on another channel to relay the information, Köttgen et al. report.

In the kidney, bending of the cilia in response to the flow of fluid through the nephron tubule triggers intracellular calcium transients, setting off multiple response pathways. This cilia deflection-induced calcium increase requires the ion channel TRPP2. But TRPP2 is not itself a mechanosensor. That role, it turns out, is played by another channel called TRPV4.

TRPV4 is similar in sequence to a worm mechanosensory channel, is expressed in the kidney, and has been shown to associate with cilia. With that in mind, the authors investigated its relationship with TRPP2. They found that the two proteins both physically and functionally interacted and that blocking TRPV4 abrogated flow-triggered calcium transients.

Mutations in TRPP2 lead to cysts throughout the kidney, liver, and pancreas. It had been assumed that the primary step in polycystic disease pathogenesis was the loss of mechanosensation and downstream calcium transients. But while absence of TRPV4 abolished calcium increase, neither zebrafish nor mice deficient in TRPV4 developed cysts. This suggests that TRPP2 has an unknown function in addition to triggering calcium transients.

Köttgen, M., et al. 2008. *J. Cell Biol.* doi:10.1083/jcb.200805124.

Two microtubules means one-way movement

For the microtubule motor Eg5, binding two microtubules gives it direction, say Kapitein et al.

Eg5, the vertebrate form of kinesin-5, moves along microtubules either randomly or directionally. In other kinesins, directionality is triggered when the motor binds to its cargo and to the microtubule track. But for Eg5, microtubules are both the track and the cargo, as both ends of the motor protein bind microtubules.

The authors showed that Eg5 moved predominantly randomly when bound to only one microtubule, but switched solely to plus end-directed movement when a second microtubule bound.

Eg5 is one of the main organizers of microtubules in the mitotic spindle, and its ability to slide antiparallel fibers along one another is crucial for pushing opposite poles apart. Alternatively, when encountering parallel fibers, it can “zip them together” if they are skewed, says co-PI Tarun Kapoor. He thinks the ability to move randomly on a single microtubule allows Eg5 to “explore” its environment for another microtubule, “dramatically increasing the efficiency of crosslinking.”

Kapitein, L.C., et al. 2008. *J. Cell Biol.* doi:10.1083/jcb.200801145.

Aquaporin clears its own path

Aquaporin takes charge of getting itself to the membrane, say Noda et al.

In the renal collecting duct, aquaporin channels increase permeability and are central to water homeostasis. The channel normally hangs out in the cytoplasm, but when the body needs to retain water, it relocates to the apical membrane, allowing water to flow from the tubule into the cell.

This relocation is under the control of antidiuretic hormone. The hormone activates protein kinase A (PKA), which in turn phosphorylates aquaporin. But once phosphorylated, how does aquaporin relocate? The only clue was the authors’ previous study showing aquaporin can bind both actin and tropomyosin (TM5b).

Phosphorylation, the team found, dissociated aquaporin from G-actin molecules, but also destabilized F-actin. They speculated that this destabilization might be related to aquaporin’s ability to bind TM5b, because TM5b is a known F-actin stabilizer.

Overexpression of TM5b indeed increased the amount of F-actin and prevented aquaporin from reaching the membrane. The authors thus propose a model whereby, upon phosphorylation, aquaporin detaches from G-actin and binds to TM5b, causing TM5b to lose its grip on F-actin. The F-actin then depolymerizes, opening the way for aquaporin to reach the membrane.