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New Insight Into the Protrusions and Paddles That Link Lens Fiber Cells

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The lens is a tissue in which structure defines function. The formation of this transparent, focusing epicenter of the eye depends on precise morphogenetic processes that include the elaboration of complex lateral interactions between its component fiber cells. This differentiation process is dynamic, with fiber cells first developing small, interlocking lateral protrusions and then forming large interconnected paddles evocative of jigsaw puzzle pieces. While we have known for many years that these morphogenetic specifications exist, there has been little understanding of their component elements, how they form and how they are maintained. In their paper entitled “Tropomodulin 1 Regulation of Actin is Required for the Formation of Large Paddle Protrusions Between Mature Fiber Cells,” Velia Fowler and colleagues¹ now provide significant insight into the actin-associated cytoskeletal structures that regulate formation of these elaborate fiber cell projections, both small protrusions and large paddles. Many of their findings were made possible by a powerful new methodology they developed in which individual fiber cells are isolated prior to analysis. This approach provided a level of resolution of the molecules that comprise these structures not previously possible. The Fowler team mapped the specific actin cytoskeletal structures in protrusions and paddles, and showed them to be distinct. Their results revealed that formation/maintenance of paddles involves a spectrin-actin network that is stabilized by Tropomodulin 1 (Tmod1), while formation of the small protrusions between fiber cells involves Arp3-branched F-actin networks and fimbrin-bundled F-actin. These studies have provided an understanding of the molecular regulators of protrusion and paddle formation in cortical, differentiating, and mature fiber cells not previously appreciated, and have greatly advanced our knowledge of the structures through which neighboring mature fiber cells interact to form a transparent lens tissue.

References

1. Cheng C, Nowak RB, Biswas SK, Lo W-K, FitzGerald PG, Fowler VM. Tropomodulin 1 regulation of actin is required for the formation of large paddle protrusions between mature lens fiber cells. *Invest Ophthalmol Vis Sci.* 2016;57:4084–4099.

