Hair cells are the sensory receptors of both the auditory system and the vestibular system in the ears of all vertebrates and in the lateral line organ of fishes. Through mechanotransduction, hair cells detect movement in their environment.

Auditory hair cells are the mechanical sensors of sound waves in the inner ear, and the stereocilia, which are actin-rich protrusions of different heights on the apical surfaces of hair cells, are responsible for the transduction of sound waves into electrical signals. As a crucial actin-binding and bundling protein, espin is able to cross-link actin filaments and is therefore necessary for stereocilia morphogenesis. Using advanced super-resolution stimulated emission depletion microscopy, we imaged espin expression at the sub-diffraction limit along the whole length of the stereocilia in outer hair cells and inner hair cells in order to better understand espin's function in the development of stereocilia [1].

The mechano-electrical transduction (MET) channel of the inner ear receptor cells, termed hair cells, is a protein complex that enables our senses of hearing and balance. Hair cell MET requires an elaborate interplay of multiple proteins that form the MET channel. One of the MET complex components is the transmembrane protein LHFPL5, which is required for hair cell MET and hearing. LHFPL5 is thought to form a multi-protein complex with other MET channel proteins, such as PCDH15, TMIE, and TMC1. Despite localizing to the plasma membrane of stereocilia, the mechanosensing organelles of hair cells, LHFPL5 requires its binding partner within the MET complex, PCDH15, to localize to the stereocilia tips in hair cells and to the plasma membrane in heterologous cells. Using the Aquaporin 3-tGFP reporter (AGR) for plasma membrane localization, Soler et al from the University Hospitals Cleveland Medical Center, found that a region within extracellular loop 1, which interacts with PCDH15, precludes the trafficking of AGR reporter to the plasma membrane in heterologous cell lines. Our results suggest that the presence of protein partners may mask endoplasmic reticulum retention regions or enable the proper folding and trafficking of the MET complex components, to facilitate the expression of the MET complex at the stereocilia membrane [2].

1)
Qi J, Zhang L, Tan F, Liu Y, Chu C, Zhu W, Wang Y, Qi Z, Chai R. Espin distribution as revealed by super-resolution microscopy of stereocilia. Am J Transl Res. 2020 Jan 15;12(1):130-141. PMID: 32051742; PMCID: PMC7013225.
2)
Soler DC, Ballesteros A, Sloan AE, McCormick TS, Stepanyan R. Multiple plasma membrane reporters discern LHFPL5 region that blocks trafficking to the plasma membrane. Sci Rep. 2023 Feb 13;13(1):2528. doi: 10.1038/s41598-023-28045-w. PMID: 36781873.