Abstract: The inner ear is a complex sensory organ that functions to monitor environmental stimuli such as sound, motion (linear and angular acceleration), and gravity. Within each compartment of the inner ear, specialized sensory epithelia contain mechanosensory hair cells that serve as both receptors and transducers of auditory or vestibular information. In mammals, loss of auditory sensory hair cells is irreversible and a primary cause of hearing impairment or deafness. Thus, a major goal of the hearing research field is to determine the molecular mechanisms of sensory hair cell formation and then devise strategies to replace missing or lethally damaged hair cells in vivo.

Several non-mammalian vertebrates, including zebrafish, possess an innate capacity to produce new mechanosensory hair cells throughout life, including the ability to regenerate lethally damaged hair cells in vivo. Current evidence from several model systems suggests that mitotic proliferation of progenitor cells may be the predominant mechanism of mechanosensory hair cell regeneration. Our lab has begun to investigate the mechanisms of hair cell regeneration in the lateral line neuromast, which is an additional and experimentally accessible sensory organ present in fish and amphibians. Our results suggest that regeneration of hair cells in the zebrafish neuromast is a two step process: First, new hair cells are generated by phenotypic conversion (i.e., trans-differentiation) of adjacent support cells and secondly, mitotic proliferation replaces the converted support cells. Furthermore, gamma-secretase activity is required in wild-type neuromasts to prevent precocious trans-differentiation of support cells. Our long-term strategy is to understand the molecular and cellular mechanisms of hair cell regeneration in a system that robustly regenerates hair cells and then apply this knowledge to mammalian systems that have limited or no regenerative capacity.

Relevant References:


Imaging functional mechanosensory hair cells in vivo. Confocal image of sensory hair cells in the posterior crista, viewed along the axis of the posterior semicircular canal. All nuclei express a

“Regeneration of mechanosensory hair cells in the zebrafish lateral line”

4:00 p.m.
Wednesday, November 29, 2006
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There will be a reception from 3:30 – 3:30p.m. in Watson’s Crick, Lilly 1-125