Mechanosensory hair cells in the inner ear transduce sound energy or head movement into neural input to the brain, and are the receptor cells of hearing and balance. Hair cells are sensitive to death from a variety of stresses, including noise trauma, aging, genetic mutations, and exposure to therapeutic drugs with ototoxic side effects. Our lab conducts basic, translational, and clinical studies on hair cell degeneration and hearing loss in the mature inner ear, and develops therapeutic strategies to prevent or reverse hearing loss. I will describe our recent basic science studies examining non-autonomous cellular mechanisms that promote survival of sensory hair cells under stress. I will also describe translational and clinical studies that use this mechanistic information to guide the rational design of therapies to prevent hearing loss in humans undergoing lifesaving therapy with ototoxic drugs.