SENSORY SYSTEMS

Linking cadherin to hearing

The hair cells of the inner ear provide a mechanosensory mechanism that converts mechanical stimuli into electrochemical signals. Each hair cell is topped by a bundle of stereocilia, which are linked together at their tips. When the stereocilia are deflected by a sound or head movement, tension is generated in the tip links. This causes mechanotransduction channels at either end of the link to open, allowing ions to flow into the cell. Little was known about the chemical composition of the tip links, but two groups have recently reported in *Nature* that the adhesion molecule cadherin 23 (Cdh23) is one of the main constituents.

It was previously thought that Cdh23 was lost from stereocilia as the hair cells become mature, but Siemens *et al.* were able to detect Cdh23-coding messenger RNAs in the inner ears of adult mice. The protein itself was localized to the tips of stereocilia, and using immuno-electron microscopy, the authors pinpointed its location to the tip link. They also showed that the tip link could be severed by agents that disrupt the adhesive functions of Cdh23, and that Cdh23 interacts with myosin-1c, another component of the mechanotransduction apparatus.

Mutations in the *Cdh23* gene have been shown to cause deafness and balance problems in mice and humans. The zebrafish *sputnik* mutant shows a similar phenotype, and in the second study, Söllner *et al.* showed that the *sputnik* gene codes for Cdh23. The authors examined the hair cells in the *sputnik* mutant, and they found that the stereocilia were frequently splayed out rather than bundled together.

The discovery that Cdh23 is a crucial component of the tip link has important ramifications for our understanding of the inner ear's mechanotransduction mechanism. The mechanotransduction channels seem be gated by a spring-like structure, which was suggested to be the tip link itself. However, Cdh23 filaments are unlikely to be sufficiently stretchy to carry out this function. In a News and Views article, Corey and Sotomayor propose a new model, in which the gating spring is an integral part of the channel. In support of this model, an ion channel that has been implicated in mechanotransduction in zebrafish has been shown to contain ankyrin repeats, which form a helical structure that is predicted to have spring-like properties.

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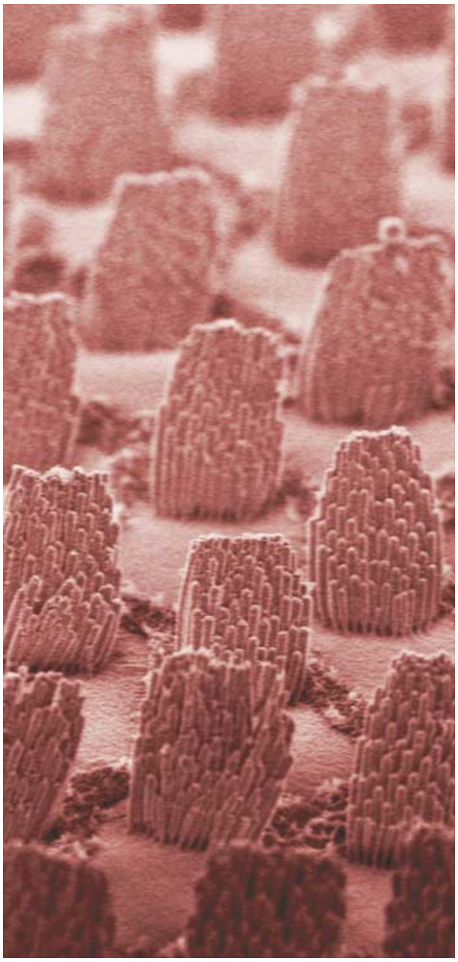

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References and links

ORIGINAL RESEARCH PAPER Siemens, J. *et al.* Cadherin 23 is a component of the tip link in hair-cell stereocilia. *Nature* **428**, 950–955 (2004) | Söllner, C. *et al.* Mutations in *cadherin 23* affect tip links in zebrafish sensory hair cells. *Nature* **428**, 955–959 (2004)

FURTHER READING Corey, D. P. & Sotomayor, M. Tightrope act. *Nature* **428**, 901–903 (2004)

IN BRIEF

SENSORY PHYSIOLOGY

Neural mechanism underlying complex receptive field properties of motion-sensitive interneurons.

Haag, J. & Borst, A. *Nature Neurosci.* 9 May 2004 (10.1038/nn1245)

At higher processing levels in the visual system, motion-sensitive neurons often have complex receptive field properties. In the blowfly, lobula plate neurons have different preferred directions in different parts of the receptive field and are tuned to rotational flow fields. Haag and Borst found that the receptive fields of these cells consist of two components. The first is produced by local motion detectors on their dendrites, but the second is imported from other neurons to which each cell is electrically coupled.

MOLECULAR NEUROSCIENCE

Defining a molecular atlas of the hippocampus using DNA microarrays and high-throughput *in situ* hybridization.

Lein, E. S. *et al. J. Neurosci.* **24**, 3879–3889 (2004)

The authors used DNA microarrays to look for genes that were predicted to be enriched in the dentate gyrus and areas CA1 and CA3 of the hippocampus. They then carried out high-throughput *in situ* hybridization to localize the transcripts of more than 100 of these genes at the cellular level. The resulting expression patterns correlate well with the microarray data, and a number of genes show expression that is 'restricted' to one or more subregions of the hippocampus.

NEURAL DEVELOPMENT

Engulfing action of glial cells is required for programmed axon pruning during *Drosophila* metamorphosis.

Awasaki, T. & Ito, K. *et al. Curr. Biol.* **14**, 668–677 (2004)

Glia engulf degenerating axons during developmental axon pruning.

Watts, R. J. *Curr. Biol.* **14**, 678–684 (2004)

These studies use genetic techniques to investigate the mechanisms that underlie the pruning of γ-neuron axons in the mushroom bodies during larval metamorphosis in *Drosophila melanogaster*. They provide evidence that the steroid hormone ecdysone, which induces axon degeneration in these neurons, also signals neurons to recruit glia, which engulf and phagocytose the degenerating axons.

SYNAPTIC PLASTICITY

Enhanced synaptic plasticity in newly generated granule cells of the adult hippocampus.

Schmidt-Hieber, C. *et al. Nature* **429**, 184–187 (2004)

The formation of new granule cells in the adult mammalian hippocampus is thought to be connected to learning and memory. Schmidt-Hieber and colleagues now show that these young neurons have distinct active and passive membrane properties that facilitate the induction of long-term potentiation, compared with more mature neurons.