

Introductory Remarks to Symposium 11

How hearing happens: speed, precision and sensitivity

Jutta Engel and Eckhard Friauf, Homburg and Kaiserslautern

Analyzing complex sound signals and localizing sound sources require ultrafast and temporally precise signal processing in the auditory system. The DFG has launched a Priority Program in which these aspects are investigated. Hearing impairment or deafness affects 1 in 600 newborns. The incidence rises steeply in the sixth decade, causing enormous problems to aging societies. Unfortunately, hearing aids and cochlear implants do not restore speech perception in noise and sound localization. The poor accessibility of hair cells and spiral ganglion cells in the bony otic capsule and of brainstem neurons in the center of the head causes some technical challenges. Detours for gaining physiological insight are whole-mount preparations, primary cultures and slice preparations.

The transduction channel complex in cochlear hair cells enables fast and ultrasensitive excitation. Recent work identified TMC1 as an essential component of the transduction channel complex yet the exact nature of the channel is still unknown as will be elucidated by CJ Kros.

J Engel will report on the structural coupling of presynaptic Ca^{2+} channels with postsynaptic AMPA receptors at the inner hair cell synapse. The coupling allows for highly sensitive and temporally precise synaptic transmission from inner hair cells to spiral ganglion neurons forming the auditory nerve.

Sound localization is accomplished by neuronal processes involving projections from cochlear nucleus bushy cells to the contralateral MNTB (medial nucleus of the trapezoid body) and, in turn, to the lateral superior olive (LSO). The presynaptic calyx of Held at MNTB neurons is a very prominent example for structural and functional specializations guaranteeing maximum fidelity and transmission speed with minimal temporal jitter. G Spirou will present novel results on the development of this giant synapse and on competition of inputs during circuit formation.

Sound localization via analysis of interaural intensity differences requires reliable inhibition at glycinergic MNTB-LSO synapses. E Friauf will focus on the exceptional performance of these synapses and compare them to 'conventional' hippocampal counterparts.

Two talks by T Butola and S Michanski will complement our symposium.

Symposium 11

Thursday, March 23, 2017
11:30 - 13:30, Lecture Hall 102

Chairs: Jutta Engel and Eckhard Friauf,
Homburg and Kaiserslautern

11:30 Opening Remarks

11:40 Corné Kros, Brighton, UK
CLUES TO THE MOLECULAR IDENTITY OF THE HAIR-CELL MECHANO-ELECTRICAL TRANSDUCER CHANNEL FROM EXPERIMENTS WITH PORE BLOCKERS (S11-1)

12:00 Jutta Engel, Homburg
THE CALCIUM CHANNEL SUBUNIT $\alpha 2\delta 2$ IN INNER HAIR CELLS IS ESSENTIAL FOR SENSITIVITY AND TEMPORAL PRECISION IN HEARING (S11-2)

12:20 George Spirou, Morgantown, USA
THE NANOSCALE CONNECTOME OF BUSHY CELL NETWORKS IN MOUSE COCHLEAR NUCLEUS (S11-3)

12:40 Eckhard Friauf, Kaiserslautern
SYNAPTIC PERFORMANCE IN THE SUPERIOR OLIVARY COMPLEX: RELIABILITY AND PRECISION (S11-4)

13:00 Tanvi Butola, Göttingen
ROLE OF PICCOLO IN HIGH FREQUENCY SIGNAL TRANSMISSION AT A CENTRAL AUDITORY SYNAPSE (S11-5)

13:10 Susann Michanski, Göttingen
MATURATION AND HETEROGENEITY OF RIBBON SYNAPSES EVALUATED BY HIGH-RESOLUTION MICROSCOPIC TECHNIQUES (S11-6)

13:20 Concluding Remarks



Ultrafast and temporally precise
information processing:
Normal and dysfunctional hearing