CEA - Saclay 91191 Gif-sur-yvette Cedex

Service de Physique de l'Etat Condensé

SÉMINAIRE

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Teaming up to boost the hair-bundle amplifier in sensory hair cells

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The dazzling sensitivity and frequency selectivity of the vertebrate ear rely on mechanical amplification of small sound stimuli by hair cells. In an acute preparation of the bullfrog's sacculus, the mechano-sensory hair bundle that adorns each hair cell can oscillate spontaneously and harness these active movements to amplify its response to small stimuli at frequencies near that of the oscillation. Frequency-selective amplification relies on negative hair-bundle stiffness, myosin-based adaptation of the transduction process and electro-mechanical feedback by the Ca2+ component of the transduction current. We have developed a physical description of active hair-bundle motility which provides quantitative agreement with experiments. Because hair-bundle oscillations are noisy, a single hair bundle can afford only limited frequency selectivity and gain in sensitivity. In vivo, however, tens of hair cells of similar characteristic frequencies are mechanically coupled by accessory structures. By combining mechanical stimulation with a micro-fiber and a dynamical-clamp technique, we demonstrate experimentally that both sensitivity and frequency selectivity of a single hair bundle are enhanced by elastic coupling to "cyber bundles" of similar characteristics.
