# ***INTERNSHIP PROPOSAL***

**Laboratory name:** Laboratoire Physico-Chimie Curie
**CNRS identification code:** UMR168
**Internship director'surname:** Pascal MARTIN
**e-mail:** pascal.martin@curie.fr **Phone number:** 01 56 24 67 48
**Web page**: link
**Internship location:** Institut Curie, 11 rue Pierre et Marie Curie 75005 Paris
**Thesis possibility after internship:** YES **Funding:** NO

## TITLE: Electrical control of hair-cell mechanosensitivity in the inner ear.

**SUMMARY:** Sounds are detected in the inner ear by mechano-sensory "hair cells". Hearing starts with sound-evoked deflections of the hair bundle, a cohesive tuft of stereocilia that works as the hair cell's mechanical antenna (Fig. 1). These movements modulate tension in the tip links (Fig 1, inset) that pull on mechanosensitive ion channels, resulting in an ionic influx into the hair cell. Mechanosensitivity depends on the sigmoidal relation between the transduction current and the hair-bundle deflection: the steeper the relation, the bigger the change in current in response to small deflections and thus the more sensitive is the hair cell. In vivo, there exists an electric potential difference of about 100 mV across the sensory epithelium. This potential clearly matters for increasing the magnitude of the electric field that drives the ions through the transduction channels and thus to set the magnitude of the transduction current. However, our preliminary results indicate that there is more: the transepithelial potential may also regulate mechanosensitivity per say, by affecting gating of the transduction channels in response to force. We propose here to study quantitatively how applying a transepithelial potential affects hair-cell mechanosensitivity. The trainee will develop a two-compartment ex-vivo preparation of the sensory hair-cell tissue from the frog's ear, mechanically stimulate "en masse" an ensemble of about 300 hair cells by shearing the overlying membrane that couples their hair bundles, measure the resulting current-displacement relation, and measure how it varies with application of an external transepithelial potential. The work will be performed in close collaboration with two PhD students in the group.

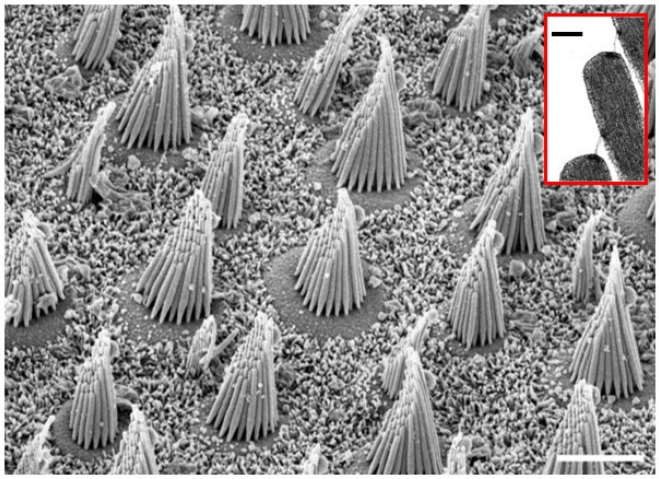

*Figure 1: Electron micrograph of hair bundles protruding from the apical surface of the sensory epithelium in a frog's ear; the inset shows the "tip links". Scale bars: 5 µm (bottom), 200 nm (inset).*

**Reference:**

Martin, P. & Hudspeth, A. J. Mechanical Frequency Tuning by Sensory Hair Cells, the Receptors and Amplifiers of the Inner Ear. Annu. Rev. Condens. Matter Phys. 12, 29–49 (2021).