ACOUSTICS2008/1014
The nano-mechanics of mechanosensory neurones in vivo

James Windmill[a], Victoria Pook[b] and Daniel Robert[a]
[a]University of Bristol, D34 School of Biological Sciences, Woodland Road, BS8 1UG Bristol, UK
[b]University of Bristol, School of Biological Sciences, Woodland Road, BS8 1UG Bristol, UK

The ability to detect and process sound is a sense particularly important in many animals, including insects, playing a key role in predator, prey and mate detection. Acute hearing, both in the sense of extreme sensitivity to sound and sharp frequency selectivity, relies on the active participation of auditory mechanoreceptors. In insects, active auditory mechanics was first demonstrated in mosquitoes, whereby auditory sensitivity is enhanced by the action and reaction of mechanosensory neurones to sound-induced vibrations. The mosquito's auditory neurones can generate motions that mechanically drive the antenna and tune it to biologically relevant sounds. The mechanosensory neurones are capable of detecting exquisitely small mechanical displacements, down to 100 picometres. In the mosquito's Johnston's organ (300 μm in diameter) there is a high density of these neurones (16,000 units). The mechanical response of the mechanoreceptors was measured in vivo using an Atomic Force Microscope, in response to stimulation of the external antenna. The work establishes the link between the previously measured non-linearities of the mosquito's antennal vibrations and the nanoscale mechanics of the mechanosensory neurones.