Emergence of tuning to natural stimulus statistics along the central auditory pathway

J. A. Garcia-Lazaro, Bashir Ahmed and J.W. H. Schnupp

Department of Physiology, Anatomy and Genetics, Sherrington Building, Parks Road, Oxford

We have previously shown that neurons in primary auditory cortex (A1) respond more strongly and reliably to dynamic stimuli whose statistics follow “natural” 1/f dynamics than to stimuli exhibiting faster (1/f^0.5) or slower (1/f^2) modulations. To investigate where along the central auditory pathway this 1/f-tuning arises, we extend our study here to the central nucleus of the inferior colliculus (ICC) and the ventral division of the medial geniculate nucleus of the thalamus (MGV). We found that while the great majority of ICC recording sites showed a strong preference for the most rapidly varying stimuli, whose pitch and amplitude profiles changed according to 1/f^γ distributions with small values of γ, most recordings in the MGV did not exhibit a marked preference for any particular γ exponent. Only in A1 did a majority of neurons respond with higher firing rates to stimuli in which γ takes values near 1. Taken together, these results suggest that, while tuning to 1/f statistics is relatively common and pronounced in primary auditory cortex, this property is not inherited from lower stations of the auditory pathway, but only emerges as signals are passed from the ICC, where neurons clearly prefer more rapidly changing stimuli, through the MGV, where tuning properties seem to lie somewhat in-between those seen in the ICC or in A1.