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Dynamic dendritic compartmentalization as a potential mechanism for auditory stream segregation in insects

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The process of Auditory Stream Segregation (AudSS) allows animals to separate relevant acoustic signals from non-relevant signals by grouping them into useful perceptual objects. AudSS has been described extensively in vertebrates and recently also in an invertebrate: in the katydid *Neoconocephalus retusus*, an identified auditory interneuron, TN-1, segregates bat cries with slow pulse rates from conspecific male calls with fast pulse rates. Here we characterize the properties of AudSS by TN-1, with respect to stimulus amplitude and frequency, to understand the underlying mechanisms of AudSS. We recorded the spiking activity of TN-1 using extracellular electrodes. First we tested how the amplitude of male calls influences their masking effect. We measured TN-1 thresholds for bat cries while playing male masking frequencies ranging from 50 to 80 dB SPL. TN-1 responded to bat cries even when their amplitude was considerably lower than the masker's amplitude. With increasing amplitude of the masking call, the threshold for bat cries increased. This indicates that the suppression of fast pulse rates is caused by dendritic processes intrinsic to TN-1 rather than due to processes occurring on TN-1's afferents. Next we tested how the carrier frequency of bat cries and male calls influenced TN-1 responses. We varied carrier frequency of male calls and bat cries independently of each other in the range of 6.3 to 60 kHz. If male and bat frequencies differed by more than 5 kHz, TN-1 responded selectively to bat cries. TN-1 responded to bat cries even when the bat frequency was lower than the male call frequency, which is the opposite of the natural situation. This means that AudSS by TN-1 may also function in other contexts than bat detection. Based on our results we suggest a potential dendritic mechanism underlying auditory stream segregation in TN-1.

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