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Behavioral categorization of sound frequency and its neural correlates in auditory cortex of freely behaving mice

Human and other animals have the ability to put varying items into a group based on their similar properties. This ability is so-called categorization. It is essential for survival in complicate and changing environment. Categorization of sensory information is regard as a basic and general feature of sensory systems, but little is known about how the brain categorizes varying stimuli. We explore this issue using behavioural analysis in combination with neural recording in freely behaving mice. Mice were first trained to form different sound categories and their categorization behaviour was tested afterwards. To seek the neural correlates of categorization behaviour, using multichannel silicon probes, we measured the neuronal responses before, during and after behaviour in freely moving mice. Here we show that mice can divide sound frequency categorically with sharp boundary in between based on formed categories. Moreover, the alternation of learnt categories will affect psychometric function of categorization. Physiologically, we preliminarily found neurons in auditory cortex will increase their firing rate during specific task conditions. A type of slow and long-lasting ‘off-response’ in auditory cortex was observed in our study. Analysis of its firing pattern indicates those responses may be behavioural specific and may play important role in categorization. Besides, changing in tonotopic map occurred in one trained animal immediately after behavioural training. This result suggests rapid task-related plasticity may be involved in perception and categorical learning.