SOUND DURATION SELECTIVITY IN BAT MIDBRAIN INFERIOR COLLICULUS

CHUNG-HSIN WU

Dr. Philip H.-S. Jen, Dissertation Supervisor

ABSTRACT

Sound duration is an important acoustic parameter that contributes to the distinct spectral and temporal attributes of individual biological sounds and is therefore important for sound recognition in human speech, animal communication and bat echolocation. The main objective of this thesis is to examine the duration selectivity of neurons in the central nucleus of the midbrain inferior colliculus (IC) using bats as the mammalian model system under stimulation conditions of single pulses, temporally patterned pulse trains and pulse-echo (P-E) pairs. This thesis also studies the role of GABAergic inhibition in shaping the duration selectivity of IC neurons using iontophoretic application of GABA or bicuculline, which is an antagonist for $GABA_A$ receptors. The data obtained from these studies show the following. (1) Neurons at upper IC have sharper duration selectivity than neurons in the deeper IC. (2) GABAergic inhibition contributes to sharpening of duration selectivity of IC neurons to sound pulses in rapid sequences, pulse repetition rate (PRR) of pulse trains, and shortening of pulse duration and P-E gap. (3) The effect of bicuculline application on duration selectivity is more pronounced at high than at low PRR while the opposite is true during GABA application.