Abstract

Mouse ultrasonic vocalizations (USVs) are of communicative significance and can serve as one of the major tools for behavioral phenotyping in mouse models of neurobiological disorders with social communication deficits. Mouse models also enable examination of changes in neural circuitry underlying the above dysfunctions and hence can provide therapeutic strategies. Using information-theoretic measures, we show that mouse USVs have predictability that undergoes modulation with social context, like birdsong and aspects of speech. Mathematically informative sequences were obtained from adult male mice USVs. Such sequences also had behavioral relevance as female mice exhibited higher preference for the sequence with statistical regularities over the sequences with randomized configuration based on a two-choice task, similar to the observations in humans. Neurons in the primary auditory cortex (A1) are selective to species-specific vocalizations; however, cortical encoding of behaviorally relevant structured sequences of vocalizations as a whole unit has not been studied in the mouse. Since male mice emit specific sequential structures influenced by the proximity and presence and absence of females, we looked into the alteration in the sensory representations at the receiver end in the female A1 with and without social exposure. In our study, context-specific selectivity is observed at the mono as well as disyllabic level. However, the effect of social experience is apparent only in higher-order structures i.e. when we observe representation of sequences as a whole. Thus an evident aspect and requirement of speech perception is observed in mouse A1 at least at rudimentary level; *that is*, A1 single neurons adaptively represent the entire order of acoustic units without altering selectivity of individual acoustic units. The experience-dependent adaptive representation of single neurons in A1 was found to be differential in nature in excitatory neurons and somatostatin positive inhibitory neurons (SOM INNs). The results indicate no clear involvement of another large class of INNs that are parvalbumin positive (PV). The observed plasticity was replicated by optogenetic reversible silencing of SOM INNs paired with sound sequence presentation. The involvement of the SOM INNs thus indicates possible pathways involved in perception of sound sequences.