Plasticity of the neural network for spatial recognition

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Linkage between behavior indicative of spatial recognition and molecular mechanisms of synaptic plasticity has been elusive. We hypothesize that postnatal tuning of synaptic efficacy in the vestibular nucleus is required for the recognition of head orientation and the expression of vestibular behavior. Sensory cues of orientations are transmitted from the inner ear to neurons in the vestibular nucleus via glutamate synapses. During postnatal development, these synapses became functional after acquisition of specific glutamate receptor subtypes that triggered long-term potentiation. GABAergic network within neonatal vestibular nucleus also exhibited synaptic efficacy, mediated by BDNF. Perturbation of glutamatergic or GABAergic transmission during a neonatal period of susceptibility shifted postnatal emergence of graviceptive behavior. These rats when reached maturity also exhibited deficits in spatial navigation. Altogether, we provide evidence that postnatal tuning of the synaptic plasticity of the neural network for head direction is critical for orchestrating the expression of vestibular-related behaviors. [Supported by HKRGC 761710M, 761711M, 761812M]