Poster Abstract

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Perineuronal chondroitin sulfates and semaphorin 3A regulate postnatal maturation of the vestibular circuit for gravity detection

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Perineuronal chondroitin sulfate proteoglycan networks are implicated in restricting plasticity of the mature CNS. Less is known of the impact of ligands associated with the perineuronal network (PN) in the formative period of neural circuits. The emergence of negative geotaxis with postnatal maturation of the vestibular circuitry for gravity detection offers a behavioral readout in tests for roles of the PN and associated ligands in vestibular plasticity. Using postnatal rats as model, we found that negative geotaxis was mature by postnatal day (P) 9, in correlation with consolidation of PN around GABAergic neurons in the vestibular nucleus (VN). Treatment of the VN at P6 with chondroitinase ABC cleaved chondroitin sulfate moieties of PN and delayed emergence of negative geotaxis to P13. Delay to P13 was also observed following treatment of the VN with a $GABA_A$ receptor antagonist, reinforcing GABAergic transmission as regulated by perineuronal chondroitin sulfate components is a key step for the maturation of negative geotaxis. The chondroitin sulfate moieties of PN have been shown to interact with semaphorin 3A (Sema3A), a secreted glycoprotein that regulates neuronal polarization and dendritic arborization**.** Our double immunohistochemical study also showed Sema3A in colocalization with consolidated PN in the VN as early as P9 although expression of Sema3A was detectable by both immunocytochemistry and RT-PCR much earlier. Our results suggest that Sema3A interacts with PN in the VN to regulate the morphological and functional properties of GABAergic interneurons in the postnatal VN, thereby contributing to the maturation of vestibular behavior. [Grant support by HKRGC-GRF 774608M & 777911M.]