October 1, 2009

Maturation of the perisynaptic extracellular matrix affects various forms of synaptic plasticity

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ABSTRACT OF THE TALK

Brain synapses are wrapped by a dense meshwork of extracellular matrix (ECM), which consists of glycoproteins and proteglycans of glial as well as neuronal origin. This specific ECM is known since 100 years as perineuronal nets (PNN) and is thought to be critical for the development and the function of brain synapses and has been shown to stabilize synaptic contacts. Here, we tested the hypothesis whether the PNN can act as diffusion barrier for AMPA-type glutamate receptors on the cell surface. Using single particle tracking and fluorescence recovery after photobleaching we found that this net-like appearing ECM forms surface compartments, which act as lateral diffusion barriers for AMPA-type glutamate receptors. Removal of the ECM using the hyaluronic acid digesting enzyme hyaluronidase increased extrasynaptic receptor diffusion and the exchange of synaptic AMPA receptors via lateral diffusion. Using whole-cell patch-clamp recording we measured an increased paired-pulse ratio as a functional consequence of ECM removal. These results suggest that surface compartments formed by the ECM hinder lateral diffusion of AMPA receptors and thereby may modulate short-term synaptic plasticity.