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Studying Dopaminergic Synapses in Brain Tissue and in Cell Culture: Molecular Composition of Tyrosine Hydroxylase Containing Varicosities

Synaptogenesis is a highly complex process. Its dynamics and the underlying mechanisms are best understood for glutamatergic synapses. In contrast, little is known about the development of the molecular and biochemical architecture of dopaminergic synapses, including those made onto hippocampal cells. The Ventral Tegmental Area (VTA) is a group of neurons located in the midbrain and is involved in the natural reward circuitry of the brain. Dopaminergic neurons from the VTA also project into the Hippocampus, where dopamine release is involved in the transition of memory from short-term to long-term. In this thesis I verified the existence of dopaminergic input from the VTA into the Hippocampus by staining brain slices of adult mice with antibodies against tyrosine hydroxylase (TH), an enzyme involved in the biosynthesis of Dopamine, which is widely used as a marker for dopaminergic neurons. Additionally, I established a cell culture system for dissociated midbrain neurons, which enables the culture of neurons from the VTA, and also established a co-culture system of hippocampal cells and midbrain cells, enabling the study of the VTA-hippocampal pathway in a simplified manner. Using the coculture system, I stained for different synapse markers (Bassoon/active zone marker; Synaptophysin/general synapse marker; vGluT1/marker for excitatory synapses; vGAT/marker for inhibitory synapses) and found varying levels of colocalization between the varicosities and the synapse markers. The findings of this study give insight into the molecular composition of dopaminergic varicosities and will aid in the understanding of dopaminergic synaptogenesis.