Cannabinoid Receptor Type 1 Expression in the Developing Avian Retina: Morphological and Functional Correlation With the Dopaminergic System

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The avian retina has been used as a model to study signaling by different neuro- and gliotransmitters. It is unclear how dopaminergic and cannabinoid systems are related in the retina. Here we studied the expression of type 1 and 2 cannabinoid receptors (CB_1 and CB_2), as well as monoacylglycerol lipase (MAGL), the enzyme that degrades 2-arachidonoylglycerol (2-AG), during retina development. Our data show that CB_1 receptor is highly expressed from embryonic day 5 (E5) until post hatched day 7 (PE7), decreasing its levels throughout development. CB_1 is densely found in the ganglion cell layer (GCL) and inner plexiform layer (IPL). CB_2 receptor was also found from E5 until PE7 with a decrease in its contents from E9 afterwards. CB_2 was mainly present in the lamination of the IPL at PE7. MAGL is expressed in all retinal layers, mainly in the IPL and OPL from E9 to PE7 retina. CB_1 and CB_2 were found both in neurons and glia cells, but MAGL was only expressed in Müller glia. Older retinas (PE7) show CB_1 positive cells mainly in the INL and co-expression of CB_1 and tyrosine hydroxylase (TH) are shown in a few cells when both systems are mature. CB_1 co-localized with TH and was heavily associated to D_1 receptor labeling in primary cell cultures. Finally, cyclic AMP (cAMP) was activated by the selective D_1 agonist SKF38393, and inhibited when cultures were treated with WIN55, 212–2 (WIN) in a CB_1 dependent manner. The results suggest a correlation between the endocannabinoid and dopaminergic systems (DSs) during the avian retina development. Activation of CB_1 limits cAMP accumulation via D_1 receptor activation and may influence embryological parameters during avian retina differentiation.

Keywords: cannabinoid, retina, development, dopamine, cAMP