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BRAIN RESEARCH REVIEWS

Review

Dopaminergic signaling in the developing retina

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ABSTRACT

The role of dopamine in the retina has been studied for the last 30 years and there is now increasing evidence that dopamine is used as a developmental signal in the embryonic retina. Dopamine is the main catecholamine found in the retina of most species, being synthesized from the L-amino acid tyrosine. Its effects are mediated by G protein coupled receptors constituting the D_1 (D_1 and D_5) and D_2 (D_2, D_3 and D_4) receptor subfamilies that can be coupled to adenylyl cyclase in opposite manners. Dopamine-mediated cyclic AMP (cAMP) accumulation, via D_1-like receptors, is observed very early during retina ontogeny, before synaptogenesis and, in some species, before the expression of tyrosine hydroxylase (TH), the enzyme that characterizes the neuronal dopaminergic phenotype. D_2-like receptors appear in the tissue days after D_1-like activity is detected. In the embryonic avian retina, before the tissue is capable of synthesizing its own dopamine via TH, dopamine synthesis is observed from L-DOPA supplied to the neuroretina from retina pigmented epithelium which results in dopaminergic communication in the embryonic tissue before TH expression. Müller cells, the main glia type found in the retina, seem to actively contribute to dopaminergic activity in the retinal tissue. Understanding the dopaminergic role during retina development may contribute to novel strategies approaching certain visual dysfunctions such as those found in ocular albinism.

Contents

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Abbreviations: AC, adenylate cyclase; cAMP, cyclic AMP; CNS, central nervous system; DDC, DOPA decarboxylase; DA, dopamine; DAT, dopamine transporter; E, epinephrine; FK, forskolin; IPL, inner plexiform layer; INL, inner nuclear layer; NO, nitric oxide; NMDA; N-methyl-D-aspartate; NE, norepinephrine; OPL, outer plexiform layer; PACAP, pituitary adenylyl cyclase-activating polypeptide; RPE, retina pigmented epithelium; TH, tyrosine hydroxylase

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