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Visual system

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Summary

None of the living monotremes place great reliance on vision, but the structure and genetics of their visual system is of some significance for the evolution of mammalian visual pathways. The visual pathways of both platypus and short-beaked echidnas show evidence of adaptation to their crepuscular and nocturnal lifestyles, with rod-dominated retinas. The suite of distinctive features of the monotreme eye includes the presence of a scleral cartilage, SWS2 cones, double cone photoreceptors and oil droplets in the cone photoreceptors (at least in the platypus) (Zeiss *et al*. 2011). Retinal topography is relatively unspecialised for all monotremes, with a low centre to periphery gradient of photoreceptor and retinal ganglion cell density, consistent with the relatively low visual acuity shown for the echidna and suspected for the platypus. The central visual pathways in both platypus and echidna are much like those in therians, with the exception that the pregeniculate and lateral geniculate nuclei have adopted distinctive positions in the two extant groups thanks to differential expansion of the caudal thalamus. The pretectal nuclei of the caudal diencephalon are just as differentiated as in therians, but questions remain concerning the capacity of the monotreme eye for accommodation. Two visual areas have been identified in the cerebral cortex, both with visuotopic (i.e. visual field based) organisation, one of which appears to be homologous to the primary visual cortex of therians.

Overview of the visual system

The mammalian visual system not only serves the gathering and processing of visual information from the external environment, but also allows visual information to influence the function of the hypothalamus and endocrine system. Anatomically it consists of the retina; visual pathways to the brain (optic