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The retina as a window to the brain-from eye research to CNS disorders.

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Abstract

Philosophers defined the eye as a window to the soul long before scientists addressed this cliché to determine its scientific basis and clinical relevance. Anatomically and developmentally, the retina is known as an extension of the CNS; it consists of retinal ganglion cells, the axons of which form the optic nerve, whose fibres are, in effect, CNS axons. The eye has unique physical structures and a local array of surface molecules and cytokines, and is host to specialized immune responses similar to those in the brain and spinal cord. Several well-defined neurodegenerative conditions that affect the brain and spinal cord have manifestations in the eye, and ocular symptoms often precede conventional diagnosis of such CNS disorders. Furthermore, various eye-specific pathologies share characteristics of other CNS pathologies. In this Review, we summarize data that support examination of the eye as a noninvasive approach to the diagnosis of select CNS diseases, and the use of the eye as a valuable model to study the CNS. Translation of eye research to CNS disease, and deciphering the role of immune cells in these two systems, could improve our understanding and, potentially, the treatment of neurodegenerative disorders.

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