Postnatal changes in nerve growth factor and brain derived neurotrophic factor levels in the retina, visual cortex, and geniculate nucleus in rats with retinitis pigmentosa

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Abstract

Royal College of Surgeons (RCS) rats are a well established animal model of inherited retinitis pigmentosa (RP). Using RCS rats we examined the distribution of nerve growth factor (NGF) and brain derived neurotrophic factor (BDNF) in the visual cortex, geniculate nucleus and retina at three different postnatal ages. It was found that the retina of rats with RP expresses low amounts of NGF and BDNF in young and adult life. Altered levels of these factors were found in the visual cortex and in the geniculate nucleus. Our findings indicate that NGF and BDNF are differentially affected in the visual system of developing and adult RCS rats, suggesting that neurotrophins may be implicated in the pathogenesis of inherited RP.

Keywords: Nerve growth factor; Brain derived neurotrophic factor; Neurotrophins; Retinitis pigmentosa; Visual system

There is consistent evidence indicating that nerve growth factor (NGF) and brain derived neurotrophic factor (BDNF) are involved in the survival and function of cells of the visual system. NGF is known to promote stabilization of cortical synapses during postnatal development [2,9,10,16], while BDNF exerts a marked role in the maintenance, function and neuronal plasticity of retinal, cortical and geniculate cells during development and in adult life [9,16]. NGF and BDNF can affect the normalization of ocular dominance of the postnatal visual system [8,14] and the functional organization of the visual cortex (VC) [5,14,15,17]. These neurotrophins are also involved in retinal cell development and survival [4,13,17,20]. We have previously shown that NGF can delay retinal degeneration in rodents [13]. Retinitis pigmentosa (RP) comprises a group of inherited retinal disorders that represent a major cause of blindness in the world. There is at present no resolutive therapy for this disorder and the availability of experimental animals with similar genetic defects, either occurring naturally or obtained through transgenic manipulations, has provided information for understanding some mechanisms implicated in RP [19]. The Royal College of Surgeons (RCS) rat is a well-known animal model of genetic retinal degeneration [11,18]. These rats represent, therefore, an attractive animal model to address questions regarding the role of biologically active molecules in retinal degeneration. The aim of the present study is to investigate developmental changes of NGF and BDNF in the retina, geniculate nucleus (GN) and VC of RCS rats. Surprisingly, no data are available on the concentration of NGF and/or BDNF in VC, GN and retina of normal rats and in rats with RP. In the present study we found significant changes in NGF, BDNF and their receptor distribution within the retina, VC and GN in selected time-points. These findings will be presented and discussed.

RCS rats, obtained by Dr R. Hanitzsch from the Carl Ludwig Institute of Physiology, University of Leipzig, Germany, were raised in our institutional. The experiments were carried out on RCS and Sprague–Dawley animals as controls (see Ref. [11]). Animals used in our studies were maintained on a 12 h light/dark cycle and were provided with food and water ad libitum. For the housing care and experimental procedures, we followed the guidelines indicated by our Institutional Animal Care and Use Committee and in conformity with the Institutional Animal Care and Use Committee.