Retinal Dopamine and its Metabolite Contents in Zitter Rats and Spontaneously Epileptic Rats

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In order to investigate the relationship between visual dysfunction and retinal DA metabolism in zitter rats and spontaneously epileptic rats (SER), we measured the amounts of retinal dopamine (DA) and its metabolites, 3,4-dihydroxyphenylacetic acid (DOPAC) and homovanillate (HVA). DA, DOPAC and HVA contents were markedly decreased in zitter rats as compared with the controls, Kyo: Wistar or Sprague-Dawley rats. In contrast, in SER, retinal DA and its metabolite contents were not significantly different from those of Kyo: Wistar rats. SER showed higher levels of DA and its metabolites in comparison with Sprague-Dawley rats. Thus, it is suggested that the debilitation of retinal DA synthesis is at least partly related to the visual dysfunction observed in zitter rats, but not that of SER.—KEY WORDS: dopamine, retina, spontaneously epileptic rats, visual dysfunction

Kuse et al. previously studied visual function in spontaneously epileptic rats (zi/zi, tm/tm: SER) and their parent mutants, tremor rats (+/+, tm/tm) as well as in zitter rats (zi/zi, +/+ ) [1]. They found similar electroretinographic abnormalities in zitter rats and SER. As to dopamine (DA) contents in the retina, however, no conclusive evidence was obtained because of the study design. This report, as a supplement to the previous study, describes the results of analysis of retinal DA and its metabolite in an attempt to clarify the relationship between visual dysfunction and retinal DA metabolism in these epileptic rats.

Five males each from SER, zitter, Sprague-Dawley and Kyo: Wistar groups, nine weeks of age, were used in this study. Sprague-Dawley rats and Kyo: Wistar groups are the parent strains of zitter rats and SER respectively, and were used as controls.

Based on the results of Melamed et al., suggesting that retinal DA synthesis is dependent on light stimulation and that retinal DA concentration reaches a maximal level at four hours after the onset of light stimulation [3], animals were sacrificed by decapitation at about four hours after the onset of illumination, and the retina was rapidly dissected from the enucleated left eye. Supernatant obtained from the ultrasonic-homogenized retina was assayed for DA, 3,4-dihydroxyphenylacetic acid (DOPAC) and homovanillate (HVA) using reverse phase high performance liquid chromatography (L-2000 or L-4000 W, Yanagimoto Seisakusyo Co., Ltd.) with electrochemical detection (VMD-501, Yanagimoto Seisakusyo Co., Ltd.). The protein quantity in the retina was measured according to the method of Lowry et al. [2].

Mean retinal DA, DOPAC and HVA contents, shown as vertical bars, were statistically analysed by Student's paired t-test. Differences
Fig. 1. Retinal dopamine (DA), 3,4-dihydroxyphenylacetic acid (DOPAC) and homovanillate (HVA) contents in Kyo : Wistar, Sprague-Dawley, zitter and spontaneously epileptic rats (Mean±S. D., N=5). Significant differences between Kyo : Wistar rats and other rats are indicated by * (0.01 ≤ P ≤ 0.05) or **(0.001 ≤ P ≤ 0.01). Significant differences between Sprague-Dawley rats and other rats are indicated by # (0.01 ≤ P ≤ 0.05), ## (0.001 ≤ P ≤ 0.01) or ### (P ≤ 0.001).

with a P <0.05 were considered significant. As shown Fig. 1, the mean contents of retinal DA, DOPAC and HVA were significantly decreased in zitter rats as compared with Kyo : Wistar rats or Sprague-Dawley rats. Retinal DA and its metabolite contents in SER were not significantly different from those in Kyo : Wistar rats, while retinal DA and its metabolite contents in SER were higher than in Sprague-Dawley rats.

This result suggests that retinal DA synthesis was reduced in zitter rats but not in SER. Our previous study showed that the main sites of histopathological change were the external plexiform and nuclear layers in zitter rats, but only the internal nuclear layer in SER [1]. These two epileptic mutants exhibited essentially the same electoretinographic changes [1]. However, the present results suggest that the site of involvement in the retina may be different. Thus, we conclude that the entity of visual dysfunction in zitter rats and SER differs biochemically as well as histopathologically.

References