6-Hydroxydopamine effect on the retina: An autoradiographic study

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Summary. Labelled uridine uptake was studied in the control and 6-hydroxydopamine-treated retina by autoradiography. Decrease labelled uridine uptake was detected in the 6-hydroxydopamine-treated retinas.

The effect of 6-hydroxydopamine (a catecholaminergic blocker) on the development of the retinas in the avian and rodent models was reported by using various methods including teratology, histology, histochemistry and biochemistry (rhodopsin determination)[1,2]. After blocking the catecholaminergic terminals in the retinas, metabolic enzymes, such as monoamine oxidase and rhodopsin began to decrease in rodents and more drastic conditions like the disappearance of outer segments were reported in the avian embryos. These led us to the hypothesis that catecholamines might be related to outer segment (or rhodopsin synthesis). To further pursue this problem, we studied the RNA uptake of 6-hydroxydopamine-treated retinas by using the method of autoradiography.

Materials and methods. 16-day-old neonatal albino rats (strain: Simonsen) were used. These rats were divided into 2 groups, control and experimentals. Control rats were injected with saline and experimental rats were injected with 0.1 mg 6-hydroxydopamine per animal. Injections were made every other day and a total of 2 injections were used. The animals were then sacrificed and the retinas dissected out. They were then quickly placed in Hanks culture solution at 37 °C. The culture solution contained labelled uridine (H^3) with an activity of 80 μCi/ml Hanks solution. Oxygen was bubbled into the incubation medium. After a period of incubation, the retinas were removed and fixed, dehydrated, embedded and sectioned at 6 μm. After mounting the sections on the slides (with or without hematoxylin staining), emulsion (Ilford Nuclear Research) was spread on the slides, and the slides were kept in a dark box in a refrigerator for 1 month. Then the emulsion was developed and the positions and amount of the silver granules were observed using a light microscope.

Results. In the control retinas, particles of labelled uridine were observed in the visual cell layers (figure 1). These appeared as groups of dark dots. Some of the cell bodies in the outer nuclear layer also demonstrated labelled particles, especially those nearest to the visual cell layer. In a few cases, labelled sites were also observed in the inner plexiform layers. In the 6-hydroxydopamine-treated retinas, however, very few labelled particles were spotted in the visual cell layer (figure 2). Positive labelled sites in the outer nuclear layer and the inner plexiform layer were almost non-exsistent.

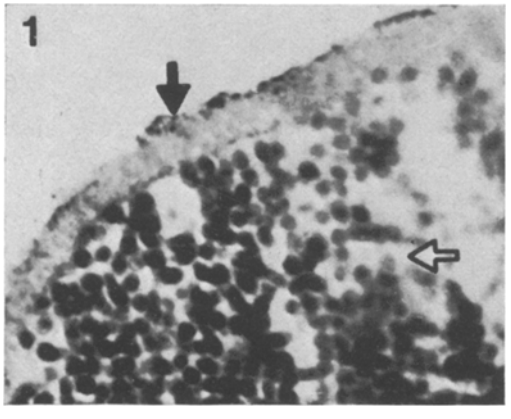

Fig. 1. Labelled uridine uptake in the retina of the control. Note the positive sites (silver granules as indicated by black arrow) are located in the visual cell layer. The outer nuclear layer (white arrow) is below the visual cell layer. The sections are stained with Hematoxylin. × 1800.

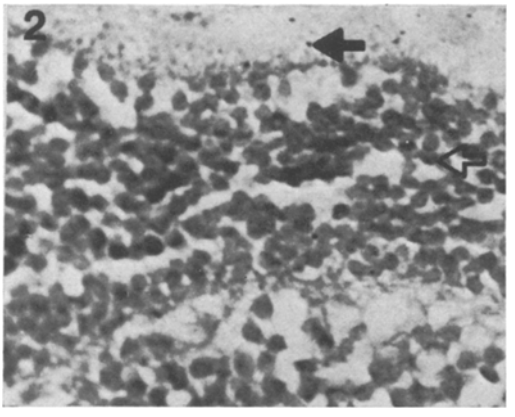

Fig. 2. Labelled uridine uptake in the 6-hydroxydopamine-treated retina. Note only very few silver granules in the visual cells (black arrow). The outer nuclear layer (white arrow) is below the visual cell layer. Hematoxylin staining. × 1800.

Conclusion. If RNA turnover in the visual cell layer is indeed involved with the turnover of the outer segments (or rhodopsin) as suggested[3], then the decrease uptake of labelled uridine in the 6-hydroxydopamine-treated rat retinas indicates that there is a decrease in outer segment turnover or rhodopsin synthesis in these cases. It is then tempting to speculate that the effect we found by blocking the catecholaminergic terminals in the retinas may be mediated through the synthesis of RNA in the visual cell layers. In other words, it appears that the catecholaminergic neurotransmitters may be able to control the rate of RNA synthesis. To push it one step further, since the RNA produced in the visual cell layer is undoubtedly related to the DNA inside the visual cells, and since the DNA inside the visual cells is stable in quantity as in all other cells, it is then highly probable that the regulation of RNA synthesis are influenced by the neurotransmitters. At this moment, we are studying the possible mechanism in this laboratory.

1 D. T. Yew, A. K. S. Ho and D. B. Meyer, Experientia *30*, 1320 (1974).
2 D. T. Yew, Experientia *32*, 504 (1976).
3 R. W. Young, Anat. Rec. *151*, 484 (1965).