QUANTITATIVE AND QUALITATIVE INVESTIGATION OF NUCLEIC ACIDS IN THE RETINA DURING TOXIC DEGENERATION

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In rabbits with toxic degeneration of the retina caused by administration of monoidoacetic acid, almost no RNA can be found in the damaged ganglion cells. The DNA content in the gangion cells is unchanged.

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Early disappearance of RNA from the cytoplasm of damaged cells has recently been demonstrated [1-5]. In the present investigation quantitative and qualitative changes in ganglion cells of the retina during toxic degeneration were studied for the first time.

EXPERIMENTAL METHOD

Altogether 54 eyes of experimental rabbits and 12 of control rabbits were investigated. The experimental animals received from 1 to 4 injections of 4% monoiodoacetic acid solution into the auricular vein in a dose of 0.5 ml/kg. Observations were made from 10 days to 6 months thereafter. Besides histological surveys, preparations were stained by the Nissl and Feulgen method, the Danielli reaction, and the ninhydrin reaction of Yasuma and Ichikawa. By means of an integrating microspectophotometer, the DNA and RNA content of the retinal ganglion cells of 8 animals (1599 cells) was investigated. Sections of different thicknesses stained by a modification of Deitsch's method [6] also were studied.

TABLE 1. Relative Content of RNA and DNA in Ganglion Cells (numbers inversely proportional to content of nucleic acids in cell)

Expt. No.	Without hydrolysis (total content of DNA and RNA in ganglion cells)			After hydrolysis (DNA content)
	intact and damaged cells together	intact cells	damaged cells	
1	88.21	84.77	93.33	94.20
3	83.83	–	–	92.24
5	87.65	83.42	93.95	93.75
8	86.48	84.06	93.14	92.54
11	87.69	83.74	92.80	93.32
20	86.20	84.54	93.58	93.50
Control 1		85.60	–	92.84
Control 2		83.26	–	93.36

EXPERIMENTAL RESULTS

From 10 days to 2 months 5 days after injury central and peripheral tigrolysis, pycnosis, and acute swelling of individual cells were observed in the retinal ganglion cells. Later the number of ganglion cells decreased, and ghost cells and bare nuclei, without cytoplasm, appeared.

The results of staining by Feulgen's method were the same in the experimental and control series. Danielli's reaction showed an increase in staining of ganglion cells in the experimental retina, compared with the control from (++) to (+++) and (++++). The ninhydrin method also gave brighter staining of the cytoplasm of the ganglion cells than in the control.

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Cytophotometric investigation of RNA and DNA revealed highly constant results for the DNA content (investigated after removal of RNA from the sections by hydrolysis in 1 N HCl). Meanwhile in the damaged ganglion cells staining due to RNA was considerably weakened. Figures for the content of nucleic acids in the damaged cells and DNA content in hydrolyzed sections were practically identical. In other words, damaged retinal ganglion cells lose RNA (Table 1).

During chemical degeneration of retinal ganglion cells RNA can thus disappear from the cytoplasm while the mean DNA content is preserved. The increased strength of Danielli's reaction and of staining with ninhydrin are evidently associated with liberation of reactive groups during RNA breakdown.

LITERATURE CITED

1. L. F. Larionov and E. M. Brumberg, Dokl. Akad. Nauk SSSR, 54, No. 3, 267 (1946).
2. V. G. Petrova, Arkh. Anat., Gistol. i Émbriol., No. 5, 67 (1961).
3. G. I. Roskin and M. E. Struve, Tsitologiya, No. 4, 415 (1959).
4. G. I. Roskin and E. S. Kirpichnikova, Arkh. Anat., Gistol. i Émbriol., No. 5, 27 (1961).
5. A. N. Trifonova, Dokl. Akad. Nauk SSSR, 61, No. 5, 917 (1948).
6. A. D. Deitch, J. Histochem. Cytochem., 12, 451 (1964).