The results of the present experiments thus show conclusively that the pituitary plays a role in the regulation not only of erythropoiesis, but also of neutrophilopoiesis.

LITERATURE CITED

1. E. M. Voino-Yasenetskaya and L. M. Gol'ber, Byull. Éksp. Biol. Med., No. 11, 29 (1971).
2. P. D. Gorizontov, Arkh. Patol., No. 8, 3 (1973).
3. Yu. B. Deshevoi, Probl. Gematol., No. 11, 37 (1977).
4. L. N. Karlik, I. I. Burachevskii, and N. N. Belavina, Byull. Éksp. Biol. Med., No. 2, 112 (1937).
5. R. V. Petrov, R. M. Khaitov, N. V. Aleinikova, et al., Radiobiologiya, No. 4, 560 (1976).
6. V. P. Fedotov, É. R. Bagramyan, and L. V. Aleshina, Probl. Éndokrinol., No. 2, 102 (1971).
7. I. Berman and A. S. Gordon, Am. J. Physiol., 173, 184 (1953).
8. R. C. Crafts, Endocrinology, 29, 595 (1941).
9. R. C. Crafts and H. A. Meineke, Ann. N.Y. Acad. Sci., 77, 501 (1959).
10. D. Landaw and A. S. Gordon, Endocrinology, 51, 157 (1952).
11. H. A. Meineke and R. C. Crafts, Blood, 12, 11 (1957).

MITOTIC ACTIVITY AND CELL COMPOSITION OF ACINI IN REGENERATING EXTRAORBITAL LACRIMAL AND SUBMANDIBULAR SALIVARY GLANDS

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After partial injury to the salivary and lacrimal glands proliferative processes spread to all the residual parts of the glands [1, 3, 5] and, according to the concept of regeneration hypertrophy [4], they ought to lead to a definite increase in its weight. It has, however, been shown that the terminal portions in the remnant of the glands do not increase in size [1]. The question thus arises: how can new cell formation be interpreted in this case. It has been suggested that before proliferation begins, cells throughout the remnant of the gland die at a more rapid rate, and that the wave of mitosis is intended to make good this loss. To shed light on this phenomenon, it seemed logical to study the composition of the terminal portions, where a decrease in the number of cells could indicate the scale of cell death, whereas an increase could indicate the completeness of regeneration.

The object of this investigation was to compare mitotic activity in remnants of the extraorbital lacrimal and submandibular salivary glands with data on the cell composition of their acini at successive periods of regeneration.

EXPERIMENTAL METHOD

Experiments were carried out on 59 noninbred male albino rats weighing 250-300 g. In the experiments of series I about one-third of the extraorbital lacrimal gland was destroyed by burning in 21 rats. In series II the submandibular salivary gland was subjected to the same injury in 23 rats. The glands of five (series I) and ten (series II) animals, not subjected to any form of procedure, served as the control. The material was processed by the usual histological methods. Cells found in the acinus (total secretory cells, mono- and binuclear cells separately) were counted in sections 7-10 μ thick in regions remote from the site of trauma in 100 terminal portions from each animal. Mitoses were counted in 10,000 cells in the same zone. The numerical results were analyzed by Student's t-test and the Wilcoxon–Mann–Whitney U-test [2].

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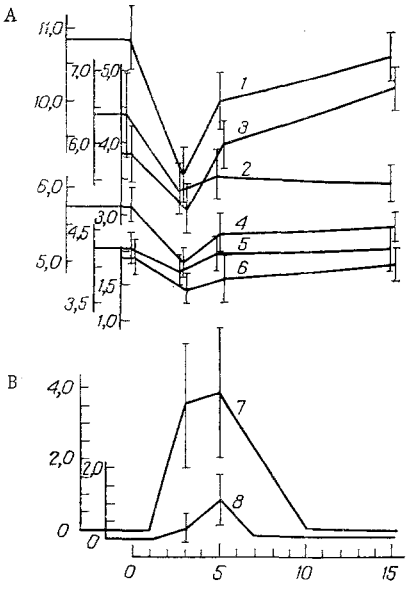

Fig. 1. Cell composition of terminal portions and mitotic activity in intact parenchyma of regenerating extraorbital lacrimal and submandibular salivary glands. Ordinate: A) number of secretory cells per section through acinus as a whole (1, 4) and number of mononuclear (2, 5) and binuclear (3, 6); B) mitotic index (in $^0/_{00}$); abscissa, time after trauma (in days). 1-3, 7) Extraorbital lacrimal gland; 4-6, 8) submandibular salivary gland.

TABLE 1. Correlation between Composition of Acini and Mitotic Index (MI) in Remnants of Extraorbital Lacrimal Gland in Individual Rats Killed 3 and 5 Days after Trauma (M ± m)

No. of Rat	3 days		5 days	
	Number of cells per section through terminal portion	MI, ‰	Number of cells per section through terminal portion	MI, ‰
1	7,58±0,24	6,00±0,77	9,23±0,42	0
2	7,81±0,26	15,90±1,26	9,33±0,39	3,50±0,59
3	8,70±0,43	0,40±0,20	9,50±0,35	14,70±1,21
4	8,75±0,33	3,00±0,54	9,93±0,39	0,20±0,14
5	9,01±0,34	1,80±0,42	9,95±0,37	0,70±0,26
6	9,23±0,36	2,20±0,47	10,19±0,47	8,70±0,93
7	9,72±0,42	0	10,88±0,55	0,10±0,10
8	10,49±0,36	0	11,34±0,46	3,10±0,56
	8,92±0,36	3,66±1,78	10,04±0,31	3,88±1,80

EXPERIMENTAL RESULTS

The principal quantitative data obtained are given in Fig. 1. Three days after trauma, when proliferative processes in the old parenchyma were beginning to intensify, a statistically significant ($P < 0.01$) decrease was found in the number of secretory cells per acinus. The fall in the number of mono- and binuclear cells counted separately showed even greater fluctuations ($P \leq 0.05$), but from approximate calculations the impression was obtained that binuclear secretory cells died at a relatively higher rate than mononuclear.

The deficiency of cells in the acini was most probably the result of their death. Evidence in support of this conclusion is given, in particular, by pictures of vacuolation of the cytoplasm, pycnosis of the nuclei, and total disintegration of single cells or, less frequently, of several cells located side by side in the acinus; these

phenomena were particularly intensive between 24 and 54 h after trauma. Judging from the reduction in the composition of the acini of the uninjured parenchyma, the remnant of the extraorbital lacrimal gland lost about 18%, and that of the submandibular salivary gland about 14% of its secretory cells as a result of secondary destruction. Characteristically, the subsequent proliferative processes took place more intensively in the extraorbital lacrimal gland than in the submandibular gland.

The fact that some sort of correlation exists between the degree of the cell deficiency in the terminal portions (or the scale of their mortality), on the one hand, and mitotic activity on the other hand, can be judged also from a comparison of these parameters in individual rats killed 3 days after trauma (Table 1). It was found that on the whole, the fewer cells that remained in the acini, the higher the mitotic index. Correlation analysis revealed fairly strong negative correlation in this case (coefficient of correlation $r = -0.71 \pm 0.29$; $P < 0.05$), which, as might be expected, was not linear in character (correlation ratio $\eta = 0.86$; curvature $\beta = 0.73$). This situation was valid, evidently, only for triggering of proliferation, for later (5 days) the mitotic index was virtually independent of the number of cells in the acini ($r = -0.18 \pm 0.20$).

By the time of the last observations (15 days) the number of cells in the secretory portions was almost back to the initial level, but did not exceed it; moreover, in the extraorbital gland some degree of disproportion still remained between mono- and binuclear cells. Mitotic activity was virtually reduced to zero.

These results confirm the view that proliferation of parenchymatous cells in the remnant of an organ is regenerative in character [4]. At the same time, under the conditions of these experiments with the extraorbital lacrimal and submandibular salivary glands, the intensification of mitotic activity evidently served to make good the deficiency of secretory cells arising as a result of degenerative changes in the acini of the old parenchyma rather than to make good the loss of tissue destroyed during injury.

LITERATURE CITED

1. A. G. Babaeva, in: Regeneration and Cell Multiplication in Animals [in Russian], Moscow (1964), p. 78.
2. E. V. Gubler and A. A. Genkin, The Use of Nonparametric Statistical Criteria in Medical and Biological Research [in Russian], Leningrad (1973).
3. P. P. Gusak, Byull. Éksp. Biol. Med., No. 10, 106 (1966).
4. L. D. Liozner, in: Advances in the Study of Regeneration [in Russian], Moscow (1977), p. 7.
5. T. P. Poradovskaya, Ontogenez, No. 6, 586 (1971).