factorily with the corresponding values for nondividing neutrophils in rats of another strain [2]. The mean renewal time of the subcompartments of metamyelocytes and band and segmented neutrophils, allowing for the reserve population, was 14.1 and 31 h respectively. Hence it follows that the mean total transit time through the compartment of nondividing neutrophils in rats is 45.1 h.

LITERATURE CITED

1. K. N. Muksinova, L. D. Murzina, and V. S. Voronin, Med. Radiol., No. 1, 67 (1975).
2. T. B. Constable and N. M. Blackett, Cell Tissue Kinet., 5, 289 (1972).
3. C. G. Craddock, S. Perry, L. E. Ventzke, et al., Blood, 15, 840 (1960).
4. D. M. Donohue, R. H. Reiff, M. L. Hanson, et al., J. Clin. Invest., 37, 1571 (1958).
5. J. Heilmeyer, Dtsch. Med. Wochenschr., 82, 683 (1957).
6. J. C. Marsh and S. Perry, Blood, 23, 581 (1964).

CYTOLOGICAL ANALYSIS OF THE INTACT AND REGENERATING LIVER OF VARIOUS STRAINS OF RATS

Z. A. Ryabinina

UDC 612.6.03:612.35.014.2

A comparative cytological study was made of the control and regenerating liver in two strains of rats: August and cotton-tail. Two-thirds of the liver was removed from both groups of experimental animals and the intact organ served as the control. The animals were killed five or six at a time 30 h and 3, 8, 42, and 120 days after partial hepatectomy. The number of binuclear cells, the dimensions of the mononuclear hepatocytes and of their nuclei, and the mitotic activity and ploidy of the cells were studied. With the exception of mitotic activity, the regenerating and intact liver of the August rats differed from the regenerating and intact liver of the cotton-tail rats in all the above-mentioned cytological parameters. It is concluded that differences in the cytological parameters between the two different strains are due to the genotype of the particular strain.

KEY WORDS: *Hepatocytes; regenerating liver; August rats; cotton-tail rats.*

There is little information in the literature on the dependence of the cytological features of regenerating mammalian internal organs on genotype. For instance, in inbred mice considerable differences have been found in the number of nucleoli in the lymphocytes and liver cells [4]; polymorphism of certain proteins in different strains has been discovered [1]; significant differences in the number of ovulations and in the pre- and postimplantation mortality of embryos have been demonstrated in female mice of different strains [5]; differences in the cell composition of the liver have been established [3] and differences in mitotic activity, associated with different rates of regeneration of the liver after resection have been found in mice of different strains [2].

The object of this investigation was to compare the cytological features of the intact and regenerating liver of rats belonging to different strains.

Laboratory of Growth and Development, Institute of Human Morphology, Academy of Medical Sciences of the USSR, Moscow.

(Presented by Academician of the Academy of Medical Sciences of the USSR A. P. Avtsyn.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 82, No. 8, pp. 987-989, August, 1976. Original article submitted December 24, 1975.

TABLE 1. Intact and Regenerating Liver of Inbred Rats (M±m)

	Cotton-tail rats						August rats					
	body weight (in g)	weight of liver		diameter of		% of bi-nuclear cells	body weight (in g)	weight of liver		diameter of		% of bi-nuclear cells
		g	%	hepatocyte	nucleus			g	%	hepatocyte	nucleus	
				μ						μ		
Intact liver												
Control	119±5,0	5,2±0,28	4,3±0,23	9,8±0,34	4,6±0,11	8,7±1,12	192±5,1	10,2±±0,15	5,3±0,06	15,2±0,42	6,1±0,10	17,0±±1,26
Regenerating liver												
Time after operation:												
30 h	117±8,0	3,5±0,22	3,0±0,11	11,5±0,43	4,9±0,10	3,4±0,28	156±7,5	4,0±0,42	2,5±0,04	14,5±0,42	5,8±0,22	8,0±0,44
3 days	108±9,4	3,9±0,42	3,6±0,21	12,0±0,43	5,8±0,21	5,0±1,76	227±1,3	7,4±0,42	3,2±0,03	14,6±0,48	5,5±0,22	3,0±0,44
8 days	111±7,3	4,7±0,21	4,2±0,13	10,9±0,22	4,6±0,05	4,8±0,88	204±20,1	6,6±0,84	3,3±0,04	16,0±0,48	7,0±0,22	6,5±0,42
42 days	152±7,1	4,9±0,84	3,2±0,07	11,9±0,38	4,8±0,16	7,8±1,68	241±5,0	8,2±0,36	3,4±0,06	15,2±0,48	6,5±0,32	6,2±0,54
120 days	189±7,0	6,4±0,20	3,4±0,05	10,6±0,27	4,6±0,11	8,0±0,21	269±11,8	9,5±0,42	3,5±0,03	16,1±0,42	6,4±0,11	10,2±±1,40

EXPERIMENTAL METHOD

Young sexually mature August and cotton-tail rats aged 3-4 months were used. Two-thirds of the liver was removed from the experimental animals; the intact liver and the part of the liver resected at operation served as the control. The dynamics of changes in weight of the regenerating organ, the number of binuclear cells, mitotic activity, the dimensions of the cells and their nuclei, and the distribution of the hepatocytes among the classes of ploidy were studied. The regenerating liver was studied 30 h and 3, 8, 42, and 120 days after resection of the organ. Control animals were killed at the corresponding times.

EXPERIMENTAL RESULTS

The process of restoration of the weight of the regenerating liver conformed to the ordinary pattern for animals of this species in both groups of rats (August and cotton-tail): the weight of the resected liver gradually increased and was fully restored to the control level after 42 days.

Counting the number of binuclear cells revealed differences in the cytological picture of the intact and regenerating liver in the two strains. In the control cotton-tail rats binuclear cells accounted for 8.7% of the total number of hepatocytes, whereas in August rats they were twice as numerous (17%).

Partial hepatectomy caused a decrease in the number of binuclear cells. This phenomenon was observed in both strains of rats, but in the cotton-tail rats the number of binuclear hepatocytes was restored to the control level after 42 days, whereas in the August rats this recovery was not observed even after 4 months.

Measurements of the diameters of the mononuclear hepatocytes and their nuclei are given in Table 1. The dimensions of the hepatocytes and their nuclei in the regenerating liver of the cotton-tail rats showed little change throughout the period of investigation. A similar picture was observed also in the August rats. However, differences between the strains were observed with respect to this parameter: the hepatocytes and their nuclei were always larger in the August than in the cotton-tail rats.

The results of the cytophotometric analysis showed that the intact and regenerating liver of the cotton-tail rats at all times of the investigation except 3 days after partial hepatectomy consisted of diploid cells, and the number of tetraploid cells did not exceed 10%; the class of octaploid hepatocytes was gradually absent. The control liver of August rats contained 27-30% of tetraploid cells, but the main mass of hepatocytes, just as in the cotton-tail rats, consisted of diploid cells.

During regeneration the liver tissue underwent polyploidization: the number of tetraploid cells increased and, starting with the 8th day after resection, cells with octaploid nuclei began to appear. This class of nuclei was found 42 and 120 days after the operation; after 120 days octaploid cells accounted for 8-12% of the total number of hepatocytes in the August rats. In the regenerating liver of the cotton-tail rats the ratio between the classes varied only between diploid and tetraploid cells (with an increase in the percentage of the latter), for even in the later stages of regeneration, no octaploid cells were observed in these animals.

Consequently, as regards the distribution of hepatocytes among the classes of ploidy, the regenerating liver of the August rats also differed from the regenerating liver of the cotton-tail rats.

A study of mitotic activity revealed no significant differences between the two strains investigated, for considerable individual variations were observed in this parameter. In August rats the mitotic index 30 h after partial hepatectomy was $14^{\circ}/_{oo}$, compared with $20^{\circ}/_{oo}$ in the cotton-tail rats. On the 3rd day the index fell to $14^{\circ}/_{oo}$ in August rats and to $2^{\circ}/_{oo}$ in cotton-tail rats. In the later stages mitoses were seen only rarely in the regenerating liver of both strains of rats.

Comparative cytological analysis of the intact and regenerating liver of cotton-tail and August rats thus revealed differences between the strains in the cytological mechanisms participating in restoration of the lost mass of the organ (polyploidy, presence of binuclear cells), probably on account of the genotype of the particular strain.

LITERATURE CITED

1. N. N. Klepikov, in: The Biology of Laboratory Animals [in Russian], No. 3, Moscow (1971), p. 3.
2. L. D. Liozner, A. G. Babaeva, V. F. Sidorova, et al., Byull. Éksp. Biol. Med., No. 2, 95 (1972).
3. Z. A. Ryabinina, Byull. Éksp. Biol. Med., No. 10, 94 (1973).
4. D. Ivanyi, Exp. Cell Res., 64, 240 (1971).
5. A. Leonard and G. Deknudt, Exp. Anim., 4, 1 (1971).

SPECIFICITY OF THE ESTRADIOL-BINDING SYSTEM OF THE GUINEA PIG UTERUS

R. N. Shchedrina, S. V. Sturchak,
E. G. Bobrova, V. L. Ishkov,
K. K. Pivnitskii, and N. D. Fanchenko

UDC 612.627.8:612.621.31

The degree of affinity of steroids of the estrone series for the estradiol-binding system of the guinea pig uterus was analyzed. The factor determining interaction with the receptor system of the guinea pig uterus was found to be the presence of free hydroxyl groups in positions 3 (phenol) and 17β and their mutual orientation. The results suggest that the biological activity of steroids is determined by the character of their structural interaction with the receptor systems of the uterus.

KEY WORDS: *Estradiol-binding system; steroid-receptor interaction.*

Much attention is now being paid to the mechanism of interaction of hormones with tissue receptors [8-10].

In this investigation the properties of the estradiol-binding system, identified previously [4] in the uterus of guinea pigs, were studied.

EXPERIMENTAL METHOD

The estradiol-binding system consisted of the 105,000g cytosol and the 800g supernatant of the uterus of sexually immature guinea pigs [4]. The same general pattern is observed when both fractions are used [4, 13]. The protein content in the system was determined by Lowry's method [12]. The following substances were used: estradiol-17β-6,7-^{3}H (specific activity 56 Ci/mmole, Radiochemical Centre, Amersham, England) and unlabeled steroids (Fig. 1) — estradiol (No. 1), estrone (No. 5), estriol (No. 7), ethinylestradiol (No. 2; Calbiochem, USA), and L-estradiol, Jenapharm, East Germany; steroids Nos. 9, 11-13, 15-17, 19-43, and 45-48 (all of the D-series) were obtained in the course of the writers' synthetic investigations [1-3, 5, 6] and they had constants which corresponded to data in the literature. The remaining steroids were obtained from the Laboratory of Steroid Hormonal Chemistry, All-Union Pharmaceutical Chemical Research Institute.* Radioactivity was measured on a Tricarb 3320 liquid scintillation spectrometer with a counting efficiency as ^{3}H of 50%.

*The writers are grateful to Candidate of Chemical Sciences G. S. Grinenko for providing the series of synthetic steroids.

All-Union Research Institute of Obstetrics and Gynecology, Ministry of Health of the USSR. Institute of Experimental Endocrinology and Hormone Chemistry, Academy of Medical Sciences of the USSR, Moscow. (Presented by Academician of the Academy of Medical Sciences of the USSR L. S. Persianinov.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 82, No. 8, pp. 989-993, August, 1976. Original article submitted March 28, 1975.