

MORPHOLOGY AND PATHOMORPHOLOGY

PERCENTAGES OF VARIOUS TYPES OF ADENOHYPOPHYSIAL CELLS IN FEMALE MICE OF STRAINS C3H AND C57B1

(UDC 611.814.32-018.1-019)

V. I. Romanov

Institute of Experimental Biology, Academy of Medical Sciences of the USSR, Moscow

Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 61, No. 5,

pp. 116-118, May, 1966

Original article submitted July 8, 1964

It is well known that female mice of the strain C3H develop cancer of the mammary glands in 90% of cases, even when they remain virgin. By contrast, mice of the C57B1 strain practically never contract this disease. Many oncologists consider that cancer of the mammary glands arises as a result of some disturbance in the correlation between the hormonal activity of hypophysis and ovary. From experiments carried out on rats [4, 6] it appears that the proliferative processes in mammary glands are controlled by the combined influence of estrogens and the follicle-stimulating hormone of the hypophysis. Without the follicle-stimulating hormone, however, there can be proliferative processes taking place in the mammary glands and consequently no hypoplasia, even though the estrogen level is high [2, 3]. It should be noted, however, that certain authors have put forward other points of view [8].

The aim of this particular investigation was a comparative determination of the percentage composition of the various types of cells in the anterior lobe of the pituitary gland in mice belonging to the strain C3H, which are highly susceptible to cancer, and the strain C57B1, which has a low cancer incidence. We also aimed at determining any quantitative changes which might occur in the adenohypophysis at various stages of the estrous cycle.

EXPERIMENTAL METHODS

The experiments were conducted on 20 sexually mature, nonpregnant female mice. Ten of these belonged to the strain C3H (weight 15 to 19 g) and the other ten to the strain C57B1 (weight 18 to 24 g). The animals were in various stages of the estrous cycle. They were killed at 11 to 12 h. Their hypophyses were fixed in mercuric formol fixative and the material embedded in paraffin wax; sections 4 μ in thickness were cut from the block. These sections were stained by the methods of McManus and Hotchkiss [9, 7] with certain modifications. Cells were counted in the following zones: on the boundary with the intermediate lobe, centrally, and peripherally. In all we counted about 100,000 cells of the pars anterior of the hypophysis. In order to determine quantitative changes among the different types of cell in the adenohypophysis at various stages in the estrous cycle, we took two animals from each line at four different stages of the cycle.

The data was treated statistically using the Fisher-Student test.

RESULTS

As can be seen from Table 1, acidophilic cells predominate in the pars anterior of mice belonging to both strains, although they are somewhat less abundant than the chromophobic cells in the zone forming the boundary with the pars intermedia in mice of the strain C57B1 (chromophobes 48.28%, acidophils 47.36%). The basophils are least numerous.

The abundance of basophilic cells in the central zone of the pars anterior in mice of the C57B1 strain is greater (7.27%) than in the same zone among mice of the C3H strain (4.22%).

Statistical treatment of data relating to the percentage composition of analogous cells in the adenohypophyses of mice belonging to the two different strains C3H and C57B1, revealed a significant difference between the two contents of basophilous cells in the central zone ($P < 0.0001$), and also between the acidophils and chromophobes of the zone adjacent to the pars intermedium ($P = 0.001$; $P = 0.011$). In all other cases the differences were statistically insignificant.

TABLE 1. Percentage Composition of Different Types of Cells in the Adeno-hypophysis of Female Mice of the C3H and C57B1 Strains

Zone	C3H			C57B1		
	acido- philis	baso- philis	chromo- phobes	acido- philis	baso- philis	chromo- phobes
Peripheral	53,08	4,39	42,50	50,03	4,41	45,53
Central	56,31	4,22	39,44	52,35	7,27	40,35
Boundary with pars intermedium	54,27	4,12	41,58	47,36	4,32	48,28

TABLE 2. Percentage Composition of Different Types of Cells in the Adeno-hypophysis of Female Mice of the C3H and C57B1 Strains at Different Stages of the Estrous Cycle.

Zone	C3H			C57B1		
	acido- philis	baso- philis	chromo- phobes	acido- philis	baso- philis	chromo- phobes
Diestrus						
Peripheral	53,03	6,16	40,79	50,62	5,16	44,15
Central	60,23	4,82	34,94	53,05	7,77	39,17
Boundary with pars intermedium	59,60	4,62	35,76	48,75	4,19	47,04
Proestrus						
Peripheral	52,70	3,94	43,34	50,41	4,48	45,09
Central	56,23	3,86	39,89	51,71	6,54	41,73
Boundary with pars intermedium	54,42	4,45	41,11	48,81	4,18	46,07
Estrus						
Peripheral	55,48	2,51	42,00	45,73	4,53	49,73
Central	50,87	4,06	43,05	52,17	7,81	40,00
Boundary with pars intermedium	52,12	4,03	43,82	44,98	4,18	50,82
Metestrus						
Peripheral	57,06	3,80	39,12	56,62	2,56	40,81
Central	60,09	4,67	35,23	52,60	6,69	40,70
Boundary with pars intermedium	56,05	4,47	39,47	46,49	3,35	50,14

It is evident from Table 2, that the variation in relative numbers of cells at various stages of the estrous cycle is mainly a variation in the basophilic cell content of the peripheral zone. This agrees with what has previously been reported in the literature [10, 11]. On the basis of the structural peculiarities exhibited by the basophilic cells, it is possible to show that they are concerned with gonadotropic hormone production, and that this hormone is therefore produced in the peripheral zone of the adenohypophysis.

It is not clear why there should be an increase in the number of basophilic cells in some phases of the estrus, whereas in other phases the cells partially disappear. It is possible that this sequence is related to the accumulation and liberation of the secretion which gives the basophilic cells their specific staining properties.

It can be seen from Table 2, that the minimum content of basophilic cells in the peripheral zone of the adenohypophysis of C3H mice is associated with estrus (2.51%), whereas in mice of the C57B1 strain it coincides with metestrus (2.56%). The maximum content of basophils in mice of both strains coincides with diestrus (6.16 and 5.16%, respectively). Hence, the basophilic cell content of the peripheral zone in relation to the phases in the estrous cycle differs from the two strains. The two strains are out of step with each other in this respect.

In C3H mice, the transition from the maximal content of basophilic cells (diestrus) to the minimal (estrus) takes place gradually. In C57B1 mice, whereas the transition from maximal to minimal basophilic cell contents is a smooth one, that from minimal (metestrus) to maximal (diestrus) is not smooth but takes place in a rapid jump.

In mice of the highly cancerous strain C3H, it has been found possible to observe some disturbance in the regular rhythm of gonadotropic hormone secretion, such that periods of increased secretion in these mice do not alternate with periods of diminished hormone production [5]. It has been shown that the mammary gland epithelium of C3H mice does not proliferate only during the period of estrus but during diestrus also [1]. These observations taken together with the results of the experiments just described suggest that the absence of any sharp change in the number of basophilic cells elaborating gonadotropic hormones in C3H mice is indicative of a relative constancy in gonadotropic hormone secretion in such mice. Disturbance in the normal periodicity of gonadotropic hormone secretion causes hyperplasia of the mammary glands and tumor formation. One cannot, however, overlook the fact that among mice of the C57B1 strain, the basophil cell content of the central part of the adenohypophysis (7.27%) is considerably greater than in mice of the strain C3H (4.22%). The central zone of the adenohypophysis consists mainly of basophils of the thyrotropic series. These differences between the two groups of thyrotropic cells are evidently related to different degrees of activity of the thyroid gland, which in turn is of great interest in relation to providing a possible explanation for the causes underlying the development of mammary gland cancer.

S U M M A R Y

It was shown that in mice of strains C3H and C57B1 acidophilic cells predominate in the hypophysis. Basophilic cells are least in number. These are followed by chromophobic cells. Variations in the quantitative composition of cells according to the cycle stages occur among the basophilic cells of the peripheral zone of the hypophysis. The largest content of basophils was noted in the diestrus, the smallest of the estrus (in mice of strain C3H) and metestrus (in mice of strain C57B1).

LITERATURE CITED

1. S. S. Laguchev, *Byull. Éksper. Biol.*, No. 3 (1962), p. 83.
2. N. I. Lazarev, *Arkh. Pat.*, No. 2 (1960), p. 3.
3. N. I. Lazarev, *Vestn. AMNSSSR*, No. 1 (1961), p. 13.
4. V. I. Samoilov, *Proceedings of the 2nd Conference for Young Scientists of the Institute of Pathology and Cancer Therapy, USSR Academy of Medical Sciences [in Russian]*, Moscow (1958), p. 12.
5. N. M. Turkevich, *Pat. Fiziol.*, No. 3 (1957), p. 28.
6. T. G. Khaleeva, *Probl. Endokrinol.*, No. 4 (1958), p. 93.
7. R. D. Hotchkiss, *Arch. Biochem.*, Vol. 16 (1948), p. 131.
8. W. R. Lyons, *Proc. Roy. Soc. B.*, Vol. 149 (1958), p. 303.
9. J. F. A. McManus, *Nature*, Vol. 158 (1946), p. 202.
10. H. D. Purves and W. E. Griesbach, *Endocrinology*, Vol. 49 (1951), p. 244.
11. *Idem, Ibid.*, Vol. 56 (1955), p. 374.

All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. Some or all of this periodical literature may well be available in English translation. A complete list of the cover-to-cover English translations appears at the back of the first issue of this year.
