THE MUCOID CELLS OF THE ADENOHYPOPHYSIS OF THE RABBIT DURING PREGNANCY AND LACTATION

E. CAMERON, C. L. FOSTER AND M. ALLANSON

Department of Biology, St Mary's Hospital Medical School, London

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Summary. Following a fall *post coitum*, the mucoid cells of the adenohypophysis of the female rabbit increase in numbers to values up to 100% higher than normal during the second half of pregnancy. Then follows a sharp decrease before parturition and, thereafter, the numbers remain at approximately normal levels during lactation.

This general pattern is observed in both the pars distalis proper (pdp) and zona tuberalis (zt), except that in the latter the small decrease *post coitum* may not be significant. It is suggested that:

(1) The drop in numbers in early pregnancy in pdp is due to a loss of specific mucoid granules and is to be correlated with the preovulatory release of LH.

(2) The increase in cells in mid-pregnancy in pdp is correlated with an increased production of LH necessary to maintain pregnancy.

(3) The increase in zt is correlated with the production of FSH associated with parturition and the subsequent post-partum oestrus.

INTRODUCTION

The following is a more detailed account of an investigation which has already been presented in abstract form (Cameron, Foster & Allanson, 1966). It is a continuation of work whose object has been to elucidate the function of the cells of the adenohypophysis (Foster, 1963; Foster & Cameron, 1964; Young, Foster & Cameron, 1965a, b; Allanson, Cameron & Foster, 1966).

Wolfe, Phelps & Cleveland (1934) investigated the alteration in cell numbers in the adenohypophysis of the rabbit during oestrus and pseudopregnancy, using trichome stains. They did not, however, distinguish between the pars distalis proper and the zona tuberalis regions of the gland which differ from each other in a number of important respects (Allanson, Foster & Menzies, 1959; Foster & Cameron, 1964; Young *et al.*, 1965a).

MATERIALS AND METHODS

Five virgin female and thirty pregnant and lactating primiparous Dutch rabbits were used. All were approximately 6 months old. The grouping of the animals is shown in Table 1.

The technique of fixation by perfusion with formal-calcium chloride-cadmium chloride has been described elsewhere (Allanson *et al.*, 1959). Paraffin sections at 5 μ were cut serially in the horizontal plane and were stained with PAS-orange G.

Cell counts were made from suitable fields of the pars distalis proper and the zona tuberalis imaged on the ground-glass screen of a microscope fitted with a projection head. By this means, because of the large size of the fields, a considerable number of cells could be counted in three or four comparable areas from each gland.

TABLE 1
GROUPING OF EXPERIMENTAL ANIMALS

Group (days post coitum)	No. of animals in group	
	<i>Pars distalis proper</i> (pdp)	<i>Zona tuberalis</i> (zt)
Control	5	5
Pregnancy 1 to 5	2	2
6 to 10	3	2
11 to 15	2	3
16 to 20	2	1
21 to 25	3	2
26 to 30	3	3
Lactation 31 to 35	4	4
36 to 40	2	4
41 to 45	2	3
46 to 50	3	3
51 to 55	0	0
56 to 61	3	3

The sections were from approximately midway through the gland and always included the pars distalis proper (pdp), zona tuberalis (zt), pars intermedia and infundibular process at one and the same time (for the relations of these regions see Young, Foster & Cameron, 1965a, b).

RESULTS

Since the individual granules of mucoïd cells cannot readily be resolved by the light microscope, the extent of the granulation of these cells must be inferred from the intensity of their staining with PAS. The histograms shown in Text-fig. 1 were based on the number of cells showing a strong PAS reaction. These were assumed to be heavily granulated and thus to possess a high hormone content.

EXPLANATION OF PLATE 1

All sections are horizontal and stained with PAS-orange G. The PAS-positive mucoïd cells are darkly stained. All $\times 190$.

FIG. 1. A small representative portion from the lateral area of the pars distalis of a normal female rabbit showing distribution of PAS-positive mucoïd cells.

FIG. 2. A similar area to that shown in Fig. 1 from a rabbit 5 days pregnant. There is a marked decrease in the number of PAS-positive mucoïd cells.

FIG. 3. A similar area from a rabbit 15 days pregnant showing a marked increase in the number of PAS-positive mucoïd cells.

PLATE 1

(Facing p. 200)

It will be seen (Text-fig. 1a) that, during the first week or so of pregnancy, there was a decrease in the number of mucoïd cells in pdp as compared with the control animals (Pl. 1, Figs. 1 and 2). Thereafter, the numbers of mucoïd cells rose to well above normal values until just before parturition (Pl. 1, Fig. 3), when there followed a sharp decline to numbers slightly below those of the virgin females. This condition persisted for the whole of the lactation period, i.e. up to about 60 days *post coitum*.

TEXT-FIG. 1. Histograms to illustrate changes in the frequency of PAS-positive mucoïd cells in the pars distalis (a) and zona tuberalis (b) of the rabbit during pregnancy (left) and lactation (right). The horizontal broken line indicates the numbers of these cells in control animals and the vertical one the time of parturition.

Events in the zona tuberalis (Text-fig. 1b) followed a similar pattern. The reduction in the number of mucoïd cells in early pregnancy, however, was neither so striking, nor so prolonged, as in pdp, and may be of doubtful significance. On the other hand, the increase in mucoïd cells in mid- and late-pregnancy was even more marked and the decline in numbers to about normal levels at parturition was equally sharp.

DISCUSSION

Although the PAS-orange G technique probably demonstrates both gonadotrophic and thyrotrophic cells in this material and with the fixative employed, it has not been possible to distinguish between them. The methods recommended by Da Lage & Racadot (1963) and by Kanematsu & Sawyer (1963) for differentiating between gonadotrophs and thyrotrophs in the rabbit hypophysis

were also tried, but the results obtained were unsatisfactory. This may have been due to the fact that, in this work, a different fixative was used. Thus any attempt to correlate the results described above with gonadotrophic activity rests on the assumption that, during pregnancy and lactation, it is the gonadotrophic cells which are likely to show the greatest numerical fluctuations.

The tentative conclusion from previous work (Foster, 1963; Foster & Cameron, 1964) was that the LH gonadotrophs were located primarily in pdp and the FSH gonadotrophs in zt, although electron microscopical studies have not shown these cell types to be morphologically distinct (Salazar, 1963; Young *et al.*, 1965a, b).

It could, therefore, be argued that the increase in mucoid cells in pdp was associated with an increased production of LH and the maintenance of pregnancy, whereas that in zt was correlated with the production of FSH in preparation for parturition and a post-partum oestrus. Likewise, the sharp drop in numbers in both pdp and zt just before parturition would, in this view, be associated respectively with the termination of pregnancy and the initiation of oestrus. This interpretation is supported by the work of Hill (1934), who showed that the gonadotrophic potency of the rabbit pituitary, after decreasing *post coitum*, climbed to its highest level at mid-pregnancy before declining again during late pregnancy.

The decrease in mucoid cells in pdp during the first week or so of pregnancy is presumably to be correlated with the release of the LH responsible for ovulation and corresponds rather closely with the decreased gonadotrophic potency reported by Hill (1934). Wolfe *et al.* (1934) also described a reduction in the numbers of basophil cells in the rabbit during the first 6 days of pseudo-pregnancy; they did not differentiate, however, between pdp and zt. As was mentioned earlier, the small decrease *post coitum* in zt may have no special significance.

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