Inability of LH Administered in a Delay Vehicle to Maintain Luteal Function[1] (34915)

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Luteinizing hormone (LH) has the capacity to modify progesterone secretion in the rat, increasing it in acute experiments (1) and reducing it when given chronically (2). It has been observed that LH is also an effective inducer of estrogen secretion in intact and hypophysectomized rats when administered in a delay vehicle, such as sesame oil plus 5% beeswax (3, 4). The present experiments were designed to test the ability of LH administered in a delay vehicle to maintain luteal function (*i.e.*, progesterone secretion).

Methods and Materials. The rats used in this experiment were obtained from the Holtzman Company, Madison, Wisconsin at 55 days of age. They were housed in a light-, temperature-, and humidity-controlled room. Food and water were supplied *ad libitum*. Vaginal smears were observed for 1 week prior to hypophysectomy. Hypophysectomy was done under ether anesthesia on the day the vaginal smears became leukocytic following estrus, and all animals were assigned to their respective treatment groups by formal randomization. One group was treated with prolactin[2] (NIH-P-S8, 2.5 IU in 0.2 ml of saline injected twice daily); other groups received 0, 2, 10, and 50 μg of NIH-LH-S12, respectively. The LH was administered in sesame oil plus 5% beeswax. Treatment with prolactin or LH was initiated immediately after hypophysectomy and continued for 5 days.

To test luteal function all rats received 20 μg of estradiol in 0.2 ml of corn oil on the day of hypophysectomy and 10 μg in 0.1 ml of corn oil on alternate days thereafter. In the absence of endogenous progesterone the vaginal smear becomes filled with cornified epithelial cells, to the exclusion of leukocytes. In the presence of progesterone, the smear remains leukocytic. All hormones were administered subcutaneously.

Results and Discussion. Rats treated with prolactin developed leukocytic vaginal smears within 72 hr following hypophysectomy (Table I). The smears remained leukocytic until termination of the study on the fifth to sixth day indicating continued progesterone secretion from the corpora lutea. The vaginal smears of all rats treated with LH remained cornified following hypophysectomy independent of the amount of the hormone administered in the delay vehicle. The biological activity of the LH used was verified by injecting two hypophysectomized rats with 50 μg daily. Although these animals received no exogenous estrogen the vaginal smears became cornified in 96 hr, an established response to this hormone (4, 5). Thus, it was demonstrated that three dose levels of LH administered in a delay vehicle did not maintain progesterone secretion in the nonpregnant, hypophysectomized rat. This finding is in accord with those of previous investigations in which LH administered in an aqueous vehicle failed to support luteal progestational function in nonpregnant rats (2, 6).

In contrast, LH administered alone in a delay vehicle has been shown to be effective in maintaining pregnancy in hypophysectomized rats (7). This finding may be dependent upon the presence of the conceptus. Alloiteau

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TABLE I. Inability of LH Carried in a Delay Vehicle to Maintain Leukocytic Vaginal Smears in Estrogen-Treated Hypophysectomized Rats.

Group	Treatment[a]	No. of rats	Percentage of rats having cornified vaginal smears (hr after hypophysectomy)		
			72	96	120
A	Prolactin	5	0	0	0
B	Sesame oil + 5% beeswax (oil)	7	100	100	100
C	2 μg LH in oil	8	87.5	87.5	100
D	10 μg LH in oil	8	87.5	100	100
E	50 μg LH in oil	6	100	100	100

[a] Each animal received 20 μg of estradiol on the day of hypophysectomy and 10 μg on alternate days thereafter. Prolactin, NIH-P-S8, was given as 2.5 IU in 0.2 ml of saline twice daily. Sesame oil plus 5% beeswax (oil) alone or as a vehicle for NIH-LH-S12 was administered as 0.2 ml once daily.

and Bouhours (7) have suggested that LH is required to maintain estrogen titers necessary for the continuance of pregnancy. Armstrong *et al.* (9) hypothesize that prolactin promotes progesterone synthesis by preventing increase in the levels of 20α-hydroxysteroid dehydrogenase which converts progesterone to the nonprogestational compound 20α-hydroxypregn-4-en-3-one.

Thus, LH, which we have found unable to support progestational function in the nonpregnant rat, appears to have a role in support of gestation. Whether this role involves maintenance of progesterone secretion *per se* as suggested by Moudgal *et al.* (10), is under investigation. The overview of rat corpus luteum function remains that progesterone secretion in the nonpregnant animal is maintained by prolactin and this secretion can be modified but not maintained by LH alone.

Summary. It has been demonstrated that LH administered in delay vehicle to hypophysectomized nonpregnant rats does not support the progestational function of corpora lutea.

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