

were not taken. This is being done in the present series of experiments. The calcium and phosphorus returned to normal in 4½ to 7 hours in 4 of the dogs but remained elevated in 3 dogs 7 hours after the injection.

When normal heparinized blood was perfused through the thyroid-parathyroid apparatus, the collected perfusate upon intravenous injection yielded no significant change in serum calcium and serum inorganic phosphorus. The maximum elevation in calcium was 0.6 mg % and in phosphorus 1.0 mg %. Eleven experiments involving the perfusion of both decalcified and normal bloods have been performed and are interpreted as evidence that a low serum calcium is a stimulus for the parathyroid glands to produce more hormone.

Summary. Preliminary investigations involving (a) the intravenous injection of sodium oxalate into normal and parathyroparal dogs and (b) the perfusion of decalcified blood through the thyroid-parathyroid apparatus and injection of the perfusate into normal dogs, indicate a humoral control (low blood calcium) of the parathyroid glands.

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Progesterone Effect on Pituitary Lactogen Content and on Mammary Glands of Ovariectomized Rats.*

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Selye^{1, 2} has shown that the administration of progesterone alone is sufficient to induce the development of the lobule-alveolar system of the mammary glands of ovariectomized rats. Since the mammary glands of such rats showed no histological evidence of secretory activity, it was of interest to determine the influence of progesterone on the lactogen content of the pituitary gland.

Twenty-four sexually mature virgin rats were ovariectomized and

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¹ Selye, H., *Proc. Soc. Exp. Biol. and Med.*, 1940, **43**, 343.

² Selye, H., *Anat. Rec.*, 1940, **78**, 253.

divided into 4 groups on the basis of body weight. Beginning 14 days after ovariectomy 6 rats were injected subcutaneously daily for 10 days with 15 mg of progesterone,[†] in 0.5 cc of peanut oil, 6 were injected subcutaneously daily for 10 days with 33 gamma of estradiol benzoate,[†] 6 were injected subcutaneously daily for 10 days with 15 mg of progesterone + 33 gamma of estradiol benzoate, and 6 rats received no treatment. About 24 hours after the last injection the rats were killed and the pituitaries, adrenals, and thyroids (with the exception of the progesterone group) weighed. The 2 abdominal mammary glands were removed from each rat and one was studied as a whole mount and the other one in histologic section. The pituitary glands were assayed for their lactogen content by injecting the suspended tissue intradermally over the crop gland of common pigeons. Each group of pituitaries was assayed against each other group of pituitaries in 10 pigeons. Since the assay results for any one group of pituitaries were quite consistent the average of the 3 assays is presented.

Progesterone increased the lactogen content of the pituitary and this increase was brought about to a great degree by increasing the hormone concentration, since there was very little increase in pituitary size. Estrogen was more effective in augmenting the lactogen content than was progesterone, for estrogen not only increased the hormone concentration but it also caused pituitary hypertrophy. Progesterone + estrogen was slightly less effective in increasing pituitary lactogen content than was estrogen alone but slightly more effective than progesterone alone. Pituitary hypertrophy and an increase in hormone concentration were responsible for the increase in hormone content. The adrenal glands of the progesterone group and those of the progesterone + estrogen group weighed slightly less and those of the estrogen group slightly more than did those of the control group. During the 10-day injection period the control group made an average gain in body weight of 7 g, the progesterone group 17 g, and the progesterone + estrogen group 4 g. The estrogen group, on the average, lost 10 g in body weight. These results are summarized in Table I.

The mammary glands of the control rats consisted of an involuting duct system. The estrogen group's mammary glands consisted mainly of an extensive duct system with the ducts distended with secretory products. Progesterone treatment stimulated moderate

[†] The progesterone and the estradiol benzoate were kindly supplied by Dr. E. Schwenk of the Schering Corporation.

TABLE I.
Effect of Progesterone in the Spayed Rat.

Treatment (No. of rats)	Avg body wt		Avg pituitary wt, mg	Bird units per pituitary gl.	Bird units per mg pituitary tissue	Avg adrenal wt, mg	Avg thyroid wt, mg
	beginning g	end g					
None (6)	219	226	9.5	15	1.58	44.2	23.0
15 mg progesterone daily—10 days (6)	217	234	10.1	27	2.67	39.9	
33 γ estrogen daily—10 days (6)	215	205	14.9	38	2.55	48.3	24.5
15 mg progesterone + 33 γ estrogen daily—10 days (6)	215	219	15.1	33	2.19	41.0	27.1

lobule-alveolar development and only very limited secretory activity. The mammary glands of the progesterone + estrogen group showed extensive lobule-alveolar development and secretory activity somewhat greater than that observed in the progesterone group.

We were able to confirm Selye's^{1, 2} observations of the positive effects of progesterone alone on the vagina and uterus of the spayed rat.

Conclusions. The daily injection of 15 mg of progesterone for 10 days into sexually mature spayed rats increased the lactogen content of their pituitary glands, caused no significant increase in pituitary weight, and induced moderate development of the lobule-alveolar system and limited secretory activity of the mammary glands. The daily administration of 15 mg of progesterone + 33 γ of estrogen for 10 days caused extensive lobule-alveolar growth of the mammary glands. The secretory activity of the glands was somewhat greater than that observed following progesterone treatment. This treatment was less effective than estrogen but more effective than progesterone in increasing the lactogen content of the pituitary gland.