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Luteinizing Hormone in Bird Hypophyses.*

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Since the follicle stimulating and luteinizing hormones have been shown to exist in mammalian hypophyses, an investigation to determine their presence in bird hypophyses seemed of interest. This would be of particular interest since the absence of corpora lutea in birds'[1] ovaries might lead one to suspect an absence of the luteinizing hormone in their hypophyses, when tested on mammals. An early observation led me to believe that bird hypophyses lacked the effective gonadotropic hormones for mammals because 10 fresh glands from 12-week-old chickens failed to induce ovarian changes or sexual precocity in an immature mouse.

More recently, Benoit,[1] working with duck hypophyses, and Witschi, Stanley and Riley,[2] working with turkey hypophyses, showed that the gonad-stimulating hormones from these birds were active in mammals. The results of similar studies on chicken hypophyses particularly with regard to the luteinizing hormone are reported here.

Chicken heads from a local butcher were collected at the end of each Saturday's kill during the spring of 1937. The hypophyses were removed and dropped into acetone and dried. Because of difficulties in obtaining material, no separation according to sex or age of the birds was made. In all, 2.5 gm. of powdered glands were obtained from approximately 2,000 birds.†

For testing, normal and hypophysectomized female rats and female rabbits were used. The powdered glands were injected as a watery suspension. Several different methods were used to detect the luteinizing hormones.

Pairs of immature female rats, 30 days old, received total doses of 10, 20, 30, 40, and 50 mg. of the powdered gland suspended in water. Three injections were made in 3 days, the animals killed

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1 Benoit, J., *C. R. Soc. Biol.*, 1935, **118**, 672.

2 Witschi, E., Stanley, A., Riley, J., PROC. SOC. EXP. BIOL. AND MED., 1937, **36**, 647.

† The help of Mr. R. Royal and Mr. A. Riley in the laborious task of removing the glands is acknowledged with thanks.

24 hours after the last injection. The average ovarian weights obtained were 18.0, 28.3, 58.0, 53.4, and 39.8 mg. respectively (control 15 mg.). Follicular growth accompanied by oestrous changes in the uterus and vagina occurred in every case except in the 10 mg. dose and corpora lutea were found in the ovaries of rats receiving 30 mg. doses or higher. The loss of some material at the injection site at the highest dosage accounted for the drop in ovarian weight. These results, in general, are the same as obtained ordinarily with rat hypophyseal implants.

The augmentation test has been used to detect luteinizing hormone whereby in the presence of the follicle stimulating hormone, the luteinizing hormone will markedly increase the ovarian weight in immature rats and produce luteinized ovaries.[3] An extract of menopause urine was injected as the follicle-stimulating hormone (F.S.H.). In the first experiment (Table I), F.S.H. equivalent to

TABLE I.
Augmentation Test for Luteinizer.

Exp.	Ovarian Weights, mg. F.S.U.	Chick A.P.	Combined	% Augmentation
1	15.0	25.5	36.3	
	16.0		29.0	155
			31.0	
2	29.4	21.3	56.3	
	31.3	23.0	49.2	222
			89.2	

100 cc. of urine and 50 mg. of chicken hypophyses were used; in the second experiment, F.S.H. equivalent to 150 cc. and 30 mg. of chicken hypophyses were used. The results are given in Table I. Using 15 mg. as an established control ovarian weight, the gain in ovarian weight in the combined injections divided by the sum of the separate gains gave the percentage of augmentation. The resulting 155% and 222% augmentation, in addition to the luteinized ovaries obtained with the combined treatment, indicated the presence of luteinizing hormone in chicken hypophyses.

The hypophysectomized rat ovary will respond to the luteinizing hormone, in the presence of an adequately grown follicle, by forming corpora lutea. Immature female rats were hypophysectomized and after a period of 12 to 14 days were injected with varying amounts of chicken hypophyses. The results are given in Table II. The vaginas of all injected rats were opened on the fourth day in the

[3] Leonard, S. L., *Endocrinology*, 1937, **21**, 330.

TABLE II.
Effect of Chicken A.P. on Hypophysectomized Rat Ovaries and Adrenals.

Exp.	Treatment	Adrenals, mg.	Uterus, mg.	Ovaries, mg.	Lutein Tissue
A131	90 mg. chick A.P. in 10 days	11.7	107.1	13.6	Traces
	" " " " " " " "	12.6	109.5	38.6	C. lutea
	30 mg. chick A.P. in 4 days	—	66.0	35.5	Traces
	Control	3.8	12.6	2.6	None
	"	4.5	19.6	1.6	"
A135	160 mg. chick A.P. in 15 days	3.8	129.8	26.3	C. lutea
	Control	2.8	23.8	2.1	None

oestrous stage and the ovaries contained ripe follicles. Some of the ovarian follicles in one rat had begun to luteinize on the fourth day. In 2 cases, many corpora lutea were formed after prolonged treatment.

The chicken hypophyses were also capable of inducing some repair of the atrophied adrenals. This was indicated by an increase in weight over the controls and marked enlargement of the cortex in every case when examined histologically. No changes were observed in the thyroids.

Evidence has been forwarded that ovulation in the rabbit is due, in part, to the luteinizing hormone.[4] Three adult female rabbits in heat were injected with an aqueous extract equivalent to 40 and 75 mg. of chicken hypophysis. Ovulation occurred in the ovaries of two rabbits receiving the 75 mg. dose but failed with the 40 mg. dose.

Summary. These results indicate that the chicken hypophysis is capable of stimulating both follicular growth and luteinization of the rat ovary. The presence of the luteinizer is verified by 3 different methods which are used to identify the luteinizer in mammalian hypophyses. Witschi, *et al.*,[2] have shown that turkey hypophyses contain the luteinizer, based on the results of corpus luteum formation in the ovaries of 2 hypophysectomized rats. This raises the question as to the function of the luteinizing principle in birds since no corpora lutea form in their ovaries. If the stimulation of ovulation is one of the functions of the luteinizing hormone, its presence in the bird gland may be explained on the basis of this particular function. It is possible that the luteinizing hormone will be found in the anterior pituitary of all vertebrates.

[4] Foster, M., and Hisaw, F. L., *Anat. Rec.*, 1935, **62**, 75.