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Lactogenic Hormone Content of the AP of the Pigeon.*

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It is quite generally accepted at the present time that the factor in the anterior pituitary which stimulates the proliferation of the pigeon crop glands and the initiation and maintenance of milk secretion in mammals is the same.[1,2] As a consequence the pigeon assay method for the determination of the amount of lactogenic hormone in the anterior pituitary of experimental animals has been preferred to the mammalian lactation test due to the much smaller amount of hormone and the short time required to obtain a positive response. This is true, especially, of the intradermal "micro" assay method.[1,3]

In spite of the general use of the pigeon as an assay animal, only a few qualitative observations have been reported concerning the lactogen content of the pigeon anterior pituitary. Riddle and Schooley[4] observed crop weight increases in pigeons following the implantation of pituitary glands from mature female and immature common pigeons.

* Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series No. 889.

1 Bergman, A. J., Meites, J., and Turner, C. W., *Endocrinology*, 1940, **26**, 716.

2 Bergman, A. J., and Turner, C. W., *J. Dairy Sci.*, 1940, **23**, 1229.

3 Meites, J., Bergman, A. J., and Turner, C. W., *Endocrinology*, 1941, **28**, 707.

4 Riddle, O., and Schooley, J. P., PROC. SOC. EXP. BIOL. AND MED., 1934, **32**, 1610.

Leblond and Noble[5] reported that the implantation of 5 mixed male and female pigeon pituitaries intradermally over the crop glands of pigeons gave definite proliferation which they graded between +3 to 4. Later Schooley and Riddle[6] showed that the pituitaries of male and female pigeons which had been incubating eggs would cause an increase in crop gland weight when implanted or injected into pigeons.

It seemed of interest, therefore, to determine the lactogen content of the anterior pituitary of the type of pigeon long used in our assays and compare it with the content in one type of large domestic pigeon, the White King.

Procedure. Normal male and female common and White King pigeons were sacrificed and the pituitaries removed, weighed and stored at a freezing temperature until assayed. For the assays, the pituitary glands were macerated, suspended in distilled water, and injected in a constant volume intradermally over the crop gland of common pigeons weighing 260-340 g. Both the minimum-micro technic[1] and the Reece-Turner[3,7] method of assay were employed. Previous study indicated that these assay methods are reproducible within a range of about ± 10%.[1,3]

Results. As in mammals, the pituitary of the male pigeon contains less lactogenic hormone than do the females. This is true in spite of the fact that the male pigeon aids the female in incubating the eggs and in feeding the squabs. The pituitary of the male White King as well as of the common pigeon by both methods of comparison contain only ½ to ⅓ as much lactogen as the female (Table I).

The common female pigeon, although considerably lighter in body weight than the Silver King, contains as much or more lactogen per pituitary. Per 100 g body weight, the pituitary of the Silver King contains only ½ to ⅔ as much lactogen as the common pigeon.

Discussion. The presence of a factor in the pituitaries of birds which appears to be identical with the factor in the mammalian pituitary concerned with the initiation of lactation is of interest phylogenetically. In the chicken, this factor seems to be related to the condition of broodiness;[8,9] in the pigeon with both broodiness and the secretion of a crop "milk" as well. In the pigeon, the proliferation of the crop glands is initiated with the onset of the incubation period[10,11] and reaches a climax at the time of hatching to feed the young. From these observations, it appears that the primitive activity of this factor of the pituitary was concerned with the brooding action of birds and in the preparation of the crop glands to secrete a satisfactory food; *i.e.,* pigeon crop milk for the newly hatched young.

In the evolution of the mammalian types,

TABLE I.
Lactogenic Hormone Content of the Pigeon Pituitary.

Group	Sex	No. of birds	Body wt, g	Pituitary wt, mg	Avg I.U. of lactogen: Per pituitary	Per mg pituitary	Per 100 g body wt
White King	F	8	486	4.29	.09*	.02	.02
" "	M	3	505	4.40	.03*	.01	.005
Common Pigeons	F	11	303	3.15	.13*	.04	.04
" "	F	8	276	4.32	.09†	.02	.03
" "	M	16	302	3.92	.03†	.01	.01

* Assayed by the minimum-micro technic.[1] (160 units = 1 I.U.)
† Assayed by the Reece-Turner method.[7] (22.2 units = 1 I.U.)

[5] Leblond, C. P., and Noble, G. K., PROC. SOC. EXP. BIOL. AND MED., 1937, **36**, 517.

[6] Schooley, J. P., and Riddle, O., *Am. J. Anat.*, 1938, **62**, 313.

[7] Reece, R. P., and Turner, C. W., *Mo. Agr. Exp. Sta. Res. Bul.* 266, 1937.

[8] Burrows, W. H., and Byerly, T. C., PROC. SOC. EXP. BIOL. AND MED., 1936, **34**, 841.

[9] Byerly, T. C., and Burrows, W. H., PROC. SOC. EXP. BIOL. AND MED., 1936, **34**, 844.

[10] Beams, H. W., and Meyer, R. K., *Physiol. Zool.*, 1931, **4**, 486.

the egg-laying monotremes, such as the duckbill platypus and the Australian ant-eater, would require a factor comparable to that present in birds to stimulate the act of incubation and thus provide for the hatching of the young.[12] It would seem reasonable that this same factor would play a role in the initiation of lactation at the close of the incubation period in many ways comparable to the relation of this factor in stimulating the gradual proliferation of a crop secretion to be utilized by the newly hatched squab.

The male pigeon takes part in the incubation of the eggs and in the feeding of the squabs. It is strange, therefore, that the inactive male pigeon pituitary contains definitely less lactogenic hormone than the female. In this respect it is quite comparable to the sex difference in the lactogenic content of mammals.[13]

The mechanism by which the pigeon pituitary is activated to the production of lactogen and the incubation of the eggs is not known. In the male, Patel[11] has indicated an association with the incubating female and the act of sitting on the eggs to be necessary for the formation of crop milk. Further, castration in one incubation cycle did not influence crop milk production by the male in that cycle but prevented "milk" production in succeeding periods.

The mechanism by which the lactogenic hormone in birds is stimulated to increased production in order to produce broodiness and crop milk formation and in the primitive mammals, the egg-laying monotremes, broodiness and milk secretion may be a sensory nervous stimulation comparable to the influence of light upon the gonadotropins of the pituitary. Whether the estrogens and androgens play roles in mediating the effect requires further investigation.

Summary. The lactogen content of the anterior pituitary of two types of pigeons, the common and the White King, were compared in both sexes. As in mammals, the pituitaries of the male pigeons contained only ½ to ⅓ as much lactogen as the female by all methods of comparison even though the male pigeon aids in the incubation of the eggs and in feeding the squabs.

The common female pigeon, although considerably lighter in body weight than the White King, contains as much or more lactogen per pituitary. Per 100 g body weight, the pituitary of the White King contains only ½ to ⅔ as much lactogen as the common pigeon.

[11] Patel, M. D., *Physiol. Zool.*, 1936, **9**, 129.

[12] Turner, C. W., *The Comparative Anatomy of the Mammary Glands*, Pub. Univ. Coop. Store, Columbia, Mo., 1939.

[13] Hurst, V., and Turner, C. W., *Endocrinology*, 1943, **31**, 334.

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Inactivation of Estrone in Normal Male Rabbits.

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The metabolism of estrogens in rabbits has been the subject of several conflicting reports. Smith and Smith[1] recovered less than 10% of the injected estrogens in the urine of these animals; Frank and his collaborators[2] found practically none in the blood after 30 minutes. The original observations were confirmed by Pincus and Zahl[3,4] and their findings implicated the uterus as an agent in the conversion of estrone to estriol, and the ovaries

[1] Smith, G. S., and Smith, O. W., *Am. J. Physiol.*, 1931, **98**, 578.

[2] Frank, R. T., Goldberger, M. A., and Spielman, F., PROC. SOC. EXP. BIOL. AND MED., 1931, **29**, 1229.

[3] Pincus, G., *Cold Spring Harbor Symposia on Quant. Biol.*, 1937, **5**, 44.

[4] Pincus, G., and Zahl, R. A., *J. Gen. Physiol.*, 1937, **20**, 879.