

amount of that factor increases when the testes are increasing in size.

The weight of the penis ranged between 0.25 and 0.40 gm. in 4 thyroidectomized ducks whose testes weighed between 2.3 gm. and 3.2 gm. The penis of 4 untreated control animals, with testes of approximately the same weight, (2.3 to 3.7 gm.) weighed from one to 2 gm., that is to say 4 to 5 times more than in the animals under experiment. In experimental ducks having larger testes, that difference exists also but is less marked (ratio = 2.1 to 2.5): Six thyroidectomized ducks with testes from 36 to 57 gm. had penis weighing from 0.9 to 1.7 gm., but the penis of 5 control ducks with testes from 31 to 61.6 gm. weighed from 2.3 to 3.6 gm.

*Summary.* Thyroidectomy exerts an inhibiting effect on the growth of the testis of the duck stimulated by electric light. This effect is very marked during 3-4 weeks, but diminishes later on. It is not yet possible to say if it disappears completely after a sufficient length of time.

Thyroidectomy exerts also an inhibitory effect on the development of the penis. This inhibition is more marked and more prolonged than that of the testes.

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#### **Influence of Hypophysis and Thyroid Glands on the Liver of the Duck.**

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It has been shown previously that the removal of the thyroid glands induces a very marked hypertrophy of the liver in both male and female ducks, mostly through an increase of the lipids, and that the injection of anterior pituitary extract enhances this hypertrophy.<sup>1</sup>

Other experiments were made on 38 ducks (with 33 controls) in order to study the weight of the liver under different experimental conditions: \* thyroidectomy, injections of different pituitary extracts, of urinary extract, and of benzogynoestryl<sup>2</sup> with varying

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<sup>1</sup> Benoit, J., *C. R. Ac. Sc. Paris*, 1936, **203**, 468.

\* The histological and chemical analysis of the livers obtained in these experiments will be published later.

<sup>2</sup> Benoit, J., *C. R. Ac. Sc. Paris*, 1934, **199**, 1671.

TABLE I.

Experiments	No. of birds	Duration experiment (days)	Wt. of 2 testes at autopsy (gm.)	Liver (gm.)		Ratio Liver (gm.) Body (gm.)	
				aver. wt.	extreme wt.	aver. wt.	extreme wt.
I. Pekin Ducks							
♂ Controls (d.l. or D)	17	—	1-10	54.59	36.87	22.84	14 to 36
♂ Controls (e.i.)	14	—	14-144	43.74	33-65	18.23	14 to 24
♂ Thyroidectomized (d.l. or D)	4	32 to 33	0.4-1.3	110	84-140	42.80	28 to 67
♂ Thyroidectomized (e.i.)	18	27 to 61	0.5-9.4	79.12	45-140	30.96	19 to 50
♂ inj. total extract anter. lobe (sheep) (d.l.)		28	1.87	52.84		26.75	
		30	0.52	141.63		42.92	
♂ Thyroidectomized + total extract ant. lobe (sheep) (d.l.)		31	0.78	180.87		72.64	
		31	0.86	63.21		32.92	
♂ inj. Antuitrin-S (d.l.)		20	—	53.31		23.6	
		20	—	31.32		15.3	
♂ inj. Benzogynoestryl (Roussel) (e.i.)		26	0.44	61.4		34.88	
		25	1.28	72.63		33.55	
		27	0.3	73.7		38.8	
		26	13.75	63.47		28.78	
♀ Controls (e.i.)		—	—	81.15		31.82	
		—	—	67.52		31.33	
II. Mallard Ducks							
♂ Controls (d.l.)	879	—	57.35	21.65		13.7	
	880	—	43.46	17.43		17.2	
♂ inj. Antuitrin-S (d.l.)	868	24	57.85	15.95		17.1	
	867	24	e (castrated)	20.71		21.	
♂ inj. Prolactin (d.l.)	873	21	47.7	30.75		28.7	
	874	21	o (castrated)	27.85		27.85	
d.l. = slight daylight (Fall). D = darkness. e.i. = electrical illumination.							

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degrees of illumination. The size of the testes, which depends upon the intensity of the illumination<sup>2</sup> was shown to be related to the size of the liver.

Table I shows that thyroidectomy is followed by a marked increase in the weight of the liver. On the other hand, this operation delays the testicular growth induced by illumination, as has been shown in another paper.<sup>4</sup> When in the thyroidectomized animals the testes have grown to some extent, the increase of the liver is less marked. Such an inverse relation between testes and liver has been observed in the pigeon by Schooley and Riddle.<sup>3</sup>

Anterior lobe extract induced in 2 ducks a hypertrophy of the liver. Extract of pregnancy urine (Antuitrin S) gave no significant changes, but prolactin did increase the weight of the liver.‡

The injection of pituitary extract seems to have increased the response of the liver in a thyroidectomized duck. A similar result had already been obtained in 2 thyroidectomized animals.<sup>1</sup>

The injection of benzogynosteryl (Roussel) induced an increase of the weight of the liver. Further experiments will show if the female sex hormone secreted by the ovary is responsible for the heavier liver in the female than in the male (Cf. table and <sup>1</sup>).

It must be added that neither castration nor hypophysectomy induced an increase in the weight of the liver (unpublished data).

It is probable that the prehypophysis affects the growth of the liver. The hypertrophy of the liver caused by the removal of the thyroids seems due, to a certain extent, to a change in the hypophyseal activity, namely stimulation of the hepatotropic function. Since the development of the testes and penis are lessened by removal of the thyroids<sup>4</sup> and the weights of the liver and testes vary inversely in both normal and thyroidectomized ducks, it is suggested that the gonadotropic and hepatotropic functions of the hypophysis act to balance each other. Finally, the possible interference of some disturbance of the general metabolism after thyroidectomy must not be overlooked.†

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<sup>3</sup> Schooley, J. P., and Riddle, O., *Anat. Rec.*, 1936, **67**, 51.

<sup>4</sup> Benoit, J., *PROC. SOC. EXP. BIOL. AND MED.*, 1937, **36**, 782.

‡ The increased weight of the liver after injection of pituitary extracts has already been observed by Carraro (1908), by Cooper and Chamberlain (1925) (posterior lobe extract), Riddle and Flemion (1928), Riddle and Polhemus (1931), Schooley and Riddle (1936) (extracts containing the gonad stimulating factor, or growth hormone, or prolactin), and by Best and Campbell (1936) (anterior lobe extract).

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