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Testosterone Propionate, a Bisexual Hormone in the American Chameleon.

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The androgen, testosterone propionate, is known to have some estrogenic effect in mammals;[1] in reptiles this effect is greater. It enlarges the oviduct of the immature alligator[2] and the adult lizard *Sceloporus,*[3] in the latter causing a growth of the mucous glands similar to that produced by theelin. In *Anolis carolinensis,* it will hypertrophy both male and female genital ducts and induce both male and female sex behavior.

Pellets of crystalline testosterone propionate (Ciba)* were implanted subcutaneously into gonadectomized and intact immatures of both sexes and into similar adults. Each category was composed of 4 experimentals and 4 controls occupying the same cage.† Immatures received an average of 2.68 mg, of which approximately 1.58 mg was absorbed in 24 days. Adults received an average of 5.22 mg of which 3.03 mg was absorbed in 30-36 days. A group of adult gonadectomized males and another of females were also implanted with pellets of crystalline estradiol dipropionate, averaging 8.50 mg, with absorption of approximately 1.04 mg in 17 days.

The oviducts of ovariectomized and intact immature and adult females were markedly hypertrophied by the pellets. Oviducts of adult ovariectomized controls averaged 6.79 mg while treated females averaged 36.34 mg. In cross-section, their mucosa exhibited numerous glands similar to those produced with estradiol dipropionate. Testosterone-treated immature females showed the same glandular hyperplasia of the mucosa.

Both testosterone and estradiol produced an intense keratinization of the cloaca in all treated females. Dantchakoff[4] has described this

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1 Groome, J. R., *Quart. J. Exp. Physiol.*, 1939, **29**, 367.

2 Forbes, T. R., *Anat. Rec.*, 1938, **72**, 87.

3 Gorbman, A., Proc. Soc. Exp. Biol. and Med., 1939, **42**, 811.

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† Assistance in the preparation of these materials was furnished by the personnel of Works Progress Administration Official Project No. 65-1-97-23 (WP. 10).

4 Dantchakoff, V., *Compt. rend. Soc. biol.*, 1938, **128**, 895.

effect in the *Lacerta* embryos of both sexes following folliculin treatment. The cloacal lining is mucoid in spayed and out-of-season females and also in all males. Testosterone will keratinize the cloacas of castrate immature and adult males. This estrogenic effect was also produced by estradiol in adult castrate males.

Testosterone propionate strikingly enlarges the ovaries of both immature and adult females. Ovaries of the immature females were as much as 3 times the size of controls. Normally only one egg enlarges in each adult ovary at one time. In treated adults, 2 or more ova developed together in one ovary. Weights of ovaries of adult controls ranged from 3.35 mg to 65.63 mg. Ovaries of treated adult females ranged from 31.29 to 309 mg. Testes, however, were smaller than in controls and showed little evidence of active spermatogenesis.

Wolffian ducts, which were very rudimentary in the immature females, were greatly hypertrophied by the testosterone pellets. They became as large as those of treated immature males. The epididymis and ductus deferens of adult castrate males were maintained by testosterone but not by estradiol dipropionate. The latter result is surprising since theelin will produce an enlargement of the male ducts in adult *Eumeces*[5] and young *Anolis*.[6]

Certain tubules of the kidney were markedly hypertrophied in all testosterone-treated *Anolis*. This "sexual segment" of Regaud and Policard[7] is in secretory activity in the normal adult males and assumes this condition in all testosterone-treated males and females. Kehl[8] reported this effect with benzoate of androsterone in adult female *Uromastix*. Gonadectomized control and estradiol-treated *Anolis* showed uniformly small kidney tubules.

Testosterone propionate pellets will induce male courtship and copulation in immature and adult females, whether ovariectomized or intact. The same implanted females will show estrous behavior and may be copulated with by either males or treated females. Estrous behavior includes: (1) a distinctive bend of neck, and (2) voluntary submission to copulation. Testosterone-treated females were observed to stand with necks flexed in this manner before males and treated females.

Pellets of testosterone propionate increase the aggressiveness of females. One treated female eventually dominates the group and assumes the rôle of a territory-holding male. Her activity partially

5 Turner, C. D., *Biol. Bull.*, 1935, **69**, 143.

6 Clapp, M. L., *Anat. Rec.*, 1937, **70** (Suppl. 1), 97.

7 Regaud, C., and Policard, A., *Compt. rend. Soc. biol.*, 1903, **55**, 973.

8 Kehl, R., *Compt. rend. Soc. biol.*, 1938, **127**, 142.

inhibits that of the other treated females. These, however, may show male behavior and also submit to copulation. Adult males, through their larger size and aggressiveness, are able to subdue the most dominant treated female which then submits to copulation.

Testosterone propionate pellets also produce full sex activity in immature and adult castrate males. One treated immature male, on 3 separate occasions, exhibited the estrous bend of neck and was copulated with 5 times. This male likewise copulated twice in male manner.

Summary. Testosterone propionate enlarges the Müllerian duct, keratinizes the cloaca and produces estrous behavior in *Anolis*. It also enlarges the epididymis, ductus deferens and sexual segment of the kidney, while producing male sex behavior. It has a gonadotropic effect on the ovary but not on the testis.

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Size and Stroke of the Normal Human Heart During Neosynephrin Bradycardia.*

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Marked bradycardia with pulse rates from 30 to 50 per minute is produced in normal young adults by therapeutic doses (3 to 10 mg subcutaneously) of neosynephrin—1-α-hydroxy-β-methylamino-3 hydroxy ethylbenzene hydrochloride (Keys and Violante[1]). The effect persists for 30 to 60 minutes or more and is not attended by any symptoms or sensations of cardiac or respiratory embarrassment. Since repeated trials failed to disclose any significant change in the total oxygen usage during the bradycardia it seemed probable that the total minute output of the heart was not seriously diminished. If this were so there should be a very appreciable increase in the stroke output. We have investigated this question with the roentgenkymographic method of Keys and Friedell.[2]

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1 Keys, Ancel, and Violante, Antonio, PROC. SOC. EXP. BIOL. AND MED., 1940, **44**, 4.

2 Keys, Ancel, and Friedell, H. L., *Am. J. Physiol.*, 1939, **126**, 741.