# EFFECT OF ADRENALECTOMY ON THE TESTES OF THE RAT.

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# Effect of Adrenalectomy on the Testes of the Rat.

S. C. FREED, B. BROWNFIELD, AND HERBERT M. EVANS.
*From the Department of Anatomy, University of California.*

In the literature, clinical observations are the most prominent in dealing with the relationship between the adrenals and the sex organs. There are many cases on record of precocious maturity, virilism, hermaphroditism, and other sex disturbances associated with adrenal pathology.[1] Most of the work on laboratory animals demonstrates changes in the adrenals due to castration,[2] pregnancy,[3] and ovulation.[4] The effect of adrenalectomy in suppressing the estrous cycle in rats is of little significance since the altered metabolism easily obscures any specific relationship.[5] Novak[6] found that the testes of adrenalectomized rats contained degenerated tubules, the younger rats being more susceptible to this condition than the older ones. MacMahon and Zwemer[7] noticed only changes in the interstitial cells of the cat testes. Jaffe[8] in working with large numbers of rabbits concluded that tubular degeneration occurs in only a small percentage of cases and that it is due to the general poor health of the animals. Feeding adrenal cortex is said to increase the size of rat and chick testes.[9, 10]

One is impressed, from Britton's recent review,[11] by the lack of

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[1] Barker and Hoskins, *Endo. and Metab.*, 1922, **2**, 345.

[2] Altenberger, *Pflüg. Arch.*, 1924, **202**.

[3] Donaldson, *Am. J. Phys.*, 1924, **68**, 517.

[4] Riddle, *Am. J. Phys.*, 1923, **66**, 322.

[5] Weyman, *Am. J. Phys.*, 1928, **86**.

[6] Novak, *Arch. f. Gynäk.*, 1913, **101**, 36.

[7] MacMahon and Zwemer, *Am. J. Path.*, 1929, **5**, 491.

[8] Jaffe, *J. Exp. Med.*, 1923, **38**, 107.

[9] McKinley and Fisher, *Am. J. Phys.*, 1926, **76**, 268.

[10] Hoskins and Hoskins, *Arch. Int. Med.*, 1916, **17**.

[11] Britton, *Phys. Rev.*, 1930, **10**.

uniformity in the results of numerous experiments on the effects of adrenalectomy. This is especially noticeable in the reports on the survival times of rats, a point of fundamental importance. Workers of much experience have for years stated that adrenalectomized rats live on for long periods due to the possession of accessory cortical tissue. In the hands of different experimenters, from 20 to 80% of the rats are able to withstand the operation successfully. In our first group of operations we found that about one-quarter of the animals seemed unaffected by having their adrenals removed, an outcome which was expected. Later in excising the gland, we detached with them one-quarter inch of the pedicle, the result being that there were no survivals. The immature males died regularly in 4 to 6 days after extirpation of their adrenals. Mature males in a smaller series lived on the average a day or two longer. Pencharz, Giragossintz and Olmsted[12] have shown convincingly that a minute fragment of cortical tissue is capable of regeneration which permits survival indefinitely. This explains the high percentages of animals which fail to develop adrenal insufficiency. In our experiment there were used only animals which displayed the symptoms of acute insufficiency.

The rats, after adrenalectomy, were observed continually until death was obviously near; they were then killed, the testes were weighed and fixed immediately. On gross examination, the testes were pale, soft, and edematous. In the immature rats, they were considerably lighter than their controls (Table I); the mature rats were unaffected in this respect. Histologically, the spermatic tubules were ragged, fragmented, and disorganized; clumps of cells lay in the lumina and often only the germinative layer remained in position. In the adult testes the spermatocytes were severely affected, staining ghost-like with eosin. The mature testis undergoes as great a degeneration as the immature, contrary to Novak's observations.

We offer here some evidence which indicates that this effect on the testes is not through any action on the hypophysis. Smith has conclusively shown that there is a direct relationship between the adrenals and the anterior lobe.[13] Hypophysectomy causes an atrophy of the cortex which returns to normal on replacement therapy. Absence of the anterior lobe results similarly in atrophied testes. There is a possibility that adrenalectomy might injure the hypophysis and so destroy the testes.

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[12] Pencharz, Giragossintz and Olmsted, *Science*, 1930, **72**, 175.

[13] Smith, *J. Am. Med. Assn.*, 1927, **88**, 158.

TABLE I.

| Adrenalectomized Males | | | Controls |
|---|---|---|---|
| Age at Operation in days | Age at Death in days | Weight of Testes in gm. | Weight of Testes in gm. |
| 26 | 29 | .320 | .405 |
| 26 | 29 | .360 | .410 |
| 26 | 29 | .430 | .440 |
| 26 | 30 | .490 | |
| 26 | 30 | .305 | .530 |
| 26 | 30 | .340 | .605 |
| 26 | 30 | .340 | .620 |
| 26 | 30 | .400 | .560 |
| 26 | 30 | .410 | .650 |
| 26 | 30 | .450 | |
| 26 | 30 | .410 | .520 |
| 26 | 30 | .480 | |
| 27 | 31 | .345 | |
| 26 | 32 | .690 | .320 |
| 27 | 33 | .370 | .710 |
| 27 | 33 | .335 | .700 |
| 27 | 33 | .330 | .810 |
| 30 | 34 | .610 | |
| 30 | 35 | .580 | |
| 30 | 35 | .500 | |
| 30 | 36 | .620 | .840 |
| 30 | 38 | .890 | 1.130 |

Daily injections of 1 to 2 cc. of urine of pregnancy containing maturity hormone is capable of stimulating readily the accessory sex organs in the male. After adrenalectomy, 4 or 5 daily injections will double the size of the immature seminal vesicles; the testes in the meantime, however, are rapidly degenerating in spite of the abundance of hypophyseal sex hormone.