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Thermo-Regulatory Function of Rat Scrotum. I. Normal Development and Effect of Castration.*

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It has been shown that the scrotum of certain mammals has a thermo-regulatory function,[1, 2] and that if the testes are experimentally placed within the abdominal cavity the germinal epithelium undergoes marked degeneration.[3, 4] In the ram, bull and boar the scrotum acquires the ability to contract and relax to temperature change as the testes begin the production of spermatozoa, and loses this ability following castration.[5] Further studies on the ram indicated that this function was apparently dependent upon the male hormone. Although the relations of temperature and contractility of the rat scrotum have not been investigated, Hamilton[6] reports that the rat scrotum depends upon male hormone for its development and maintenance and Wells[7] has demonstrated the dependence of the scrotal sac upon male hormone in the ground squirrel.

Procedure. The results of studies of the thermo-regulatory function of 7 normal and 6 castrate albino rat scrota are presented (age 9 weeks to maturity, Table I). Castration was performed at 5 weeks of age through a medial, abdominal incision. The contractility of the scrotum was measured by passing a thread attached to a recording lever through the skin on the ventral surface of the scrotum midway between the scrotal tip and the body; the rats were then anesthetized with nembutal and ether, securely fastened to a heavy animal board, and submerged, with the exception of the head, in a water bath. The temperature of the bath was decreased

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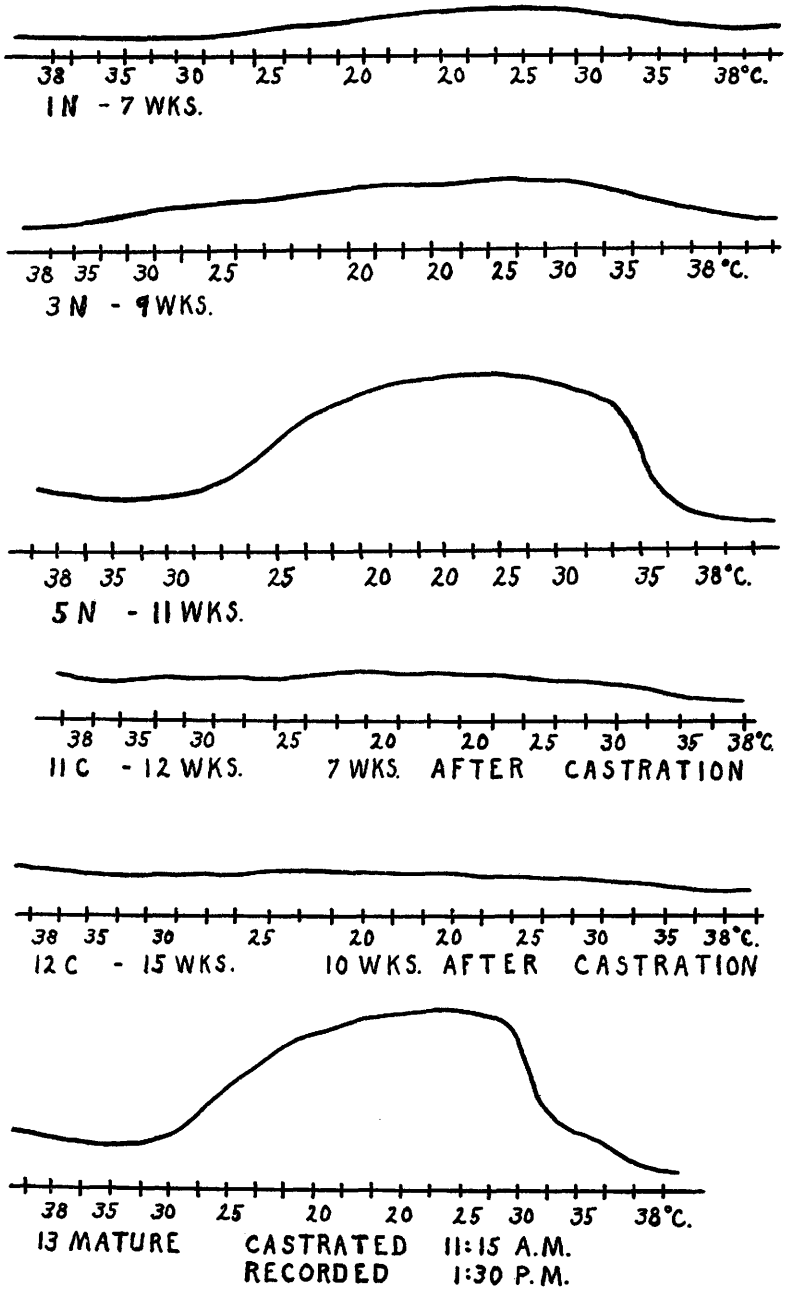

FIG. 1.

Tracings of kymograph records showing the effect of temperature change on the contractility of the rat scrotum. The time is recorded at two-minute intervals on the base line. N = Normal. C = Castrate.

TABLE I.
Development of Testis and Scrotal Sac in Normal Rats and of Scrotal Sac in Rats Castrated at 5 Weeks.

Rat No.	Age (wks)	Body wt at autopsy g	Testicular wt, g		Stage of spermatogenesis	Combined wt left and right scrotal sacs, g
			Left	Right		
1N	7	112	0.58	0.58	Sperm heads in some tubules	0.24
2N	8	141	0.76	0.72	" " " " "	0.27
3N	9	166	0.90	0.91	Abundant sperm	0.37
4N	10	191	1.10	1.17	Scattered "	0.28
5N	11	220	1.21	1.37	Abundant "	0.43
6N	12	226	1.40	1.43	" "	0.42
7N	14	249	1.27	1.20	" "	0.46
8C	6	96				0.11
9C	8	128				0.07
10C	10	184				0.11
11C	12	220				0.10
12C	15	227				0.18
13C	Mature	230				—

N = Normal. C = Castrate.

from 38°C to 20°C at the rate of about 1°C per minute and then raised to 38°C at the same rate. The scrotal movements were thus recorded on a kymograph. The rats were sacrificed immediately upon the completion of the kymograph records. The testes of the normal rats were removed, weighed fresh and fixed in Bouin's fluid, and the scrotal sacs (composed of the peritoneum, internal spermatic fascia, cremasteric skeletal muscle and external spermatic fascia[7]) were cut at the inguinal ring, weighed fresh, and fixed.

Results. Representative tracings of kymograph records showing the relation of temperature to scrotal contractility are shown in Fig. 1. The rapid testicular development initiated about the 9th week was followed by the ability of the normal rat scrotum to respond readily to temperature change. This ability did not develop in those rats castrated at 5 weeks of age. The presence of the testes in the scrotum is not essential as demonstrated by the fact that the fully developed scrotum of rat 13 responded readily although castration had been performed a few hours earlier. Testicular weights and changes, and scrotal sac weights are presented in Table I. The gradual loss of the thermo-regulatory function of the mature rat scrotum following castration, and the effects of cryptorchidism and male hormone upon scrotal contractility are now being studied in the hope that they may not only be of value in understanding the scrotal mechanism but of assistance in physiological assays of the male hormones.