COMPENSATORY HYPERTROPHY IN THE REMAINING TESTIS FOLLOWING UNILATERAL ORCHIDECTOMY IN THE ADULT RAM

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It is well known that in many mammalian species, including the sheep (Sundaram & Stob, 1967), unilateral ovariectomy leads to compensatory hypertrophy in the remaining ovary and an ovulation rate equal to that of the two ovaries in the control animals (Parkes, 1966). However, it has not been conclusively established that analogous compensatory changes occur in the remaining testis following unilateral orchidectomy. Although it has been shown in the hemicastrated adult rat that the remaining testis enlarges (Grant, 1957) and the epididymal sperm reserve increases to that of the two epididymides in the intact animals (Smelser, 1933), observations on the hemicastrated rabbit (Edwards, 1940) and other species (see Parkes, 1966) are conflicting. Previous studies were limited because of the lack of a technique for accurately assessing production of spermatozoa and fluid by the testis. Such a technique has recently been developed for the conscious ram (Voglmayr, Scott, Setchell & Waites, 1967) and has now been used to assess the function of the testis remaining after unilateral orchidectomy.

Nine Merino rams (3 to 5 years old, weighing 48 to 66 kg) were kept for 4 weeks before and during the experimental period in a controlled environment (21° C, 12 hr of light/day) and were maintained at constant body weight. In four rams one of the two testes was cannulated, allowing the collection of rete testis fluid and spermatozoa for a period of between 11 and 32 days (Voglmayr *et al.*, 1967). The cannulated testes were then removed and, at the same time, the testis remaining in one of these rams ('hemicastrates') was cannulated and the collection of testicular secretion was continued uninterruptedly for a further 120 days. In the other three hemicastrates, the remaining testis was cannulated 100 days post-operatively and testicular secretion was collected over the following 20 days. At the same time, collections of spermatozoa and rete testis fluid were made from one testis of each of five entire, control animals. The testes were weighed after excision and portions of testis tissue were fixed in Susa and stained with Alcian blue Feulgen. The diameter of the seminiferous tubules was measured as described by Hay, Lindner & Mann (1961).

By 120 days after hemicastration, the weight of the remaining testis had

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increased by 76% (S.E. $\pm 3.6\%$) above the weight of the testis removed at hemicastration, and by 94% (S.E. $\pm 16.7\%$) above the mean testis weight in the entire control animals (Table 1). Associated with the enlargement of the remaining testis was a greater rate of flow of rete testis fluid, whereas the concentration of spermatozoa in the fluid remained almost constant. The flow of rete testis fluid began to rise between the 32nd and 43rd day post-operatively and it continued to rise until about the 64th day so that the production of spermatozoa was almost twice that of the other testis before hemicastration. In both entire and hemicastrated rams the sperm output was in relation to testis weight and was approximately 17.5×10^6 cells/g testis/day. The mean diameter of the seminiferous tubules in the hemicastrates was significantly greater than in the entire animals and had increased from $181 \pm 6.5 \mu$ at hemicastration, to $238 \pm 5.9 \mu$ 120 days post-operatively.

TABLE 1
EFFECT ON THE SECRETION OF FLUID AND OUTPUT OF SPERMATOZOA IN
THE REMAINING TESTIS OF UNILATERAL ORCHIDECTOMY IN THE ADULT
RAM

	Entire rams (five)	Hemicastrated rams (four)	
		0 to 32 days pre-operatively	100 to 120 days post-operatively
Testis weight (g)	174.0 ± 8.35	192.0 ± 21.2	$338.0 \pm 26.7^{**}$
Fluid secreted (ml/testis/day)	28.3 ± 2.67	30.2 ± 4.1	$53.2 \pm 4.6^{**}$
Sperm concentration (10^6 cells/ml)	122.0 ± 18.1	111.0 ± 26.2	117.1 ± 15.7
Sperm output (10^9 cells/testis/day)	3.26 ± 0.59	3.10 ± 0.53	$6.04 \pm 0.44^*$

Values are the means $\pm$ S.E. for one testis per animal.

Numbers of rams are shown in parentheses.

* $P < 0.01$; ** $P < 0.001$.

Earlier observations in hemicastrated dogs and rabbits revealed that the compensatory enlargement of the remaining testis is attributable to an increase in the diameter of the seminiferous tubules (Ribbert, 1890). In the present study with adult rams, the expansion of the seminiferous tubules could account almost entirely for the increase in the testis weight. Further studies relating to the mechanism underlying the effect of hemicastration would be valuable.

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