ANDROGENIC AND OESTROGENIC EFFECTS ON
THE ENDOCRINOLOGY OF REPRODUCTIVE DEVELOPMENT IN
MALE AND FEMALE SHEEP (OVIS ARIES L.)

By

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SUMMARY

This thesis presents direct comparative information on growth and endocrinological aspects of reproductive development in intact and gonadectomized male and female Merino lambs born in autumn and treated prepubertally with either a non-aromatizable androgen (trenbolone acetate), oestradiol-17β (oestradiol), or a combination of these two steroid hormones. Lambs were implanted three to four times between the ages of one and eight months, and extensive endocrine measurements were made under field conditions from one to sixteen months of age. Some measurements were continued beyond this point. The effects of steroid treatment on sexual behaviour and some external body characteristics also were examined.

In gonadectomized male and female sheep, changes in activity of the hypothalamo-pituitary axis occurred in the absence of steroid feedback. The most obvious change was the seasonal rise in circulating concentrations of luteinizing hormone (LH) and follicle stimulating hormone (FSH) during summer and autumn. This gonadotrophic rise which in intact animals was modified by gonadal factors appeared to be temporally associated with pubertal events in intact ewes. Reproductive development in ewes was seasonally dependent and puberty occurred in autumn when animals were about one year of age. Reproductive development in rams appeared to be less sensitive to seasonal influences and was closely associated with body growth. There was an interaction between seasonal and nutritional effects on testis size and testosterone secretion.
Rams born in autumn reached puberty five to six months earlier than contemporary ewes.

Exogenous steroid treatment of gonadectomized lambs suppressed circulating gonadotrophin concentrations, the degree of suppression in both sexes being greater with trenbolone acetate than with oestradiol. Inhibition of gonadotrophin secretion in ram lambs with trenbolone acetate totally suppressed testicular growth and also retarded spermatogenesis for at least ten months. Oestradiol alone was less effective in suppressing testicular growth while the combination of trenbolone acetate and oestradiol was no more effective than trenbolone acetate alone in this regard. The negative effects of both steroids on maturation of the testes were reversed after steroid withdrawal. Trenbolone acetate was also effective in suppressing gonadotrophin and testosterone secretion and reducing testis size in adult rams.

Steroid treatment of intact ewes altered the normal developmental pattern of circulating gonadotrophins. Trenbolone acetate induced constant low LH and FSH concentrations. Oestradiol on the other hand did not reduce LH levels and produced variable responses in FSH concentrations. A proportion of oestradiol-implanted ewes started cycling during treatment and some time before control ewes showed signs of puberty. The latter finding suggested that oestradiol plays a key role in initiating and maintaining reproductive cyclicity in ewes.

Following suppression of the hypothalamo-pituitary axis by trenbolone acetate, reproductive development proceeded normally in intact ewes and reproductive cycles started shortly after twelve months of age. The number of cycles per ewe was higher in ewes previously exposed to trenbolone acetate than in control ewes.
However in ewes previously exposed to the androgen/oestrogen combination puberty was delayed beyond seventeen months of age.

Results for sexual behaviour in implanted gonadectomized rams and ewes, and intact ewes, support the view that male-type sexual responses in sheep are mediated by oestrogens. Testosterone acetate did not induce male-type behaviour in gonadectomized sheep and intact ewes and it abolished sexual behaviour in intact rams. The latter effect was most likely secondary to inhibition of endogenous gonadal steroid production.

A positive effect of oestradiol and a strong negative effect of trenbolone acetate on test length was observed in both males and females. Horn size in castrated rams was unaffected by either steroid, but it was reduced in intact rams, more so by trenbolone acetate than by oestradiol. The distinctive pink colouration of the skin in the inguinal region (sexual skin flush) that developed during summer and autumn in all trenbolone acetate-implanted animals, indicated that the expression of this androgen-dependent characteristic is related to season but is not sex limited.

Body growth in lambs maintained under field conditions was affected by exogenous steroids and responses appeared to be dependent on sex, presence or absence of the gonads and food availability. Intact ewes were the most responsive and intact rams the least responsive in this respect. By sixteen months of age earlier gains in body weight due to anabolic effects of exogenous steroids were less apparent.