FOLLICLE GROUPS IN THE SKIN OF A MOSAIC MERINO SHEEP.

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SUMMARY.

The section of skin growing lustre type wool had a ratio of secondary to primary follicles, approximately half that of the skin growing normal wool. The section had fewer primarily follicles and the size of the follicles was markedly larger.

INTRODUCTION.

Although somewhere in the vicinity of one hundred million sheep are shorn in Australia each year, comparatively few fleeces showing gross abnormalities seem to be brought to the notice of laboratories working on fleece improvement.

Sheep and wool classers recognise that there may be a transition from one wool quality to another in various parts of the fleece. These changes are usually gradual, although extremes may occur on the breech, or upon the neck folds of Merino rams.

Our attention was drawn recently to a Merino sheep showing mosaicism. As far as is known, the factors responsible for the development of this condition have not been determined. However, previous observers do not seem to have studied the distribution of follicle groups in the skin of mosaic animals. This paper reviews the work of previous observers and records the results obtained from examination of material which has recently become available.

REVIEW OF LITERATURE.

Ross (1933) described mosaicism in an animal from a flock in which Merino rams had been used for the previous 30 years. The fleece he saw was segregated into two distinct wool types, one being classified on character as a Lincoln wool of 46's count and the other as a finer wool of 64-66's count. The coarser wool had a staple length of $5\frac{1}{2}$ in. and mean fibre diameter of $31{\cdot}2\mu$. The fine wool had a staple length of 4 in. and a mean fibre diameter of $21{\cdot}7\mu$.

Kelley (1939) described two cases of mosaicism. One ewe had one area of coarse fibres confined to the loins. On the other there were extensive, though irregular, areas on each side of the sheep which grew fibres with fewer crimps per inch than the remainder of the fleece. The greater part of the fleece of the former animal was classed as a 74's spinning count and the mean fibre diameter was $19{\cdot}6\ \mu$. The coarser fibres were classed as a 58's spinning count and their mean fibre diameter was $26{\cdot}8\mu$.

Although the wool of the latter ewe was considered to vary between 56's and 70's spinning counts, it was found that there were only small differences in the diameters of fibres from different parts of the fleece. Histological examination of skin specimens from areas growing abnormal and normal wool revealed that the skin growing the coarser wool contained approximately half the number of follicles to be seen in the skin growing normal wool.

Bosman (1935) described a Merino sheep which had a distinctive band, about 3 in. wide, of long coarse wool growing transversely across the back and stretching over the sides towards the belly. Fibres from the abnormal part of the fleece measured 20·2 μ in diameter, while those from normal parts of the fleece measured 17·7 μ in diameter.

Lang (1952) reported examining the fibre diameters and fibre lengths of two distinct wool types growing on adjacent areas of the same sheep. One was a lustrous type of wool which had a mean fibre diameter of 27·0 μ and the other Merino type with a thickness of 18·2 μ.

Carter (1939, 1942) described a method for studying the distribution of follicle groups in the skin of Merino sheep and its application. The development and general histology of the follicle group in the skin of the Merino was described by the same author (Carter 1943), and the hair follicle group and its topographical variations in the skin of the Merino foetus were described by Carter and Hardy (1947).

Carter (1951) recorded variations in the ratio of secondary to primary follicles in different breeds of sheep. It commonly varied between 14:1 and 22:1 for Merino sheep and fell to as low as 5:1 or 4:1 for long-woolled sheep of the British breeds.

MATERIAL.

A sample of abnormal wool taken from the wither of a wether in Central Queensland was submitted to the Wool Laboratory by the representative of a woolbroking firm. Enquiries established that it came from the same sheep which grew the abnormal wool described by Lang (1952). The difference in the wool from the abnormal area and from an adjacent part of the fleece can be readily seen (Fig. 1).

Samples of skin were obtained from both the areas of abnormal and adjacent normal wool growth. These were sectioned histologically, and examined microscopically to determine the ratio of secondary to primary follicles.

The histological technique employed in the preparation of the skin samples was similar to that used by Carter (1939) with a few slight modifications.

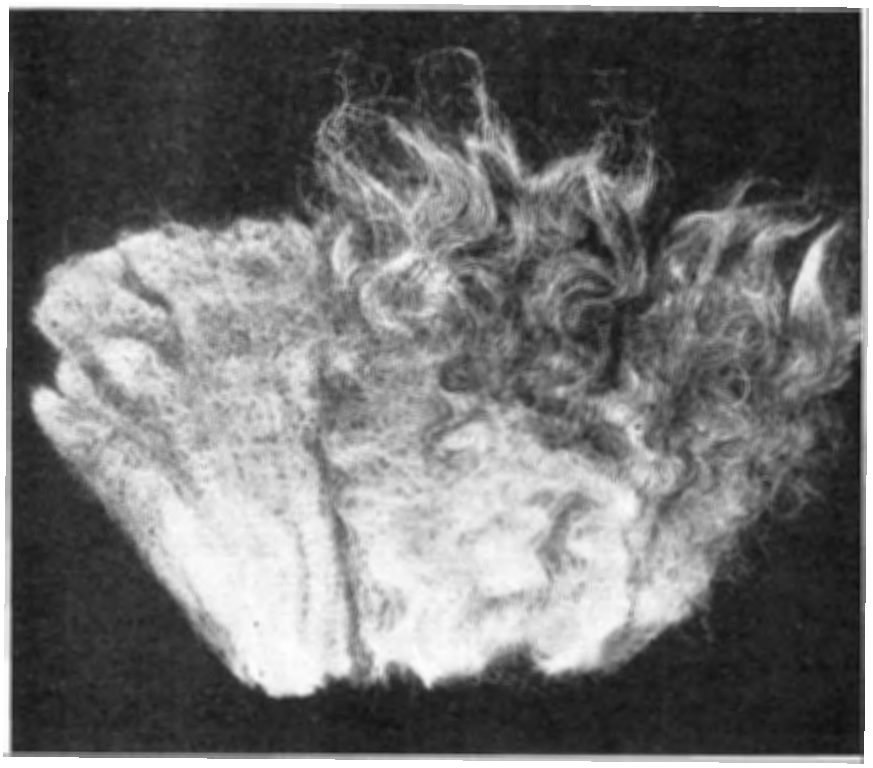

Fig. 1.

Lustre Type and Normal Merino Wools that Grew on Adjacent Areas on the Wither of a Merino Wether.

After being fixed in 5% formol saline for at least six days, any muscle and excess wool were trimmed off with scissors. The skin then went through the stages of dehydration and clearing into wax baths on an automatic tissue processor. A xylol-alcohol mixture was used as a sub-clearing agent, while the final clearing was done in two changes of xylol. The sample was impregnated with paraffin for three hours and finally in a mixture of 3% beeswax in paraffin wax for six hours before embedding. No attempt was made to prevent the skin from shrinking during processing, as the subsequent examination was primarily for ratio of secondary to primary follicles, and not for follicle population density.

During embedding, the skin was held firmly but not tightly between a glass slab and a small backing piece of glass by means of a clamp. This remained in position until the beeswax/paraffin wax mixture set. A warmed, rather than cooled, glass slab was found to be an advantage when the clamp was used.

Sections of 8μ in thickness were cut in series and mounted using an egg albumen/glycerin adhesive. These were stained with a modification of Mayer's acid haematoxylin, counterstained with an eosin-phloxine mixture and selectively stained with picric acid.

The examination of the sections was performed at a magnification of 115 x. The images of fibres falling within a square of 11·5 cm. were outlined for 18 fields on each sample. Follicles were distinguished as primary or secondary by the accessory structures described by Carter (1939). The number of each type of follicle was counted and the ratio of secondary to primary follicles calculated for each sample.

Samples of normal and abnormal wool were examined for medullated fibres by viewing them in transmitted light while immersed in orthodichlorbenzene.

RESULTS.

The results of fibre diameter measurement and skin sample examination are listed in Table 1.

Table 1.

Sample.	Mean Fibre Diameter (microns).	Standard Deviation (microns).	Coefficient of Variation (%).	Range (microns).	Rates of Secondary to Primary Follicles (Mean of 18 fields for each Sample).	Percentage of Primary Follicles.
SHEEP 1 :						
Normal area ..	18·2*	3·1†	17·1*	24†	17·3	5·5
Abnormal area ..	27·0*	6·5†	24·0*	28†	10·3	8·7

* Lang (1952) † Calculated from results*.

No medullated fibres were detected in either the normal Merino type or the lustre type wools comprising the specimen submitted by the representatives of the woolbroking firm.

DISCUSSION.

The ratio of secondary to primary follicles in the circumscribed area of skin growing the lustre type wool was approximately half that of the adjacent area on which normal wool grew. There were also fewer primary follicles in the skin carrying the abnormal wool than in that growing wool with normal Merino characteristics. The size of the follicles was also markedly larger.

Plates 2 and 3 are microphotographs at a magnification of 96x of sections cut from the skin growing abnormal and normal wools. These show the difference in the size and numbers of follicles and in the arrangement of follicle groups in the two areas.

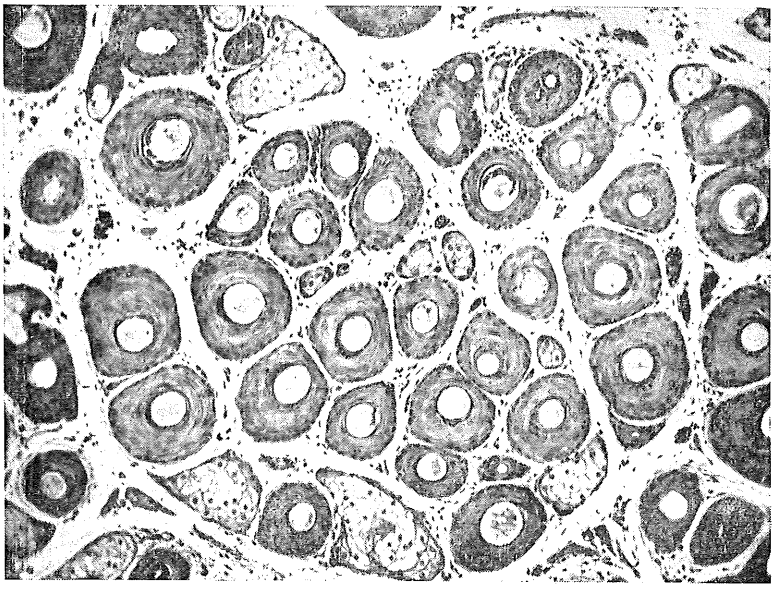

Fig. 2.

Microphotograph of a Section Cut from the Skin Growing Abnormal Wool. The fewer follicles, both primary and secondary, and the larger size of the fibres and follicles in the abnormal area can be seen by comparing Figs. 2 and 3. The average S/P ratio of 18 fields of the abnormal area is 10.3:1. (x96).

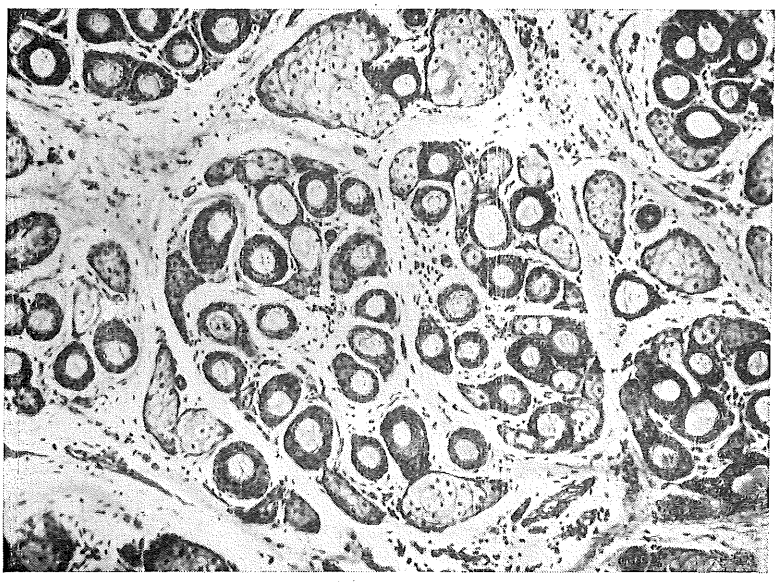

Fig. 3.

Microphotograph of a Section Cut from the Skin Growing Normal Merino Wool Adjacent to the Area of Abnormal Wool Growth. By comparison with Fig. 2, the smaller sizes of the fibres and follicles and their larger number are quite apparent. The average S/P ratio of 18 fields of this normal area is 17.3:1. (x96.)

Kelley (1939) suggested that mosaicism in sheep results from an interference during the later stages of embryonic development in the influence of certain chromosomes on cells associated with the growth of wool fibres. If this hypothesis is correct, the results reported in this paper indicate that the distribution, size and arrangement of the follicle groups are affected. The ratio of secondary to primary follicles in the skin growing the lustre type wool approximates closely to that which Carter (1951) considers to be normal to long-woolled sheep of the British breeds. In general appearance the lustre type wool is similar to that seen in British long-woolled breeds, except that it is somewhat shorter in length. The average fibre thickness of 27·0 μ is, however, finer than is normal for the British long-woolled breeds.

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