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Thesis submitted by

"B O U R N "

concerning subsection(e) 608, of
The Animal Husbandry Section of
the Master of Agricultural Science
Degree 1940.

STUDIES OF THE COAT OF THE NEW ZEALAND

ROMNEY LAMB.

practical and theoretical aspects of hair
morphology, with special reference to the
evolution of the fleece.

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INTRODUCTION.

The original purpose of the present thesis was to answer this question: "To what extent is a britch of high halo-hair abundance an indicator of the non-kemp hairiness of the fleece?" It was assumed by Dr. Dry in the light of earlier observations, that, on a britch with very many halo-hairs, the large Curly Tip fibres would be very hairy, and this has proved to be so. Especially did we want to learn about the degree of hairiness on the part of the fleece near to the britch. The gradient over the body from the britch was also much in mind, all the more because the boundary between the area on the britch with very many halo hairs and the neighbouring region with far fewer halo hairs is often abrupt.

The aim of the work was that just defined, but the analysis of the samples examined provided information on a number of other matters, several of which may be thought more interesting than the problem proposed at the outset. These various results are reported in this thesis.

In carrying out this work it was inevitable that I should review the facts and ideas contributed by earlier workers at the Massey Agricultural College. Their work has all passed through my mind. This little band of workers, it has been pointed out to me, has never been large and it has always been isolated. I have entered this school of thought from Professor Prawochenski's Department of the University of Cracow (Cracow, Poland) and have sometimes found myself offering interpretations alternative to those put forward at the Massey Agricultural College. These ideas have been welcomed, although those holding the older views tell me that they do not expect to prove wrong every time.

This will explain why I have dealt with my subject broadly and at some length. Not only has the method of presentation helped my working acquaintance with the class of fact and mode of thought of my new associates, but at the same time I have been encouraged to review critically the conceptions about the fleece which I have encountered in New Zealand.

X

W.F.

Guided thoughtfully by Dr. F.W. Dry, and his closest associate, Mr. J.A. Sutherland, who were kind enough to teach me the principles of Fibre Type Arrays, I was surprised to find the sheep's birthcoat such a wonderful object for a fundamental study of manifold aspects of wool. One may think that the birthcoat is a "microcosmos" of its own, and, if one has a suitable method of approach the birthcoat - I am sure - will turn out to be an indispensable object for biological studies.

Dr. Dry's pioneering work has already furnished not only the concept of approach, this being the Fibre Type arrays, but also the material for comparative study. This work and line of thought have opened up quite a new branch of biological science, which can be called "Comparative anatomy of wool". This new discipline - I am convinced - will open a large field for investigations, which will help to get far deeper understanding of wool, from the purely practical point of view. Also, it will, to my mind, throw light upon such vivid problems as those of Goldschmid's physiological genetics, as well as the question of evolution. Let me be permitted to give but one example. The pre-natal-check, as we understand it now, is a force, which mainly causes fibres at the head

of an array to be fine; We can distinguish at least three important properties of the check, namely:

- (i) the outset, that is, the time when the pre-natal check starts to work;
- (ii) The intensity, that is the strength of the check, whether it is powerful enough to cause the fibre to be fine throughout or in the neck region only,
- and finally,
- (iii) The extension of the check, that is, how far it extends in the Curly-Tip Group.

The pre-natal check is the result of the work of genes. This work we can measure very accurately. For instance, In Valley arrays the outset can be measured by the number of Halo-hairs and super Sickle A fibres, the intensity by number of fine sickle fibres and the extension by number of checked curly-tip fibres. We can, furthermore, express the measurement as a percentage of certain fibre types, this being decidedly more advantageous and probably ~~too~~ more accurate^{too} than arbitrary terms used in Goldschmidt's "vestigial" case in *Drosophila*. (It seems to me that the work of genes causing "vestigial" in *Drosophila*, is very similar to the work of genes causing the pre-natal check in the birthcoat).

I have dealt to some extent with the question of the evolution of the fleece in the New Zealand Romney breed. The material for this part of my thesis has been growing during the course of my investigation, which indeed had nothing to do with the problem of the evolution of the fleece and therefore I could hardly be accused of "having an eye seeing what the eye looks for". Indeed, it was too great a temptation not to use data obtained in the course of the present investigation in an attempt to outline the way in which the evolution of the fleece has probably taken place.

The study of evolutionary processes requires evidence from three sources: Paleontological, embryological, and genetical. These sources are discussed in my thesis, using perhaps different wording. In passing, we may add, that by embryology of wool, is meant the developmental changes as noted in the prenatal part of a staple. It is felt, however, that an explanation must be given as to the first source. Dry's Experimental sheep could hardly claim to be paleontological examples. Nevertheless, I feel at ease to say that as far as paleontology serves as a source of evidence of evolutionary changes, Dry's Experimental flock may be regarded as a source of phylogenetical evidence of the evolution of the fleece, provided, however, that no one will agree to regard

the Merino wool (being generally of Plain array) as the most evolved wool - that is, the most removed from the wild sheep's coat, and on the other hand, the mixed woolled sheep (Blackface, Polish Cakiel, N-type- being probably at least of Plateau array) as the last evolved wool, that is, not too far removed from the wild coat. This being so, we can claim to be in a very fortunate position to have the "paleontological" evidence not in the form of fossils, but in the form of live sheep. As to me, I have had the opportunity to get acquainted with Polish mixed woolled sheep as well as Merinos. The gap between them was too broad to bridge. The bridge, however, is to be found in Dry's Experimental flock. Indeed, it was worthwhile to sail seven seas, at least, to find the "lost" links in the chain of the fleece's evolution. Yet, although my new home is remote from Central Europe, it is interesting to have it pointed out to me that the work in which I have come to take part has roots in Vienna, in Told's fibre types, and in Amsterdam, in de Meijere's fundamentals of hair arrangement and development. I am told, besides, that the voyage from Europe should have been made by the Cape, where Duerden's "birth thinning" foreshadowed the pre-natal check.

My philosophy, it is hinted to me, occasionally shows signs of running ahead of my facts. This, if it be true, is deemed a merit in the department where I work, provided one be aware of the free rein given to imagination.

It is a source of pride rather than shame in this department that a paper once submitted to Professor T.B.S. Haldane in his capacity of Editor of "The Journal of Genetics" was refused on the score of being too speculative.

Speculation is valued here for two quite different reasons. In the first place on present knowledge the surest scoring shots in livestock breeding - one naturally thinks of progeny testing - are apt to be clumsy. Deeper understanding may make defter strokes possible, and this understanding will be gained only through lively imagination.

Speculation is also welcomed because adventurous thinking is essential if our material is to yield some contribution to fundamental genetics. When indeed one reflects how willing to speculate about evolution comparative morphologists have been on less explored material, this provides our justification. To be sure, the value of

such phylogenetic speculation has been called into question by Bateson himself. Yet whatever a paleontologist can show cause to believe has taken place, it is the business of the geneticist to discover the genetic principles therein involved, and it is a very similar sort of thing that is being attempted with the manifold variations revealed in the coat of the sheep.

The importance of the pastoral industry attracted attention to wool research. Hence the intensive study of the fibre types of the Romney coat and their development. Once this investigation was well launched, the conviction came to prevail that this class of facts, serving as a basis for the planning and interpretation of experimental breeding, would be of value to pure genetics. That this is not an unreasonable probability, as pointed out before, is apparent in this thesis.

At the end of this introduction, I feel it is my duty to apologise for having written this thesis in very poor English. In spite of having started to learn English before being taught "hair-splitting" it has turned out that I am a far poorer linguist than a "hair-splitter". I hope indulgence will be granted me all the more, if one is not apt to lay ".....blame on the pear-tree for not bearing plums". (Alain).