

### LETTERS TO THE EDITORS

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#### Inheritance of Morphological Characters in the Sperms of Cattle

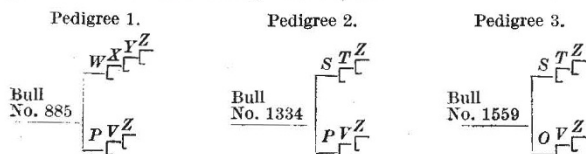
THE purpose of the present note is to record two findings which suggest the inheritance of certain morphological characters in bovine sperms as met in New Zealand.

(1) There is a fairly constant difference in the shape of the Friesian or Shorthorn sperm-head when compared with the Jersey. After a lengthy experience, I am able to distinguish between the two kinds of sperm-smears with a large measure of accuracy. In a recent test, sixteen samples were submitted by a supervising meat inspector, who stated that the samples were "Friesian and Jersey". Differentiation was correct in each of the sixteen smears. Friesian and Shorthorn sperms usually have wider heads than Jersey sperms. Recognition of differences in other breeds, such as Ayrshires, Herefords and Polled Angus, has not been sufficiently constant, so far, to warrant the statement that these breeds may be picked from Jerseys to any significant degree, although Herefords and Ayrshires have been separated from Jerseys occasionally. It is thought that Herefords might usually be thus differentiated from Jerseys by the slightly wider sperm-head.

(2) The possible inheritance of other morphological characters within the Jersey breed may also justifiably be reported because of their importance from association with poor fertility. I am convinced that the presence and abundance of sperms with the abnormal character of re-turned tails and of sperms with narrow heads are largely determined by heredity, the two types of abnormal being inherited separately. I am especially impressed by the fact that bulls, the ancestry of which led me to expect a certain sperm-picture, have shown the anticipated abnormality to a marked degree on examination. More particularly has this been the case in bulls which belong to the family known as the Z family and in the pedigrees of which bull Z figures on their sire's and dam's sides.

On occasion the sperm-picture has been foretold when the pedigree of a bull has been known; but the analysis of pedigrees so far performed does not entirely convince critical friends working in livestock genetics. Many bulls prominent in pedigrees have long been dead and were never within range, and they stand far back in most pedigrees, though such bulls may appear several times in the same pedigree. These foundation bulls have many descendants; therefore any bull has a good chance of tracing back to one of these foundation sires, and I hear more readily of bulls of poor fertility than of good ones. Caution must therefore be exercised in claiming inheritance, but further investigation is now my main concern.

To show the origin of the suggestion of inheritance of certain types of sperms, the three pedigrees which pointed the clue are given below.



It was noticed that the sperm-pictures of these three bulls were similar and, on inquiry being made, it was found that they were closely related, the bull Z being a paternal and maternal ancestor, in direct male line, of the sire and dam of all three bulls. Bulls 885 and 1334 are half-brothers through their dam P, while bull 1334 is also half-brother to No. 1559 through their common sire S. The type of sperm notable in semen from these three related bulls is similar to that shown by Williams in "The Diseases of the Genital Organs of Domestic Animals" (1939 edition, p. 376, Fig. 125); this sample was collected by me, and the bull was in the same Z family as the three whose pedigrees are shown above. This type of abnormality is known here as 're-turned tails' because the tails are turned back past the head, but it is not suggested that this is the best possible terminology. Another family, prone to narrow heads as the particular sperm-type, is well depicted in the same work by Williams (pp. 380 and 381, figs. 128 and 129); both samples were collected by me and belong to the D family, the particular sperm-type of which, fortunately known to have been that of the foundation bull, D, himself, is narrow heads. It may be mentioned that the samples of which Williams gives photographs were collected in 1930 and 1933. Fig. 125 indicates a bad bull; Figs. 128 and 129 indicate total sterility. On the data analysed, it appears that bulls which have bull Z as paternal and maternal ancestor are eight times as likely to have a sperm-picture somewhat similar to Fig. 125 by Williams as are bulls not connected with Z for several generations back. Similarly, bulls which have bull D as paternal and maternal ancestor have five chances to one of showing many narrow heads when compared with the above-mentioned lot known as 'other bulls'. In the matter of fertility, of all bulls whose pedigrees are known, the Z family shows 29 per cent sterile and the D family 18 per cent sterile, as against the 'other bulls' group which shows 13 per cent sterile.

Certain important factors in this work, namely, the ages of the bulls generally, the ages of the sterile bulls, the methods of assessing fertility and the reasons for examination, as well as details concerning other related groups, are to be discussed in a later paper. It is agreed by the critical friends mentioned above that the slowness of breeding work with large domestic animals and the value of the economic stakes make it desirable to inform fellow-workers of strong suspicions when much time may be necessary for substantiation. The facts that different breeds of bulls can be recognized by their particular sperm-morphology and that the sperm-morphology of certain individuals of different families or strains in one breed can be anticipated seem to point to inheritance of those special types. During the past fifteen years it has not been possible for me to point to any other cause, which would bear criticism, for the lack of fertility shown by so many young bulls. The present contribution is the more permissible because of the rise of artificial insemination. By that means defective fertility might be spread widely. It is hoped that other workers may be stimulated to pay attention to the hereditary basis of abnormal sperm morphology or of some character of semen which can be correlated with impaired fertility.

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