ON THE INHERITANCE OF AN AURAL ABNORMALITY IN THE AYRSHIRE CATTLE.

By

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The present paper deals with genetical studies upon a case of abnormality, which has been transmitted with striking persistence for more than half a century.

In the Ayrshire cattle a very singular abnormal peculiarity is frequently seen, which is known amongst breeders as nicked or notched ears.[1] This aural abnormality is not a traumatical but a natural one, it always occurs symmetrically in both ears. In the size of the notch, however, there are great differences among the affected individuals, and two distinct types can be distinguished. In some animals the tips of the ears are slightly notched : whilst in others it will be observed that the notches are so conspicuous that the ears seem to be not more than half the usual size. In the latter case the ridges on the inner surface of the lobe are exceedingly developed. The degree of affection is entirely constant at all ages. Rough sketches below indicate particular features, where a verbal description can not adequately explain relative differences. For convenience' sake I will call the well-notched one the first type and the slightly-notched the second type.

It would be of deep interest to know the origin of this aural abnormality in this breed of cattle, but it is naturally veiled in obscurity. A slight suggestion, however, may be obtained from a letter that was sent in 1902 to Mr. S. Takenouchi, the director of the Mayeda Farm in Ishikari Province,

1) The terms "nicked" or "notched" are used in the American Ayrshire Record.

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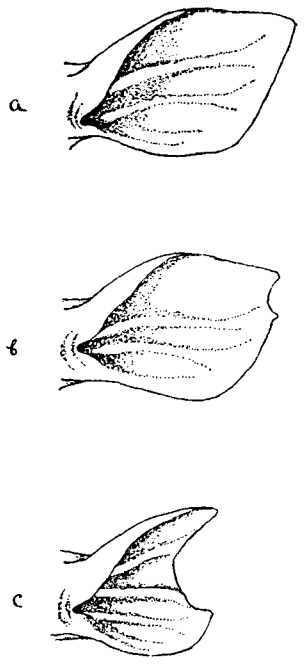
and one of our prominent Ayrshire breeders, by Mr. G. Bement, Oakland Cal., U. S. A. A quotation from Mr. Bement's letter reads: "The nicked ears above are natural and can be traced back to the imported bull Eglinton (21) described in the Herd Book as 'Dark Brown and White with Nicked Ears.' Many of my herd were calved with nicked ears."



Diagrams showing the normal and abnormal ears in the Ayrshire breed.
a, Normal type; b, Slightly nicked type; c, Well nicked type.

According to my examination of the Ayrshire Record I and II [1] five bulls and eight cows are recorded to have had such abnormal ears. With the single exception of the bull "Carleton Chief." (1568), all of these were the descendants of "Eglinton." No doubt there must be more affected individuals but many of them, I think, either have escaped notice, or have not been described as to their aural peculiarity. As the bull Eglinton was imported in 1859 from Scotland to the U. S. A., the remote origin of this abnormality should naturally be sought in its native habitat.

In our country this peculiarity of the ears can be traced almost without break to a bull "Express" (4503), once owned by the Mayeda Farm. At this farm he has produced more than 35 offspring, all of them having this characteristic. "Express" was bred in 1888 by Mr. G. Bement, above cited, imported in 1890 by Mr. M. Hori, and sold in 1894 to the Mayeda Farm. As he was a superior animal, his stock enjoyed great celebrity and popularity in its day and the nicked ears were highly valued as a distinctive indication of his

1) The Ayrshire Record I. 1876, Boston.
The Ayrshire Record II. 1878, Boston.

blood. It is said by our farmers that the animals of the "Express" family were generally small, but excellent milkers and remarkable for their feeding qualities. Many years elapsed, however, before any signs of degeneration declared themselves; eventually the animals became smaller, less fecund and the strain lost its once appreciated qualities. Consequently, there are now very few animals retaining the "Express" blood at the Mayeda Farm, most of them having been eliminated.

Recently I paid visits to this farm and to a number of breeders who have once introduced the "Express" blood in their herds, and endeavoured to collect some accurate details on the inheritance of the aural abnormality.

The genealogical table accompanying this paper has been compiled either by studying the breeding books kept at the Mayeda Farm or by examining the living animals. All the cases, where there has been the least doubt as to the individual being normal or abnormal, have been excluded in the table. The normals are represented by white circles and the abnormals, whose type is unknown, by shaded circles. In the case of such abnormals, as I have been able to verify myself by actual examination of the individuals, I have preferred to distinguish the well-nicked type (the first type) and the slightly-nicked type (the second type) with black circles and black semicircles respectively. In the table, the two lines coming together at the top of an individual trace respectively to the sire and dam, while the lines from the foot of the individual run to the offspring.

Owing to the lack of attention paid to this peculiarity on the part of the breeders, who regarded its inheritance as common rather than occasional, only a few records telling of this abnormality have come to my knowledge. As a matter of fact, the data thus far collected are decidedly fragmentary, but enough has been given to show the persistence with which the abnormality was transmitted.

In all cases cited in the table it must be admitted that the aural abnormality is inherited only from the abnormals and never from normals. An

abnormal sire No. 39 with a normal pure-bred Holstein-Friesian cow No. 41, whose origin could never be taken for heterozygous with respect to the aural peculiarity, has given an abnormal heifer No. 60. There are, therefore, indisputable evidences of dominance of this aural characteristic.

I have already mentioned that this peculiarity of the nicked ears is very different in degree. As far as my collection is concerned, sure cases of the first type were found in the bulls "Express", No. 25 and No. 39 and in the cows No. 61, No. 62, and No. 67. That the bull "Express" had well-nicked ears was stated to me by Mr. Takenouchi, who kept this bull for seven years. In five other animals it was ascertained by myself, as they are still alive at the present time. Further information from Mr. Takenouchi shows that all the offspring from "Express" were calved with nicked ears. This proves this bull to have been homozygous in regard to the aural abnormality. It appears that the other five animals, above mentioned, might also be homozygotes, considering that they descended from abnormal parents and moreover that no normal ofspring from them has so far been detected. These data lead one to conclude that the well-nicked type is pure dominant (DD).

Turning to the second type, i. e. those which were calved with slightly nicked ears, we see in the genealogical table that all animals belonging to this type are the progeny coming from parents, one of whom is abnormal, the other normal. In other words, the individuals with slightly-nicked ears must be heterozygotes (DR).

It would seem, therefore, that the homozygous dominant is externally distinguishable from the heterozygous one.

We see further in the table that the abnormality is sometimes not transmitted (cows No. 35, No. 70 and No. 71). I have endeavoured to get some further details as to the numerical ratio between the abnormals and normals. The only data obtainable were the results from crossings between abnormal sires and normal dams at the Kanei Farm in Teshio province and at the Nemuro Farm in the province of Nemuro. Each farm now owns two bulls of the second type, all being descendants from "Express." In the past two years

at the former farm and last year at the latter farm, the following results were secured:

Abnormal sires [1]	Number of matings	Abnormal offsprings	Bred at
No. I	7	5	Kanei Farm
No. III	16	9	,,
No. 120	6	2	Nemuro Farm
No. 126	3	2	,,
Total	32	18	

The calculation shows that of all the matings 56.3 % or nearly the theoretical 50 % belonged to the abnormal type. At all events the nicked character of the ears is either inherited or not inherited entirely. That is to say, there occurs a clear-cut segregation of the abnormality from the normality.

In recapitulation, it may be said that the data dealt with in this paper show that the nicked ears seen in some families of the Ayrshire breed originated at first in Scotland more than fifty years ago; that this aural abnormality is transmitted in full accord with Mendelian principles; that the zygotically different types DD and DR seem to be externally distinguishable in this case.

I wish here to express my heartiest thanks to Prof. S. Hashimoto and Assistant-Professor Y. Tanaka, to whom I am indebted for valuable suggestions in completing this investigation. I am also under obligation to Mr. K. Takenouchi and many other breeders for their kindness in placing their herds and breeding-records at my disposal.

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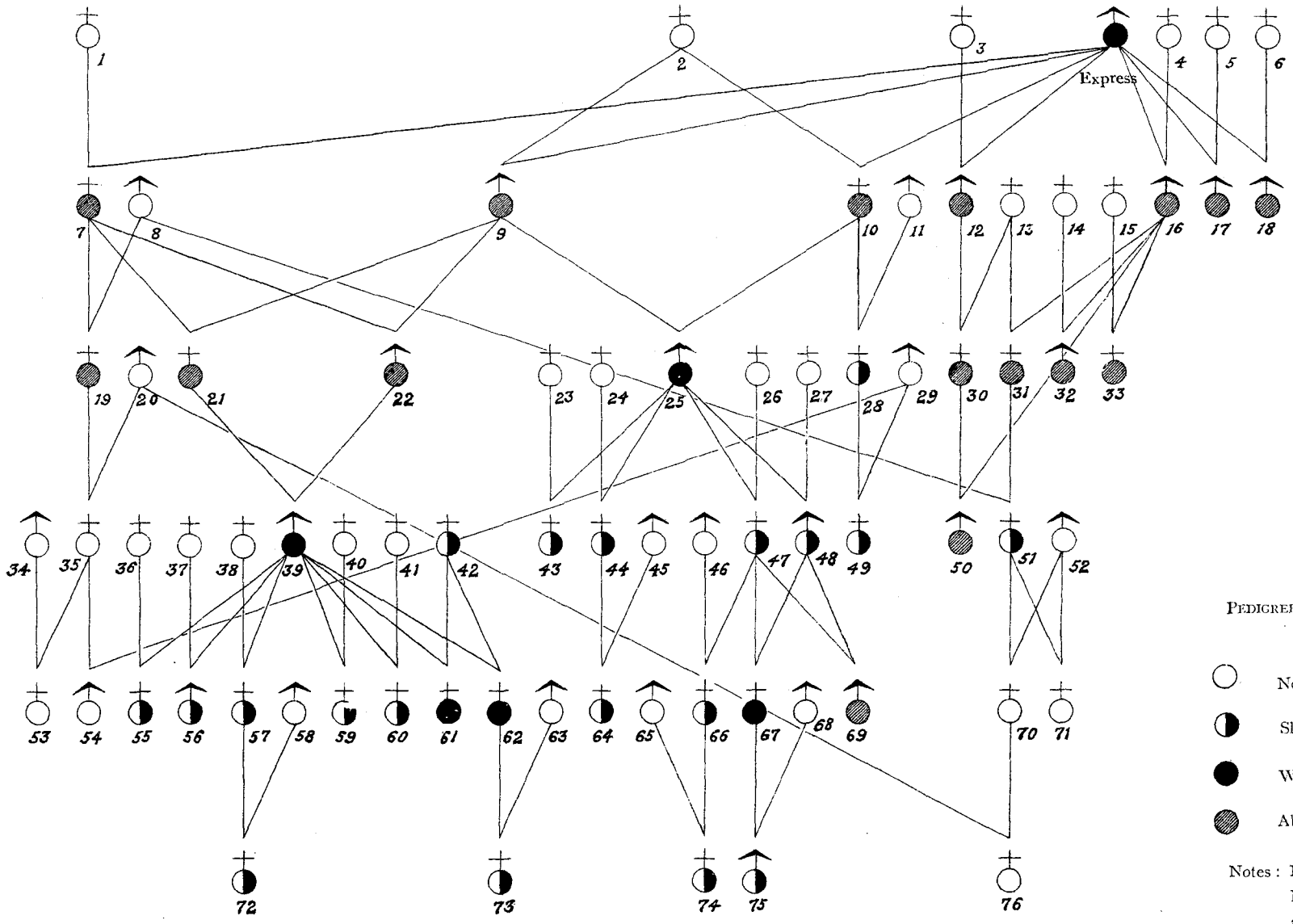
1) These sires are numbered in accordance with the breeding records of both farms.



PEDIGREE ILLUSTRATING DESCENT OF THE NICKED EARS IN THE AYRSHIRE BREED.

Normal type

Slightly nicked type

Well nicked type

Abnormal, but the type unknown

Notes: No. 41, a pure-bred Holstein-Friesian Cow.
No. 42, a decendant from "Express", but its continuous ancestors unknown.