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"IDENTICAL TWINS IN DAIRY CATTLE"

by

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ORIGIN AND USE IN RESEARCH:

Identical twins are believed to originate from a single fertilized egg, the embryo splitting at an early stage of development. The hereditary endowment of both members of the pair is thus the same, save insofar as in some twins differences may have a genetic basis in the same way as some asymmetry between the right and left sides of one individual. The sex of both members of the pair is the same. Fraternal twins arise from two eggs and are of opposite sex about as often as of the same sex. Twins provide favourable material for the disentangling of the effects of nature and nurture. In the first place, resemblances and differences between identical twins are compared with resemblances and differences between fraternal twins. In the second place, the two members of a set of identical twins may be treated differently, and the differences manifested may be compared with the differences between fraternal twins treated in the same way. In the human species the first method of inquiry can be used more frequently, though the second is used when identical twins happen to have been reared apart. In dairy cattle it is the second method that is being used in Europe and that it is planned to use here.

WORK IN EUROPE ON DIAGNOSIS:

My concern has been with diagnosis, by devices mostly imitative, following Kronacher in Germany and Bonnier in Sweden, but adding the examination of "hair landscape." The features most used are coloration, nose-prints, hair structure, and hair whorls, while various other features, now one and now another, may be very significant. The verdict - identical or fraternal - is given on the whole of the evidence judged together.

COLORATION:

Even a slight difference in shade points to fraternal origin. Marked difference in coloured and white pattern stamps twins as fraternal, but minor differences in, say, a Friesian pattern are expected in twins judged identical on all the evidence. In two taken to be identical the details of brindling were arrestingly alike. On the other hand, in two very pale strawberry roans - a colour so unusual that at first sight the cows were thought identical - there were appreciable differences in details of the coloration, and striking differences in other characters showed them to be fraternal. In an identical Jersey set it was impressive to find a few black hairs on the light belly in an area an inch in diameter in just the same position on the left side of both cows.

NOSE-PRINTS:

Nose-prints serve as the finger-prints of bovines, and help received at Police Headquarters in Wellington is much appreciated. In thirteen sets judged identical the nose-prints, though never replicas, are substantially alike in twelve; in the remaining set the differences are rather marked. In fourteen sets classed as fraternal eleven show considerable differences, two gave nose-prints very similar, so that in this feature they would be called identical, and one set could just pass as identical on nose-prints. A split-headed calf, obviously developed from one egg, which possessed two ears, had two noses, with prints less alike than any of the thirteen sets considered identical. Nose-prints are thus

very useful, but by themselves not conclusive.

HAIR STRUCTURE:

Bonnier used sections of bundles, evidently taking over the method from a colleague working on wool. In trials of sections I soon found myself apt to be unable to distinguish between calves from different cows. I prefer "hair landscape," or the picture presented by the fibres of a small tuft spread out one by one, placed roughly in order of size. So far I have no system of classifying landscapes, simply looking at them with an eye for differences in length, coarseness, and curvature. In identical twins the landscapes were always alike. In fraternal twins they were nearly always recognisably different, but occasionally, as when all the hairs were quite stiff, they were indistinguishable.

HAIR WHORLS:

Most attention is paid to the whorls, including hair meetings, on the head and back. In fraternal twins the whorls are nearly always definitely different, but in two sets with unremarkable whorls I have twice felt, from the whorls, that the animals might be identical. In identical twins the whorls are strikingly alike, though sometimes with minor differences, as when three whorls on the face of one cow appear, so to speak, to have fused to form a single feature in the other. How much difference to allow is a matter on which experience is accumulating.

In an identical set the whorls may be direct copies, or may show mirror-imaging. On experience to date the latter is more common. When mirror-imaging involves pretty detail this gives weight to the verdict.

Newman, working on human identical twins, suggests that when finger-prints, palm-prints, and sole-prints are direct copies, then the split of the developing embryo has taken place earlier than when the dermatoglyphics show mirror-imaging. In conjoined twins (Siamese twins) he finds marked differences, and suggests that the split, which was never completed, has started late, after differences have been established between what are ordinarily destined to be the two sides of the same individual. This is illuminating in view of the difference between the nose-prints of the split-headed calf.

OTHER FEATURES:

These are a few examples from different sets of twins: Horns of the same size, both with black tips, set on the head and curved similarly; seven teats; teats with very flat ends; warty protuberances of similar sort on the skin below the tail.

CONCLUSION:

Identical twins in dairy cattle can be found. That is the important practical conclusion. The twin hunt has been carried out through announcements in the "Exporter" and a good deal by correspondence. The work has been done as a side line and in an emergency fashion. It is notable that about half the twins thought by their owners to be identical have been judged on investigation to be so, and most of those decided to be fraternal have been eminently instructive. This speaks well for the judgment of those who have helped by reporting twins, for of all twins born in Sweden it appears that only about one-tenth are identical. A colony of interesting twins, fraternal as well as identical, has been started at Ruakura. With material available there for demonstra-

tion, a week-end school for field officers would supply first-hand experience. With a million births a year it would then only be a matter of organization to secure identical twins in ample abundance.

DISCUSSION.

1. (Prof. K. A. Wodzicki): Is there a possibility of a quantitative statistical basis of discrimination between identical, fraternal and doubtful cases, with one of the three methods referred to in the paper?
- 2(a) (Mr. I. Dick): Has any attempt been made at establishing a criterion for identical twins by use of R. A. Fisher's Discriminant Function?
- 2(b) (Mr. I. Dick): What does one do about the situation if one finds one set of patterns in a pair of twins which are mirror-images and another set of patterns in the same pair which are of identical symmetry?
3. Professor McMeekan pointed out that his experience had been very different from Dr. Dry's in the location of identical twins, and that out of a considerable number of twins he had not secured anything like the similarity which Dr. Dry had done with the various twins he had examined. He also asked Dr. Dry to explain why there could be clockwise and anti-clockwise hair whorls in the identical twins, and also whether Dr. Dry had any information on the number of criteria necessary to determine identical twins.

REPLIES:

- 1, 2(a) and 3. So far in cattle the verdict is given on total impression in the light of experience. The award is made as in marking an essay rather than an answer in mathematics.
 - 2(b), 3. The situation suggested by Mr. Dick has, in fact, been reported by correspondence. Newman would no doubt say that the split has started at the end of the body nearer to the whorls showing identical symmetry and reached a little later the region of mirror-imaging.
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