INHERITED BIOCHEMICAL POLYMORPHISMS AND THEIR ASSOCIATION
WITH PRODUCTION IN DAIRY CATTLE

by

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DECLARATION

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SUMMARY

Two biochemical polymorphisms, one involving the serum protein transferrin and the other the J-Oc blood group system, have been studied in dairy and other cattle in South Australia. The relationship between these systems and various production characteristics has been examined in two pure-bred dairy cattle populations.

The published evidence for an association between transferrin type and fitness is conflicting. Some of the anomalous data may be the result of difficulties in accurate determination of parentage. To obviate such errors, 337 dam-foetus pairs were collected from an abattoirs and their transferrin type determined. Analysis of these data has shown that transferrin type has no observable effect on fitness and no effect on maternal-foetal compatibility. Such dam-foetus pairs provide incomplete family data and these are in complete agreement with the hypothesis that the transferrin variants are controlled by a number of alleles at a single locus.

The transferrin genotype of the sires of 51 half-sib families has been inferred from their progeny and there is evidence for an appreciable misclassification of pure-bred animals in South Australian herds.
A bull at the Artificial Breeding Centre in South Australia was found to have an aberrant transferrin BE phenotype where the slowest E zone migrated slightly faster than normal. The transferrin types of 22 offspring of this bull have shown that the pattern is not inherited in the same way as the other known variants and may be controlled by another locus.

Sprague (1956a) proposed that the J-Oc phenotypes are controlled by a series of alleles at a single locus. As a result of observations on the presence of J and Oc substances in both the serum and seminal plasma of bulls and is the serum of the abattoirs population of cows, alternative models have been proposed and these are discussed in relation to Sprague's (1956a) data. It has been reported in the literature that certain electrophoretic variants of the enzyme alkaline phosphatase show an association with the serologically related blood groups, AB0, R-0-1 and J-Oc of man, sheep and cattle respectively. No such association with J-Oc could be demonstrated in the abattoirs population.

Transferrin patterns of J blood group types were studied in foetuses of different ages. It was shown that a given transferrin genotype has a variable expression in the foetus and approaches the adult phenotype with increasing age.

J and Oc substances were examined in foetal and immediately post-natal sera. A significant correlation was found between the titre of the two substances in J0c foetuses and between the
titre of Oc substance and foetal length in Oc foetuses. The
bearing of such observations on the proposed models for the control
of production of J and Oc substances is discussed.

Transferrin, serum albumin and J-Oc in Banteng cattle (Bos
banteng), Asian buffalo (Bubalus bubalis) and the Elans were
examined and the findings are discussed in relation to the
taxonomic relationships between these species and domestic cattle.

The relationships between seven production parameters and
the transferrin and J blood group types were examined in a
Friesian and a Jersey cattle population. In the Friesian popula-
tion, cows of transferrin type A produced milk with a significantly
higher fat percentage than those of type D. There was no
significant association between the remaining production parameters
and the phenotypes considered. These findings are discussed in
relation to other published work, to their genetic and practical
significance and to the role of artificial selection in the
maintenance of the transferrin polymorphism.