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Brief Communication

CARBONIC ANHYDRASE POLYMORPHISM IN CATTLE AND SWINE

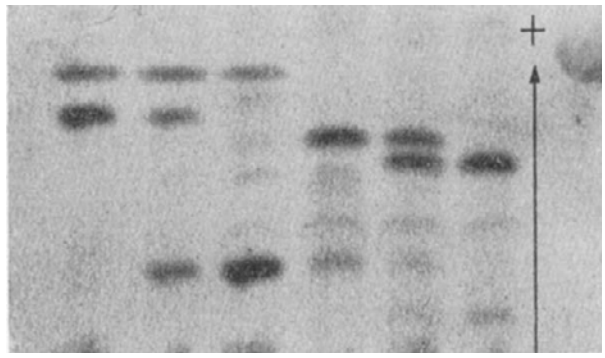
Two electrophoretically different carbonic anhydrase (Ca) isoenzymes have been demonstrated in cattle where their presence is presumed to be controlled by codominant allelic genes (*Sartore & Bernoco* 1966). Previous reports of Ca polymorphism in swine are not available.

With a view to defining the occurrence of Ca polymorphism in Danish cattle and swine, erythrocytes from a total of 828 heads of cattle were examined by starch gel electrophoresis, the material including 275 heads of RDM, 454 of SDM, and 99 of the Jersey breed. Furthermore, the study includes examination of 102 blood samples from swine randomly selected in a slaughterhouse, 348 samples from swine of the Danish Landrace collected from progeny groups at the testing stations and their parents in State-recognized Breeding Centres, and 119 samples from swine mainly of Danish Black and White belonging to private herds.

Electrophoresis was carried out on an extract produced from twice washed erythrocytes treated by 0.5 vol. of 50 % methanol and 0.8 vol. of chloroform (modified from *Roughton & Booth* 1946a) or, for some of the samples from cattle, on a haemolysate prepared from washed blood corpuscles to which 1 vol. of distilled water was added, followed by freezing. Electrophoretic method: *Voglino* (1969). Vessel buffer: 18.6 g of boric acid and 4.0 g of NaOH/l, pH 8.6. Gel buffer: 0.88 g of citric acid and 1.75 g of Tris/l, pH 7.3. 14 % starch. Electrophoresis was carried out at 5°C. After 30 min. with 13 v/cm, the paper strips were removed and electrophoresis continued for 3—4 hrs. with 27 v/cm. The gel is stained with amido black for 5 min. or incubated for 2 hrs. at 40°C in a solution of 2 ml of 1 % β-naphthylacetate in acetone and 0.2 g of Fast Blue BB salt/100 ml of water (*Tashian* 1965).

Fig. 1 demonstrates the individual variation observed in cattle as well as swine. The relatively fast moving component is termed A and the slower B (in cattle termed F (fast) and S (slow) respectively by *Sartore & Bernoco*). The components

were identified as Ca from the fact that the bands stained when the above mentioned β-naphthylacetate was used as substrate and they were inhibited by acetazolamide (*Tashian*); besides, intense Ca activity was demonstrable by a colorimetric method



Sample no.	1	2	3	4	5	6
Ca phenotype	A	AB	B	A	AB	B

Figure 1. Amido black stained starch gel showing the three Ca phenotypes observed in cattle (samples nos. 1—3) and pigs (samples nos. 4—6). Prior to electrophoresis the Ca were extracted from the red cells by chloroform - methanol.

applied to zones of the gel in which the bands were localized (*Roughton & Booth* 1946b). The component observed in cattle in front of the A band (amido black staining) does not show Ca activity.

Cattle. Table 1 illustrates the distribution of the phenotypes observed in 132 pairs of mother-offspring. The sires were not typed, but the phenotypes of offspring from cows of types A and

Table 1. Cattle. The distribution of Ca phenotypes among 132 dam-offspring pairs.

Dam	Offspring			Total
	A	AB	B	
A	5	9	0	14
AB	13	30	15	58
B	0	19	41	60
Total	18	58	56	132

B support the theory that the two iso-enzymes are controlled by codominant allelic genes. On basis of the total material comprising half-siblings and pairs of mother-offspring, the gene frequencies (q) were estimated to about:

	RDM	SDM	Jersey
q_A	0.55	0.17	0.23
q_B	0.45	0.83	0.77

Swine. Among 102 samples drawn from swine in a slaughterhouse, five were of type AB and 97 of type B. In the 348 swine of pure Danish Landrace, only type B was observed. Among the 119, mainly Danish Black and White swine, two animals were of type A, 16 of type AB, and 101 of type B. All animals possessing the component Ca A were black pied.

Table 2. Pigs. The distribution of Ca phenotypes among offspring from a boar of type AB mated to three sows of type B.

Litter no.	Phenotype			Total
	A	AB	B	
1	0	4	4	8
2	0	3	3	6
3	0	5	2	7
Total	0	12	9	21

Table 2 illustrates the distribution of Ca types in three litters of pigs from a boar of type AB mated to three sows of type B. The parentage was verified by blood group determination. These results indicate that the occurrence of the two types Ca is controlled by codominant allelic genes.

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