

# Partial Albinism (Heterochromia irides) in Black Angus Cattle

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## Introduction

Various types of albinism have been reported in many breeds of cattle throughout the world.<sup>4</sup> We describe in this paper a new coat and eye color defect (partial albinism, heterochromia irides) in purebred Black Angus cattle. In addition, the results of a breeding trial using a homozygous affected bull on normal Hereford cows are reported.

Albinism has been described in a number of breeds of cattle.<sup>1,3-8,12,16,17</sup> An albino herd from Holstein parentage was described and no pigment was evident in the skin, eyes, horns, and hooves; in addition, the cattle exhibited photophobia. A heifer of black pied parentage exhibited a complete lack of pigment in the skin, iris and hair; however, at sexual maturity some pigment was present and referred to as a "ghost pattern".<sup>1</sup> In three albino Holstein cattle, the irides were greyish-blue and photophobia was evident. The trait may have been recessive as the parents were related.<sup>5</sup>

Albinism in Brown Swiss cattle was described in which the irides were white, pupils were red and an extreme photophobia was shown. Eyes, skin, horn, hooves and hair were unpigmented. The trait was inherited as a recessive since a test mating of albino x albino resulted in albino offspring and normal x albino resulted in a normal coat color.<sup>16,17</sup>

The clinical findings of heterochromia irides, tapetum fibrosum hypoplasia and typical colobomata of the optic disc and nontapetal fundus were described in albino Hereford cattle. The incomplete albinism was exhibited by virtually complete white hair coats with occasional spots of pigmented hair and blue irides and inherited as an autosomal dominant trait.<sup>6,7,12</sup>

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Pathological changes in ocular anomalies of incomplete albino cattle showed iridal heterochromia grossly. Histopathological findings of irides showed only the posterior layer fairly pigmented and usually no pigment in the stroma nor the anterior layer. The ciliary body showed reduced amount of pigmentation and absence of corpora nigra. Choroid lacked pigmentation. The Retina showed disorganization. Fundus anomalies included colobomata of varying sizes at the ventral aspect of the optic disc and the tapetum fibrosum was hypoplastic.<sup>12</sup> In albino humans, the fundus is depigmented and the choroidal vessels stand out strikingly. Nystagmus, head nodding and impaired vision also may occur. Pigmentation is normal with the exception of pigmentation in the eye. Accumulated evidence indicates that the disease assumes several forms and may be either complete, involving a total lack of pigment, or incomplete, in which case pigment loss is restricted to particular areas.<sup>10</sup>

Melanin, the brown pigment of hair, skin and eyes, is a polymeric material of unknown structure which arises from the oxidation of tyrosine. The enzyme concerned with the conversion of tyrosine to melanin is tyrosinase (o-diphenol; O<sub>2</sub> oxidoreductase), a copper containing protein, which catalyzes the conversion of tyrosine to dihydroxyphenylalanine and subsequently to dihydroxyphenylalanine quinone (DOPA reaction). The DOPA reaction, then, is not a test for melanin but for the ability to produce melanin and is the basis of the histochemical identification of melanocytes and melanoblasts. Normally, tyrosinase is synthesized on the ribosomes and conveyed to the Golgi apparatus where it accumulates in small membrane-bound vesicles called pre-melanosomes.<sup>2,9,11,14,15</sup> Ocular albinism is therefore a disorder in the phenylalanine metabolic pathway.

Coat color inheritance and inheritance of spotting patterns in cattle have recently been reviewed.<sup>13</sup>

## Materials and Methods

The occurrence of a new coat color mutation in Black Angus cattle was reported to the Department of Pathology, Kansas State University. The methods of data collection of congenital defects have been outlined previously.<sup>8</sup> Five affected Angus cattle (2 bulls, 3 heifers) were purchased and transported to KSU for further studies. All five cattle were

from normal Black Angus parents.

A two-year-old affected bull originating from purebred Black Angus parents, was transported to the Sandhills in Nebraska for a breeding trial. The bull was placed into a small Sandhill pasture with 92 commercial Hereford cows on May 2, 1981, and removed on May 30, 1981. There was one watering location in the pasture and the cattle were receiving prairie hay ad libitum in addition to free access to freshly developing spring range. All cows exposed to the experimental bull were 30-75 day postpartum and were nursing calves during the 28-day experimental period.

Factors used to evaluate the breeding value of an Angus bull with partial albinism: 1) observation of the bulls' breeding activity during daylight hours; 2) average gestation length of cows exposed; 3) birth weights of progeny; 4) physical examination of progeny by a veterinarian; 5) evaluation of 30-50 progeny to determine the mode of inheritance of the ocular albinism trait; and 6) evaluation of female progeny of sires with the ocular albinism defect as potentially useful breeding animals in a rotational breeding system.

In addition, at Kansas State University, three affected females were bred to another affected bull (bull B).

### Results and Discussion

Heterochromia (irides) in Angus calves of both sexes is identified by hair, skin, coat color, and iris color characteristics. The hair of the entire body surface is brown (chocolate) instead of black, as is typical for Angus cattle. The muzzle, hooves, scrotum in males, also are brown. The skin surface is brownish to grey. This is particularly obvious at the glabrous skin, such as around eye lids, ear openings, muzzle, anal and reproductive openings (Fig. 1). The most distinguishing factor involves iris color. Angus cattle usually have a dark black iris. Heterochromia irides calves, however, have a light usually two-colored iris. This gives a double-ringed appearance to the iris when viewed closely: an outer, faintly brown ring and an inner, light blue ring circling the pupil (Figs. 2 and 3). The pupils always appear constricted in daylight. From a distance, the eyes appear white. The fundus of the eyes appears albinotic (Fig. 4).

Bull A affected with heterochromia was placed in a small Sandhill breeding pasture with 92 commercial Hereford cows on May 2, 1981, and removed May 30, 1981. Regular checks were made upon the cattle during the daily hay feeding operations. Observations of breeding activity by the bull were noted. A general lack of breeding activity was exhibited. These observations were the result of photophobia shown by this animal. Photophobia in albino animals has previously been shown.<sup>3,5-7,16,17</sup> However, this particular defect quite obviously did not impair the reproductive efficiency of this bull. The commercial Hereford cows were exposed to this Angus bull for a 28 day period. A total of 51 cows produced 52 calves (1 set of twin heifers) as a result of this 28-day breeding period. The

Fig. 1. Cow (purebred Black Angus) affected with heterochromia irides and brown coat color.



Fig. 2. Heifer (purebred Black Angus) affected with heterochromia and brown coat color. Notice iris color.



Fig. 3. Calf (result of breeding affected x affected) affected with heterochromia irides.





Fig. 4. Bull used in breeding trial. Notice albinotic reflex of fundus.



majority of the breeding activity took place during the hours of darkness.

Gestation length and birth weights were well within the accepted normal range for Hereford x Angus calves. The first calf was born February 17, 1982, and the last calf was born March 8, 1982. Assuming a 283 gestation length, the calving could have begun February 11, 1982, and terminated March 9, 1982. Birth weights were not taken on all calves due to weather problems during this calving period. However, the mean birth weight of female calves was 73.1 lbs.  $\pm$  8.47 and male calves 78.0 lbs.  $\pm$  8.28.

Physical examination of the progeny of this Angus Bull (bull A) with ocular albinism showed no sign of the defect.

The F<sub>1</sub>, females resulting from this project will likely be utilized as breeding animals in a three-breed rotation program. Since this trait appears to be a simple autosomal recessive, the normal precaution is to avoid repeated use of sires from this particular Angus bloodline.

Breeding another affected Angus bull (bull B) to three affected dams resulted in three affected calves (one female, two males).

### Summary

A new coat color defect (heterochromia irides) is described in Black Angus cattle. The coat color is brownish. The iris is light, two-colored, with an outer faintly brown ring and an inner blue ring. The fundus of the eye is albinotic.

The trait in Black Angus cattle does not impair the ability of an animal to reproduce even though photophobia is shown by these animals. Gestation length and birth weights were not affected in F<sub>1</sub> Hereford x Angus progeny. All progeny which resulted from this mating proved normal in every respect upon physical examination. The 52 normal F<sub>1</sub> calves resulting from this mating suggest that this trait is very likely transmitted as a simple autosomal recessive. Breeding an affected bull to three affected dams resulted in three affected calves (one female, two males). The F<sub>1</sub> females resulting from similar matings must be considered viable commercial breeding cattle when due care is exercised in future sire selection.

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