

# Anatomical Observations on a Freemartin

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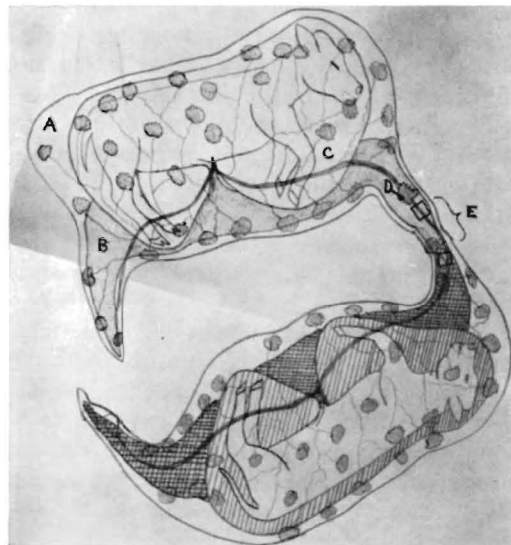
**D**URING THE SPRING QUARTER, 1952, of the gross anatomy laboratory, our group was assigned to a crossed shorthorn heifer. This heifer, in first pregnancy, had been purchased by the Anatomy Department and embalmed for the purpose of dissection.

Upon entering the abdominal cavity by routine dissection and palpating the pregnant uterus, a twin pregnancy was evident. The fetus in the left horn was not detected by external palpation due to the hardened state of the rumen on the left side. An incision was made in the right horn of the uterus and the fetuses were palpated through the incision. One fetus was in the right horn of the uterus and the other fetus in the left horn, with fusion of the fetal membranes in the body of the uterus. The entire uterus was dissected and removed from the animal.

It was at this point of the dissection that the sex of the two fetuses was evident. Our interest then turned to freemartins because of the speculation as to the cause of the freemartin and the anatomical fusion, if any, between the two fetuses.

Marshall (1) states that the freemartin (a heifer co-twin to a bull calf) has incompletely developed ovaries and so is sterile. Lillie (2) has suggested that this is due to the influence of the internal secretions of the bull co-twin, brought about by fusion of the two fetal circulations during pregnancy. Hammon (3) states that he has not observed any cases of twin pregnancies in the cow. Lillie (2)

states that in such cases he has constantly observed a continuous chorion due to the fusing of the two membranes in



**Fig. 1.** Gross, semi-schematic drawing of the fused membranes of a freemartin. Amnion reflected to expose the allantois. (A) Chorion, (B) Allantois, (C) Amnion, (D) Fetal cotyledon — see Fig. 2b, (E) Fusion of chorio-allantoic cornua, (F) Intercotyledonary area — see Fig. 2a.

their vascular layer; he bases his theory of the origin of freemartins on this observation.

Statistics quoted by Luer (4) and Keller (5) show that 95 per cent of heifers twin to bull calves are sterile.

Runnells (6) states that the most plausible explanation for the origin of a freemartin is based upon the following facts:

1. In the bovine twin pregnancy there is usually fusion of the chorions and an-

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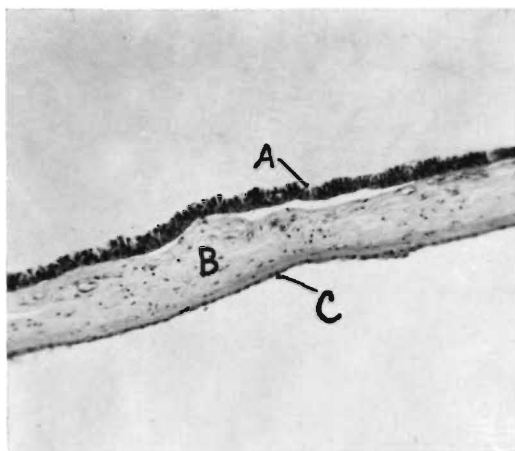


Fig. 2a. Photomicrograph of intercotyledonary area. (A) Chorionic ectoderm, (B) Mesoderm (fused mesoderm of chorion and allantois) (C) Allantoic endoderm.

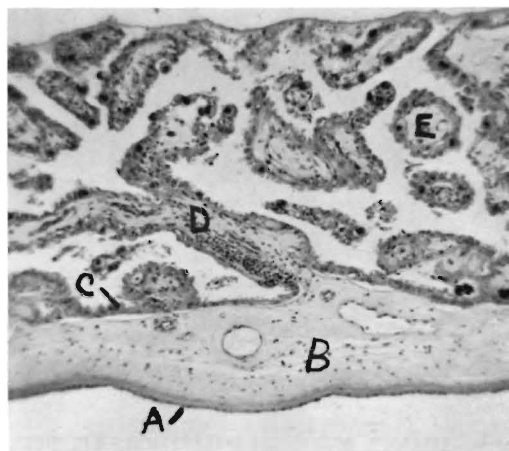


Fig. 2b. Photomicrograph of the cotyledonary area. (A) Allantoic endoderm, (B) Mesoderm, (C) Chorionic ectoderm, (D) Villus, longitudinal section, (E) Villus, cross section.

astomosis of the circulation of the fetuses.

2. Sex hormones appear earlier in the male fetus than in the female.

3. When one fetus is a male and the other a female, the male hormone circulating in the blood of the female twin stimulates the recessive male characters in the female before the dominant female characters are stimulated by her own hormones.

The result is a sterile female with internal genitals predominantly male in character, and external genitals mostly female in type. "So frequent is free-martinism that it is said that a normal female may be expected only about once in 12 cases of twinning in which both sexes are represented."

The extremities of the allantois of the cow are prolonged into the cornua of the chorion forming the chorio-allantoic membrane. It was at this chorio-allantoic horn that fusion of the two fetal membranes from the right and left horn occurred. (See Figure 1). Sections of the fusion were removed at the point indicated and studied microscopically. The stained slide preparations showed the chorionic ectoderm, the mesoderm, and the allantoic endoderm. (See Figure 2).

A large branch of the umbilical artery of the male crossed over the chorionic fusion to the female chorion and went to a fetal cotyledon on the female side. (See Figure 1). This was proven by in-

jection of dye into the artery on the male side of the fusion and the dye could be seen staining the cotyledon on the female side. A branch of the female umbilical artery also went to the same cotyledon. Dye could be made to stain the same cotyledon by injecting dye into the branch of the female umbilical artery. Thus it was shown that a single cotyledon received blood from both the male and female side.

Upon dissection of the female genitalia the uterus was found to be a small blind tube, and the ovaries were incompletely developed. The male genitalia were also dissected and grossly they appeared anatomically normal. Both testicles were in a state of partial descent.

In summary it is evident from this dissection that chorio-allantoic fusion took place, resulting in the anastomosing of the blood vessels of the two fetuses. This fact is in harmony with the explanations proposed for the cause of free-martins in the bovine species.

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