

Beef Logic

by R.A. "Bob" Long



Sex determination and sex-linkage

Sex in mammals is determined by the action of a single pair of chromosomes. Cattle have 30 pairs of chromosomes. Females have 30 pairs similar in size and shape. However, bulls have 29 chromosome pairs alike and one pair different in size and structure. The 29 pairs that are alike in both males and females are called autosomes. The remaining pair in both sexes are called the sex chromosomes.

The two identical sex chromosomes in the female are termed X chromosomes.

One of the sex chromosomes in the male is also an X chromosome; but the other, a shorter one, is called the Y chromosome. Since the sex chromosomes in cows are alike (XX), every egg produced carries the X chromosome. However, the sex chromosomes of a bull are different (XY), so half the sperm cells carry X, and half carry Y. Therefore, if an egg is fertilized with an X sperm, the offspring will be a female (XX). The Y sperm produces only males (XY).

Incidentally, sex is determined in humans exactly the same way. People possess only 23 pairs of chromosomes, but the one pair of sex chromosomes is XX in women and XY in men. And just as in cattle, whether the X or Y sperm fertilizes the egg is strictly chance.

■ What if ...

Obviously, if the sperm of a bull could be separated according to X and Y, it would be a simple matter to control the sex of the next calf crop or that of each mating. What

a tremendous advantage this would be!

In commercial production, semen carrying only X sperm from sires with breeding values superior in maternal traits could be used for production of replacement females, while Y sperm from bulls superior in growth rate and carcass characteristics could produce the steers destined for slaughter. Exclusive control of an efficient procedure for "sexing semen" would be a super moneymaker.

It is only a matter of time until scientists solve the production problems and sexed semen will be available. Watch for it. It can be of great value to the beef industry.

Unfortunately, years of research have failed to yield a process that efficiently separates sperm for sex determination. Periodically, claims of success in sexing semen are made with some semen even being offered for sale. However, to date not one procedure has withstood inspection and testing.

A few methods have been successful in determining sex; but the process has damaged sperm cells, resulting in reduced conception rates and making it impractical. The search by university personnel and private corporations for an efficient and practical procedure for sexing semen continues and no doubt will be a part of our future.

Currently the research community reports a successful procedure for separating semen into fractions containing either X or Y sperm. Unfortunately, the cost is prohibitive due to expensive laboratory equipment, low yield of processed semen and time requirements.

However, with a successful procedure in hand, it is only a matter of time until

scientists solve the production problems and sexed semen will be available. Watch for it. It can be of great value to the beef industry.

■ Gifts from Mom

Some traits in mammals are said to be sex-linked. The bovine Y chromosome is approximately half the length of the X; and apart from its role in determining maleness, Y does not appear to be genetically active. Therefore, the genes on the X chromosome do not have a counterpart (are not paired) as do all other genes on the other 29 pairs of chromosomes.

Thus, the only active genes on the sex chromosomes of a bull come from his dam. In actuality a bull is a bit more closely related to his dam than to his sire. Geneticists estimate this closer mother-son relationship to be 3%-5%. While this is not a large amount, it does justify emphasis on the dam's record in selecting herd-sire prospects. Further, it supports the belief held by many experienced cattlemen that "great bulls come from great females."

A similar situation exists between a sire and his daughters. Since a bull has only one X chromosome, every daughter receives the identical one, which results in more uniformity than the daughters of a cow, who carries two X chromosomes, which are passed on strictly by chance.

In summary, the parent-offspring relationship is higher between opposite sexes than between parent and offspring of the same sex.

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