

**Current Topics**

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## Double Muscling

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The topic for my presentation here is "Double Muscling." I am sure that all of you have experienced a good deal of interest in this topic in your practice. There is a good deal of intrigue among purebred breeders particularly, and among commercial cattlemen as well.

First of all, we should make clear that the name is a misnomer. "Double muscling" is wrong. There are no double muscles present. It is a case of hypertrophy of the muscles.

Is this a new problem? By no means. As a matter of fact, as long ago as 1834 they were talking about cattle that apparently showed exactly the same symptoms as we are seeing today. Is it restricted to only a few breeds, or even to one breed, or is it widespread? The answer is that it is very widespread. Many people associate this with the Charolais breed. Charolais breeders have a lot of interest in heavy muscling, fast growth rate and lean meat. I think they have accentuated the problem somewhat in the Charolais breed relative to some of the others. However, as far as it being a unique problem of the Charolais breed, nothing could be further from the truth. This problem has been seen in Angus, Holsteins, Herefords and Limousins. I understand from an Australian who came to Fort Collins the other day that some Ayrshires, of all breeds, have double muscling! It is reported in the Piedmonts from Italy, Maine Anjou from France (where people are trying to make a killing these days from importation), the Santa Gertrudis, and you name it.

What is it? It is a very variable characteristic. It is really a multi-faceted problem and it affects, for example, the newborn calf. Sometimes the tongue is so thick the calf cannot even nurse for two or three days. The calf may also show hypertrophy of the shoulder muscles. Depth of body is reduced in many of the animals. The rump is deeper and the attachment of the tailhead appears to be much further forward than in a normal animal. Again, a lot of hypertrophy occurs in the thighs and primarily this is the source of the name "double muscling." We see the superficial grooves between the semimembranosus and the semitendinosus muscles; another even bigger

one between the semitendinous and the biceps femoris, and between the biceps femoris and the tensor fascia latae. You see grooves between all of these muscles and also the gluteus medius is much enlarged. Sometimes you will see a great bump on the top of the rump because of the enlargement of the muscle. Those grooves appear for two reasons: one, because of the hypertrophy of the muscle, and secondly, because of the virtual absence of fat in these areas. Breeders always talk about long, smooth animals, full muscle, etc.! Muscles are not smooth, as you well know! All of you who took anatomy know that muscles are rounded and when you take the fat away you see their rounded structure underneath the hide.

What are the problems associated with double muscling? Primarily, those of fertility. All aspects of fertility. The calves are very weak at birth: this is problem number one. It is a job to keep them alive. Frequently they are about as weak as dwarf calves. Sterility due to undeveloped reproductive tracts frequently occurs. Gestation may last ten days longer in the extreme double muscle-type animals. Due to the higher birth weight of the calves and the smaller pelvic area frequently associated with the double muscled animal, you have a combination leading to severe problems with dystocia. In fact, in the French experiments where they mated double muscled cows to double muscled bulls, they lost almost 100% of the calves because of calving difficulty and so in their experimental program they went strictly to caesarean section. Another problem is lower milk production. They seem to grow faster once they get past their initial shock for up to about a year of age, when they taper off and actually reach a lesser mature weight than normal animals.

What about the inheritance factor? We still do not know exactly how it is inherited. The most acceptable hypothesis is that it is a single gene character—one major gene, probably modifiers, and when geneticists say, “probably modifiers” that is a statement of ignorance! They really don’t know exactly what is going on. But the “one gene” hypothesis fits most of the cases. It seems to be primarily recessive, not completely recessive, so that the carrier animals may show some of the symptoms. The problem is that in these carrier animals the symptoms may range from almost none to relatively severe. Some of the carriers may be about as severely affected as a homozygous double-gene carrying pure double muscled animals. Now, the French have recognized this problem and they have done work on double muscling, although Tom Cartwright and Nat Keeper in Texas are working on this problem at the present time. The French are getting around this by adopting a scoring system for each of the ten characteristics that I referred to earlier — depth of body, the macraglossia, the inclination of the rump, the “set” of the tailhead, the appearance of the superficial grooves between the muscles, etc. They score them zero if they are absolutely normal; “one” if they show some symptoms, and “two” if they are extreme. So, we can have an animal that scores, say 10, by reason of being extreme in five of the ten characteristics, or he can

score "10" by reason of being intermediate in every one of the "10." Thereby you can have an animal which scores 10 and may be quite different in appearance from another animal which scores "10," and we would characterize both of these as carrier animals—a great deal of variability exists. Personally, I think that the problem could well be explained by more than one gene. It could be a quantitative factor like the inheritance of growth rate, milk production, or disease resistance. There isn't a single gene for any one of these things. It is a "many genes" situation, and I personally think that the available data on matings at the present time could just as well be explained by a multi-gene situation, and that any breed that specializes in heavy musculature, growth rate, and so on, are probably going to increase the frequency of those genes in the breed, just like you do when you select for higher milk production. Soon you have a lot of heavily muscled, and later, double-muscled animals. I just threw this out because the accepted hypothesis is one major gene and some modifiers. My ignorance is just as great as that of most of the other geneticists who have looked at this, so you can decide for yourself!

What are some of the results? Test matings in France showed that mating double muscled males to double muscled females, and extreme types, resulted in virtually 100% of the calves having the double muscle syndrome, with extreme difficulty at calving. When they mated, however, extreme double muscled bulls with a rustic type of small mountain-type cows, no double muscled calves resulted. When they took these progeny and mated double-muscled bulls back to them, they had about 40% double muscled calves. When they mated double muscled bulls to these and created a third generation, they had about 90% double muscling.

These results could still be explained either by a single major gene or by a multi-gene situation where you are increasing the concentration of the genes.

What recommendations should you give your clients? By all means stay away from it for now! It spells really nothing but problems for the average commercial man; the fertility rate will suffer and there will be all kinds of problems at calving. The French are hoping to utilize this because they like a different kind of beef—very lean beef with not much fat.

If you really want to learn a lot more about this, I would like to recommend the Texas A&M Technical Bulletin No. 12 written by Oliver and Cartwright.