

Double Muscling in Murray Greys

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You cannot manage what you do not measure

The condition of double muscling (DM) in cattle is really misnamed because there are no more than the normal number of muscles, but they are enlarged or hypertrophied. (The more correct term is muscular hypertrophy.)

DM is a genetic condition caused by a mutation of the myostatin gene. Myostatin in animals controls or limits the size of the muscles. A defect in the myostatin gene allows the muscle fibers to increase in size and number. Animals with a myostatin variant gene have decreased fat and bone content and therefore have an increased dressing percentage at slaughter.

Like in other simple genetic conditions, such as horns or coat colour, one copy of the gene comes from each parent. If the calf receives a copy of the myostatin variant from only one parent, the calf will be termed as a carrier of the DM gene or a heterozygote. If the calf receives a copy of the DM gene from each parent, it will be affected (a homozygote DM).

There are at least nine mutations or variations in the myostatin gene, and these can now be detected using modern DNA testing. The mutation most found in Murray Greys is termed NT821. This mutation is also found in Belgian Blue, Angus, Speckle Park, Salers, Devon and some other breeds. Testing of semen samples has identified that a myostatin variant was present in a Murray Grey born in 1966 so DM is not necessarily a recent introduction to our breed.

Double muscling caused by NT821 in Murray Greys first came to public attention when a large UK herd encountered calving problems caused by affected calves. The UK Murray Grey Society introduced DNA testing and made these results available on the Breedplan database. Myostatin testing has enabled breeders in the UK to make informed decisions. Very little testing for myostatin variants has been conducted in Murray Greys in Australia to date.

The availability of DNA testing for variants of the myostatin gene has enabled a better understanding of the condition and allows it to be managed to best advantage. DNA testing ensures that breeders can avoid animals inheriting two copies of the gene, as a result of mating a carrier bull with a carrier cow.

An average affected (double muscled) calf has a heavier birth weight and greater width of thighs and hip bones. These traits increase calving problems, particularly in heifers. Furthermore, the affected calves can have enlarged tongues, and this affects their ability to suckle. They also have reduced exercise tolerance and greater susceptibility to heat stress. Double muscled females have a narrowed pelvic girdle which increases the likelihood of calving problems compared to normal cows.

Further research has clarified that there are definite positive effects of myostatin variants. The heterozygous (carrier) offspring have greater feed efficiency, increased rib eye area, increased retail meat yield, higher proportion of expensive cuts of meat, lean and very tender meat.

In the UK and Europe double muscled breeds are commonly used, by AI, as terminal sires in dairy herds. Most of the beef produced in the UK comes from dairy beef production enterprises. Premiums are being paid for these dairy beef carcasses sired by double muscled breeds. This has resulted in the 'infusion' of double muscled gene(s) into other beef cattle breeds. Some breeds and breeders have been using the myostatin variants to a commercial advantage, achieving better dressing percentages and results in carcass competitions.

Breeds like Speckle Park and Limousin provide routine testing and reporting of myostatin status. Just selecting for increased muscling by visual assessment will increase the likelihood of selecting for carrier animals. **This is a lesson that we have learnt the hard way as we will show.**

Our experience with muscling and NT821

When we were working for NSW Department of Agriculture in the 1990's, there was a Departmental project on improving the muscling in British cattle breeds, based on visual assessment. The Principal Investigator was Bill McKiernan. The data was clear that steers with better muscling fetched better prices in the saleyard and over the hooks. The industry opinion was that increasing muscling could increase the incidence of calving problems. The research project was to investigate this aspect and measure the effectiveness of selecting cattle with better muscling. We were both on the Animal Care and Ethics Committee (ACEC) that reviewed the design and results of the research.

Initially, Hereford cows were crossed to Angus bulls selected for low or high visual muscle score. Visual muscle score was used to select heifer offspring into Low or High muscled lines, which were joined to low or high muscled Angus bulls respectively. The results at this stage of the study indicated that there was no increase in calving problems.

Subsequently, the myostatin variant NT821 was introduced into the High line from an Angus stud which was using the gene to generate superior muscling. A third cow line with one copy of the myostatin mutation was then formed.

We felt confident enough in the muscling research to start buying and selecting better muscled cattle when we moved to Binda with our Murray Grey herd. Bill McKiernan kindly came down and gave us some advice. However, at this stage DNA testing was not available and we were limited to visual assessment.

We purchased bulls and heifers with superior EMA EBVs and visual muscle scores. We also used a superior muscled bull in our AI program. After we bred a heifer that appeared to have double muscling, we sent samples from our bulls for testing for myostatin variants. We realized we needed more information, so we tested our whole herd. Results show we had purchased several females, a bull and semen that carried NT821.

Testing demonstrated that four of the six bulls and 17 of the females we used in 2021 were carriers of NT821. At calving we closely monitored the carrier females that had been joined to a carrier bull; we had 5 affected calves; 1 bull born dead but unassisted, 1 bull born alive but assisted and 3 affected heifers born alive unassisted. We have now tested all our T calves; we

found 23 carriers, 23 free (despite at least one parent being a carrier) and 30 calves free by inheritance.

To prevent dystocia problems due to calves with double muscling, it is important to avoid mating carrier bulls to carrier females. If the myostatin status of the herd is unknown, it is wise to use only bulls free of myostatin variants, particularly over heifers. Many of our commercial clients have small herds, rear their replacements, and use one bull over cows and heifers. They are best using a bull free of NT821 and, therefore, in future we will only sell bulls free of NT821. The bull calves identified as carriers will become steers suitable for longer term feeding. Our steers free of NT821 have done better in short term carcass competitions, finishing in 60 days on feed. These will suit the domestic butcher.

We have declared the NT821 status of the bulls from which we sell semen. Some clients will wish to buy semen from known carriers. There is value in using a Murray Grey bull carrying NT821 as a terminal sire or in a dairy beef situation.

However, we see no reason not to retain the females that are carriers because they have the potential to produce offspring with superior muscling. At Crookwell Show in 2022, our animals that were subsequently identified as NT821 carriers won Champion Prime Vealer, Grand Champion Prime Exhibit and Supreme Champion Commercial Exhibit. Carrier calves and carrier females have no statistically significant difference in dystocia to non-affected calves or females

Now that the test for NT821 is available, it greatly reduces the dystocia risk when selecting for better muscling. Furthermore, if bulls with better muscling can be identified as free of NT821 they, combined with carrier females, have the potential to produce the best muscled offspring. We are fortunate that three of our well-muscled bulls (Banksia Ridge Harry H1, Cam Grove Xman L16 and Cadfor Falcon N2) tested free of NT821.

NT821 is not prevalent in Murray Greys but several popular and influential sires, past and present, have been shown to be carriers. Some breeders assume they can visually detect carriers, but the evidence is clearly otherwise. The test for NT821 can be done on hair or tissue samples and is relatively cheap when done in association with the SNP testing required of all bulls. Myostatin testing is available through the MG Society or the NSW DPI at the Elizabeth Macarthur Agricultural Institute (EMAI). We believe the testing of all bulls is a sensible policy for Murray Grey stud breeders.

By testing the herd, and by using bulls tested myostatin free, we can get the benefits of better muscling without the risk of producing affected calves. After all, you cannot manage what you don't measure.

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Our calves born in 2021 alerted us that we had double muscling associated with NT821. The silver heifer, S6, was confirmed as homozygous affected. The grey heifer S5 was heterozygous (a carrier).



The silver steer T112, tested as a homozygote, was shown at Crookwell Show in 2023 in the Commercial Section, as a calf at foot, to see what comment such a calf would produce in a breed not normally so heavily muscled. The judge noted that he was Doubled Muscled. The cow and calf won their class but did not get the Champion award. His mother Q10, an obligate carrier, was purchased in utero in a cow which was subsequently tested free. Q10's sire, therefore, must be a carrier of NT821.