

CHAROLAIS

THE BRITISH CHAROLAIS CATTLE SOCIETY

DNA TESTING



WEATHERBYS
SCIENTIFIC

British Charolais Cattle Society DNA testing

Technology has advanced so much since we started DNA testing using hair samples nearly 20 years ago and now the system we have used for testing since then (Microsatellite) is being phased out.

Microsatellite testing produces a 16-marker profile for each animal which can then be used to determine if the parentage is correct. This is being replaced by single nucleotide polymorphism (SNP) testing, which is a much more comprehensive test. It is not a new, untested technology and has been used by Weatherbys Scientific since 2010.

The SNP chip which the hair, tissue or semen samples are tested on, produces 50,000 gene markers and for the purposes of parentage analysis over 200 are used. The additional markers can be used for other tests, such as to determine if the animal has myostatin or polled genes and in the future advances will enable many more tests to be carried out from this one profile. One such advance that is being developed at the moment is TB resistance.

In order to keep up with the new technology, the Council of Management have been discussing for some time how we should proceed with the Society DNA tests and at the recent council meeting it was decided that now is the time that we should change over to SNP testing. In making this decision the Council have considered its responsibility towards ensuring that herd book entries and other recorded data is accurate, as well as considering the Society's principal charitable activity of registering and evaluating the genetics of Charolais cattle registered in the UK. The SNP testing will provide more accurate data and more detailed information which the Society believes will increase the integrity and progression of the breed.

To this end the Society are investing over £30,000 to create a database of SNP profiles for animals which have been previously microsatellite tested, so that we have a base of profiles to carry on and sire verify all the animals we DNA test. In addition to this, the society will fund the re-testing of any sires which have not had a SNP profile created in this initial run, but have been previously microsatellite tested, when you apply for their progeny to be tested.

It was also decided that we should use this opportunity to further increase the integrity of the breed through an extended DNA testing policy.

To this end, we will be introducing a number of changes which will come into effect from 1 July 2018. These changes will be also detailed in our bye-laws which are available on our website:

- **All ET animals will be fully parentage tested – currently, in cases where there is only one possible sire, only the first-born calf from each flush is tested and all ET calves with more than one possible sire are tested.**
- **All bulls privately sold to pedigree herds will be tested before they are transferred, at the vendors cost – currently, only bulls sold through Society sales are tested before they are sold.**
- **All homebred herd sires will be tested upon the registration of their first calf – currently, they are tested on the registration of their third calf.**
- **All heifers will be tested upon the registration of their first calf.**
- **All animals which are SNP DNA tested, will also be tested for the two Myostatin variants found within the breed: Q204X & F94L.**

Why are we Myostatin testing?

Knowing the myostatin status of your animals, will help you to select bulls with the most appropriate myostatin traits for your breeding program. This will lead to better calving ease and help with the ever-present trend to improve carcass confirmation and quality. Once we have established a myostatin database, the results will be displayed with the other animal details on our online database, on pedigree certificates and in sale catalogues.

As mentioned above, in order for us to change over to SNP testing, we will need to re-test samples from animals which have previously been submitted for microsatellite testing. At the same time, we will request for them to be Myostatin tested and in the future, as technology develops, they may be used for further testing.

If you have previously submitted a sample and would like any further information or have any concerns in relation to these further tests being carried out, please contact the office on 02476 697222.

DNA Prices

Due to the changes, the costs for DNA tests will increase from 1st July 2018. These changes will also be detailed in the bye laws.

When the prices change one thing will stay the same. If you have submitted a pending sample to the office before the calf reaches 10 months of age for us to hold, the price you pay for the DNA test when it is conducted at a later date will be less.

In addition to the costs when you submit the sample, from the 1st July we will be passing on the additional costs we incur when an animal has a sire or dam exclusion, when you request a DNA profile certificate and when you import an animal which already has a SNP profile.

When we first send your sample for DNA testing – if there is more than one possible sire – we can submit up to three possibilities at this stage without incurring any extra charges. We can submit three parents in total, so if the dam is DNA profiled, we can only submit two possible sires. The society is charged for any additional parents over and above the first three, and any parents submitted at a later date – for example if there is a parentage exclusion. Unfortunately, we cannot keep absorbing these extra charges, which cost the society over £1,300 last year.

Please see the table below for the new list of charges:

Test Type	Costs	
	Pending Sample	Full Price
SNP Parentage & Myostatin	£27.00	£32.00
SNP Parentage, Myostatin & Polled	£29.00	£34.00
Additional Sires & Dams	£4.00	
Sire Search	£9.00	
Profile Certificate	£3.50	
Imported Animal Profile	£3.50	

Remember that all DNA tests conducted from the 1st July 2018 will be tested using the new system. If you have outstanding DNA queries we will be writing to you separately, please help us to clear up any old DNA issues before we start the new tests by contacting us asap with the information we require to resolve them.

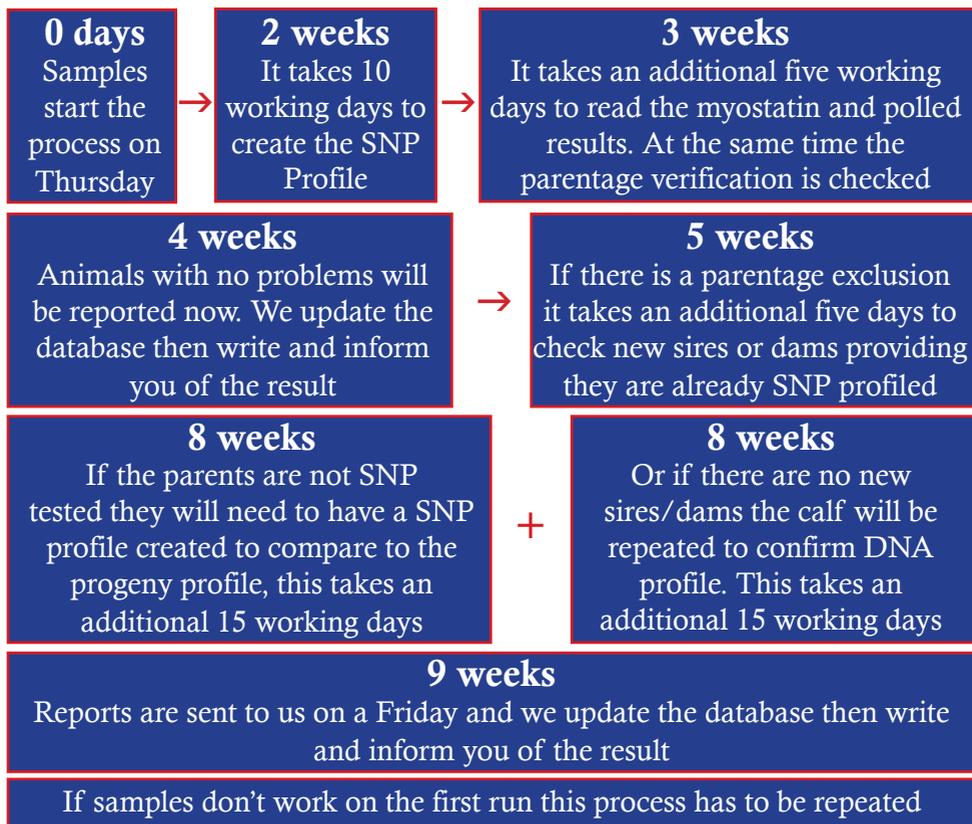
So that you have a chance to send pending samples for both bulls and heifers, from the 1st of July, we will send pending bags for all animals that are registered, not just male calves.

Before this happens, to get you started, if you have heifers which will be due to calf for the first time this year, we have enclosed some sample bags, a permanent marker and a copy of the updated sample instructions. Use the marker to write your name and the tag number of the animal on the bag and when we receive the sample in the office, we will print the DNA label. If you require the sample to be tested right away, please make sure to include a note to let us know.

Timescales for tests

We send batches of samples on from the office to via courier to Weatherbys on a Friday afternoon, so that they reach the lab in plenty of time for the start of the process on Thursdays.

How the process works at Weatherbys:



Myostatin Genetics

There are both advantages and disadvantages of breeding with animals carrying the myostatin gene, which is why it is imperative that you know the carrier status of your breeding animals.

What is Myostatin?

Myostatin is a gene that influences the production of proteins which control muscle development. When an animal is identified as having one of the mutations it means that they have inactive genes which do not control muscle growth as effectively, this can result in increased muscle mass, or “double muscling”.

Currently in cattle, there are 19 known mutations of the gene, all of which are identifiable from the profile created by the IDB SNP chip. Weatherbys are able to report nine mutations which are best understood from an economic perspective. Some of these mutations are breed specific and within the British Charolais herd book, two prevalent variants are found – F94L & Q204X

British Charolais Myostatin Variants

F94L

Research conducted by Adelaide University in Australia concluded that the effect of the F94L mutation on birth and growth traits was not significant but was associated with an increase in meat weight and a reduction in fat depth. The results for the average effect of substituting a single copy of the variant F94L variant indicated an increase in silverside between 5.8 and 7.2% and meat weight of between 5.9 and 7.3%. There was also a reduction in P8 fat depth, intramuscular fat and carcass fat weight.

Calves used for this study, carrying 2 copies of the variant F94L marker, produced carcasses with approximately 12 to 15% more meat and 16 to 33% less fat compared with calves with no copies of the variant F94L allele, while single carriers produced approximately 3% more meat weight, while fat depth measured on live calves was 9.8% lower. Therefore, the F94L variant appears to have many positive effects without correlated negative effects of some other myostatin variants.¹

1 A. K. Esmailizadeh, C. D. K. Bottema, G. S. Sellick, A. P. Verbyla, C. A. Morris, N. G. Cullen, W. S. Pitchford; Effects of the myostatin F94L substitution on beef traits, *Journal of Animal Science*, Volume 86, Issue 5, 1 May 2008, Pages 1038–1046, available at: <https://doi.org/10.2527/jas.2007-0589>

Q204X

In a study published in the Oxford University Press Journal of Science on the effects of the Q204X gene in Charolais cattle, it was shown that the Q204X mutation leads to an increase in muscle mass. This creates a dramatic increase in saleable meat yield because of the improved dressing percentage, reduced carcass fatness, and fineness of the limb bones. In this study, animals with a single copy of a mutated allele were slightly heavier at birth, as a consequence of this calving difficulties also increased in heifers, but they found no effect with cows.

These animals showed consistently greater carcass yields, the thighs were thicker and the rib eye areas were larger. They were also markedly leaner, with less internal fat and less fat on the 6th rib. Therefore, the presence of even one copy of Q204X was shown to increase the beef value of these animals drastically. Regarding meat quality, trained taste panellists indicated that the meat of young heterozygous bulls was more tender. This better tenderness can be a consequence of a reduced collagen content and a smaller mean area of the muscle fibre section because both characteristics have been shown to be related to muscle tenderness.²

	<i>Variant Name</i>	<i>Double Muscling</i>	<i>Increased Muscling</i>	<i>Increased Birth Weight</i>	<i>Increased Calving Difficulty</i>	<i>Lower Fat</i>	Breeding Recommendation
Q204X	✓	✓	✓	✓			Best for breeding terminal animals. Not recommended to use a homozygous bull on heterozygous heifers or cows with a smaller pelvis
F94L		✓			✓	✓	OK for all breeding animals to be homozygous

² S. Allais, H. Levéziel, N. Payet-Duprat, J. F. Hocquette, J. Lepetit, S. Rousset, C. Denoyelle, C. Bernard-Capel, L. Journaux, A. Bonnot, G. Renand; The two mutations, Q204X and nt821, of the myostatin gene affect carcass and meat quality in young heterozygous bulls of French beef breeds, *Journal of Animal Science*, Volume 88, Issue 2, 1 February 2010, Pages 446–454, available at: <https://doi.org/10.2527/jas.2009-2385>

How are these genes inherited?

All reproducing species have two copies of each gene – called alleles. If your Charolais has one copy of the myostatin variant (one allele) it is classed as **heterozygous**, if it has two copies (two allele) it is classed as **homozygous**.

The table below shows the chances of inheriting depending on the status of the parents:

2 Homozygous Parents	→	100% chance of Homozygous offspring
1 Homozygous Parent 1 Heterozygous Parent	→	75% chance of Homozygous offspring 25% chance of Heterozygous offspring
1 Homozygous Parent 1 Non-carrier Parent	→	100% chance of Heterozygous offspring
2 Heterozygous Parents	→	25% chance of Homozygous offspring 50% chance of Heterozygous offspring 25% chance of non-carrying offspring
1 Heterozygous Parent 1 Non-carrier Parent	→	50% chance of Heterozygous offspring 50% chance of non-carrying offspring
2 Non-carrier Parents	→	100% chance of non-carrying offspring

How to use this information

The information gained from knowing the myostatin status of an animal is helpful when making breeding decisions for your herd. However, it is just one tool which should be used in conjunction with the wider information available such as Estimated Breeding Values (EBV's) – which predict the performance of the animal based on its back pedigree, accurate measurements and the performance of its herd mates – and your own judgement on type and pedigree.