DNA-Based Parentage Testing of Cattle

Why Parentage test?

Accurate pedigree recording is the key to increasing genetic gain. Genetic gain is highly correlated with commercial & economic gain. Accurate pedigree recording prevents inbreeding and allows accurate evaluation of animal performance. It is essential when estimated breeding values (EBVs) are being used as the basis for selection.

Gathering precise pedigree data through field records by "mothering up" cows and calves can be difficult and the widespread use of artificial reproductive technologies means that the potential for human error can be high. How do you know you have got what you paid for? Paternity assignment in multi-sire herds is also not possible.

Parentage Testing & Multiple Sire Mating Analysis (paternity testing) are powerful tools for cattle producers who want to increase the rate of genetic gain in their herds.

What is DNA Typing & Parentage Testing?

DNA contains our genetic code and we inherit half our DNA from our mother and half from our father. DNA is contained in all nucleated cells and can be extracted from most tissues – although it is easiest to obtain from blood and hair follicles.

There are regions in our DNA that contain highly repetitive sequences, for example, ACACACAC. These are sometimes referred to as 'junk DNA'. The correct names for these sequences are DNA Microsatellite Markers or Short Tandem Repeat Markers. The number of repeat motifs in the sequence varies between individuals; one individual may have 50 AC repeats, while another individual may have 58 AC repeats. This repeat variation makes the size of the marker different between individuals and this size difference can be detected in the laboratory. It is the size of each marker that is reported as an animal's 'DNA Type'.

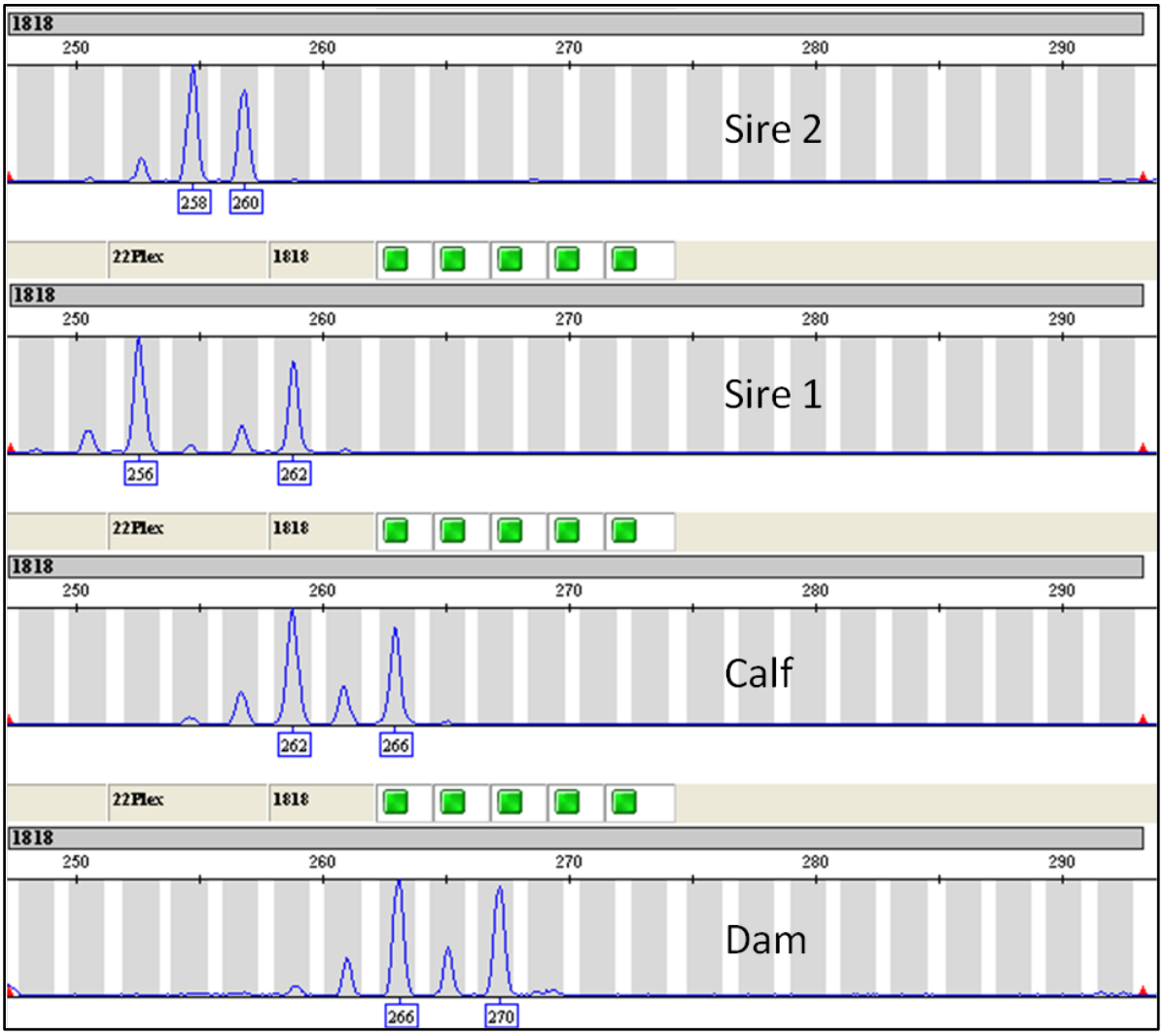
Microsatellite Markers used in parentage testing can have many different sizes (20-30) and it is this variability that makes them useful for parentage analysis. All animals, including humans, have two copies of each gene: parentage testing relies on the principle that an individual will inherit one copy from its mother and one from its father. Therefore, if a particular marker size (called an 'allele') is present in the calf, but absent in both of the nominated parents, then the parents must be excluded from the calf's pedigree.

American Wagyu Association-Inc

PO BOX 1115, POST FALLS, ID 83877 USA

Tel: ***+1 208-777-427*** *Fax:* ***+1 208-292-2670*** *Email:* ***office@wagyu.org*** *Web:* ***www.wagyu.org***

The figure below illustrates what a Microsatellite Marker looks like once it has been converted to a digital image on the computer. The numbers below each peak correspond to the size of the marker and this is the digit that appears on the animal's DNA typing report. In this simple representation it can be seen that Sire 1 is the *qualifying* sire of this calf. Sire 2 is *excluded* as a parent because it carries marker sizes 258 + 260, whereas the calf carries neither of these marker sizes. The calf has inherited its 262 allele from Sire 1 and its 266 allele from the dam.



What is the Accuracy of DNA-Based Parentage Testing?

The above example is just one marker that is used in a panel of **22 markers** at the Animal Genetics Laboratory for determining parentage. Our marker panel has been statistically validated and provides a high level of accuracy. Accuracy is determined on an exclusion basis, that is, the ability of the panel to *exclude* an *incorrect* parent from a calf's pedigree. For all breeds, 99.9% of incorrect matings will be detected by parentage analysis. For analyses which only consider one parent, such as paternity testing or multi-sire mating analyses, this figure is reduced slightly to around 99.6% to 98.7% depending on the breed.