

# FACT SHEET

## Utilising DNA for Parentage Verification



### FAST FACTS

- **Pedigree information is important for maintaining breed integrity and assisting genetic selection**
- **DNA technology offers a powerful tool for reducing pedigree errors and offers some management benefits**
- **Parentage verification works by excluding an incorrect parent rather than by identifying a correct parent**
- **Most breed societies require some level of DNA recording and parent verification**

**Having accurate pedigree records is essential for genetic evaluation and to ensure integrity of cattle breeds. Traditionally, pedigree information is collected through on-farm recording of joining details and mothering up observations. Inaccuracies are inherent in such recording methods. DNA technology allows pedigree assignment with a significantly higher degree of accuracy than is achievable through on-farm recording.**

#### Pedigree is important

Accurate pedigree information benefits both seed stock producers and breed societies as it forms an important basis for:

- making breeding decisions – ensuring the genetics of animals with desirable pedigrees are selected for breeding future generations
- genetic evaluation programs – pedigree information feeds into and is critical for analysis
- identifying linkages across herds – allowing analysis of genetic merit across herds, breeds and countries
- managing inbreeding and undesirable genetic conditions

The more accurate the pedigree information, the more useful it is. Even within farming operations that follow best practice, at least 5% pedigree errors can be expected due to cross-mothering, mis-mothering, recording and transcription errors and management issues such as animals jumping fences. Artificial insemination can produce additional errors from incorrect semen being used and from incorrect sire assignments when using backup bulls.

#### Benefits of parentage testing

Parentage testing is an important tool for beef producers. Recording accurate parentage through testing is useful to:

- reduce pedigree errors, improve genetic selection and speed up genetic progress
- enable multiple sire matings and identify the most productive bulls
- reduce labour involved in mothering up
- identify untagged animals

Most breed societies stipulate specific regulations for parentage testing but societies differ significantly in the level of testing required. For more information on testing requirements, contact your breed society.

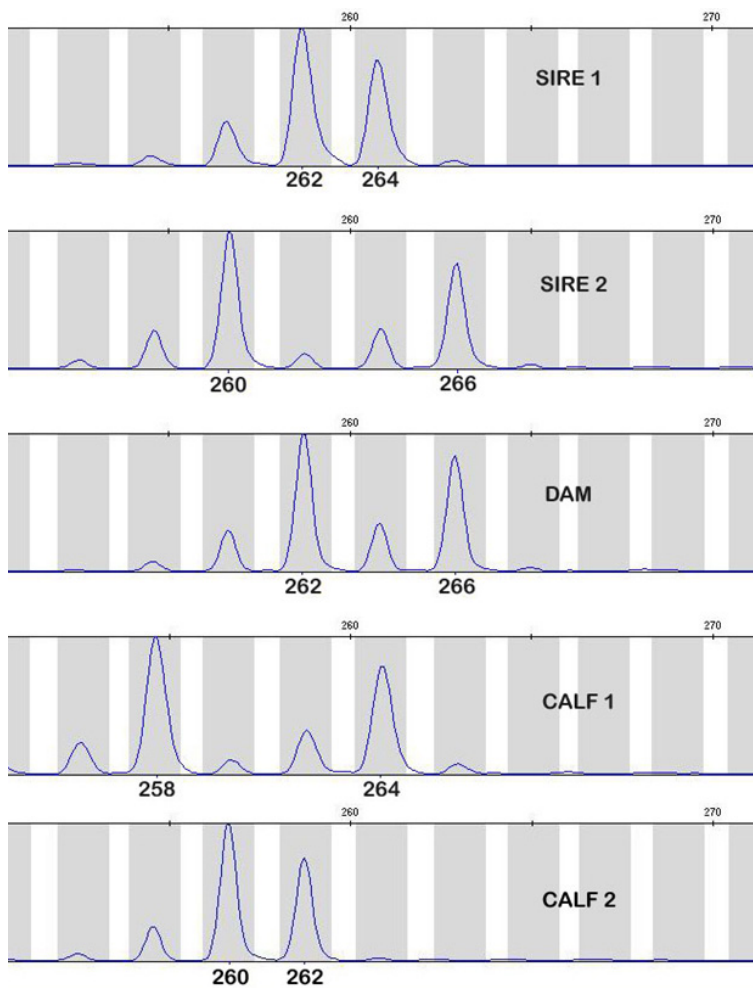
#### How parentage testing works

Parentage validation is based on the detection of genetically inherited markers that remain the same throughout an animal's life. The chromosomes are made up of DNA, sections of which can be detected and used as markers. All animals inherit two copies of each chromosome: one copy from the dam and one from the sire. Therefore, if a marker is present in the calf but absent in both nominated parents, the calf must be excluded as the offspring of that mating. Irrespective of the markers used, parentage testing always works by exclusion—that is, proving an animal is not the progeny of a sire or dam rather than proving that it is.

DNA technology employs two types of markers: microsatellites or SNPs. The use of these markers for parentage analysis is identical, although the methods of detecting them differ.

## The technology

Parentage testing using SNPs or microsatellites involves two processes: collecting DNA marker information and analysing that information to ascertain parentage.



**Figure 1:** Shows one microsatellite marker identified for five animals. Each animal's inherited alleles are labelled with the allele 'name', which reflects its number of base pairs. Calf1 could have inherited allele 264 from Sire1 but shares no common alleles with the Dam; therefore it qualifies as the offspring of Sire1 but not of the mating between Sire1 and the Dam. Calf2 could have inherited its 262 allele from Sire1 and its 260 allele from Sire2. Calf2 therefore qualifies as the offspring of both sires. By including the Dam's DNA information, the power of the test increases because only a mating of the Dam (transmitted allele 262) and Sire2 (transmitted allele 260) can explain the Calf2's genotype.

## Accuracy

The overall discriminating power, or accuracy, of a parentage test is determined by both the degree of variability of each marker and the number of markers used in the test. Microsatellite markers have high variability and SNP markers have low variability. To achieve the same level of accuracy, large numbers of SNPs are needed in a parentage test compared to microsatellites. The accuracy of a parentage test differs between breeds and is reduced in those breeds with a small gene pool. In most breeds, the accuracy of current microsatellite marker panels is around 99.9% for two-parent analyses and between 99.6% and 99.9% for single parent analyses. Accuracy is also reduced where only one parent is available for pedigree analysis.

## Tests available in Australia

In Australia, Pfizer Animal Genetics (PAG) and The University of Queensland (UQ) offer parentage validation using a basic panel of 12 microsatellites, which have been standardised by the International Society for Animal Genetics (ISAG). Standardisation aims to ensure the identification of alleles is consistent across laboratories and countries. Therefore, a DNA profile from one laboratory is able to be used by another laboratory without the need for re-testing. In addition to the standard ISAG panel, most laboratories include additional, non-standardised markers to increase the exclusion power of their tests.

A 96-SNP panel test for parentage validation will soon be available in Australia through PAG and UQ. SNP-based parentage testing can be performed simultaneously with tests for production traits, which makes the parentage testing cheaper. However, when parentage alone is required, SNPs are more expensive.

## Further reading

The Beef CRC website (<http://www.beefcrc.com.au/>) and the SBTS/TBTS webinar series (<http://sbts.une.edu.au/Webinars/webinars.html>) have additional information on utilising DNA for parentage verification. In addition your breed society and preferred commercial supplier can advise on testing options.

