



Parentage assignment using genomics

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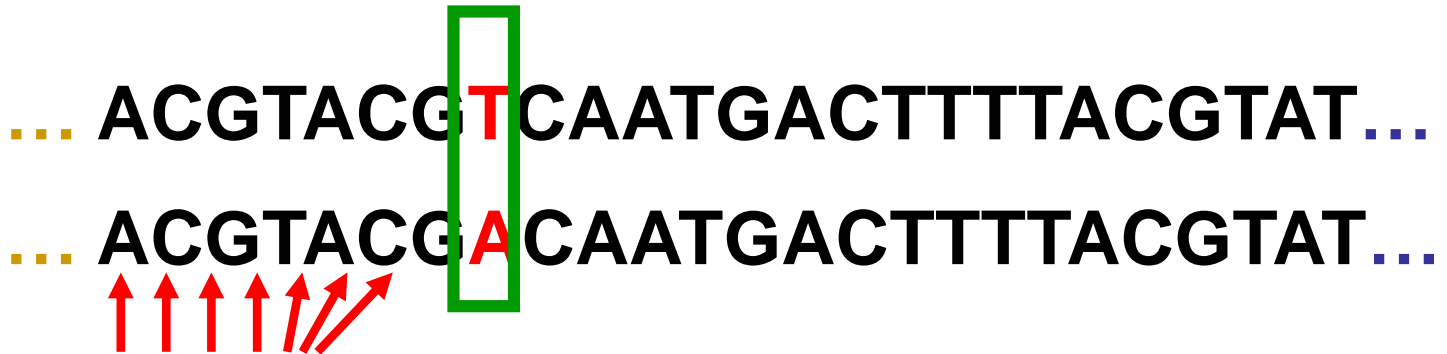
Why important?

- **Accurate genetic evaluations (national + flock)**
 - **High reliability**
 - **High precision (less fluctuations in proofs)**
- **Knowledge of inter-animal relationships**
 - **Mating plans - inbreeding**
- **Integrity of flockbook**

The theory

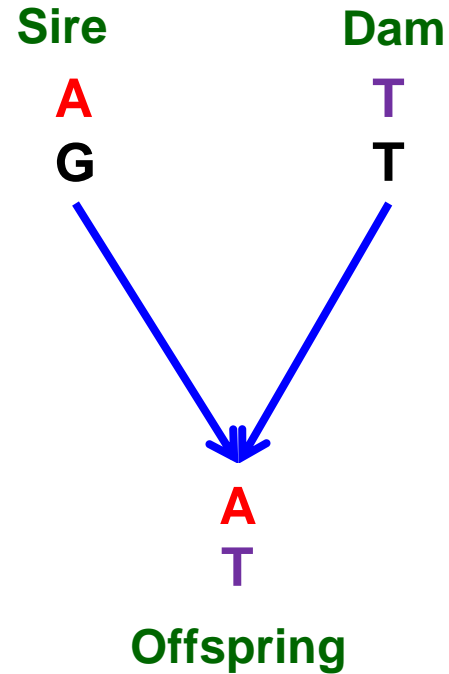
The technology

- 99.9% of human DNA is identical – most of the differences are in the form of SNPs

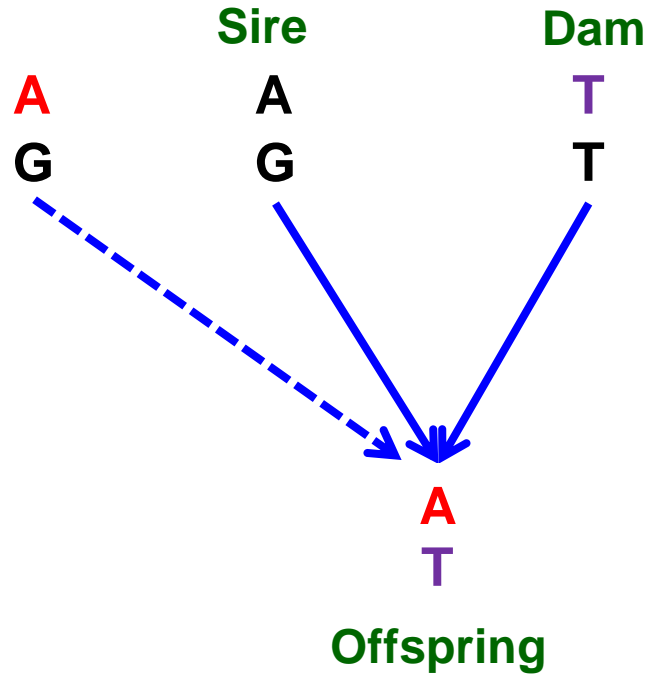


- ~~Single Nucleotide Polymorphism~~ **Change**

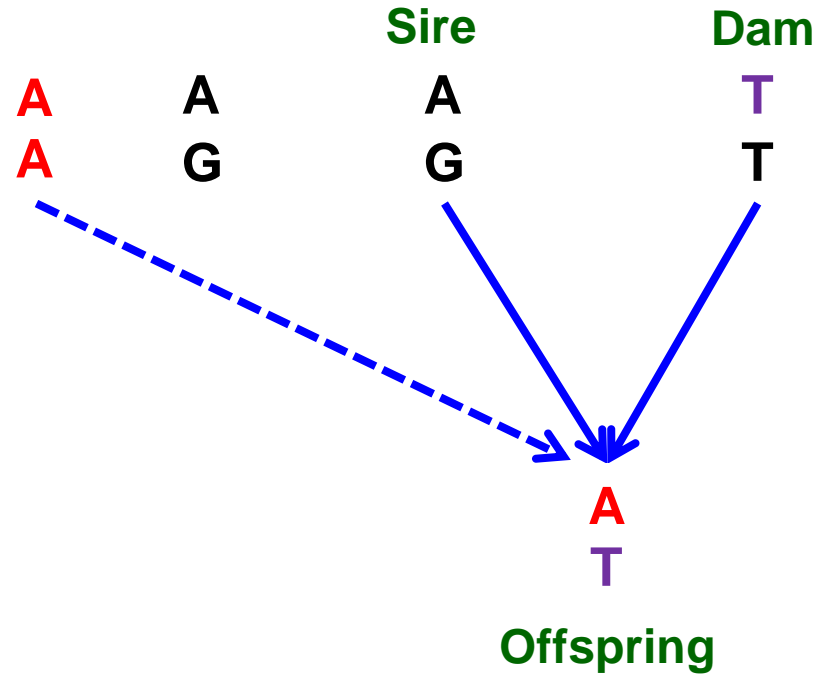
Parentage



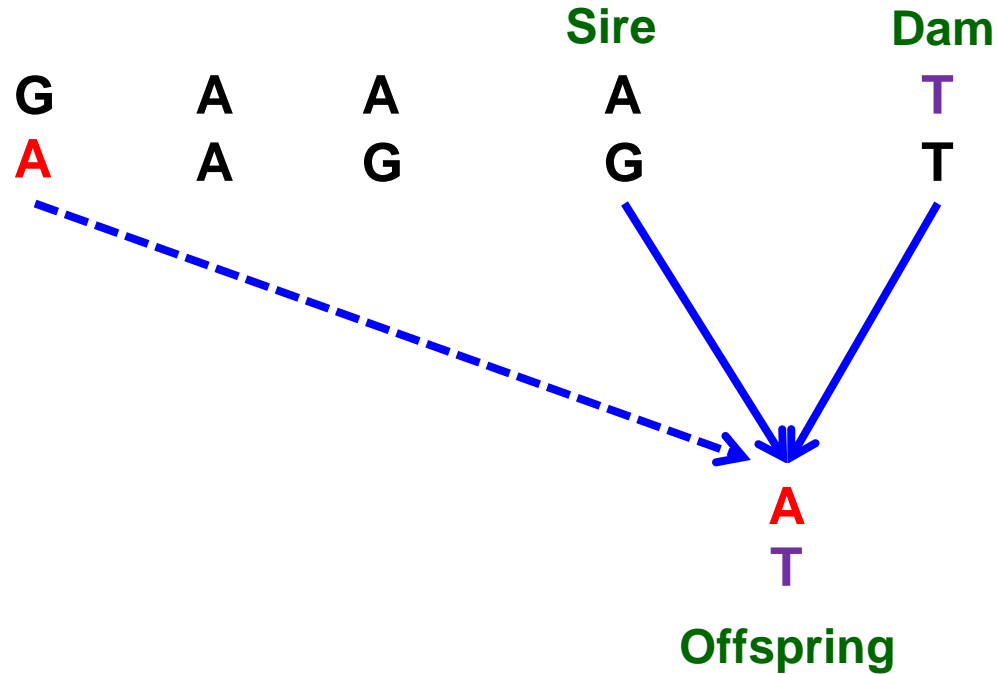
Parentage



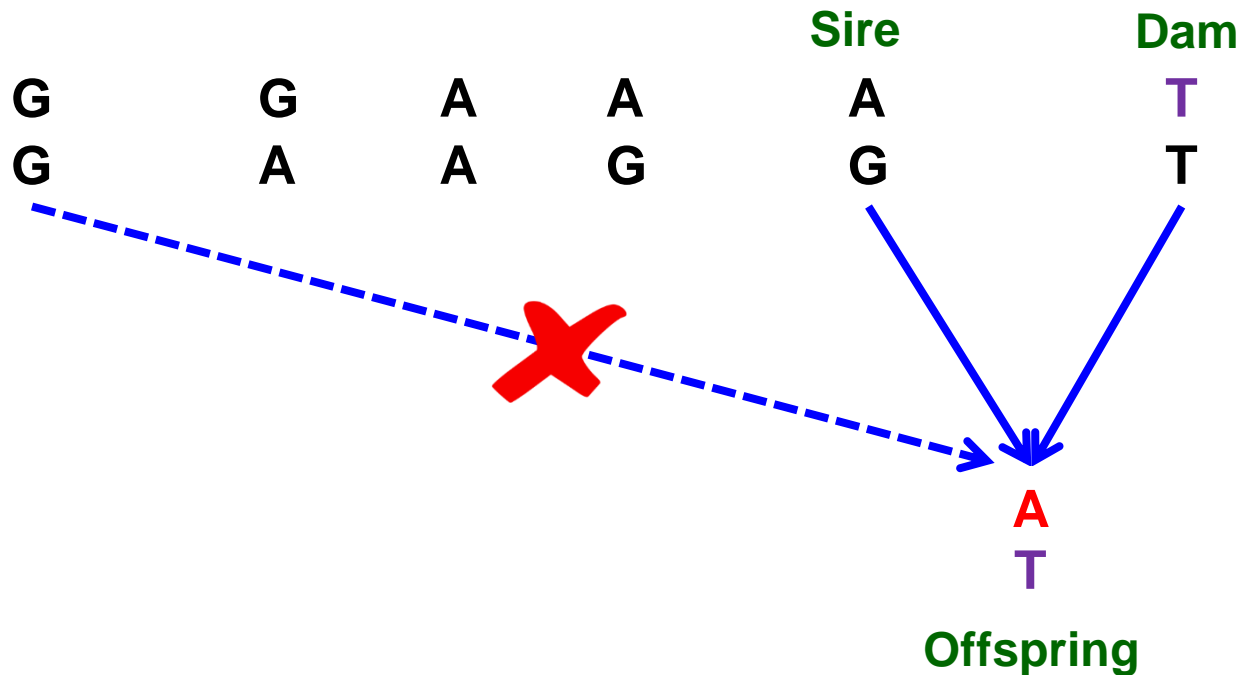
Parentage



Parentage



Parentage – why do many markers?



Parentage verification/validation

Sire

.....TCACCGCTGAG.....

.....CAGATAGGATT.....



.....CAGATAGGATT.....

.....GTTAGCCTGTCA.....

Offspring

Parentage invalidation

Sire-offspring errors

Dairy ~7.5%

Beef ~14%

Sire

.....GTCGCCGCTGA...

.....CTAGATAGGATT.....

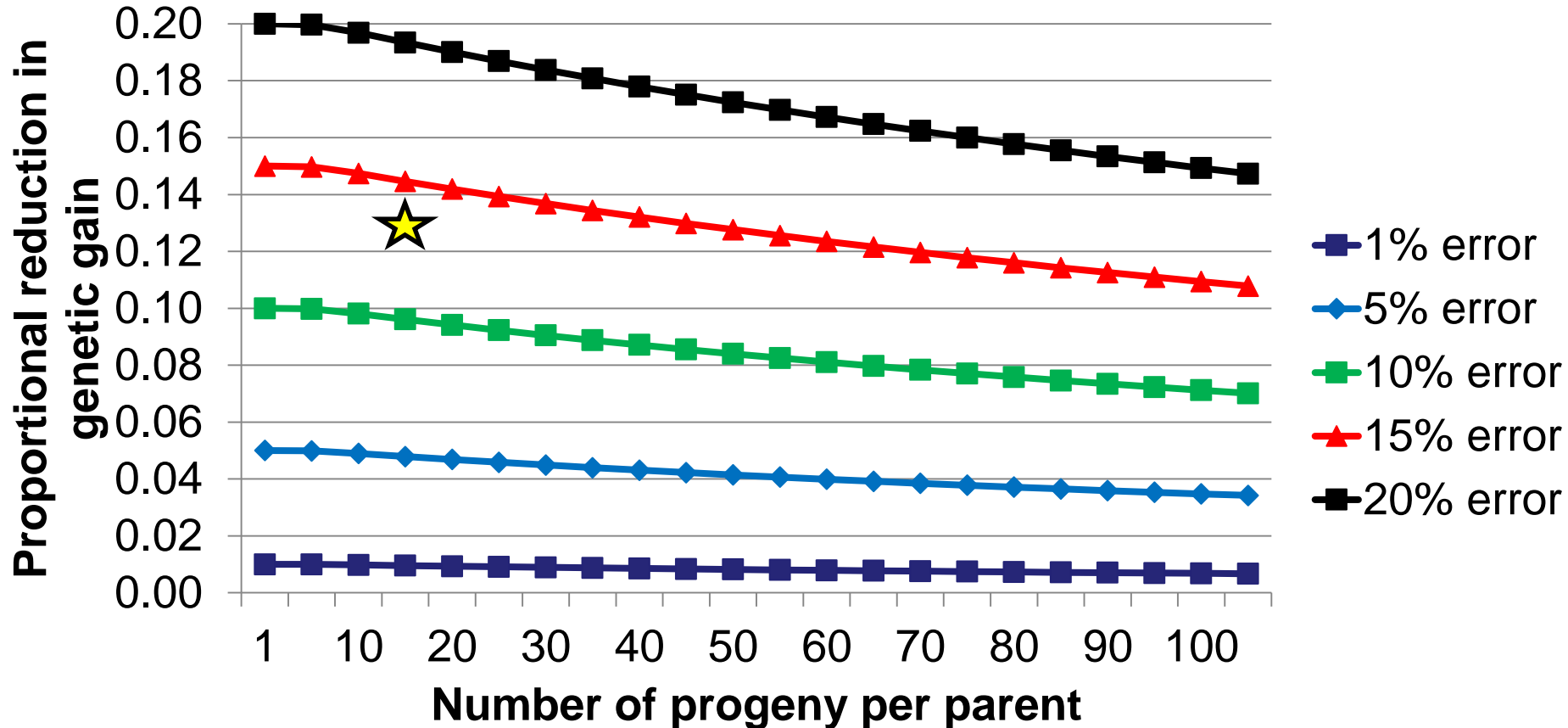


.....GCATTCAGTCAT.....

.....GCTAGTTACTGG.....

Offspring

Impact of parentage errors



Points to note

- **Parentage error is worse than no parentage recorded**
- **Need around ~100 carefully selected DNA variants for parentage (in)validation**
 - **Left in limbo if parentage not validated**
- **Parentage assignment**
 - **At least 350 carefully selected DNA variants**

Parentage assignment

“Sire 1”ATTCGGGGCTGTG.....

“Sire 2”GCGATGGCAATG.....

“Sire 3”TAGGACGCTATG.....

“Sire 4”GCATTCAGTCAT.....

Proposed Sire

.....GTCGCCGCTGA...

.....CTAGATAGGATT.....



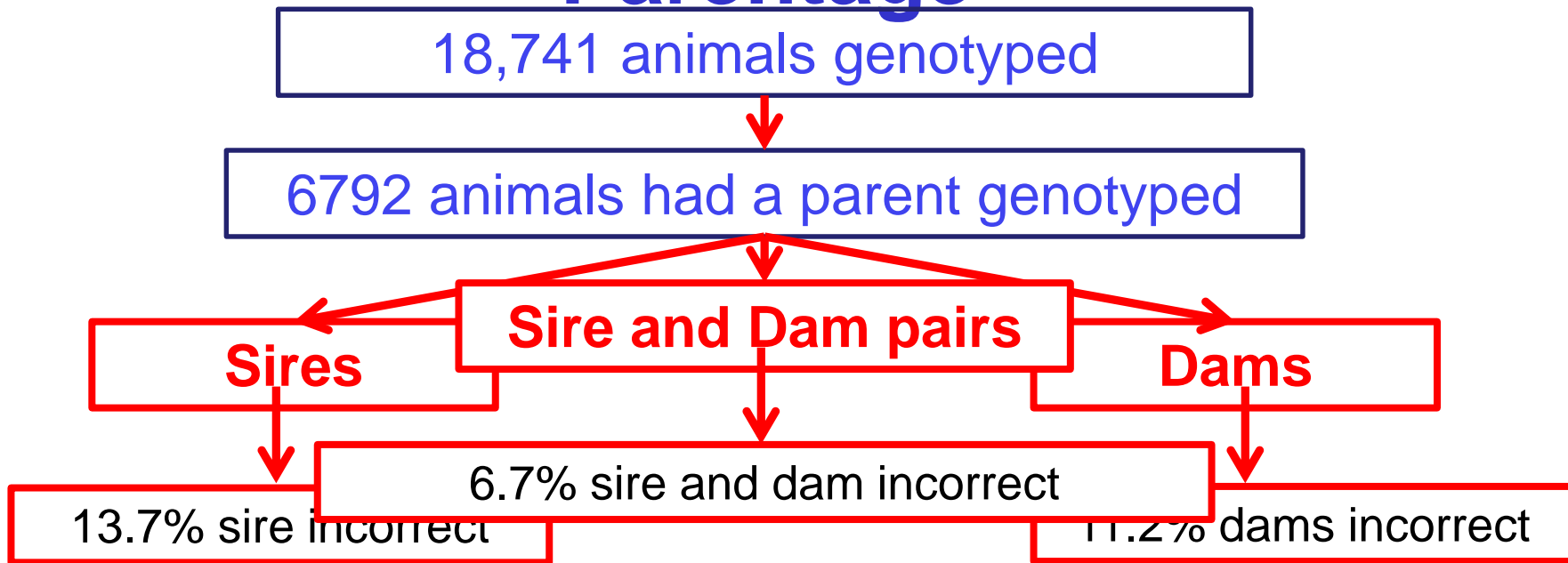
.....GCATTCAGTCAT.....

.....GCTAGTTACTGG.....

Offspring

In practice

Parentage



Progress

- **Data now uploaded to database**
 - **Greater data integrity and monitoring**
 - **Quality controls implemented**
- **Ordering genotypes**
 - **Evaluation of different tag options**
- **Parentage verification → parentage assignment**
 - **Based on cattle developments**
- **More rapid turnaround time**
 - **3-4 weeks from receiving sample**

Fool-proof???

- **Sample mix-up**
 - **Wrong parent tagged**
 - **Wrong lamb tagged**
 - **Samples mix-labelled**
 - **Samples mixed up in lab**
 - **Duplicate sample IDs (international)**
- **Dates of births mixed up**
 - **Lamb is identified as sire of the sire**
- **Poor DNA quality**
 - **Genotypes mis-called and parent is invalidated**

Fool-proof???

- **Biology**
 - Identical twins have the same DNA (very rare)
 - Very close inbred individuals
 - DNA deletions at the marker
 - Gender mis-called (sire → dam; dam → sire)
 - Swyer syndrome – female with male DNA
- **Database issues**
- **Parents not genotyped**
 - Cannot fill in the blanks

Take home message

