SNPs for Parentage Testing, Individual Identification, and Traceability

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Basic Objective

Encourage ICAR & ISAG to officially recognize and accept the use of SNP markers for parentage and identification.

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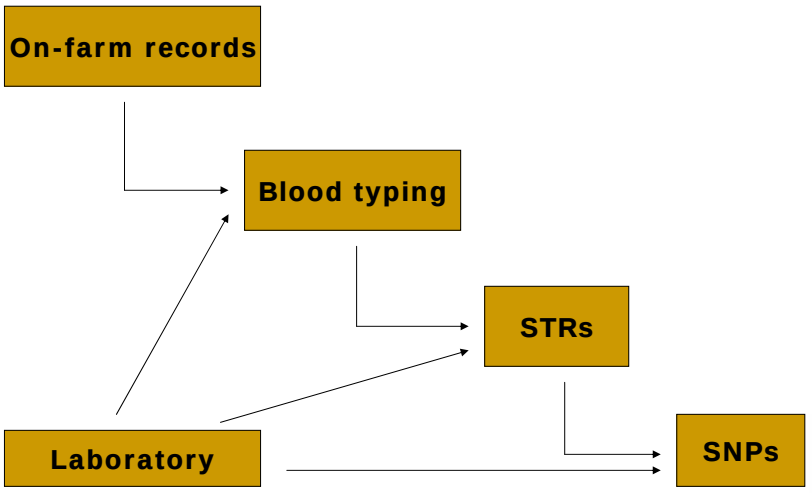
Progression of Parentage Technology



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Power of SNPs vs. STRs

- Li et al. (2006)
  - 59 SNPs in humans
  - PI, 9.02 x 10^{-15}
  - PE in duos, 98.94%
  - PE in trios, 99.92%
  - Same power as 13 STRs used by FBI for forensics

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Power of SNPs vs. STRs

- Rohrer et al. (2007)
  - 60 SNPs in pigs
  - Each with MAF >.15
  - PI, 4.6×10^{-23} across 4 breeds
  - PE in duos, 95.94% to 99.63%
  - PE in trios, 99.87% to 99.97%
  - Similar power to 10 STRs

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Power of SNPs vs. STRs

- Heaton et al. (2002)
  - 32 SNPs across 18 autosomes in cattle
  - 16 beef breeds + Holstein
  - PI, 2.0×10^{-13}
  - PE in trios, 99.9%
- Heaton et al. (2007)
  - 121 SNPs in cattle
  - PE in duos, 99.99%

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Power of SNPs vs. STRs

- Fisher et al. (submitted 2008)
  - Limited details because paper is not published
  - 40 SNPs with avg MAF = .35
  - Powerful parentage tool when combined with on-farm data
  - 40 SNPs alone were more powerful than typical commercial 14 STR panel

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Impact of Mis-ID on Genetic Gain

- 7 to 15% ID error rate
  - Spelman, 2002
  - Visscher et al., 2002
  - Weller et al., 2004
  - Sanders et al., 2006
- 2.5 to 15% decrease in genetic gain
  - Israel and Weller, 2000
  - Banos et al., 2001
  - Spellman, 2002
  - Visscher et al., 2002

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Commercial Example

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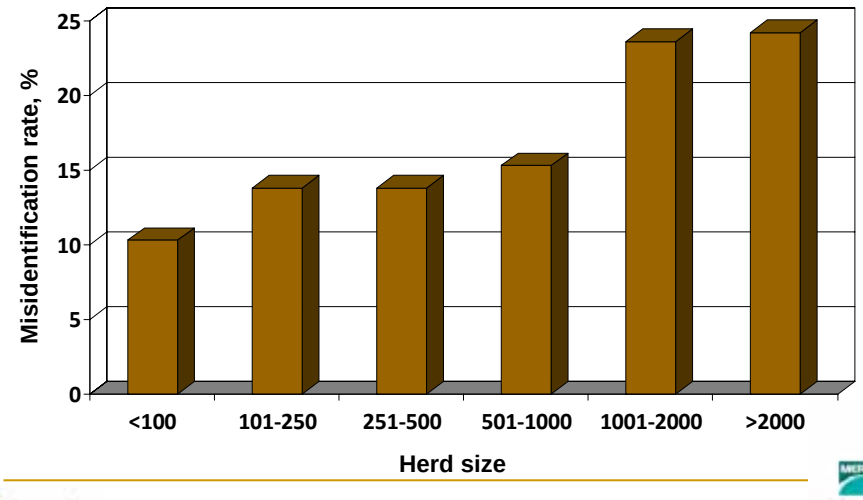
Mis-ID by Dairy Herd Size



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Daughter Contribution to Proof of a specific bull

Qualify status	Number daughters	Milk	Fat	Protein
Yes	14	2576	62	66
Not checked	2	2367	62	62
No	5	2260	51	60
All	21	2481	59	64

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SNPs

- are abundant
- are robust in terms of laboratory handling
- are amendable to high throughput
- are low cost
- have a low rate of genotyping errors
- have a relatively stable inheritance
- have a low mutation rate
- are easy to standardize between laboratories
- 50,000+ SNP chip being used worldwide to genotype thousands of influential animals in many breeds

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