

Marker-Assisted Breeding STRs or SNPs

“Despite the cost of detection remaining high, [STR] markers had pervaded all areas of plant molecular genetics and breeding in late 90s and the beginning of the 21st century. However, during the last five years, the hegemony of medium-throughput [STRs] was eventually broken with SNP markers.”¹

Short Tandem Repeat (STR)

AKA Simple Sequence Repeat (SSR)

```

ACTGTccgcccggGTCT
ACTGTccgcccggccgGTCT
ACTGTccgcccggccgcccggGTCT
ACTGTccgcccggccgcccggccgGTCT
# of repeats ▶ 3 4 5 6
    
```

- Less abundant – 1 STR/15,000 bp
- Prone to mutation via slipped-strand mispairing.²
- Requires intact DNA
- Medium throughput
- Prone to stutter products

vs Single-Nucleotide Polymorphism (SNP)

```

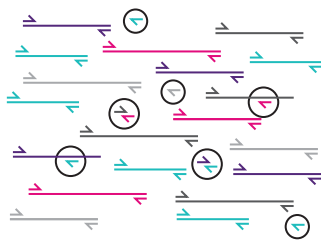
TCGTGGTCATGGTACGTCAGT
TCGTGGTCATGGCACGTCAGT
ACCTGCAAGTACACAGT
ACCTGCTGTC AAGTACACAGT
    
```

- More abundant – 1 SNP/1,000 bp
- Greater mapping resolution
- Lower error rate
- Works with degraded DNA
- High throughput

Experimental Complexity / Validation Complexity

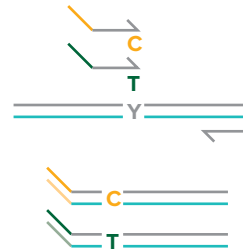
STR

- Complex multiplex design
- Need to avoid:
 - Primer dimer interaction,
 - Fluorophore overlap,
 - Imbalanced dye pooling,
 - Data variations from lab to lab due to interpretations,
 - and low reproducibility



SNP

- Simple singleplex design
- Easy to score
- No lab to lab variation
- Low primer interaction
- Good reproducibility



Novel Panel Time to Data

“...collection of microsatellite data for the present study took 3 months, while SNP data were collected in a week.”

(400 samples, 11 microsatellites, 80 SNPs)³

[~]Hauser, L. et al.

5000 Samples
32 STRs
90+ DAYS

5000 Samples
96 SNPs
21 DAYS

Did You Know...

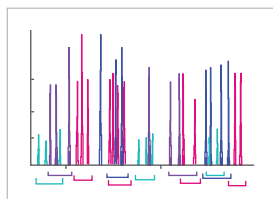
~3 SNPs provide equivalent information as 1 STR but SNPs are more amenable to ultra high throughput.

SNPs are fast!

Interpretation - What Do You See?

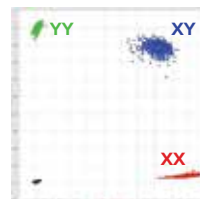
STR

- High mutation rate leading to call errors
- Difficult to score
 - Microvariants
 - Stutter products
 - > 40 possible genotypes/assay



SNP

- Low mutation rate
- Easy to score
 - 3 possible genotypes/assay



SNPs are:

Faster | **Cheaper** | **Easy To Score** | **Simpler** | **Higher Resolution**

1. <http://www.hindawi.com/journals/ijpg/2012/728398/>
 2. http://www.biotechniques.com/multimedia/archive/00087/BTN_A_000113369_O_87854a.pdf
 3. Hauser, L. et al. "An empirical comparison of SNPs and microsatellites for parentage and kinship assignment in a wild sockeye salmon population." *Molecular Ecology Resources* 11(2011): 150-161

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