“The Power of Genomic Technologies Application and Opportunities”

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Industry Meeting

T. Wilson

agresearch

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What is genomics?

“The study of the genetic content of an organism”

- **Recent Genomic successes**
- **How they get used in Industry**
- **What’s coming through the pipeline**
- **What we see the future being…….**

agresearch

Marker Tests Used In Industry

Catapult GENETICS

Marker Tests Used In Industry

Ovita™

Shepherd™

Inverdale™

iScan™

Catapult GENETICS

Ovita™

MyoMax™

LoinMax™

Catapult GENETICS

MyoMAX® and LoinMAX® – effects and value

	LoinMAX® (single paternal copy)	MyoMAX® (single copy)	MyoMAX Gold® (two copies)
Leg Muscle	0	+5%	+10%
Loin Muscle	+8%	+3%	+6%
Fat	0	-7%	-14%
$ Value (for a 38.6Kg lamb)	+$1.80	+$2.38	+$4.76

++ **M+** **MM**

Ovita™

Validation trials: LoinMax MyoMax

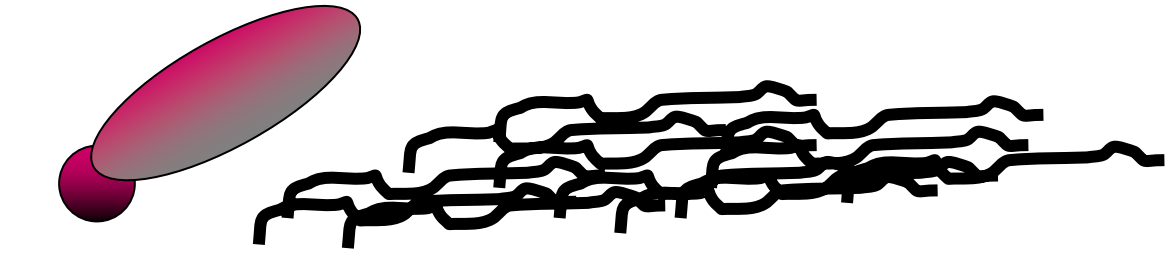
- Conduct trials over several years
  - Need to check haplotype frequency across breeds
  - Need to check effects across breeds, sexes and mode of inheritance
  - Need to check effects measured by commercial grading systems (Viascan)
  - Need to check effects on other traits
    - Growth
    - Lamb survival
    - Meat quality (pH, colour, tenderness)

Ovita™

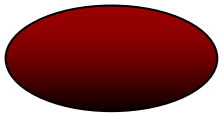
Targeted Genomic Approaches

Meat tenderisation process

“Muscle to meat”



Calpain1

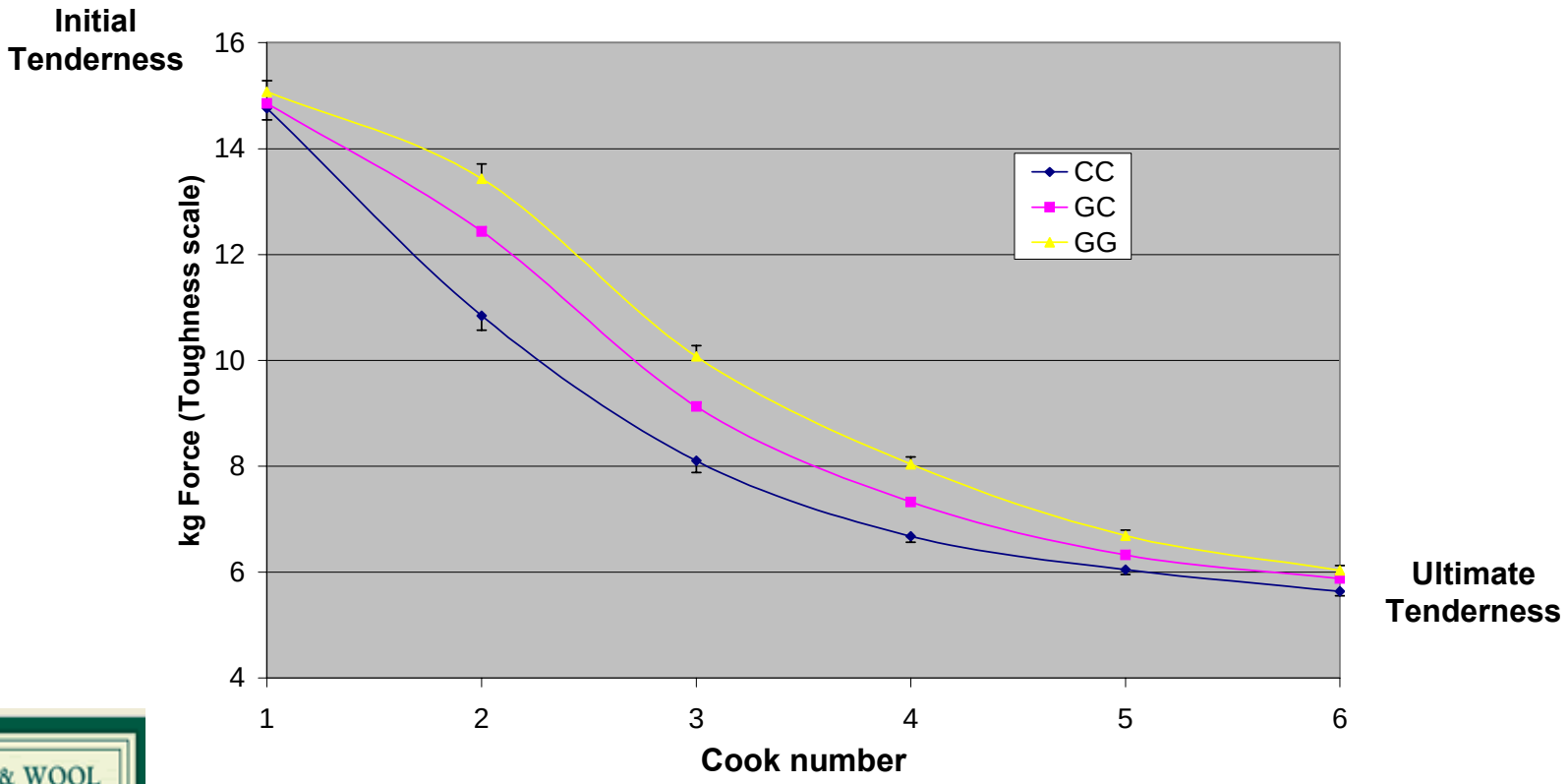


Calpastatin (negative regulator)

SNP markers identified in both calpain and calpastatin associated with meat tenderness.

Effect of Capn1 on toughness (kg force) across successive stages of aging

AgR trials found that the CC animal (lower blue line) hits the desired 8 Kg Force (tenderness measurement) sooner than the GG animal. This would be an advantage to the meat processor as it reduces time required in chiller prior to sale.



MEAT & WOOL NEW ZEALAND

Fat Colour

- Markers found that can predict fat colour
- Currently testing in industry samples (milk and beef samples).
- Interest from feedlots feeding silage (not a problem with grain fed animals)

Beef Yield

• Marker data so far indicate effects on retail beef yield, EMA and rib fat (but small effects). More to this trait than just the myostatin gene (cause of double muscling in some cattle).

Colour Stability of Meat

- **Quantify genetic component of variation (know it has good heritability).**

- **Meat Colour is the first impression for a consumer so meat colour consistency & stability important**

- **Research Industry trial with large numbers of animals from known pedigree. We vacuum pack the loins at 0°C for 3 or 8 weeks, 3 slices cut per loin and placed on meat trays and glad wrapped (without gas flushing), measure colour degradation over time.**

Colour Stability at 3 and 8 Weeks

Loins from 2 progeny displayed for 10 days after 8 wks storage

2 days

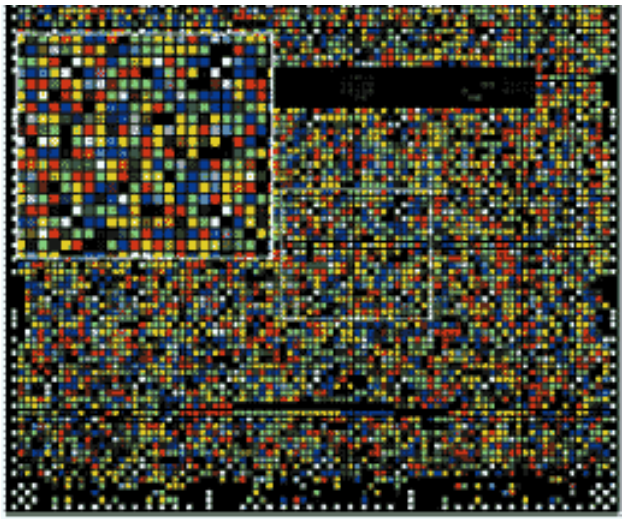
6 days

10 days

What we see the future being…….

New Genomic Technologies

“High density SNP chips”



New technology made possible by the sequencing of genomes, eg human, cattle and soon sheep.

What is a SNP ?

Single Nucleotide polymorphisms (SNP's)

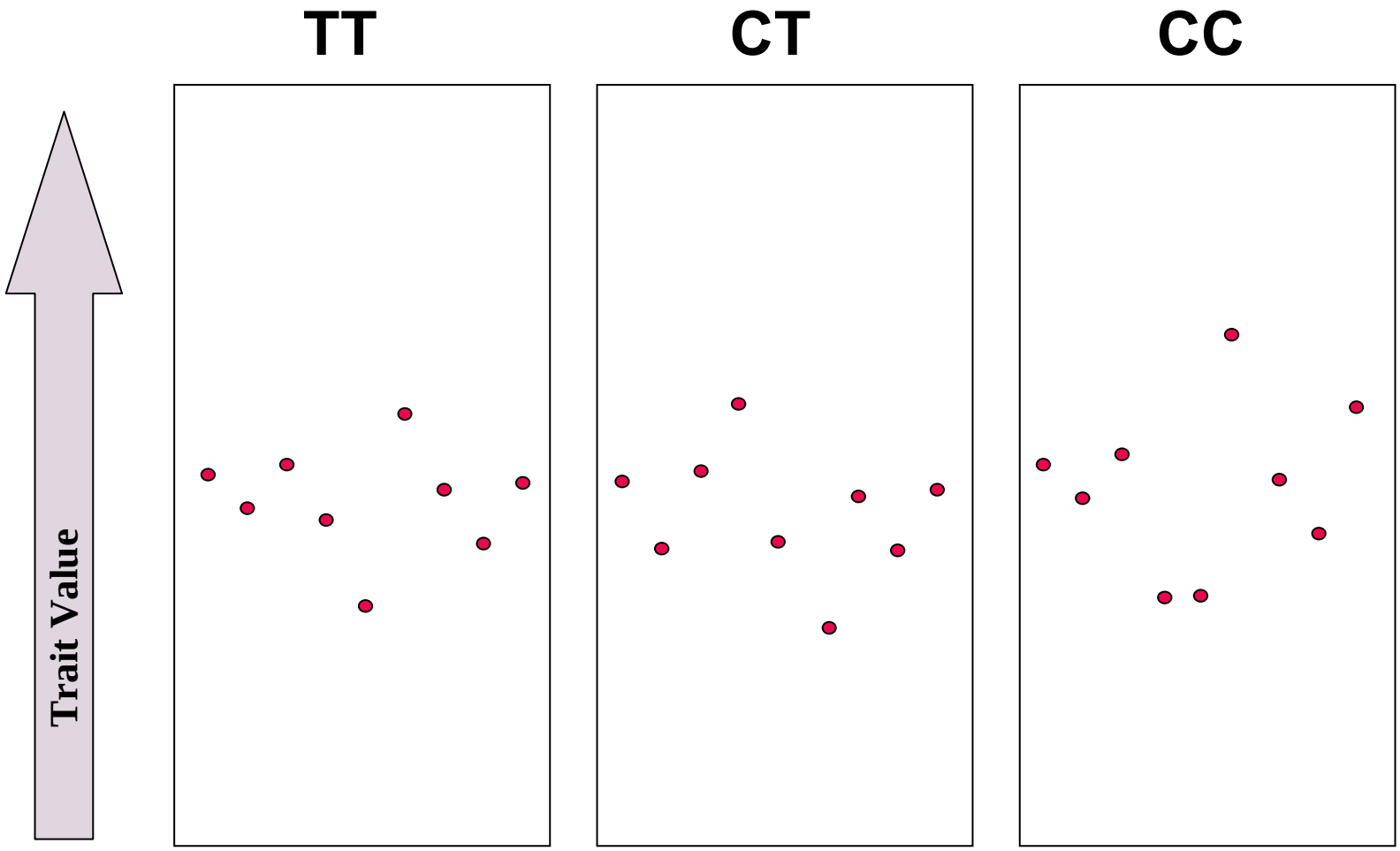
AGCTAGTTGACTGGATCA
TCGATCAACTGACCTAGT

AGCTAGTCGACTGGATCA
TCGATCAGCTGACCTAGT

Result for each animal

Primary Goal : look for an association of SNP genotype with the trait of interest

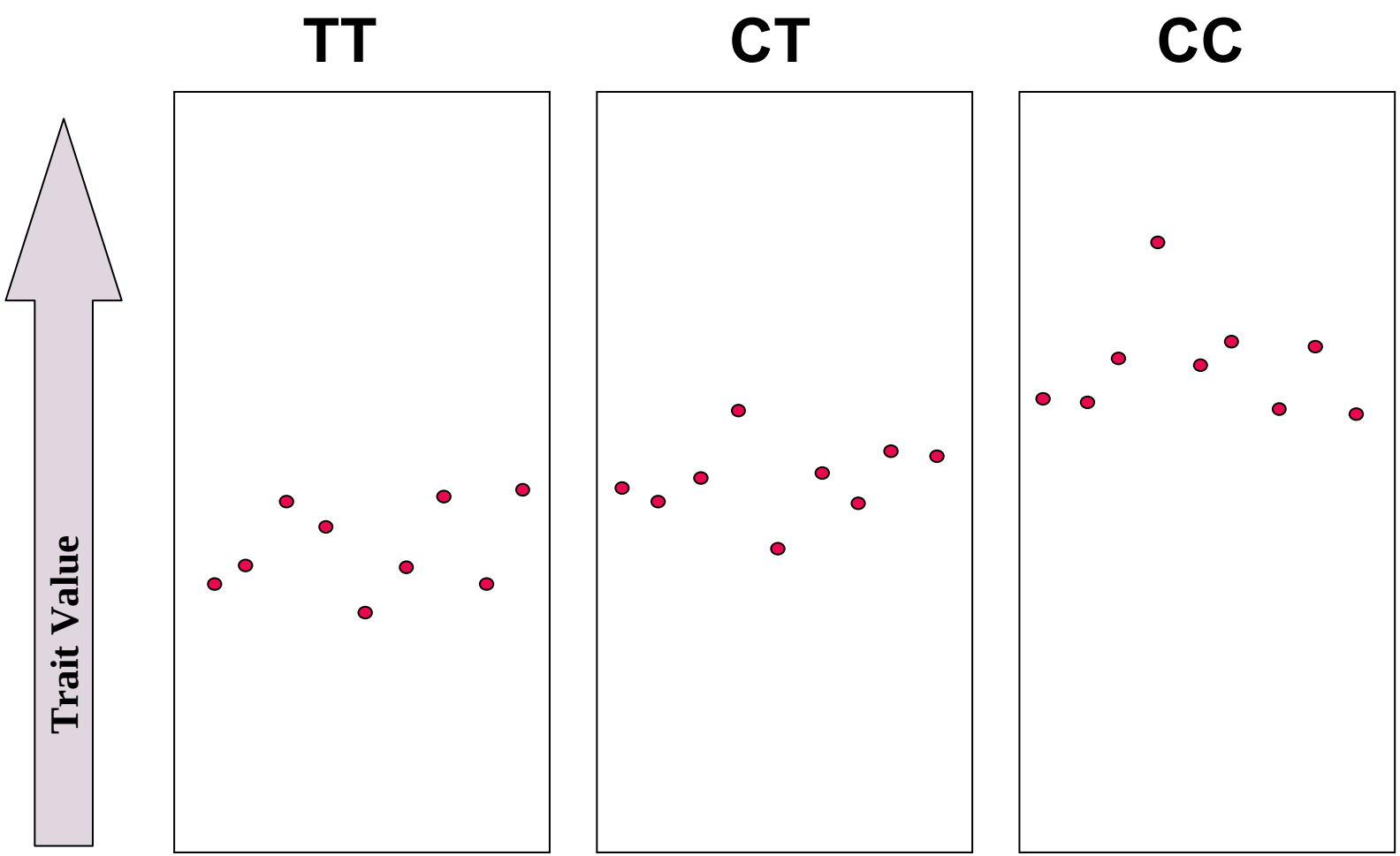
Example 1



Each Marker is given a predictive value for the trait

(In this case no association)

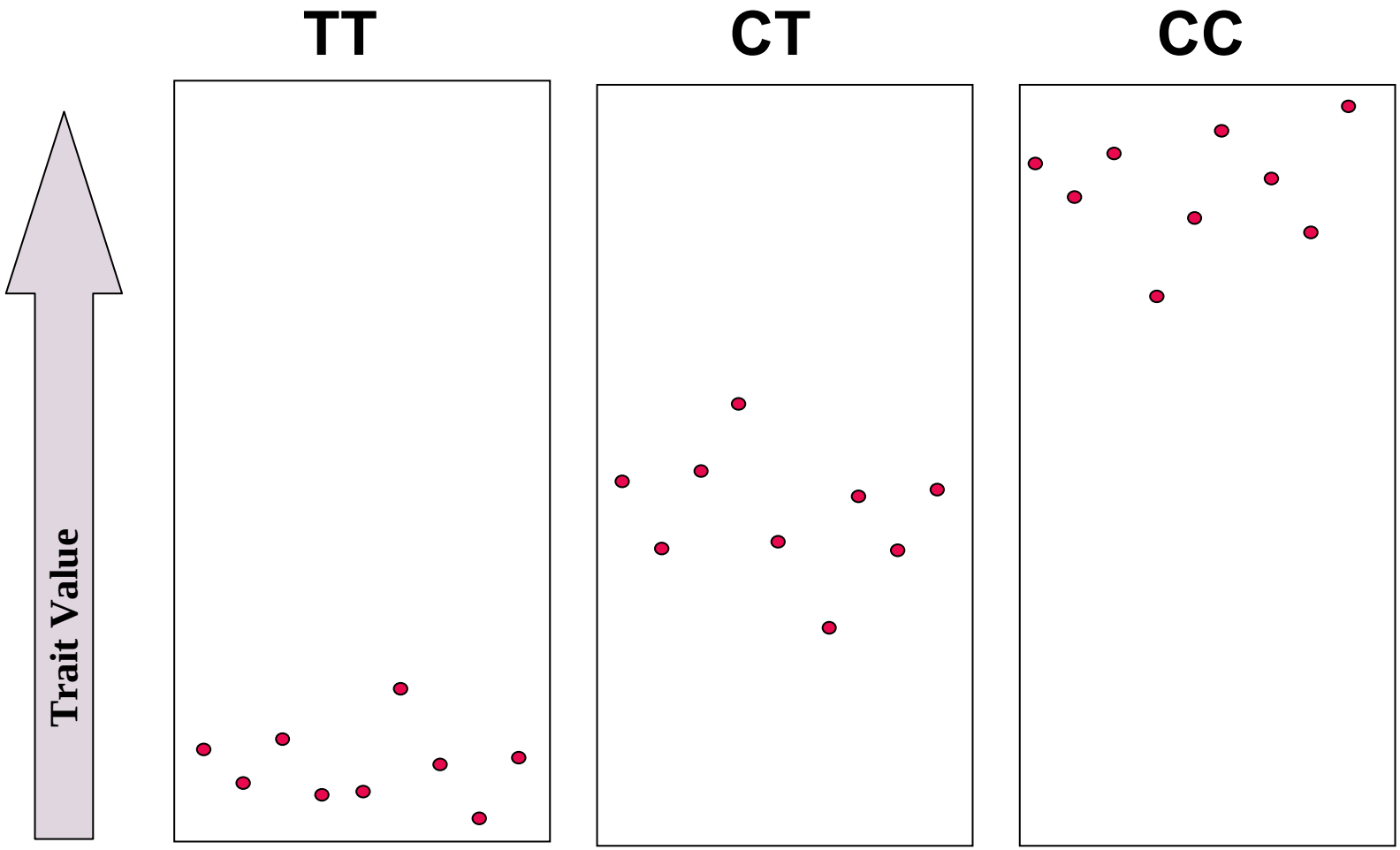
Example 2



Each Marker is given a predictive value for the trait

(In this case >0 but quite weak)

Example 3



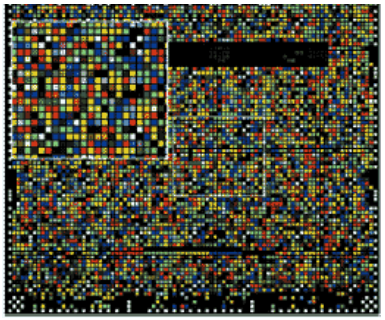
Each Marker is given a predictive value for the trait

(In this case a strong association)

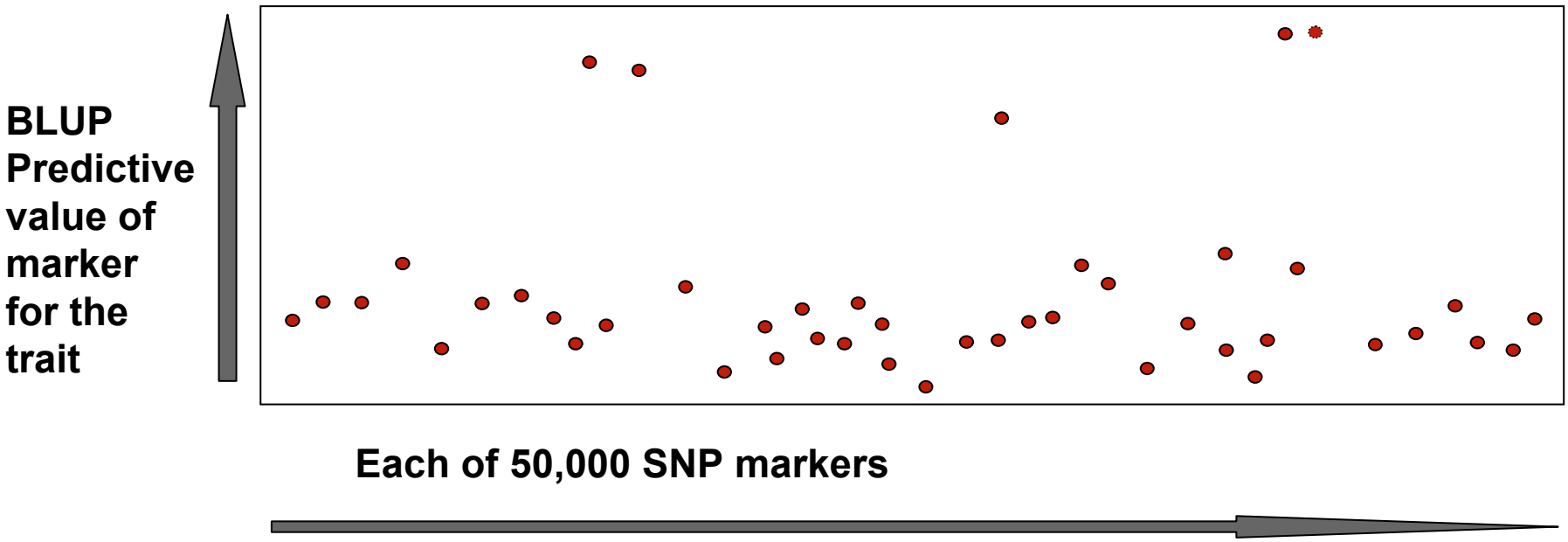
Predicting the BV of non-phenotyped animals

SNP #	BV of each genotype (eg kg)			Animal 1 Genotype	Animal 1 BV	Animal 2 Genotype	Animal 2 BV
	CC	CT	TT				
1	2	1	0.1	CC	2	TT	0.1
2	0.5	0.4	0.1	CT	0.4	CT	0.4
3	0.01	0.02	0.05	CC	0.01	CT	0.05
∑1-3 BVs					**2.41**		**0.55**

Animal 1 ranks well ahead of Animal 2 for this trait but 50,000 genotypes are scored not just 3



Then genotype each of the animals using the Sheep SNP chip



The Scientific Approach to find Markers

Collecting large numbers of well phenotyped animals from industry.

- **Outbreak of FE in the autumn (collect blood from animals showing clinical symptoms, affected as well as controls).**

- **Work with meat processors to collect thousands of samples from high and low yielding animals.**

- **Collect DNA from rams recorded in SIL for number of traits**

- **Work with specific farming groups interested in recording new traits eg colour stability**

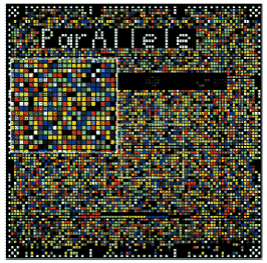
Use the information for Breeding/Drafting decisions

- Get a set of predictive markers, will be especially useful when a trait is slow to manifest itself and/or sex limited eg seasonality, fertility.
- When a trait is difficult/expensive to measure eg. Meat quality traits, parasite resistance, Johne's resistance, FE resistance, Bloat susceptibility……
- Offers the opportunity to control the genetics of the meat going into the supply chain
- Maximise the genetics of animals combined with nutrition/feeding to create niche products.

Beef Genomics Industry Research Programme

Focus research on genomics of quality attributes, and systems to express genetic potential.

- **NZ Disease free status, no BSE or foot and mouth present**
- **Most of the meat produced is grass fed and contains higher levels of omega 3 fatty acids, recognized as more beneficial for human health, than grain fed cattle.**
- **Red meat consumption is on the rise and predicted to increase as countries increase their per capita wealth.**
- **Feedlot operations in USA and Australia need access to large amounts of cheap grain (likely to change with emphasis on Biofuels).**



“Genomic Technologies”

- Improved selection tools
- Drafting strategies
- Combo of genetics and pasture finishing systems
- Feedback from the consumer on what they want to eat.