

Making the possible practical



Genetic evaluation programs and future opportunities

James Rowe

(Sheep CRC, Australia)

Raul Ponzoni

(Universidad de la República)

Daniel Brown

(Sheep Genetics, Australia)

Julius van der Werf

(UNE, Australia)

10th World Merino Conference 2018, Montevideo

Genetic evaluation

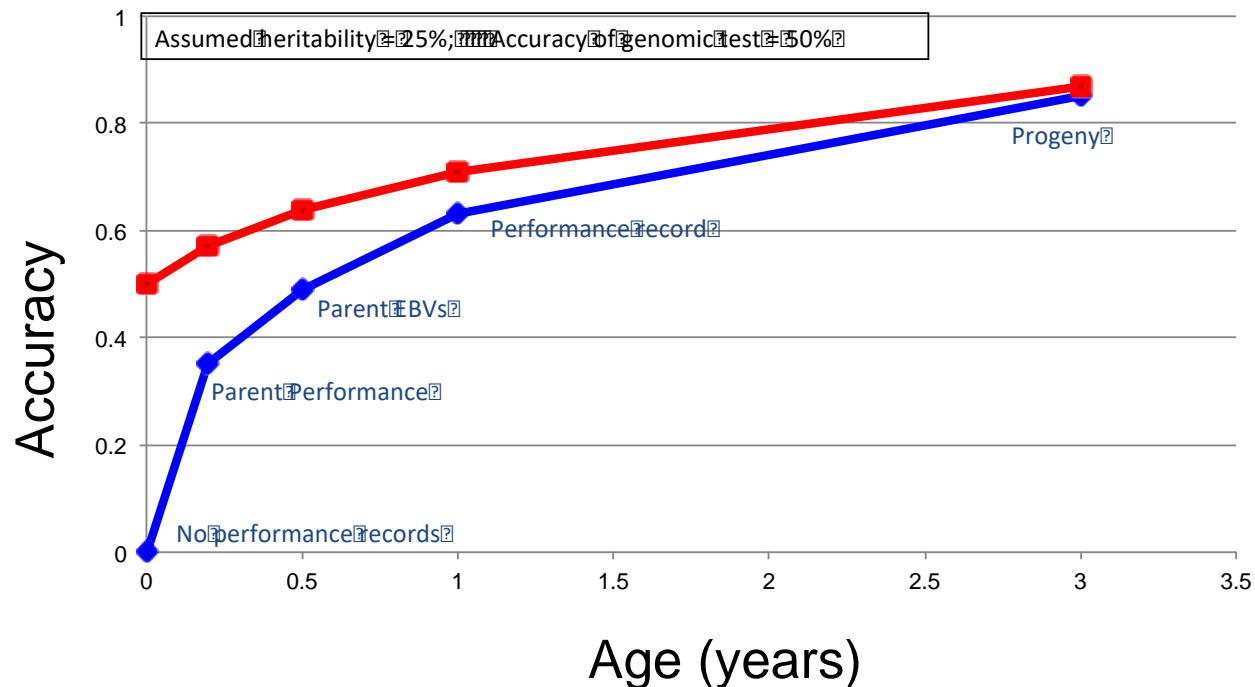
→ estimating genetic merit (breeding values)

NOT – what sort of sheep to breed

NOT – what sort of sheep to produce

Genetic gain determined by:

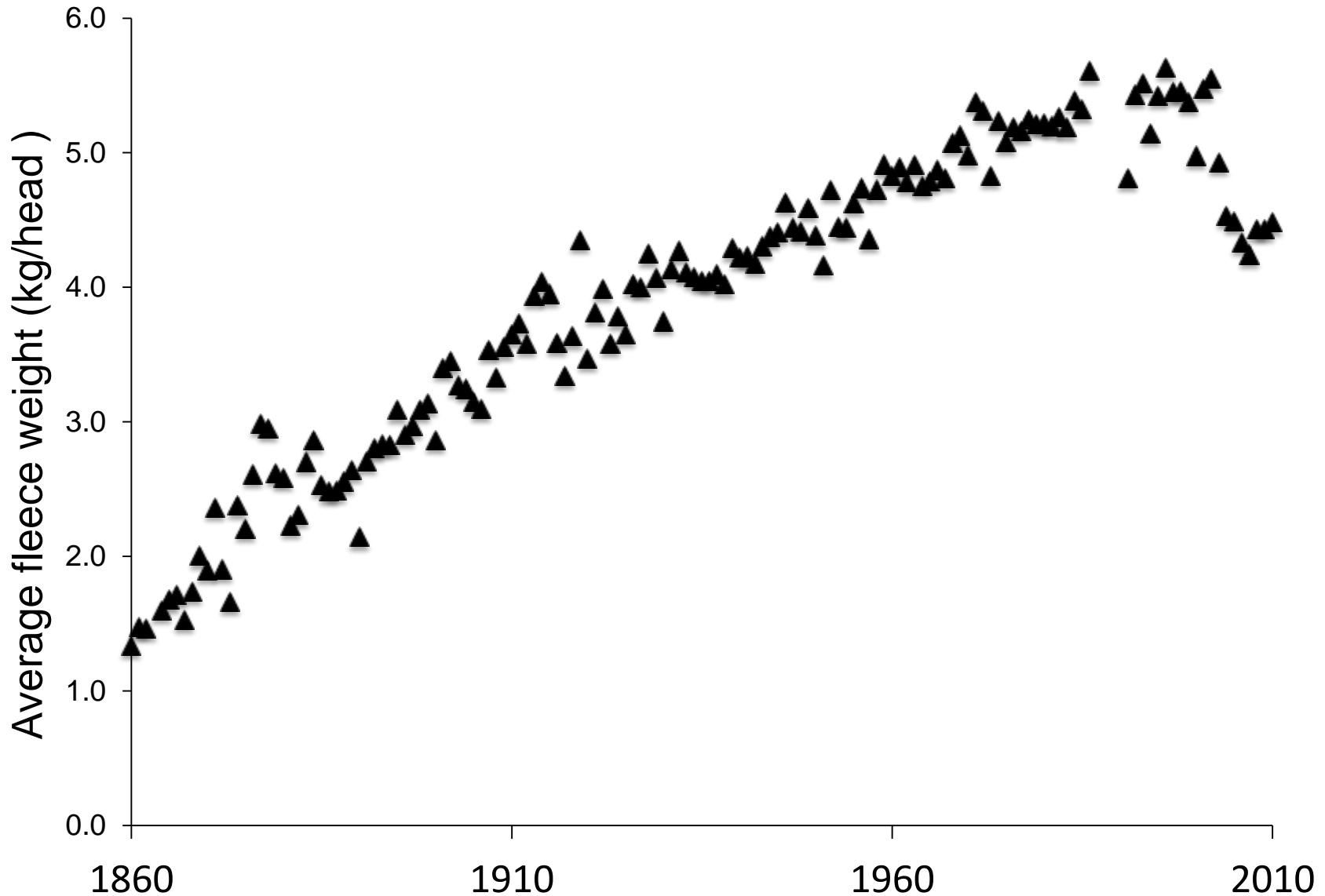
- accuracy of estimating genetic merit
- generation interval



Weighing the fleece (George Lambert 1921, Wanganella)

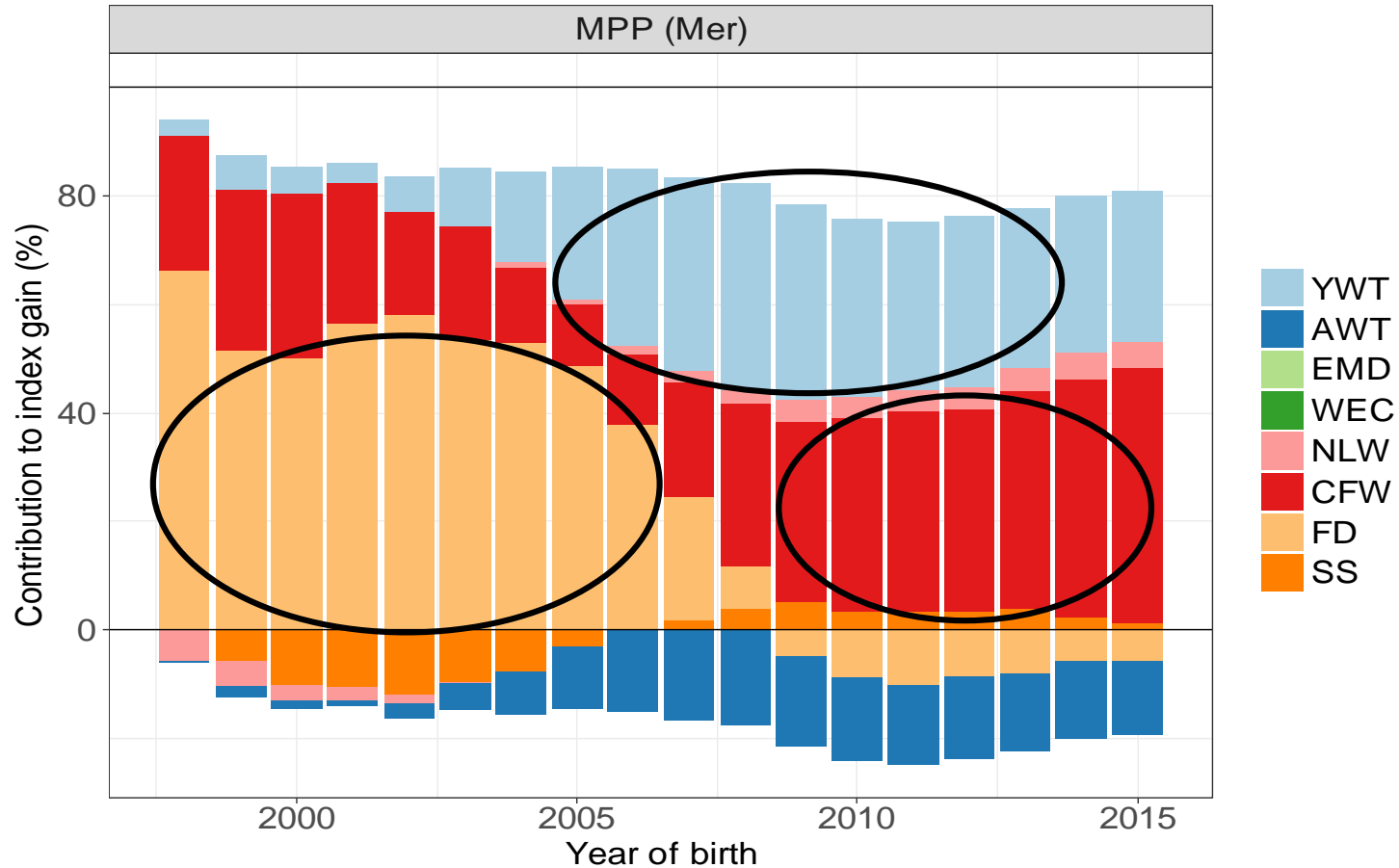


Average fleece weights – Australia 1860-2010



Trait trends in Australian Merinos

(Swan et al. 2017)

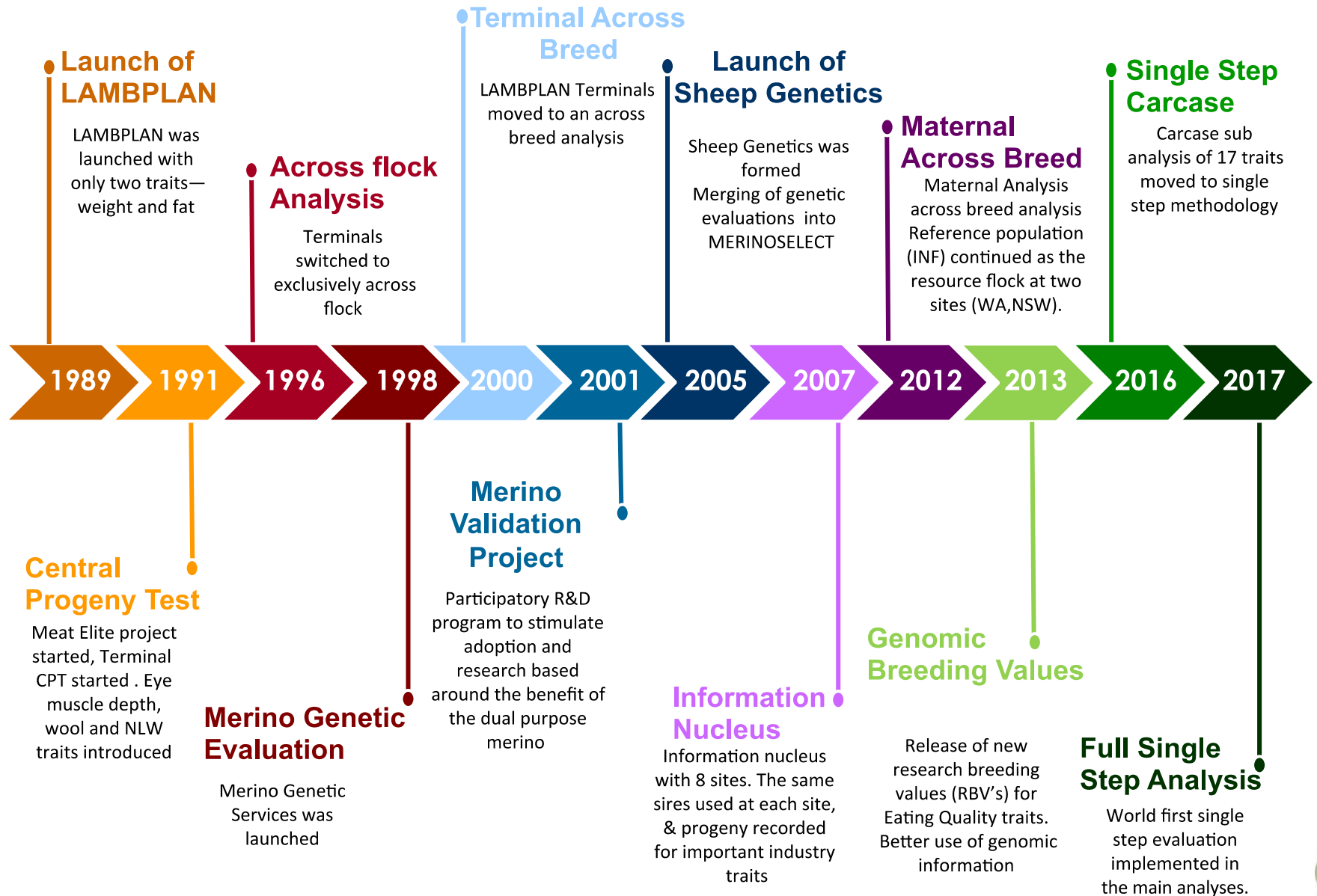


Fining the clip → FD

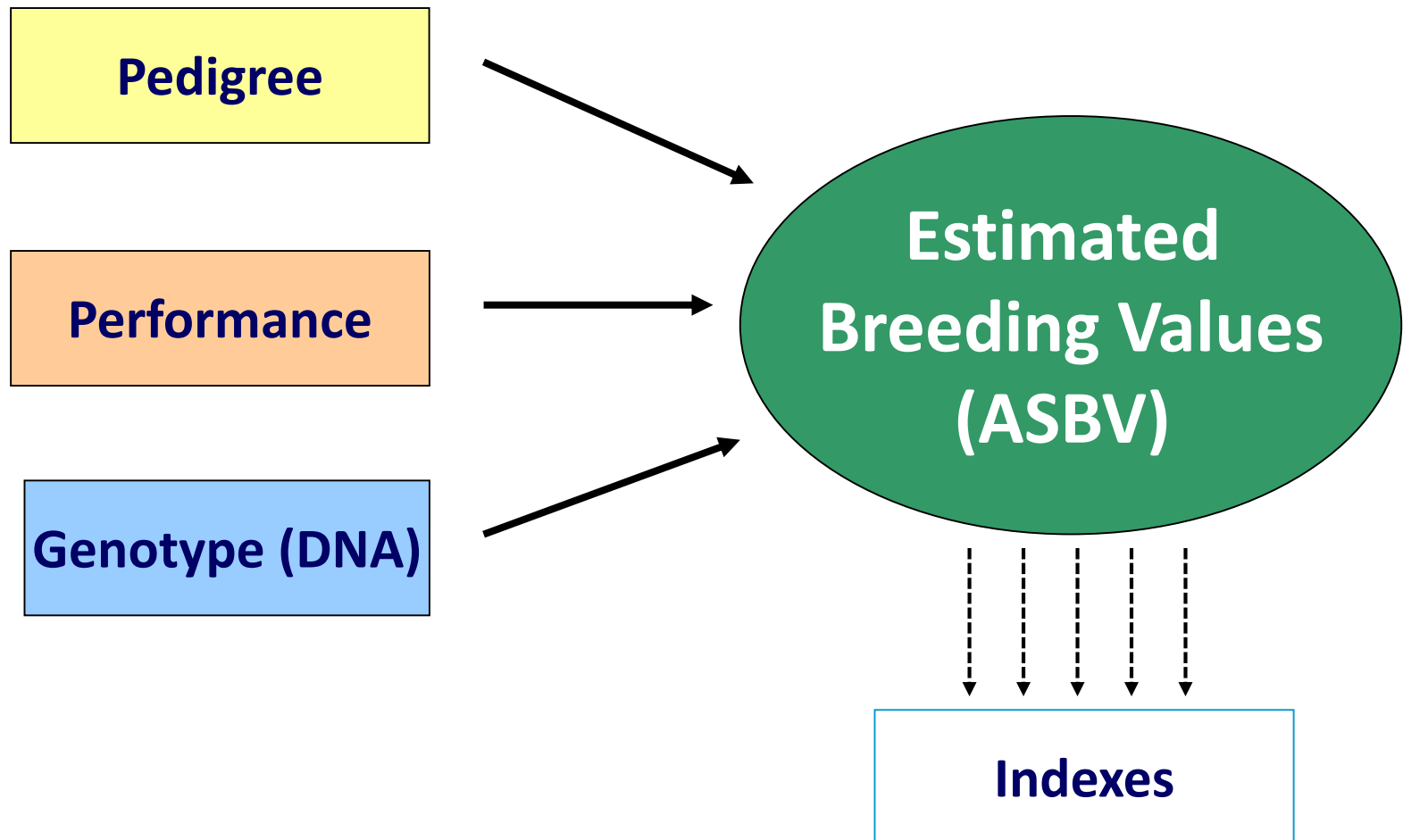
Increasing meat income → - - - - - YWT

Focus on fleece weight → CFW

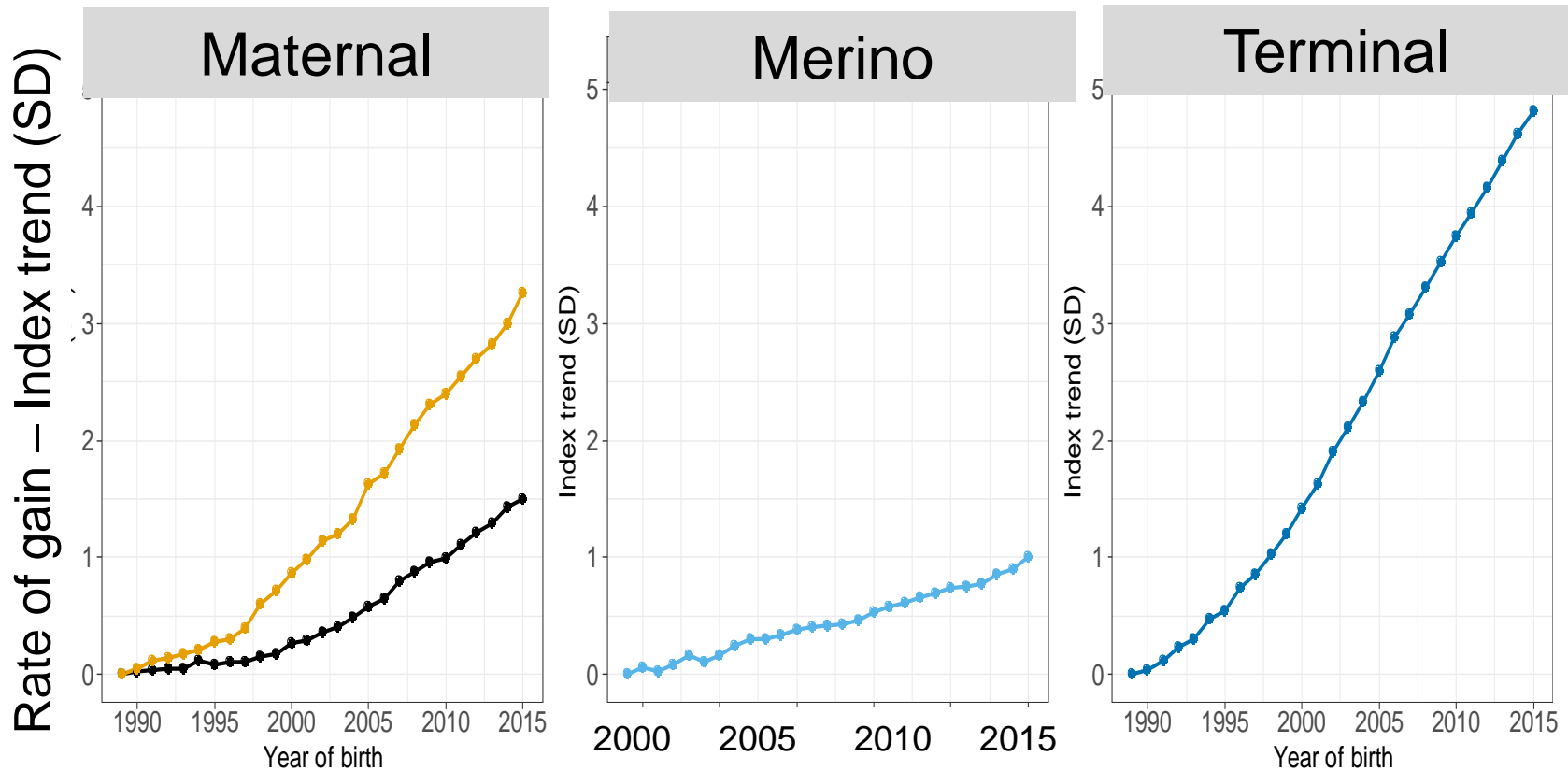
Evolution of Sheep Genetics genetic evaluation



Estimating genetic merit (breeding values)

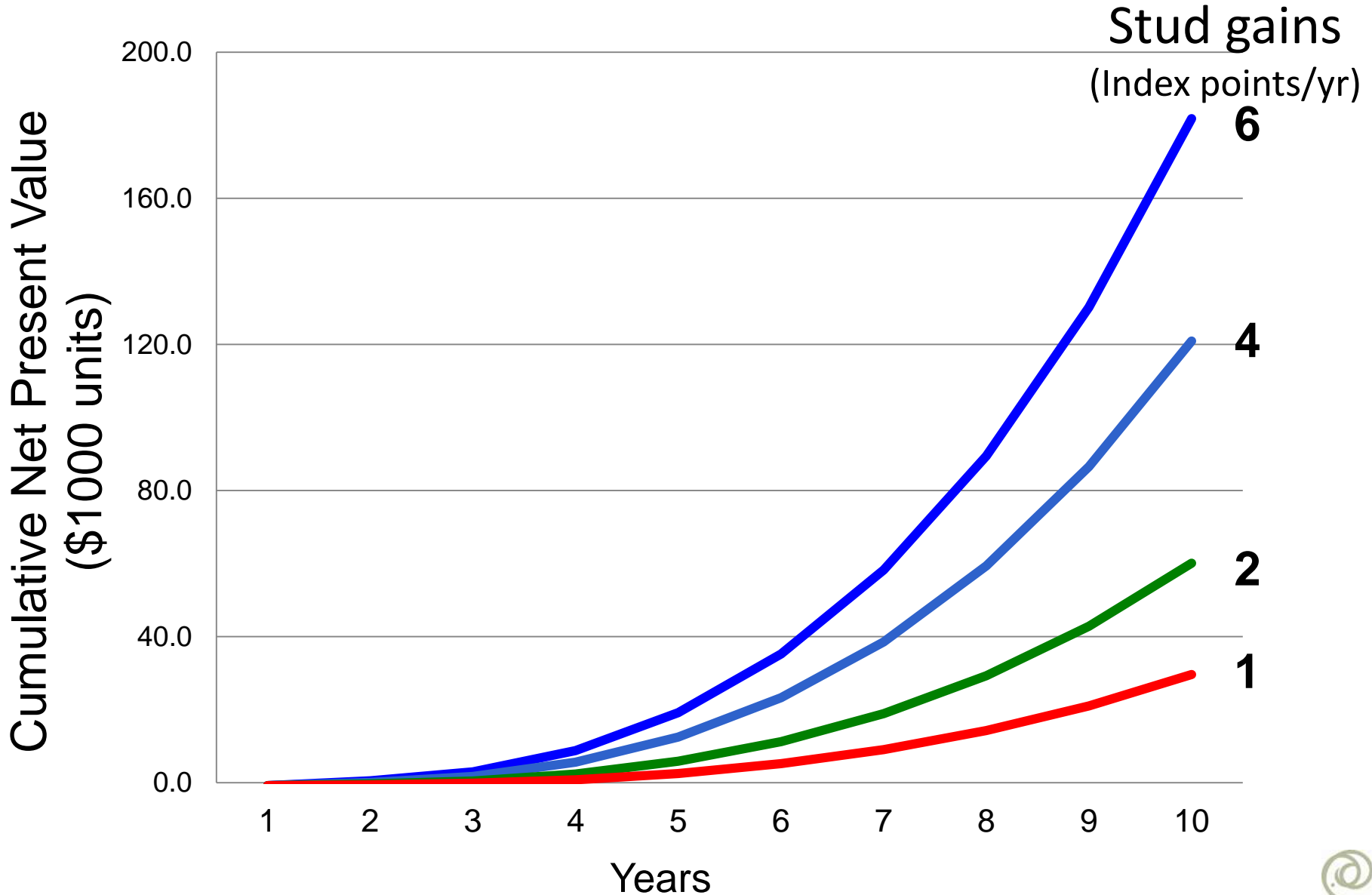


Rate of Genetic Gain (index trends)



Faster genetic gain drives profit

(Extra net income per 2,000 ewes) (Granleese 2018)



Genetic evaluation is a key tool

- helps achieve rapid genetic gain
- contributes to well-balanced genetic gain
- but..... expensive
 - Performance recording
 - Reference flocks
 - R&D of the genetic evaluation system
 - Database management and computing
 - Costly development of analytical tools
 - Single step, MateSel, RamSelect, Flock profiling

Strong case for International collaboration

- Competing against other breeds & species – not against Merino breeders in other countries
- Cloud computing makes data sharing easy
- **Compelling economies of scale in genomics**
- Standardised DNA testing in multiple countries
- Good examples in dairy and beef breeding
- G x E concerns increasingly well understood
- Shared access to tools (Single Step, MateSel, RamSelect, Flock Profiling ...)

MERINOSELECT evaluation for Australia and New Zealand (Brown & AGBU)

G x E interactions ?

- Studied a range of traits – many environments
- Accounted for sire by flock & year (SxF) interaction



Conclusions

- All traits investigated had high genetic correlations when Sire x Flock interaction included
- Breeders can select on MERINOSELECT ASBVs regardless of the country of origin
- MERINOSELECT is 'open' to concept of hosting single international evaluation for Merinos.



?



?



?



?



Tools for improved genetic gain

- **MateSel** available to Sheep Genetics client's to help with mate selection.
- **SingleStep** evaluation analysis incorporating: pedigree, performance & genomics
- **RamSelect.com.au** a web-based app to help identify rams for specific breeding objectives
- **Genomic Flock Profiling** average flock breeding values from DNA testing 20 latest drop progeny. A benchmark to guide ram purchases.

Opportunities

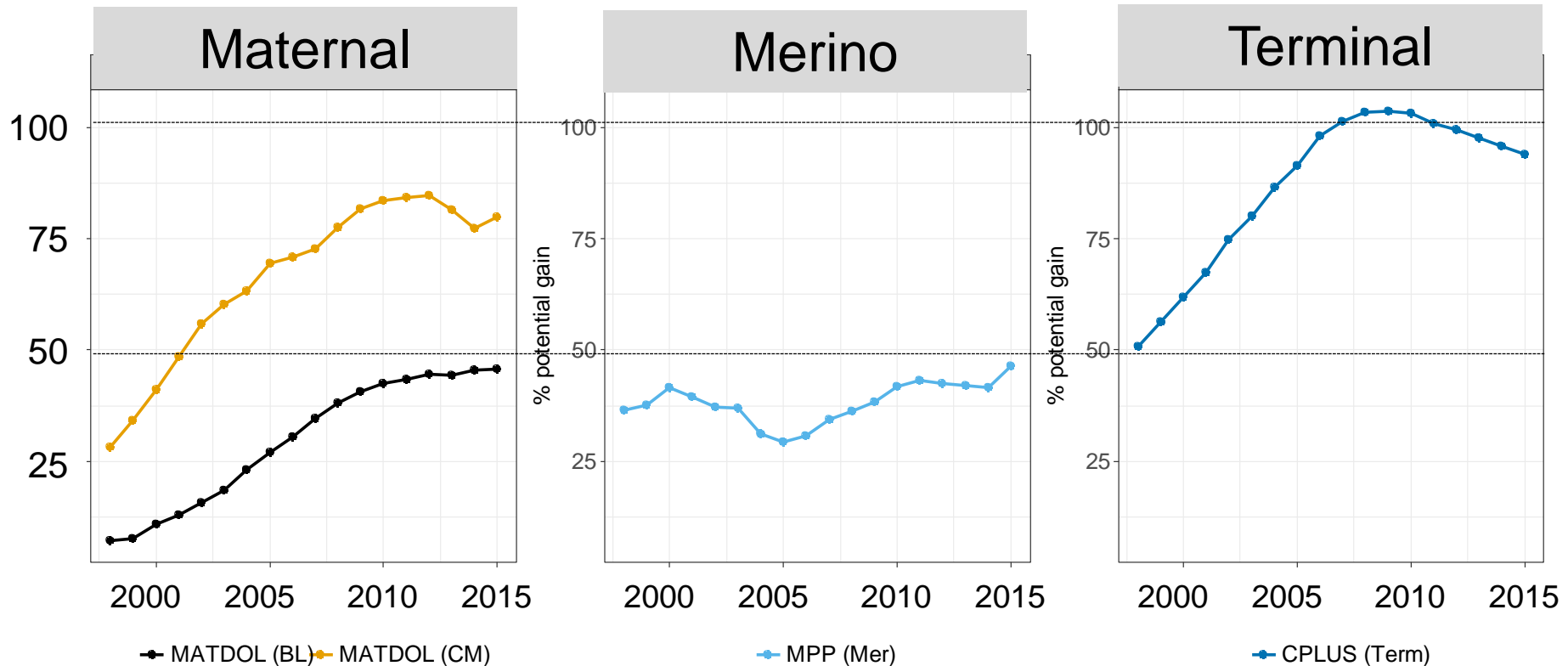
Analysing genetic gain

(From Swan et al 2017)

- How does actual gain for Merinos compare to potential gain?
- How do individual ram breeders compare?

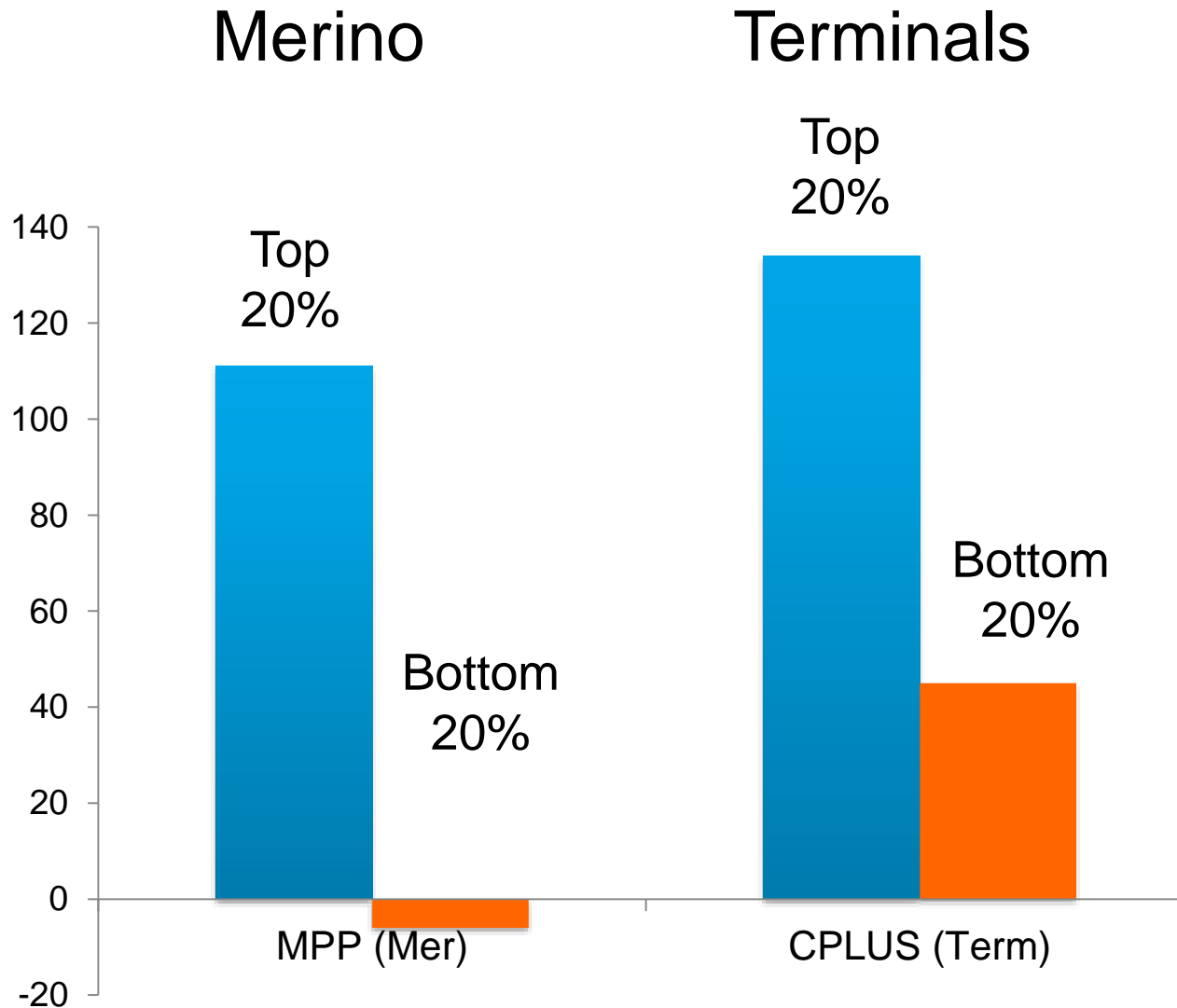
Actual gain as % of potential gain

(Swan et al. 2017)



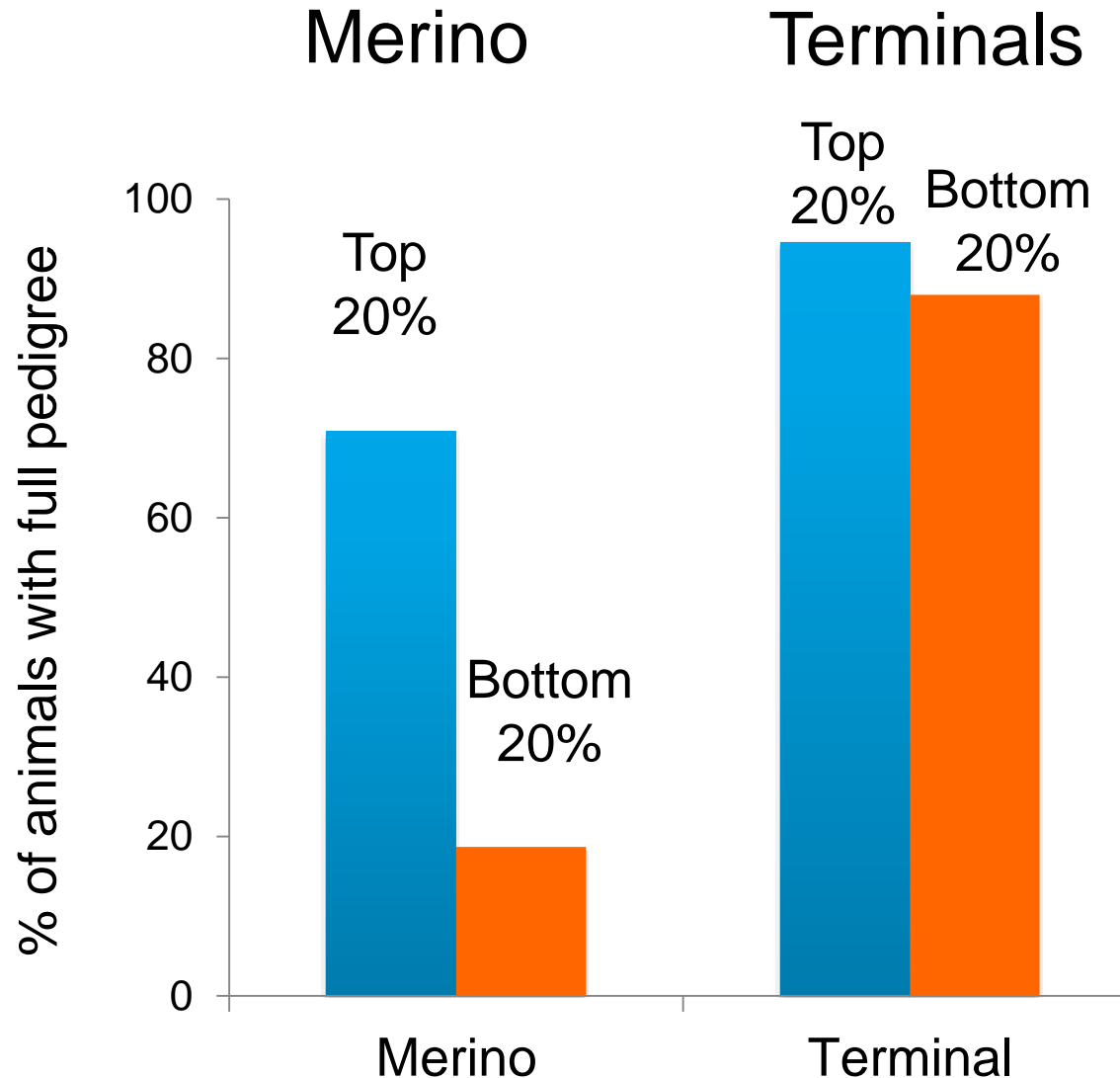
Comparing gains for individual breeders)

(From Stephen et al 2018)



Full pedigree data is one problem

(From Stephen et al 2018)

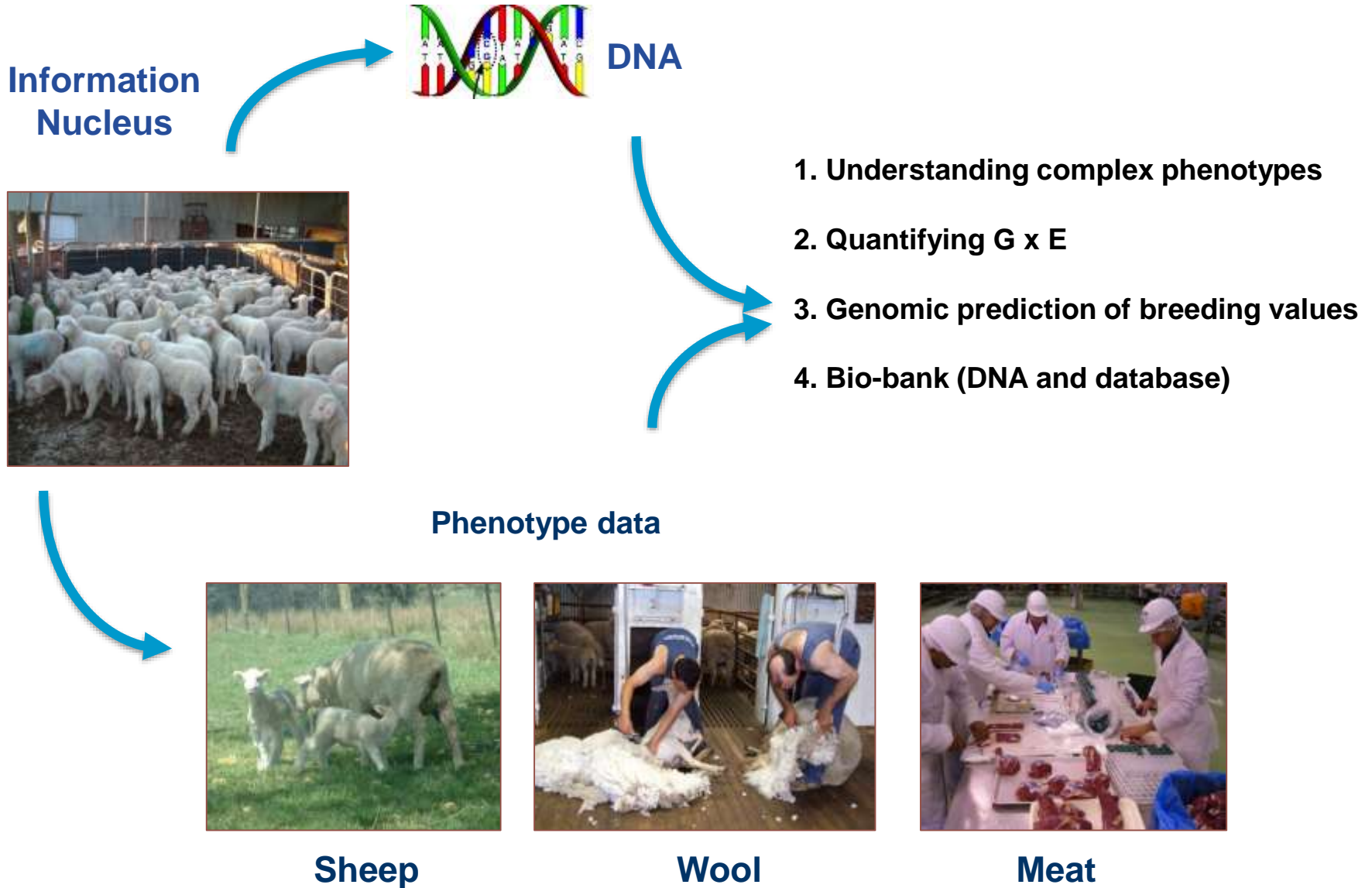


Genomic Selection: the big picture

(Photo: Julius van der Werf 2018)



Information Nucleus – innovation platform



Genomics

Blending GBLUP
EBVs with
ASBVs (2012)



Single Step
Carcase Analysis
(2016)



Full Single step
in Main Analyses
(2017)



Impact on industry through genomics (genetic gain - index points/year)

	2000-2010	2011-2017	Difference
Merinos (MP+)	1.57	2.19	+39%
Terminals (C+)	3.85	4.29	+11%
Terminals (LEQ)	1.36	2.00	+47%

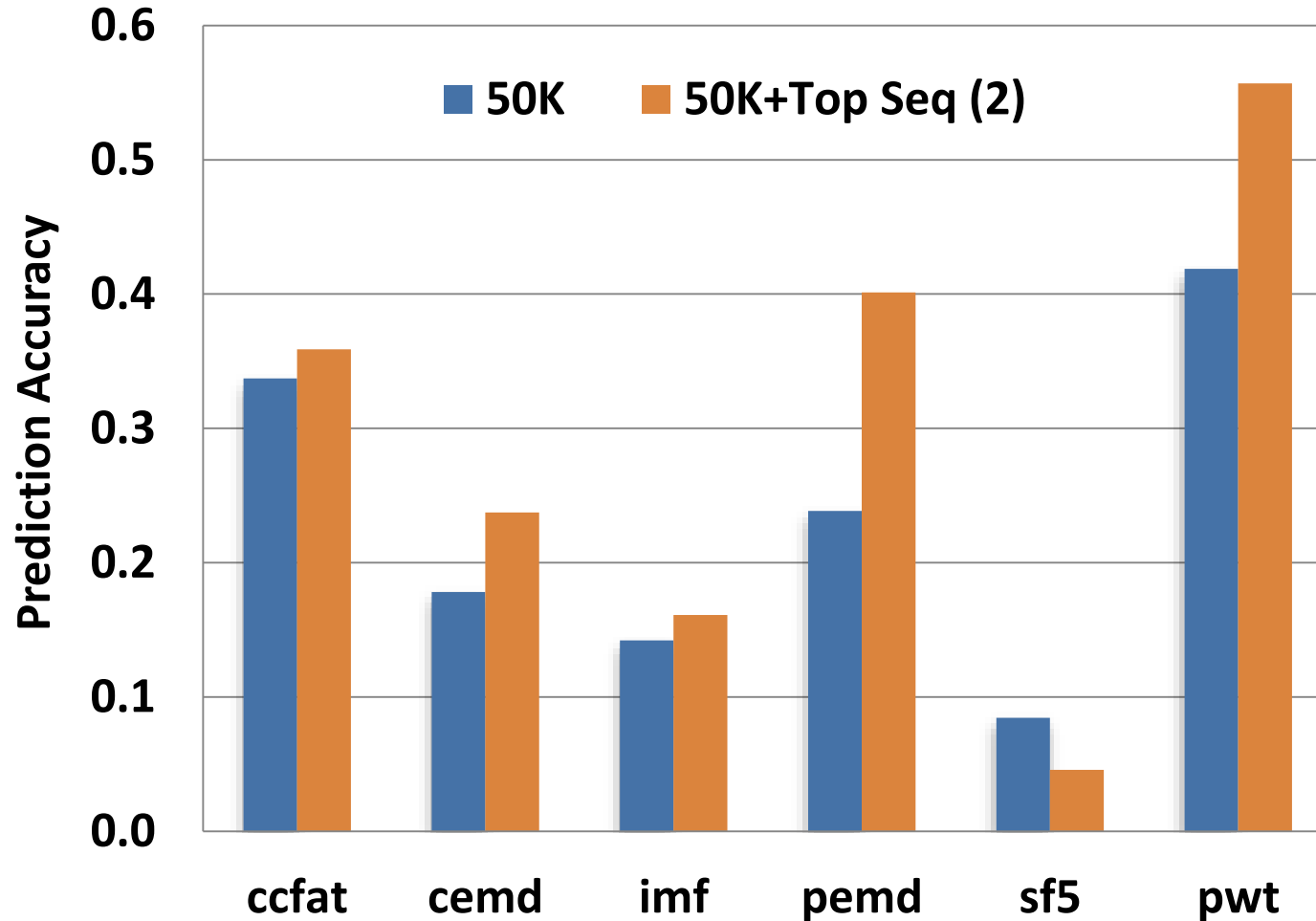
Some Confounding factors
e.g. Index development &
Reference population

(Brown et al 2018)

Making the possible practical

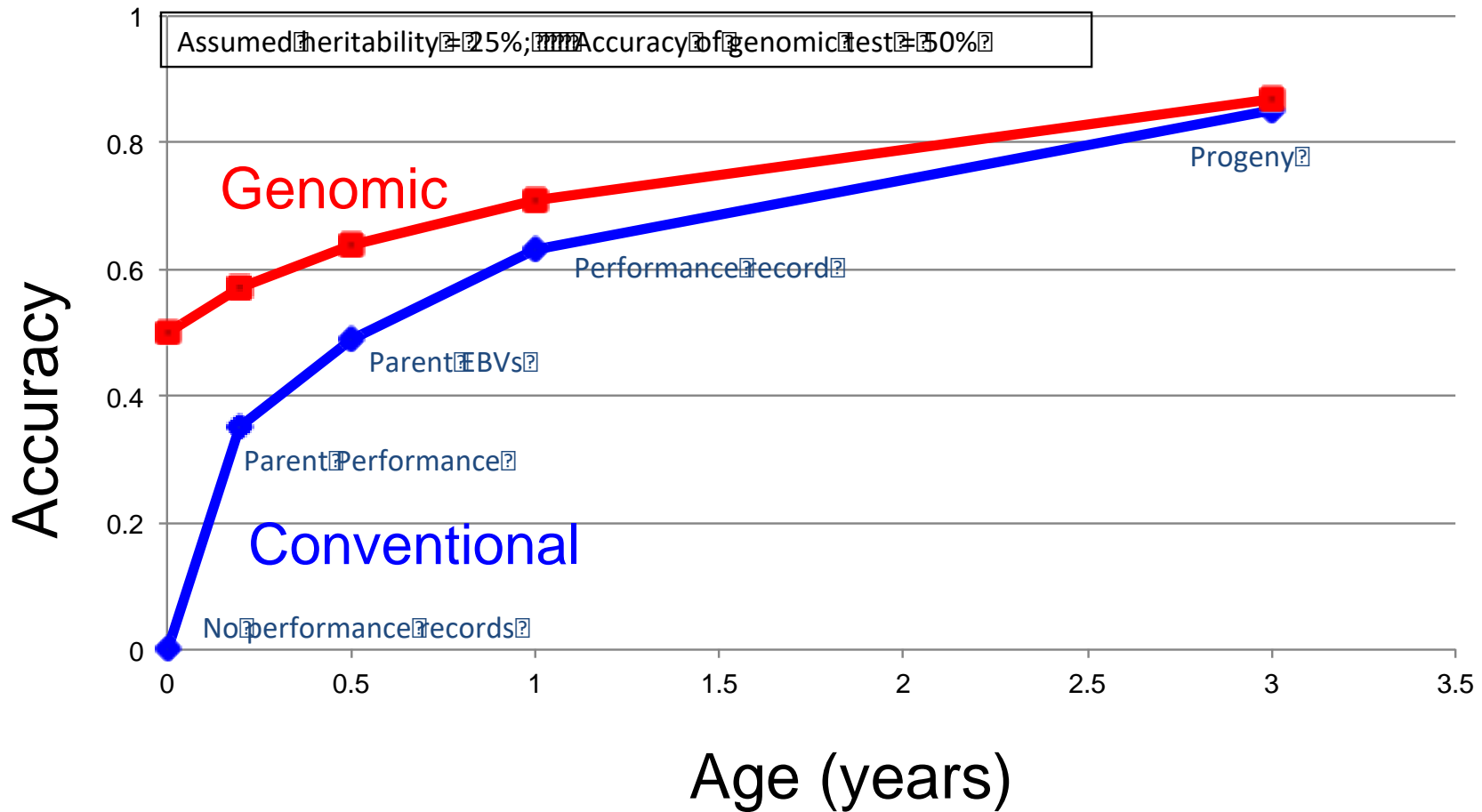


Prediction accuracy: Meat Traits in Merino



Value of genomics

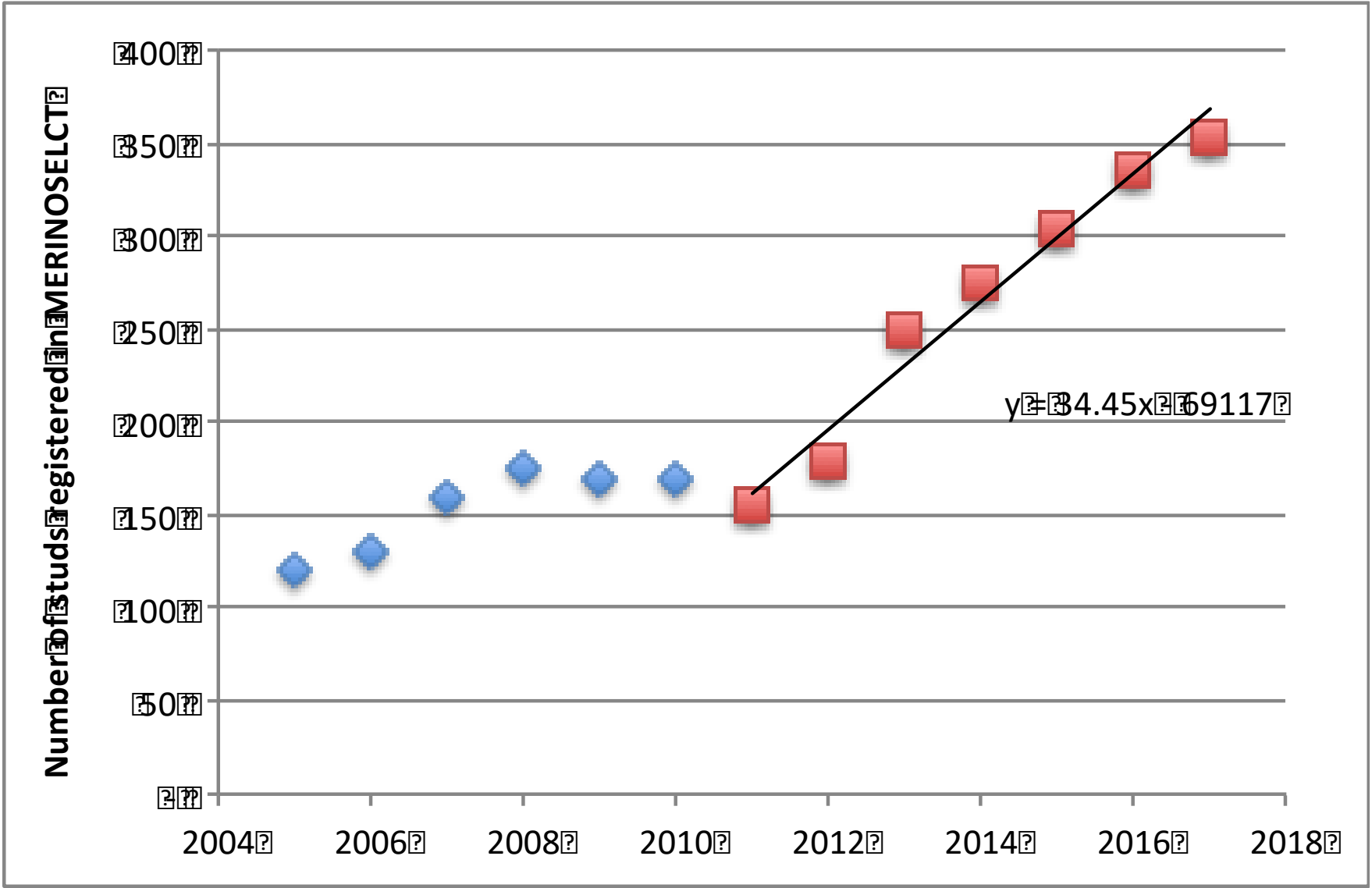
early information and difficult to measure traits



DNA tests getting cheaper and predictions more accurate

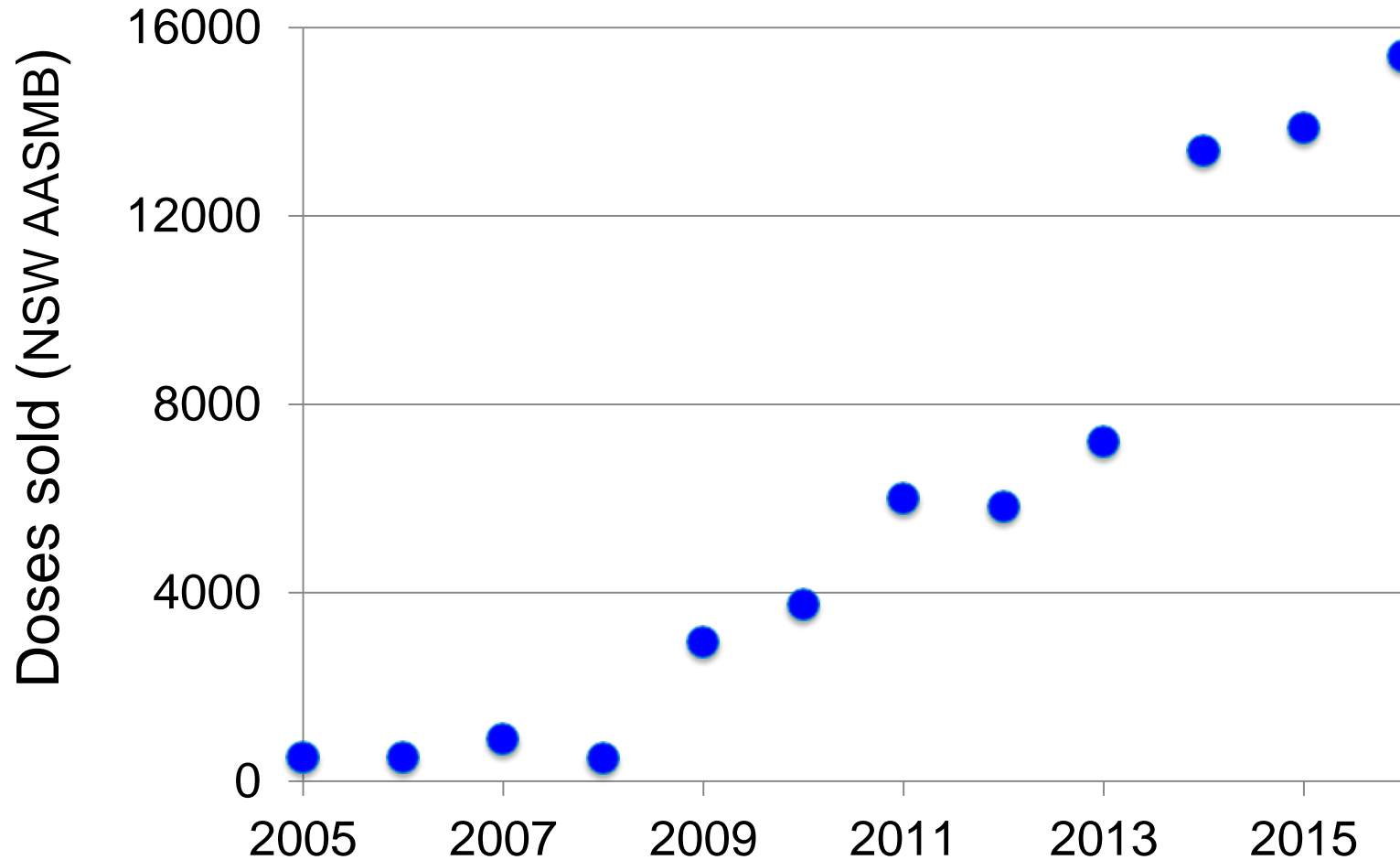
Signs of rapid change

Increase in membership of MERINOSELECT



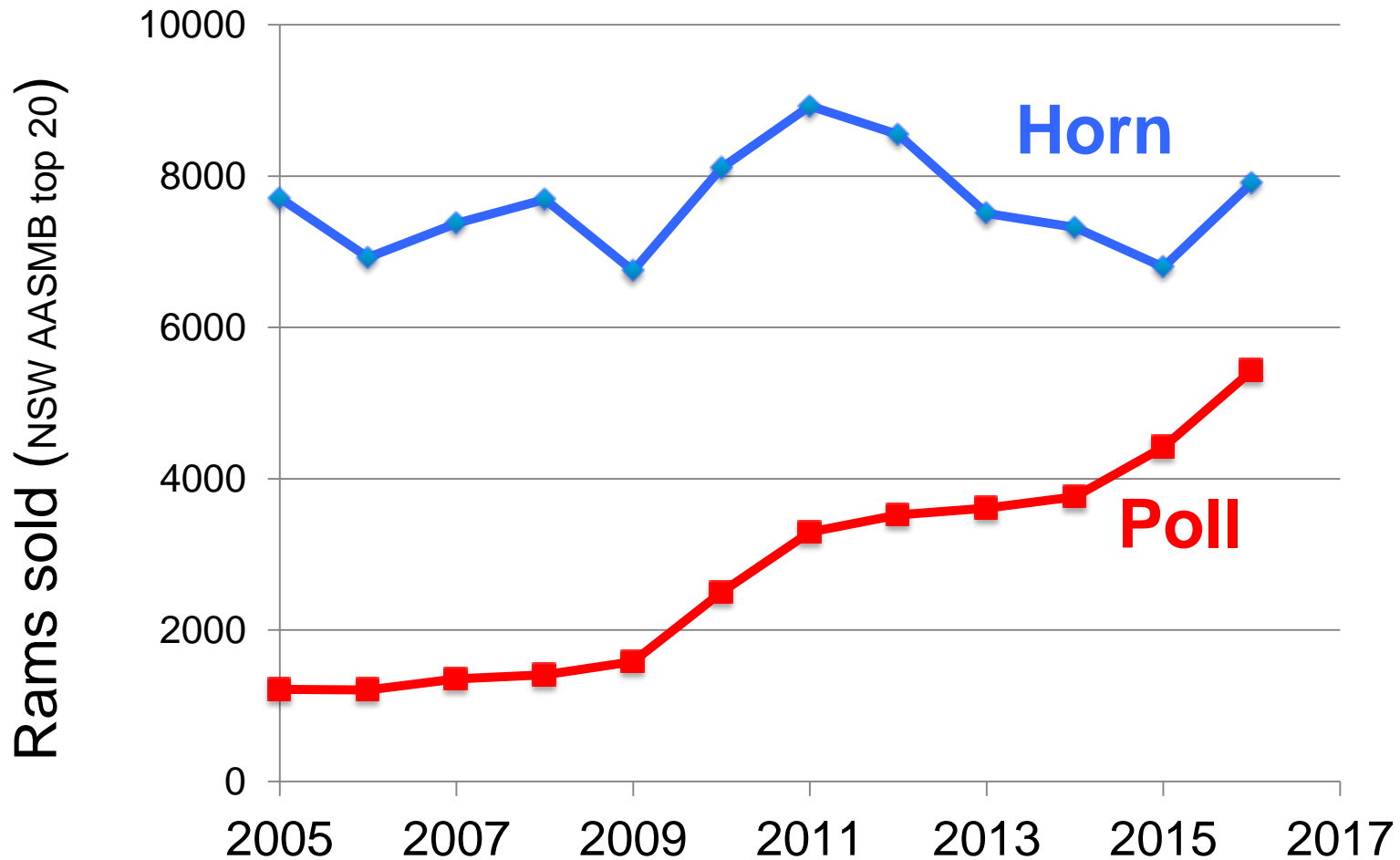
Rapid increase in poll ram semen sales

(Note: DNA test developed 2009)



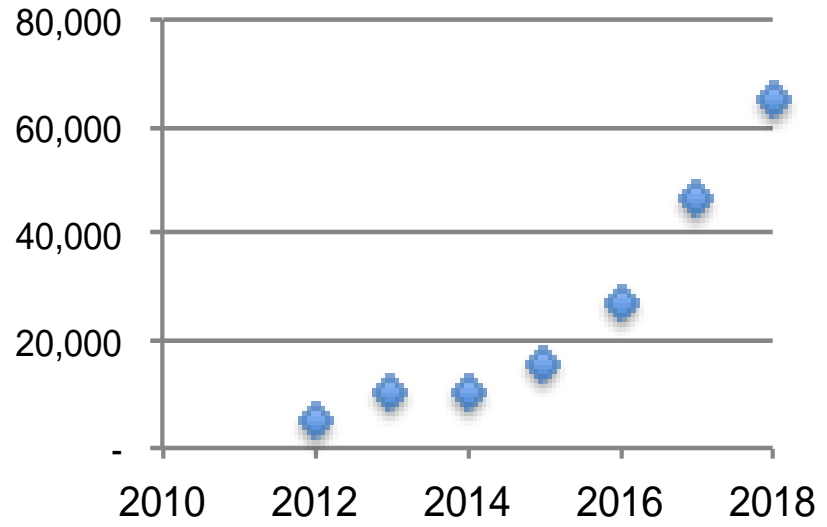
Increase in poll ram sales ('Top 20' NSW studs)

(Note: DNA test developed 2009)

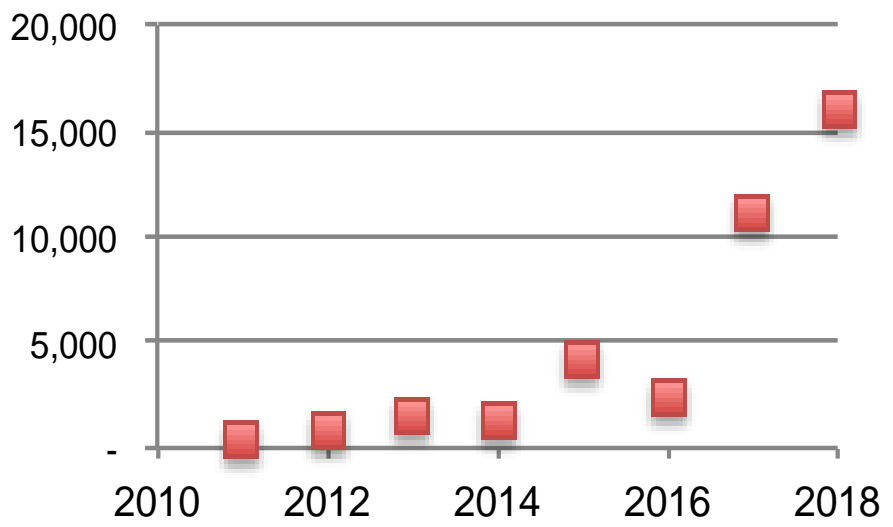


Increasing use of DNA (Genomic) testing

(a) DNA parentage test numbers (per year)



(b) Genomic test numbers (per year)



Concluding comments

- Genetic evaluation programs are crucial for rapid and well-balanced genetic gain
- Many Merino breeders can achieve much faster genetic gain for a range of traits required by their clients
- Genomics offers huge potential for Merinos
- **New tools and services (Single Step, MateSel, RamSelect, Flock Profiling) assist in making best use of genetically superior sheep**
- International collaboration – a strong case a single evaluation program based on MERINOSELECT

