Pedigree-OCS realises more genetic gain than genomic-OCS

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Optimum-contribution selection

Maximises genetic gain for given rate of inbreeding

Optimum-contribution selection

$$\max (\mathbf{c}' \hat{\mathbf{a}} - \lambda \mathbf{c}' \boldsymbol{A} \mathbf{c})$$

Optimum-contribution selection

$$\max \left(\underbrace{\mathbf{c}' \hat{\mathbf{a}}}_{\text{Merit}} - \lambda \underbrace{\mathbf{c}' \mathbf{A} \mathbf{c}}_{\text{Relatedness}} \right)$$

Optimum-contribution selection

$$\max (\mathbf{c}' \hat{\mathbf{a}} - \lambda \mathbf{c}' \boldsymbol{A} \mathbf{c})$$

Genomic
prediction

Optimum-contribution selection

$$\max (\mathbf{c}' \hat{\mathbf{a}} - \lambda \mathbf{c}' \boldsymbol{A} \mathbf{c})$$

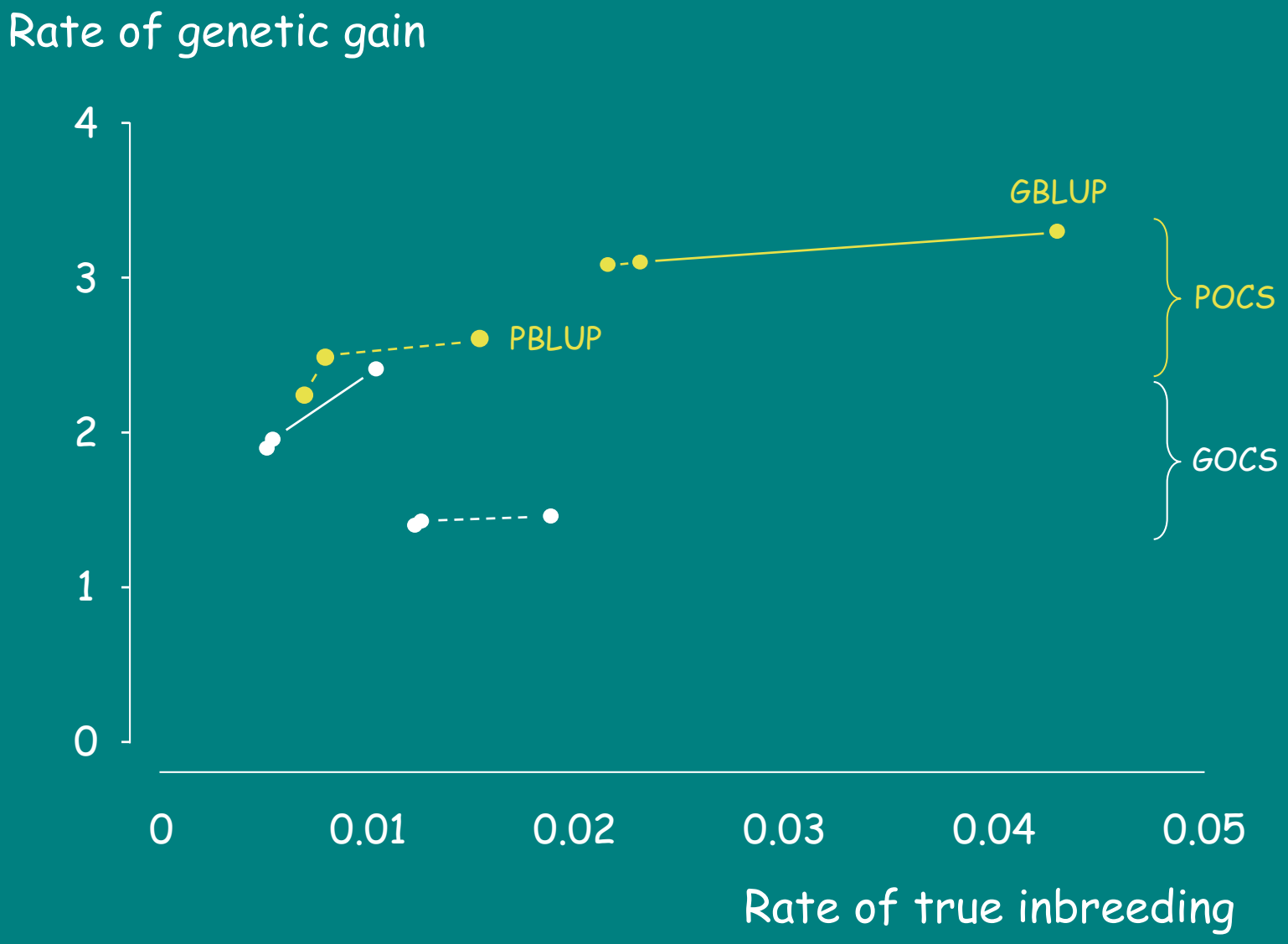
Genomic prediction

$\boldsymbol{G}$

Sonesson et al. 2012

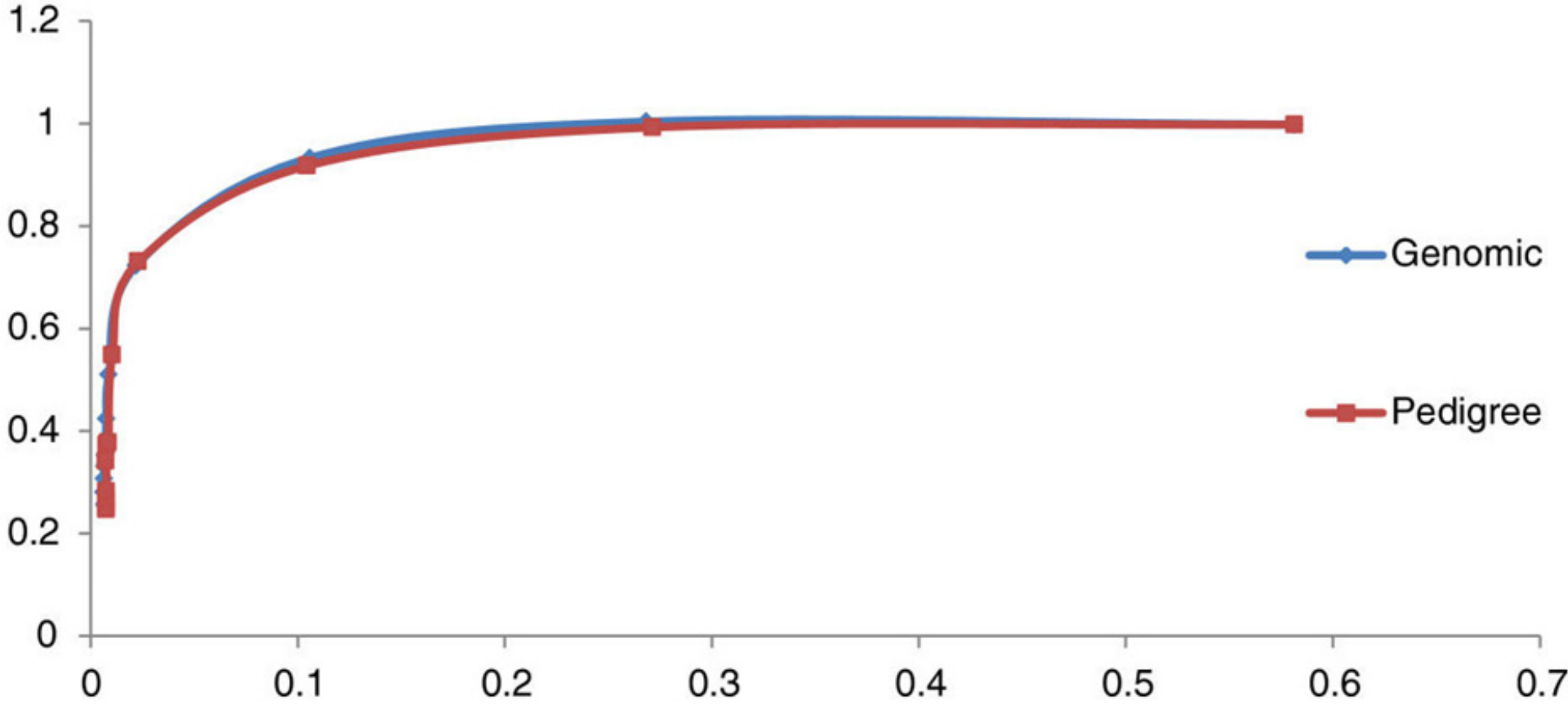
Same information for prediction and OCS

Sonesson et al. 2012



Clark et al. 2013

Merit (TBV)



Genomic co-ancestry

Premise

POCS realises as much genetic gain as GOCS

at the same rate of true inbreeding

Procedure

Prediction	OCS
PBLUP	POCS
GBLUP	GOCS
	IOCS

Single trait

h^2 0.2

QTL 7702

Markers 54218

IBD-markers 6012

All animals phenotyped and genotyped

Criterion

Genetic gain at 1% rate of true inbreeding

Genetic gain at 1% rate of true inbreeding

	PBLUP	GBLUP
POCS	100	100
GOCS	84	98
IOCS	94	103

POCS controls expected drift

Allows frequency of

favourable-QTL alleles to increase

GOCS controls realised drift and selection

Penalises changes in marker-allele frequencies

Restricts changes in QTL-allele frequencies

GOCS controls realised drift and selection

$$\max\left(\mathbf{c}' \hat{\mathbf{a}} - \lambda \underbrace{\mathbf{c}' \mathbf{G} \mathbf{c}}_{\mathbf{G} = \mathbf{Z}\mathbf{Z}'/s} \right)$$

$$\mathbf{c}'\mathbf{Z}\mathbf{Z}'\mathbf{c}/s$$

$\mathbf{Z}'\mathbf{c}/2$: Changes in marker-allele frequencies

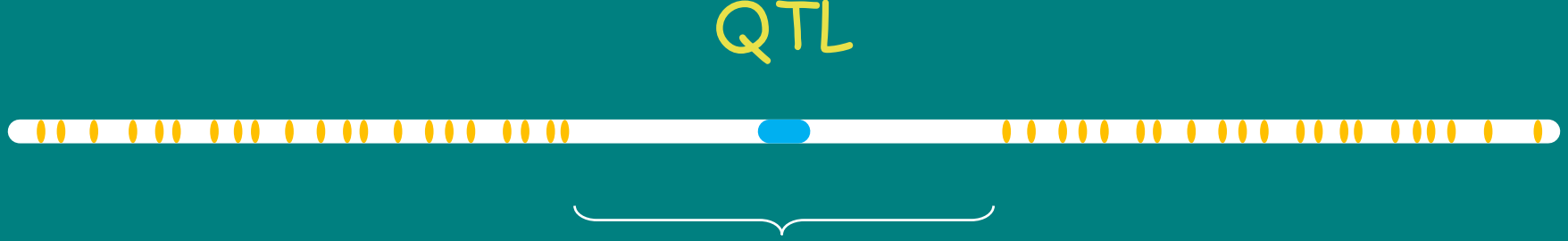
So …

GOCS counterproductive in animal breeding

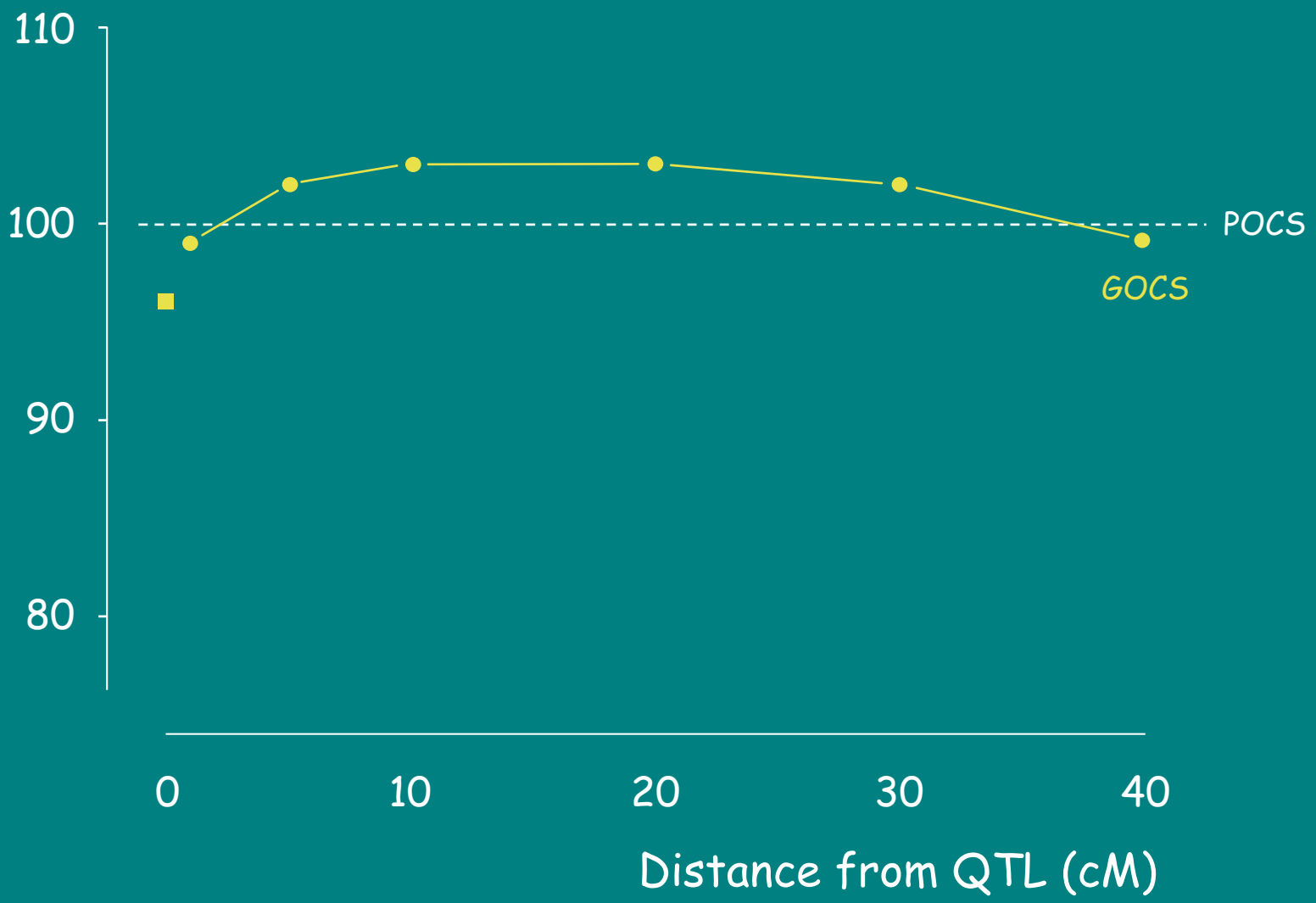
GOCS without "the brake"

QTL

GOCS without "the brake"



Genetic gain at 1% rate of true inbreeding



Implications

Little incentive to use GOCS

Not learnt to manage rates of
true inbreeding with genomic information

Conclusion

POCS is still a worthy method of OCS