TM-QTL and MyoMAX® effects in Texel x Welsh Mountain lambs

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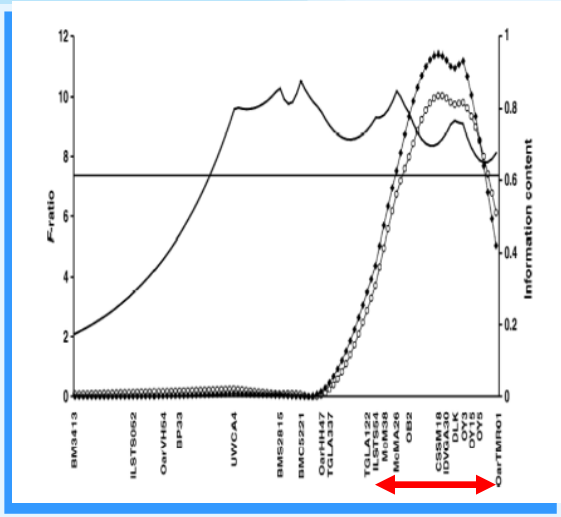
Background (TM-QTL)

- TM-QTL
  - Located on chromosome 18 in UK Texel sheep (Walling et al., 2004)
  - Inheriting single copy from the sire
    - Increases ultrasound muscle depth (4-7%) in Texel (Walling et al., 2004)
    - Increases loin muscling (4-7%) in crossbred lambs (Macfarlane et al., 2009)
  - Effect expressed only when the allele inherited from the sire and not the dam (Macfarlane et al., 2010)



From Walling et al., 2004. JAS. 82:2234-2245

Background (MyoMAX®)

- Mutations on the myostatin gene (Chr 2):
  - Several such polymorphisms have been found in the myostatin gene in sheep
  - Associated with higher muscle growth
  - Originally microsatellite test → underlying SNP identified (g+6723G-A or c.*1232G > A) (Clop et al., 2006; Hickford et al., 2009)
  - Allelic frequency in British commercial Texel is almost fixed and intermediate (0.3) in Charollais (Hadjipavlou et al., 2008)
  - MyoMAX® commercial gene test available from Ovita Ltd

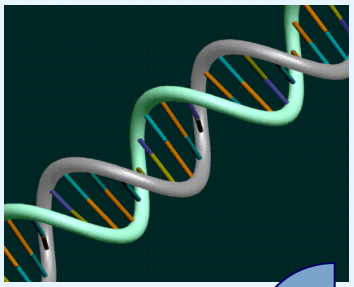
Objectives

- To evaluate MyoMAX® effects on carcass traits in crossbred lambs out of Welsh Mountain ewes

- To evaluate TM-QTL effects on carcass traits in crossbred lambs out of Welsh Mountain ewes

Materials & Methods (1)

4 Texel sires X 400 Welsh Mountain ewes



Ram 71085 → TM-carrier → MM/MM and TM/+
Ram 71088 → TM-carrier → MM/MM and TM/+
Ram 71128 → MM-carrier → MM/MM and +/+
Ram 71058 → MM-carrier → MM/+ and +/+

Materials & Methods (2)

Count of Lamb ID	TM-QTL status			
MyoMAX® status	0	1	9*	Grand Total
0	12	-	3	15
1	80	19	30	129
2	15	4	9	28
Blank	-	-	3	3
Grand Total	107	23	45	175

All ♂

* = genotype unknown

Materials & Methods (2)

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MyoMAX® status	0	1	9*	Grand Total	
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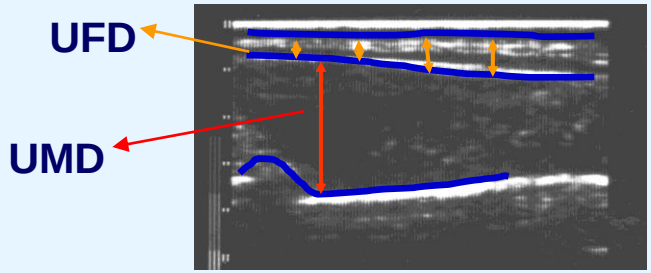
130

* = genotype unknown

Materials & Methods (3)

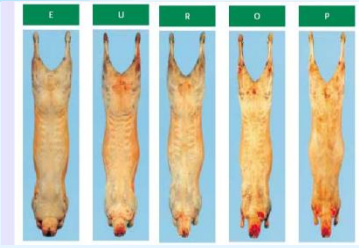
Lambs were:

- Weighed at 8 and 23 weeks of age (pre-slaughter)
- Ultrasonically measured at the 3rd lumbar vertebrae at 23 weeks of age for
  - fat depth (UFD)
  - muscle depth (UMD)

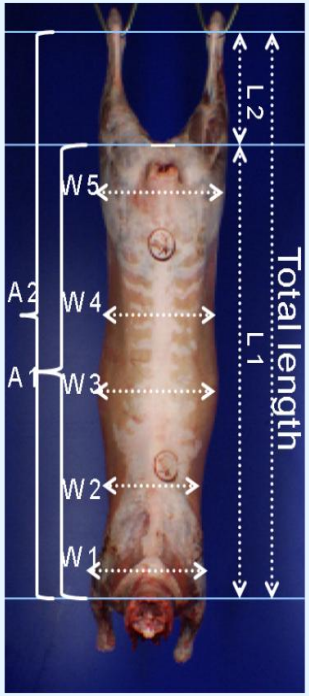


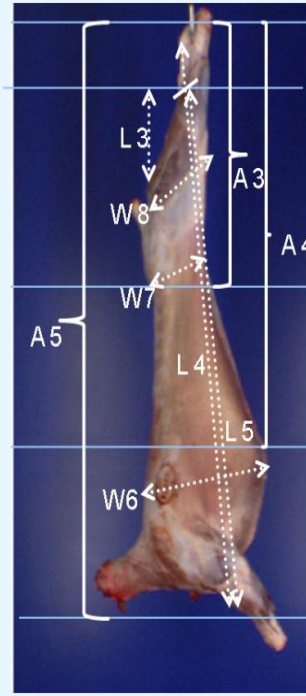
Materials & Methods (4)

Carcasses were



- Weighed and classified for conformation and fatness
- Video Image Analysis (VIA) scanned to predict
  - Saleable meat yield of the primal cuts: leg, chump, loin, breast and shoulder
  - Muscularity traits in the hind leg and the loin region
  - Widths, lengths and areas (W, L and A, respectively) of carcass regions; and carcass and hind leg compactness





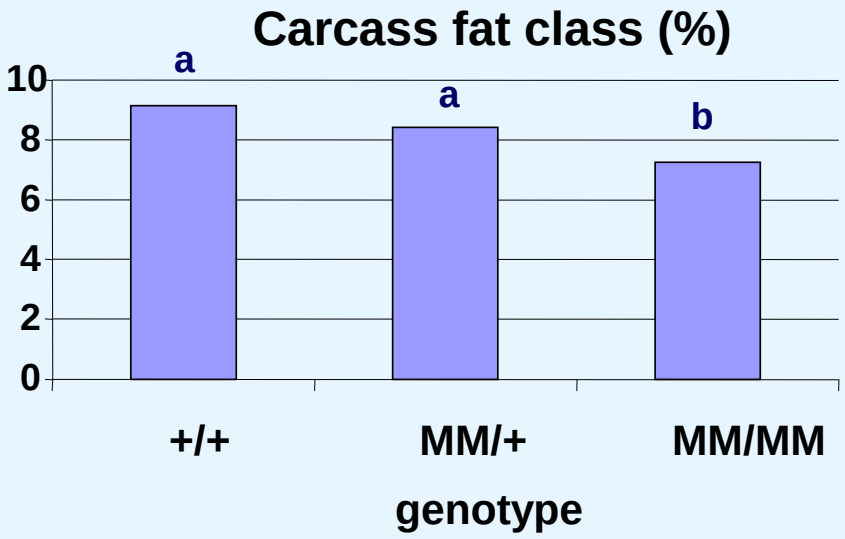
Material & Methods (5)

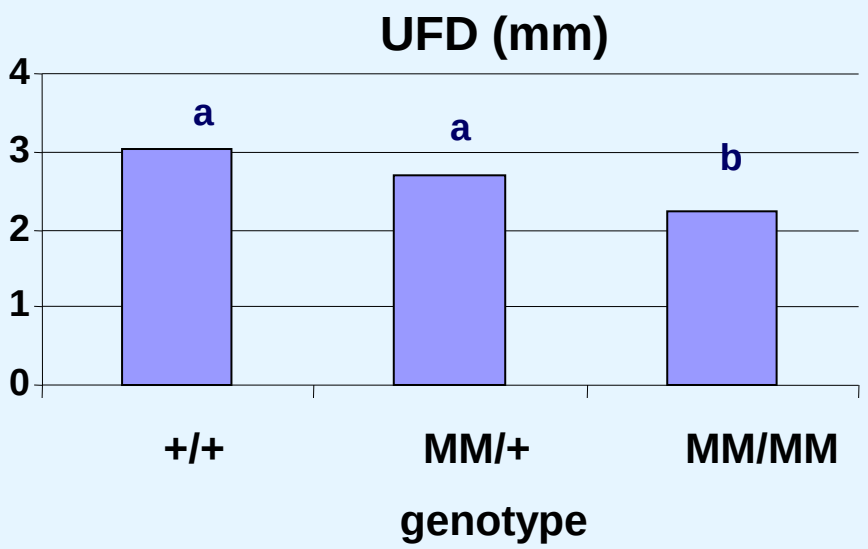
- Statistical analysis (GLM; SAS)
  - Fixed Effects
    - Genotype carrier status[1;] Litter size (when significant); Sire
  - Weight used as covariate[2] for ultrasound traits, carcass conformation and fat class and VIA-predicted primal and trimmed primal weights

1= no significant interaction between TM-QTL and MyoMAX was found for any trait

2= no covariate for weight, or VIA carcass dimensions or compactness traits

MyoMAX® Results (fat measures)



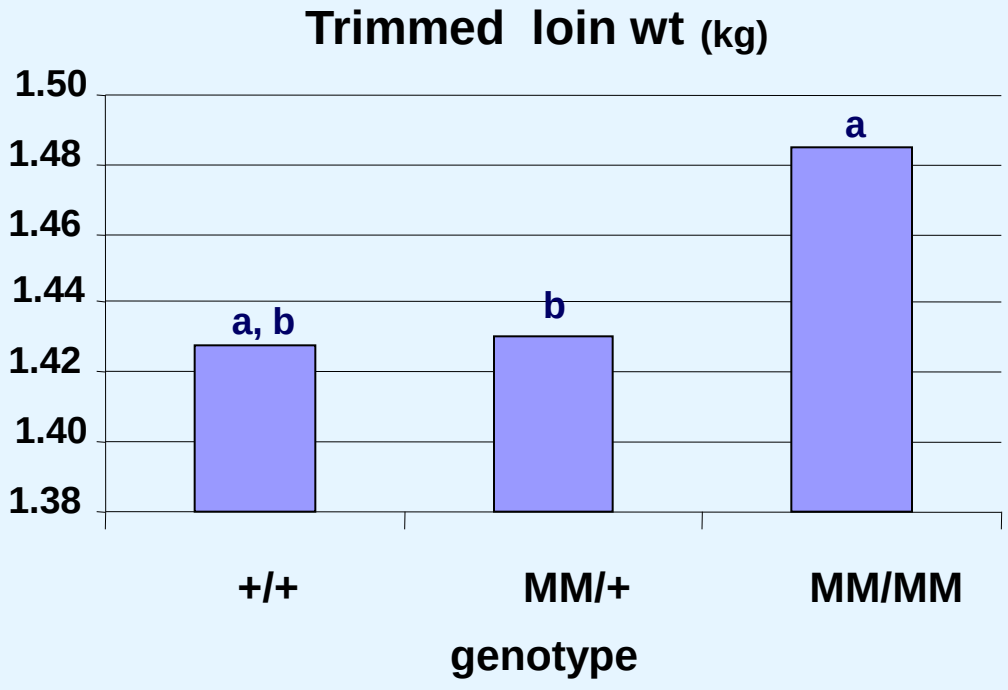


- MyoMAX® homozygous lambs had significantly less fatness compared to other genotypic groups

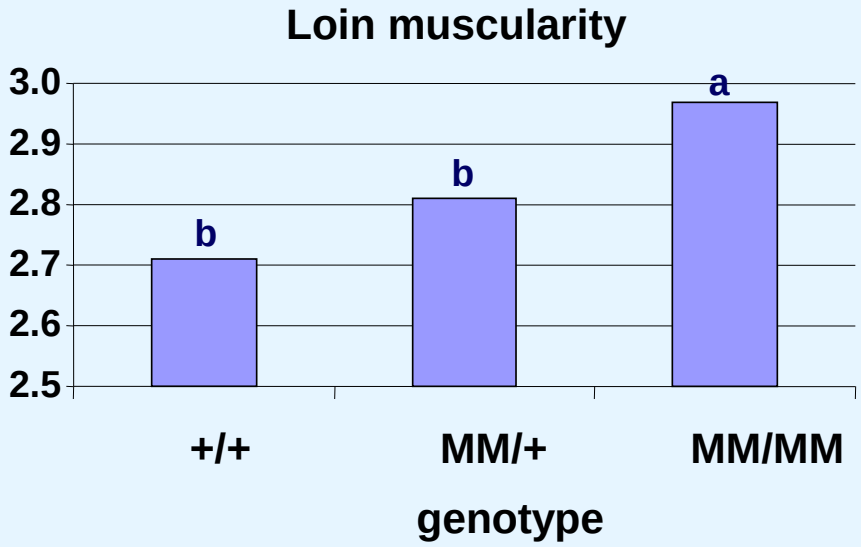
MyoMAX® Results (VIA-predicted primal cut weights)

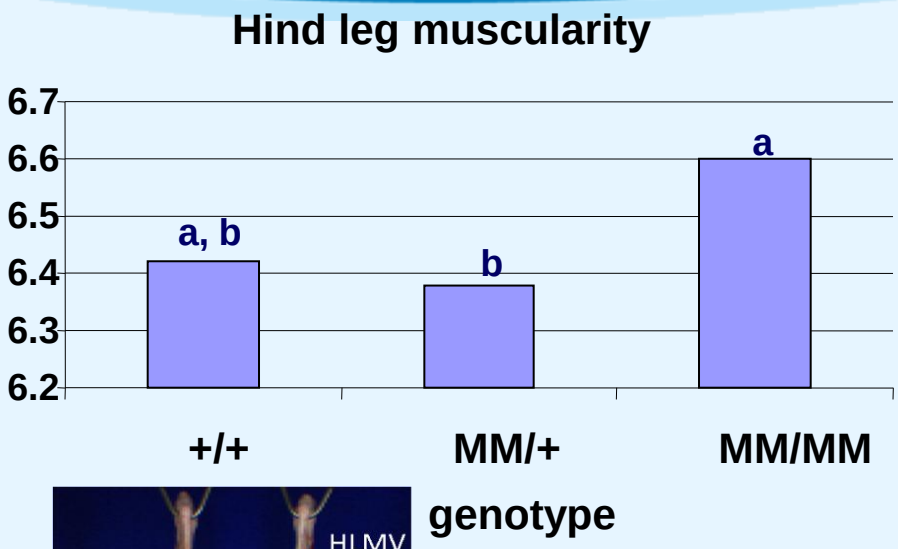
- MyoMAX® homozygous carriers were significantly greater than other genotypic groups in:
  - Leg weight (3.3%)
  - Trimmed leg weight (6.1%)
  - Trimmed chump weight (4.6%)

- Similar trend for trimmed loin weight (4%)



MyoMAX® Results (VIA-predicted muscularity traits)

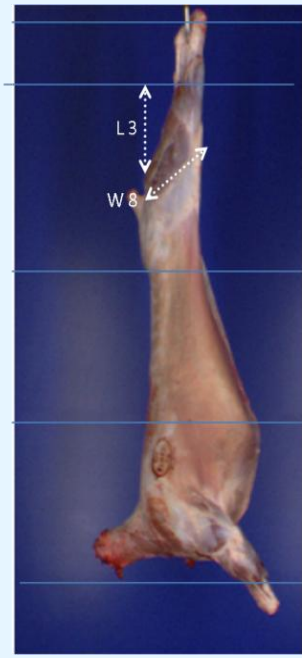




- Significant increase in hind leg muscle volume in MyoMAX® homozygous carriers compared to other genotypic groups
- Muscularity: volume of muscle per unit of bone length

MyoMAX® Results (VIA-predicted carcass measurements)

	MyoMAX® status		
Trait	**+/+**	**MM/+**	**MM/MM**
Carcass compactness[1]	**0.240^{b}**	**0.243^{b}**	**0.252^{a}**
Leg Compactness[2]	**0.212^{b}**	**0.218^{b}**	**0.230^{a}**
W1(cm)	**19.59^{ab}**	**19.49^{b}**	**20.18^{a}**
W3(cm)	**21.05^{ab}**	**21.25^{b}**	**21.80^{a}**
W5(cm)	**23.17^{b}**	**23.32^{b}**	**24.24^{a}**
A1(cm^2)	**1445^{ab}**	**1453^{b}**	**1505^{a}**
A2(cm^2)	**1636^{ab}**	**1638^{b}**	**1692^{a}**



1 Carcass compactness = W5/Total_Length
2 Leg compactness = $[W5+W8]^{1/2}$ / L3

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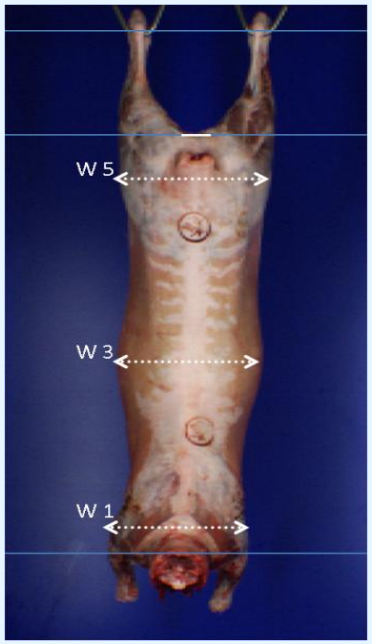

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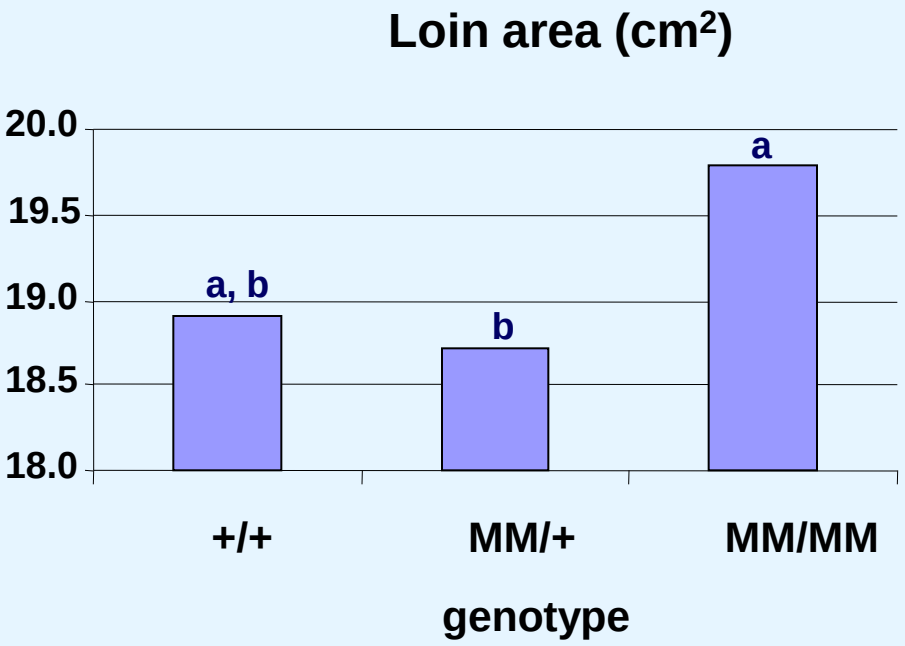
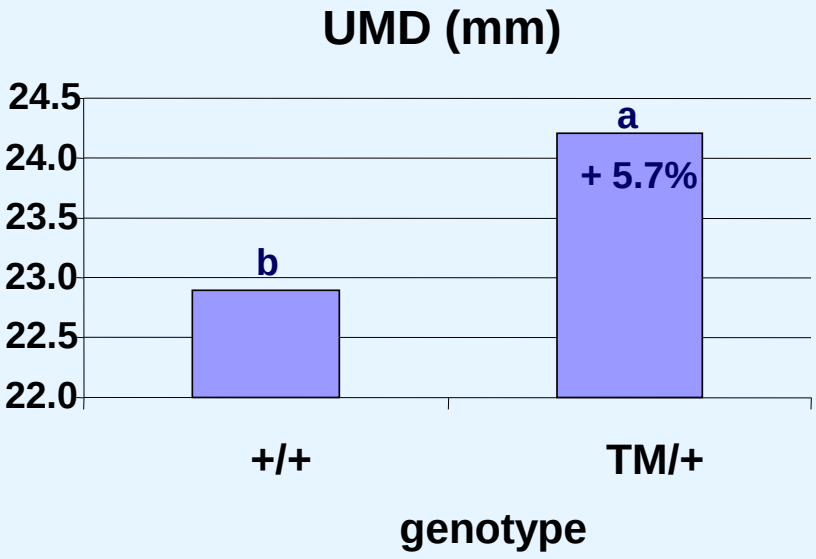
MyoMAX® Results (VIA-predicted loin muscle dimensions)

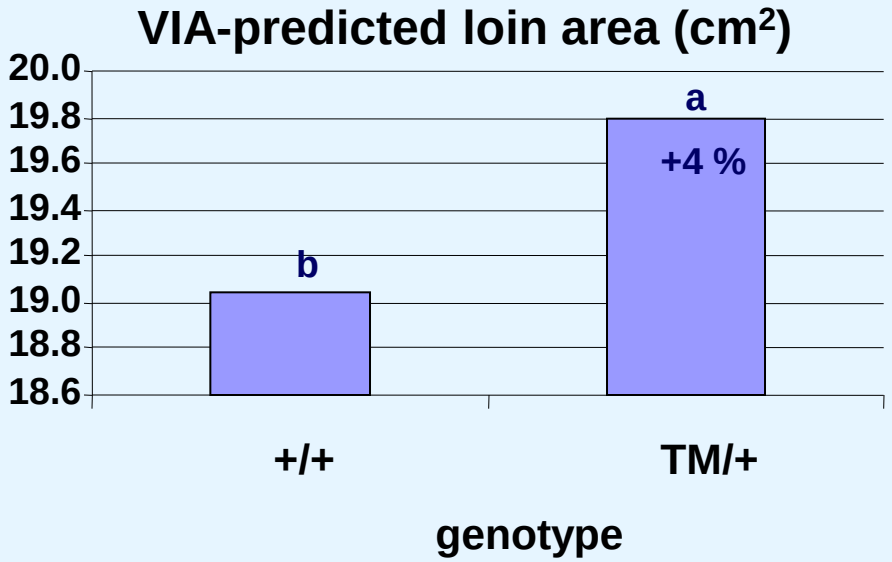
- MyoMAX® homozygous carriers were significantly greater than other genotypic groups in:
  - Loin width (2.5%)
  - Loin depth (4.4%)

- Similar trend for loin area (4.7%)



TM-QTL Results





- TM-QTL heterozygous carriers were significantly greater than non-carriers in:
  - VIA-predicted loin width (2%)
  - VIA-predicted leg weight (2.2%)

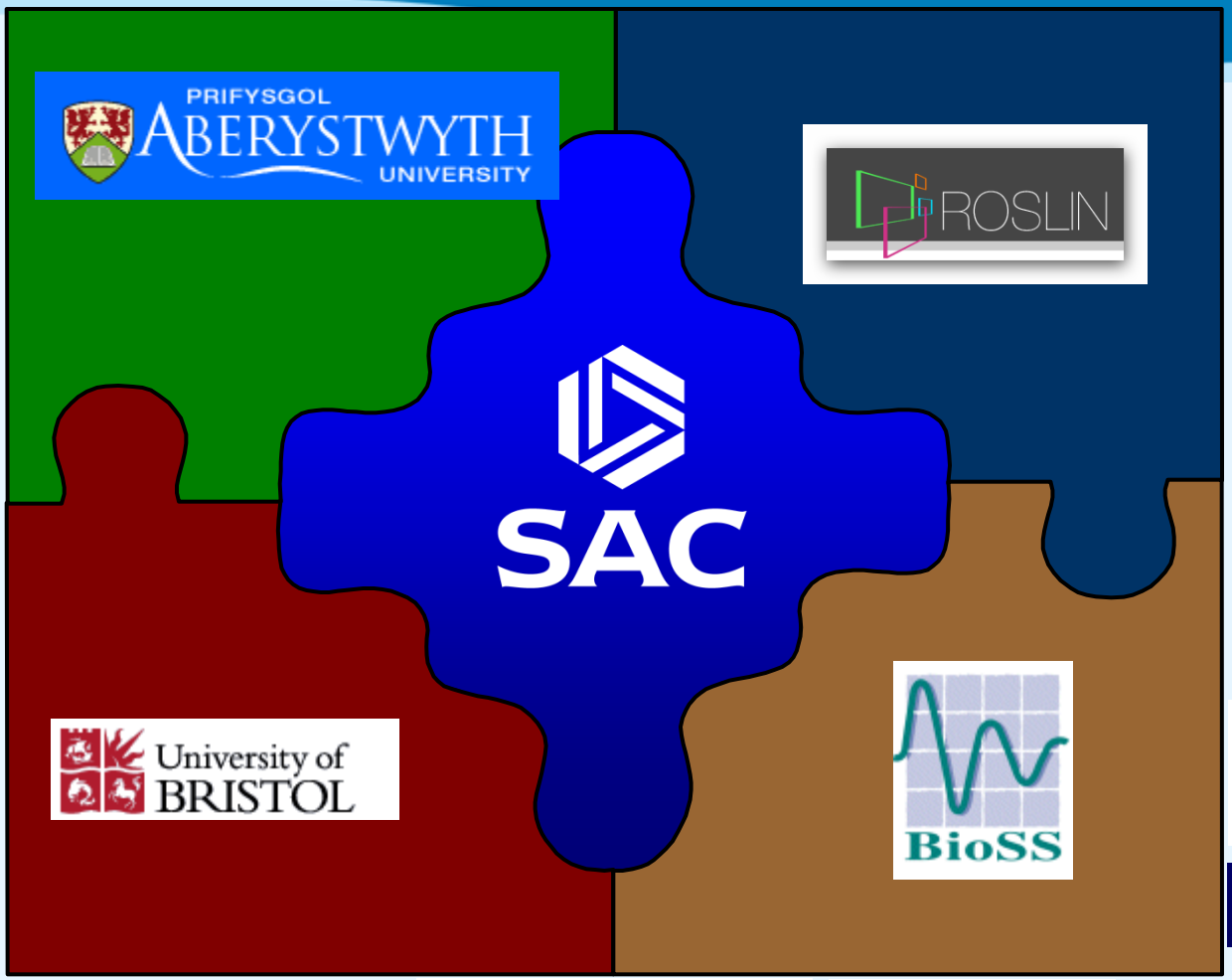
Conclusions

- MyoMAX®
  - increased VIA-predicted muscularity and muscling traits in both loin and leg
  - no significant differences in measured muscling traits (UMD & carcass conformation class)
  - decreased fatness
  - sufficient to classify homozygous carriers in lower mean MLC fat class
  - mode of inheritance seems to be ‘partially recessive’ for muscle traits and additive for fat traits
  - in maternal lines carriers should be selected to get the full benefit

Conclusions

- TM-QTL
  - increased loin muscling in Texel x Welsh Mountain crossbred lambs
  - increased saleable meat yield in leg
  - did not affect VIA predictions of muscularity or carcass shape

Acknowledgements



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