Estimation of variance components for litter size in Romanov sheep

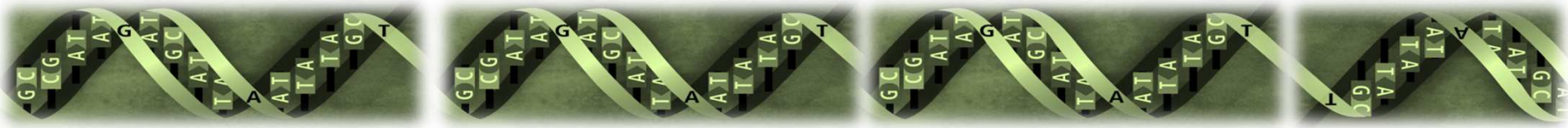
Ante Kasap[1], Marija Špehar[2], Ana Kaić[1], Boro Mioč[1]

[1]Sveučilište u Zagrebu Agronomski fakultet. Svetošimunska cesta 25. 10000 Zagreb. Hrvatska

[2]Hrvatska poljoprivredna agencija. Ilica 101. 10000 Zagreb. Hrvatska

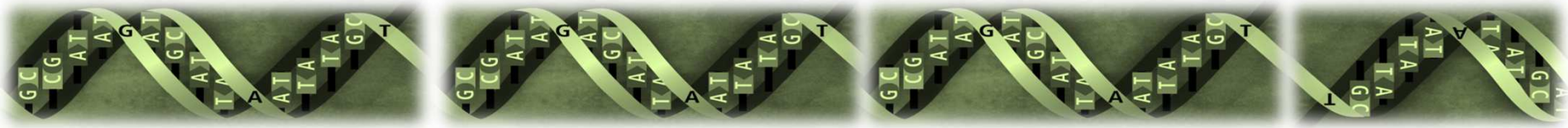
Introduction

- Romanov sheep – the most fertile sheep breed in the world
- Litter size
  - The most important reproductive trait in the meat production
  - Low heritability – limited selection
  - Important component in the breeding programs



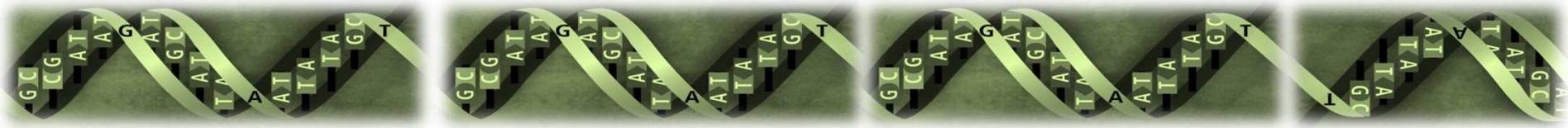
Breeding work in Croatia

- 12,023 Romanov sheep in the continental counties
- Breeding work
  - 1930 animals (4.7%)
  - 27 breeders
  - Average litter size – 1.52
- Aim: To estimate genetic parameters for **litter size**



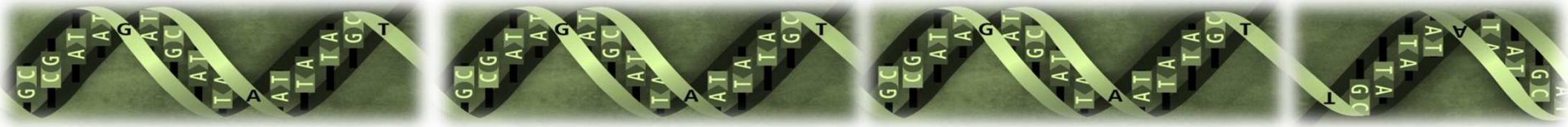
Material

- Central database of Croatian Agricultural Agency
- Records from 1995 to 2012
- Data editing
- 10,723 phenotypic records for litter size



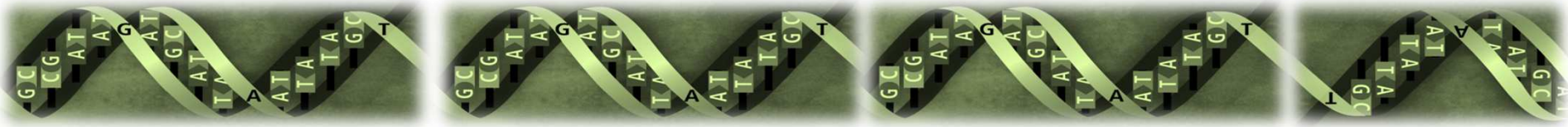
Pedigree structure

Animals with phenotypic records	4,097
Non-base animals:	3,921
-both parents known	3,686
-only sire known	83
-only dam known	152
Base animals	351
Proportion of base animals (%)	8
Total number of animals	4,272



Method

- Data preparation
  - SQL (SAS/STAT)
- GLM procedure (SAS/STAT)
- Criteria for including effect into the model
  - Significance of effect (p-value)
  - Determination coefficient (R^2)
  - Degrees of freedom (df)
- Variance components estimation (VCE-6)



Model in matrix notation

$$y = X\beta + Z_s s + Z_p p + Z_a a + e$$

Litter size

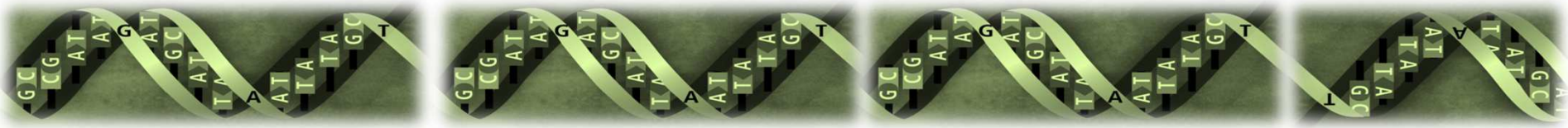
Residual

Random effects

- Additive genetic effect
- Herd
- Permanent environmental effect

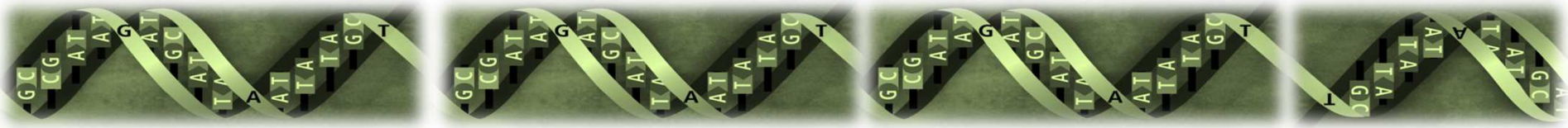
Fixed effects

- Season (int. year-mounth of lambing)
- Age at lambing nested within parity (QR)



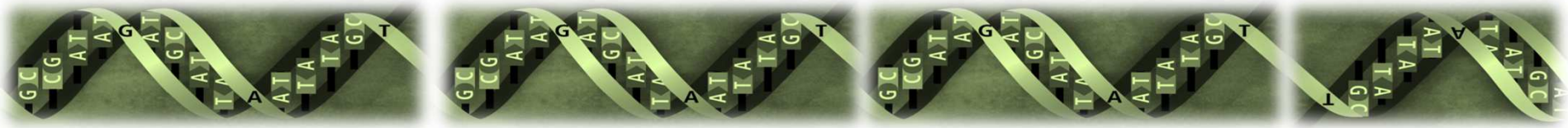
Litter size by parity

Parity	Number of lambed ewes		Litter size				
	n	%	1 (%)	2 (%)	3+ (%)	$\bar{x}$	σ
1	3446	33.5	68.2	26.8	4.0	1.35	0.55
2	1962	19.1	53.0	38.8	8.2	1.55	0.64
3	1405	13.7	47.4	40.1	12.5	1.65	0.69
4	1007	9.8	43.5	44.2	12.4	1.69	0.68
5	797	7.8	41.9	46.3	11.7	1.70	0.67
6	550	5.4	42.5	40.9	16.6	1.74	0.72
7	391	3.8	47.8	39.9	12.3	1.64	0.69
8+	719	7.0	49.6	38.9	11.5	1.62	0.69



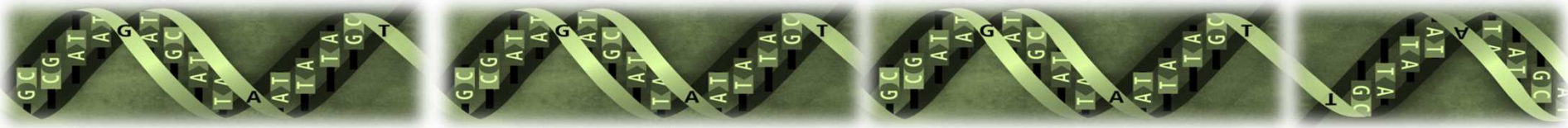
Variance components

Item	σ_a^2	σ_p^2	σ_s^2	σ_e^2	σ_u^2	$\sigma_a^2 + \sigma_p^2$
σ^2 ± S.E.	0.025± 0.003	0.004± 0.003	0.091±0.018	0.307±0.005	0.427	0.3102
σ^2 / σ_u^2	0.06	0.01	0.21	0.72	1.00	0.07



Conclusion

- Low heritability and repeatability for litter size
- Estimated heritability and repeatability are in line with previous reports for this breed
- Continuous selection improvement requires systematic breeding and selection work based on results obtained by BLUP



Thank you for the attention !!!