

Linked inheritance of particular MHC class I and class II haplotypes in domestic pigs

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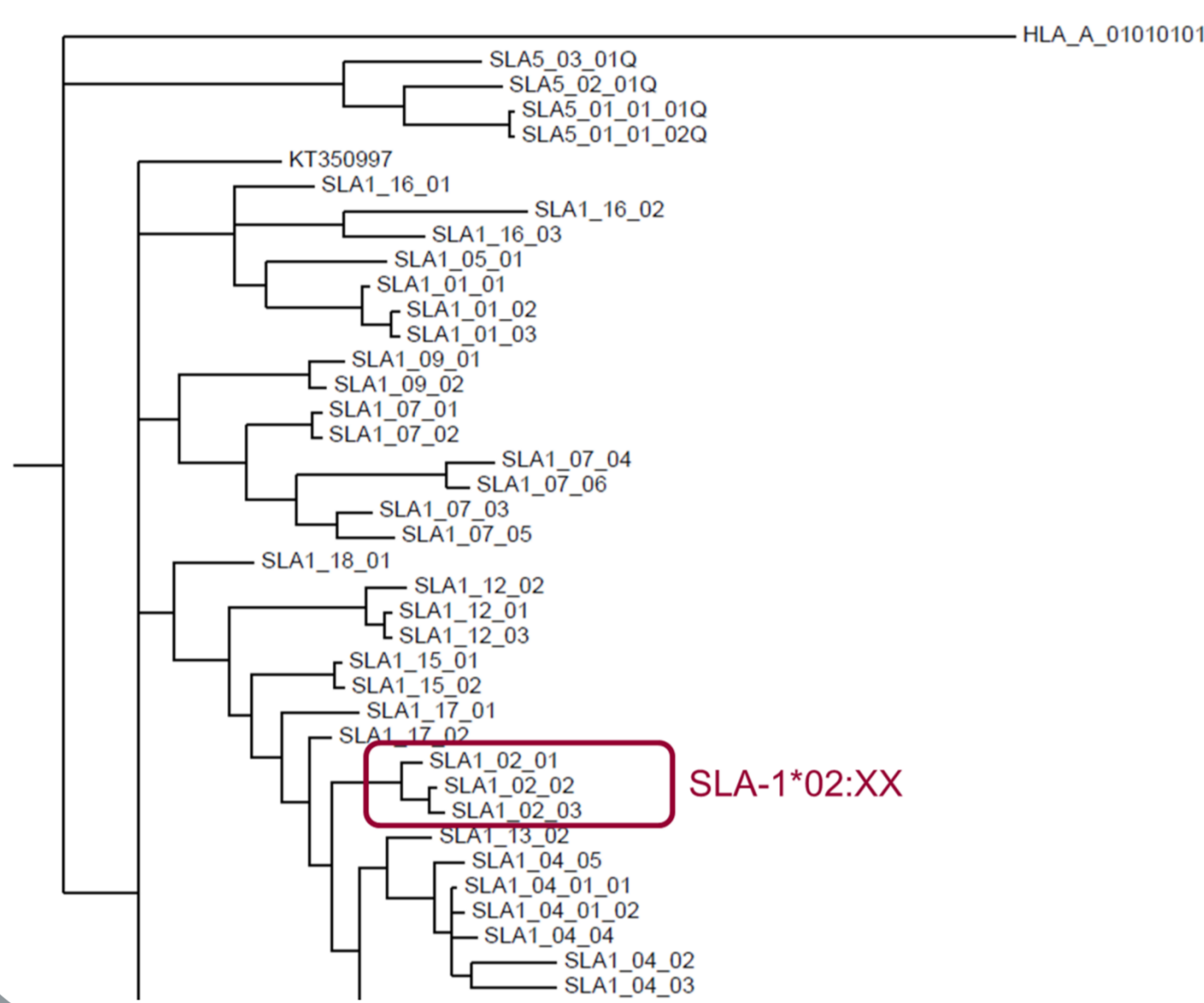
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Background & Objectives

The porcine major histocompatibility complex (MHC) codes for the swine leukocyte antigens (SLA). Heterogeneous SLA allow for a wide panel of antigenic peptides to be bound and presented, thus influencing disease resistance and vaccine responsiveness. Despite domestication involving selection for favorable traits, and inbreeding, pigs still maintain a high degree of SLA diversity being reflected in 223 and 212 officially designated SLA class I and class II alleles, respectively.

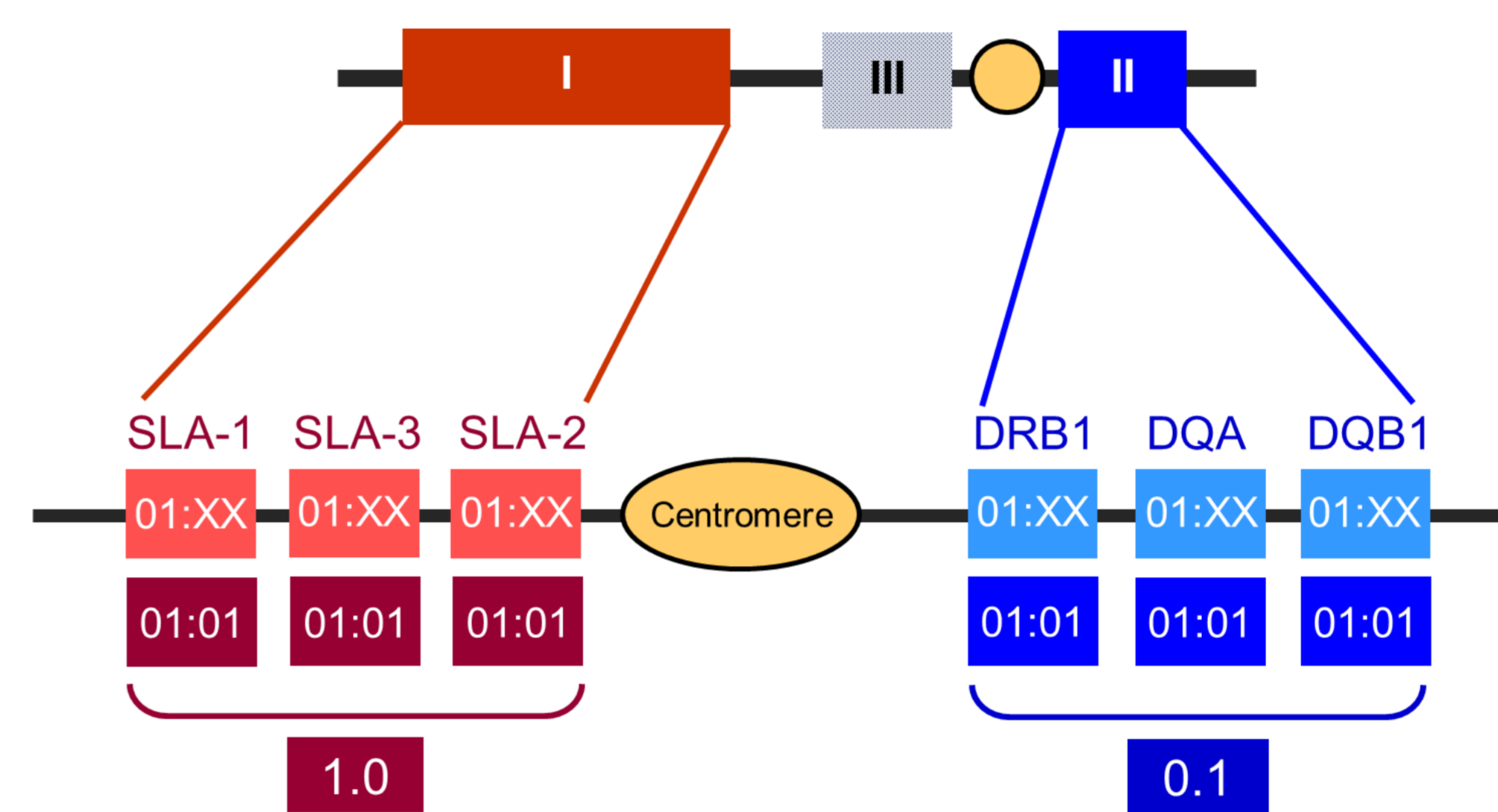
Due to the extensive polymorphic nature of SLA genes, accurate and sensitive typing methods are important for investigating their distribution in purebred resource populations and outbred pigs with diverse genetic backgrounds. In this study, we applied a low-resolution (Lr) DNA-based SLA typing method using the PCR-sequence-specific primer (PCR-SSP) strategy for high-throughput screening of a cohort of 141 pedigreed German Landrace pigs comprising 54 founders and 87 offsprings.

SLA Nomenclature System (similar to WHO HLA)



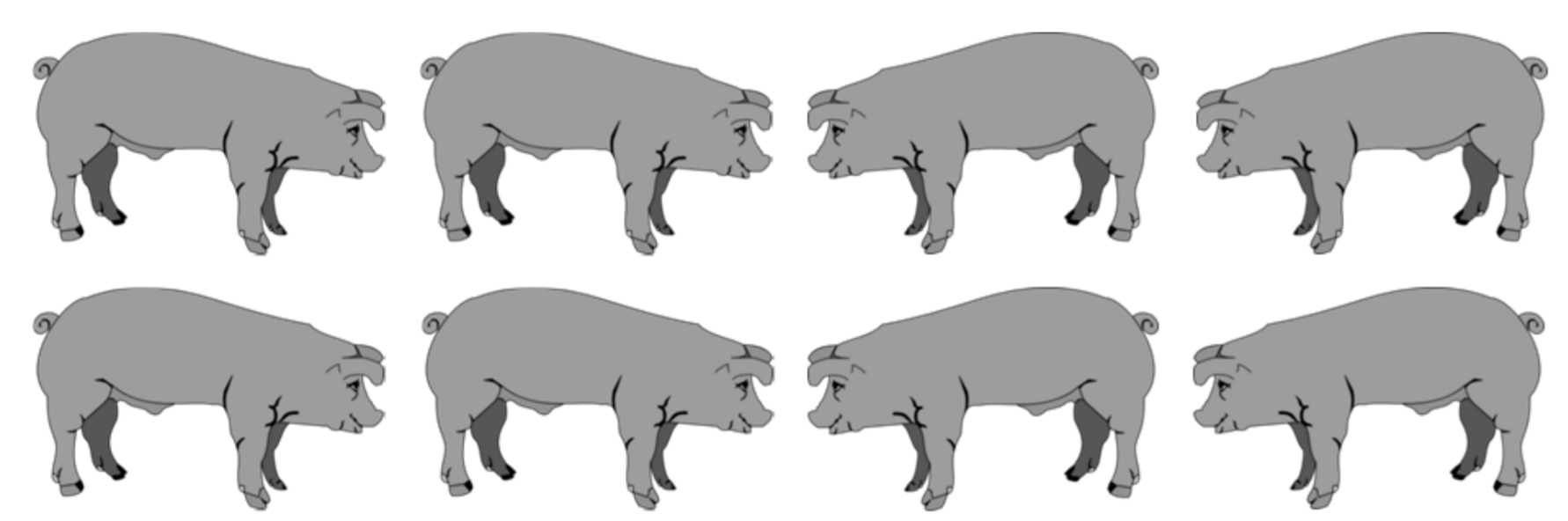
Designation	Indication
SLA-1	A particular SLA locus
SLA-1a, SLA-1b, SLA-1c	a = the most centromeric b = telomeric to a c = telomeric to b.....etc
SLA-1*02	A group of alleles (by phylogeny and/or sequence motif)
SLA-1*02:01	A confirmed allele
SLA-1*02:01:01	A confirmed allele which differs by synonymous nucleotide substitution
SLA-1*02:01N	Null allele
SLA-1*02:01Q	Questionable expression
SLA-1*02:01L	Low expression

Definition of SLA Haplotypes

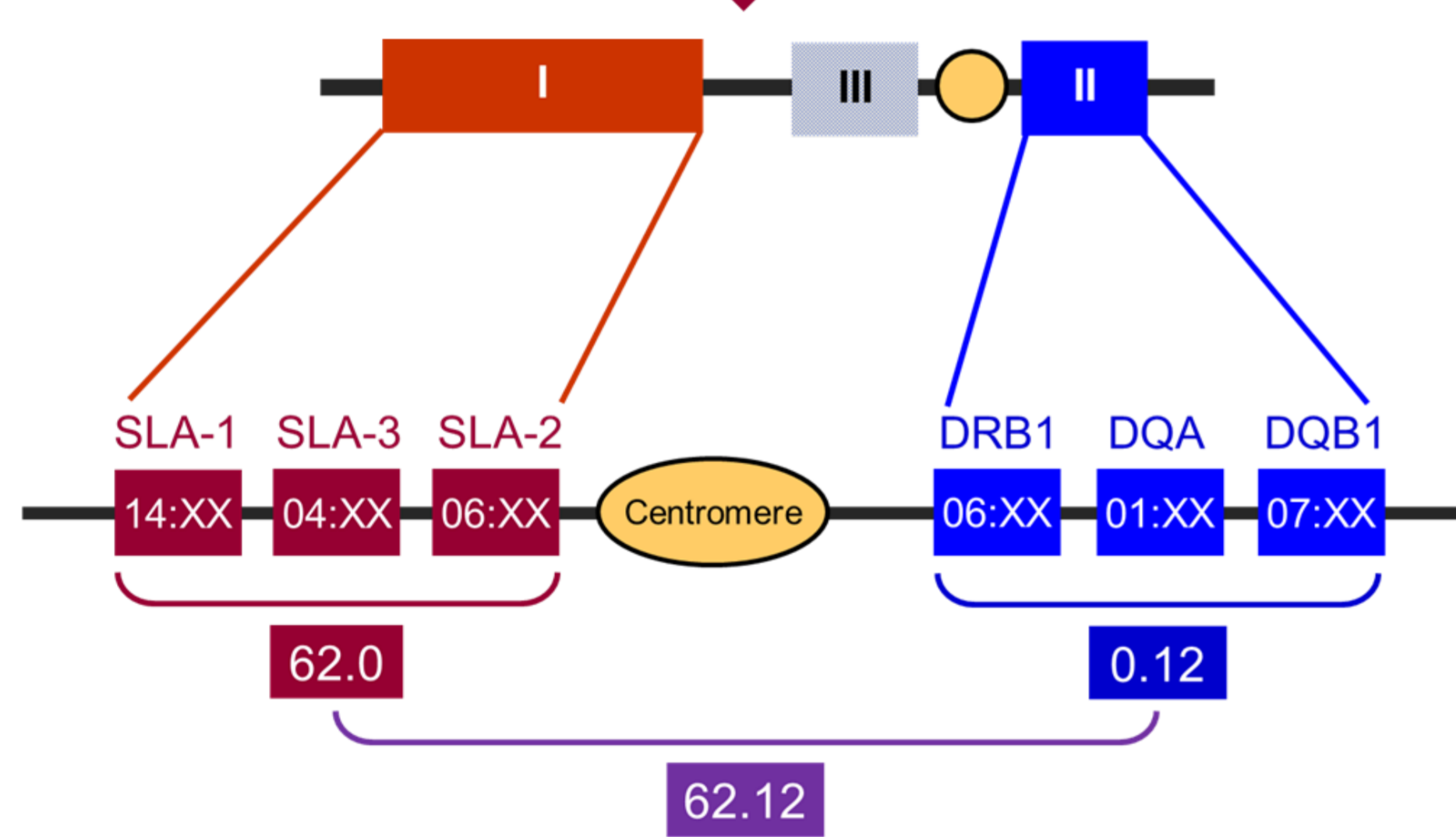


Low-resolution (Lr) haplotypes are identified by a PCR-based typing assay and define the MHC background of an animal on allele-group level → e.g., SLA-1*01:XX; DRB1*01:XX.
High-resolution (Hr) haplotypes are defined on allele level by sequence-based typing methods → e.g., SLA-1*01:01; DRB1*01:01.

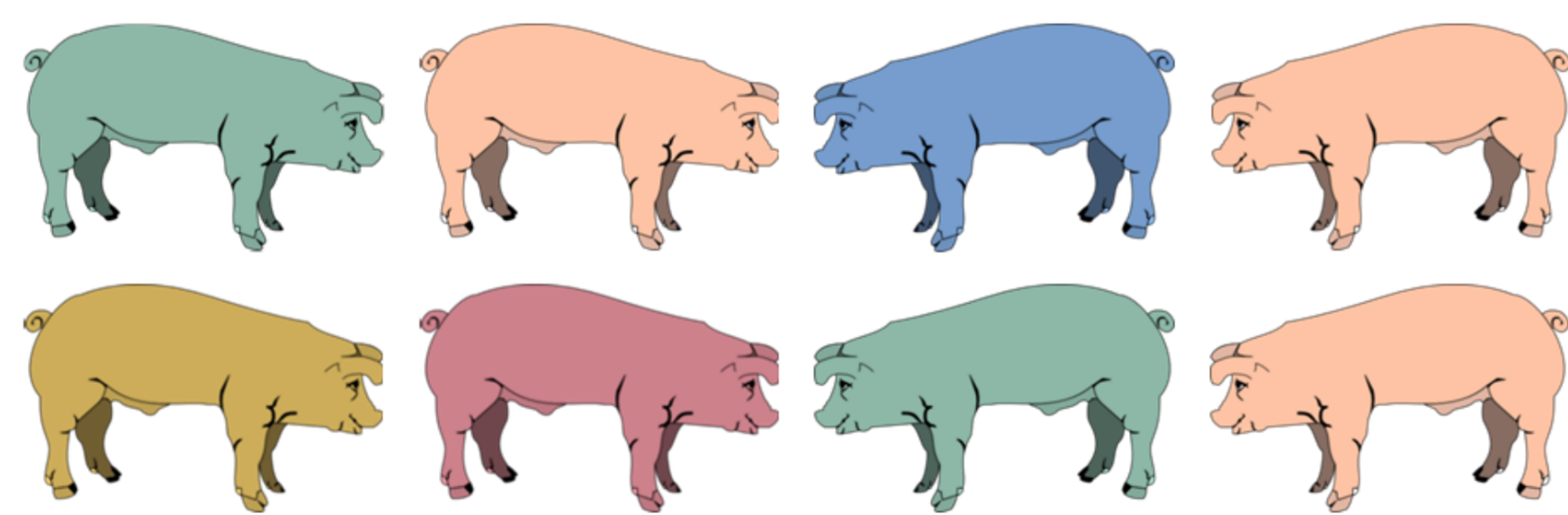
Work flow of the presented project



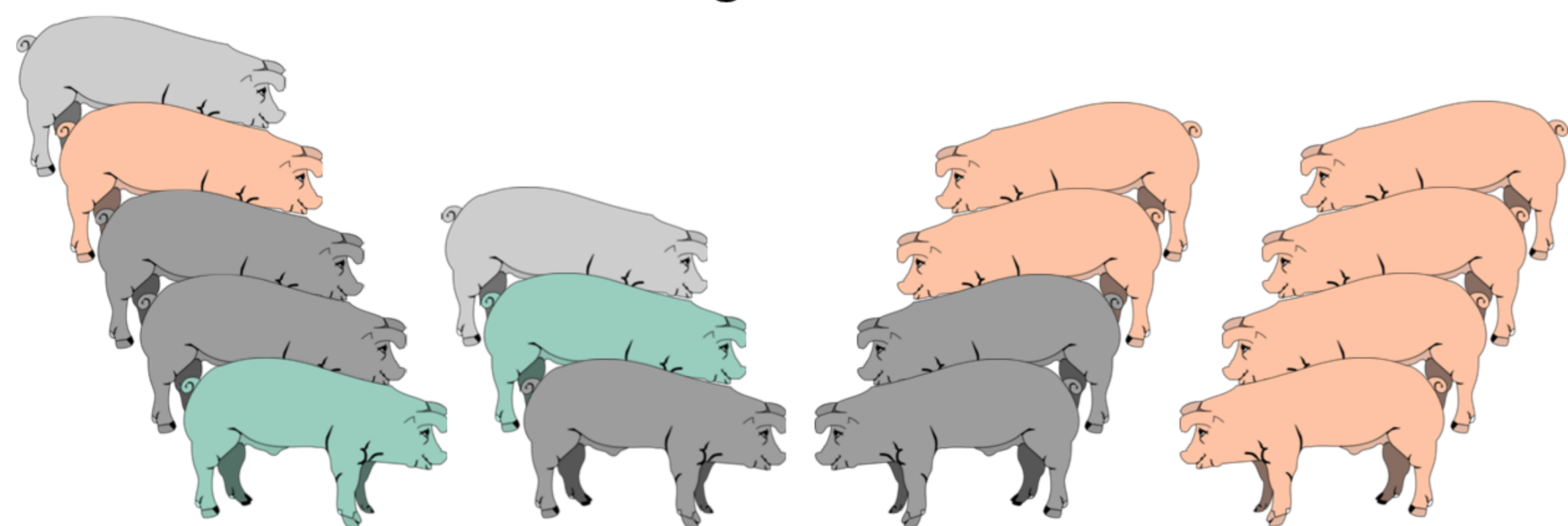
SLA SSP Typing of the resource population



Assignment of low-resolution haplotypes

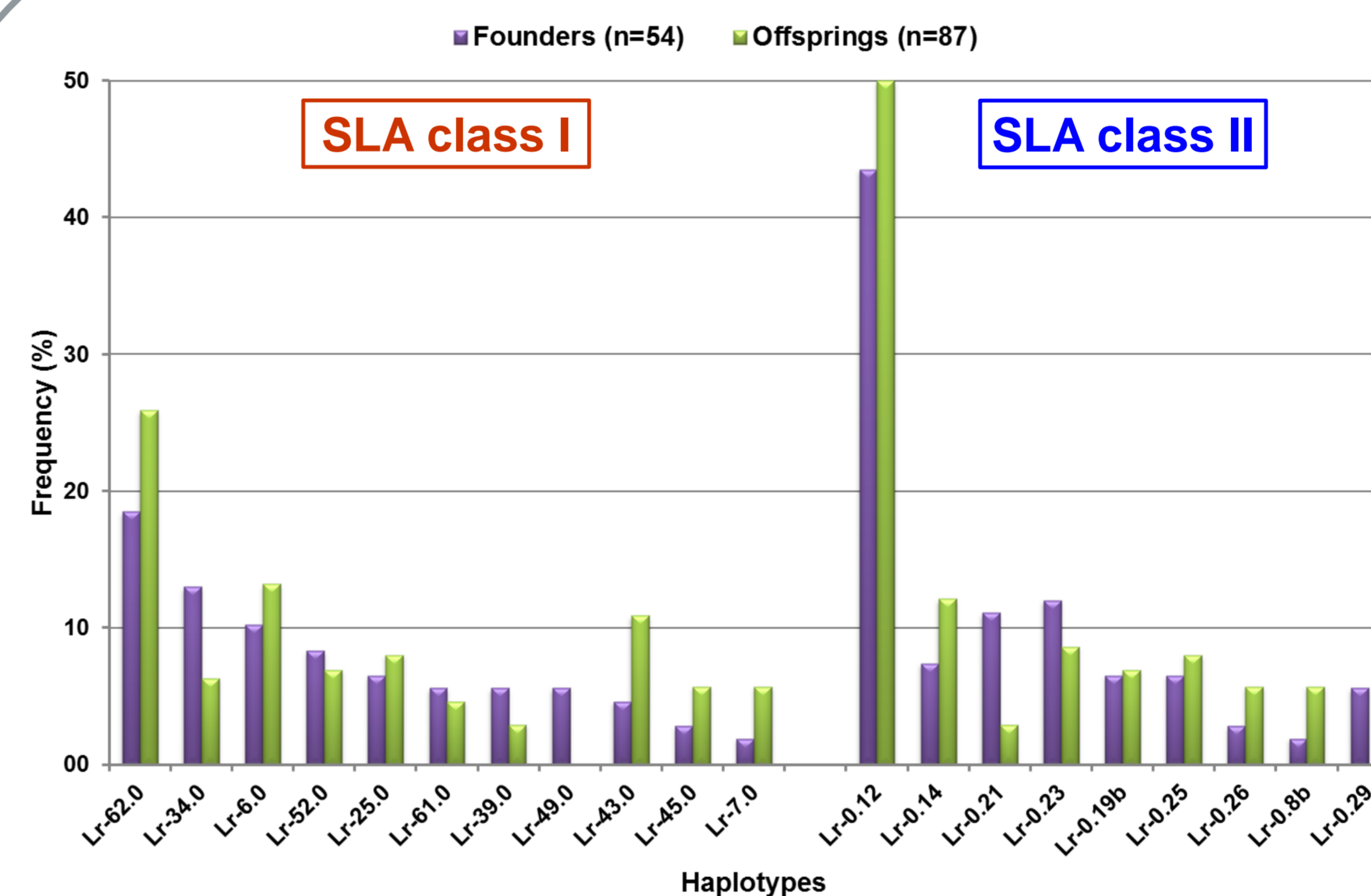


Directed mating of founder animals



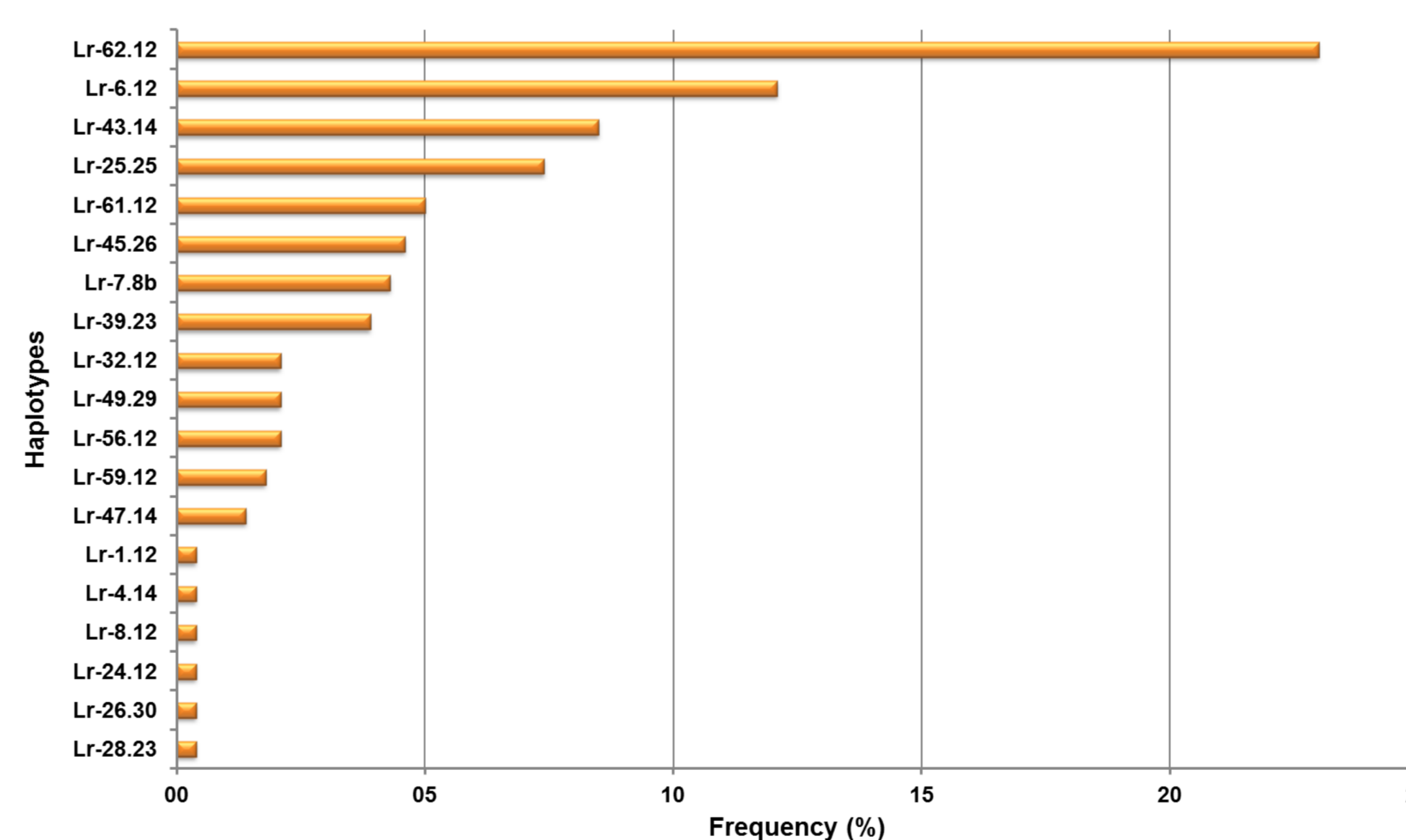
Experimental advantage of pre-selection via SLA

SLA SSP results of German Landrace pigs



Found haplotypes | In total, 141 purebred German Landrace pigs (36 sows, 18 boars and 87 piglets) were analyzed by PCR-SSP and the detected alleles were assigned into haplotypes.

We found 22 class I and 11 class II haplotypes at diverging frequencies (0.4-47.5%). The bar chart shows the most abundant SLA haplotypes, clearly indicating the predominant haplotype Lr-62.0 for SLA class I, and Lr-0.12 for class II, respectively.



Linked haplotypes | Among the studied cohort, the SLA class I haplotypes were inherited together with particular class II haplotypes in a linked fashion. The most abundant fixed haplotype combination Lr-62.12 (23.0%) was found in 62 animals, followed by Lr-6.12 (12.1%), Lr-43.14 (8.5%) and Lr-25.25 (7.4%).

	Sow	Boar	Sow	Boar	Sow
	34.21	25.25	35.23	52.19b	62.12
	A	F	C	G	E
Haplotype:	A C	A G	F C	F G	E F
Number of offspring:	2	3	2	1	3
					E H
					G F
					G H
					3
					2
					5
					1

Genotypes | The figure shows the pedigree and SLA genotypes of selected German Landrace pigs. The linked low-resolution haplotypes lead to 29 genotypes of which the genotype Lr-43.14/62.12 appeared at the highest frequency of 9.2%. Interestingly, among the 141 pigs, only two homozygous animals were found (Lr-62.12/62.12, 1.4%).

Summary & Conclusion

- I. MHC heterozygosity is still maintained in German Landrace pigs.
- II. No recombination events in the SLA complex.
- III. Linked haplotypes may play a certain role in the immune response.