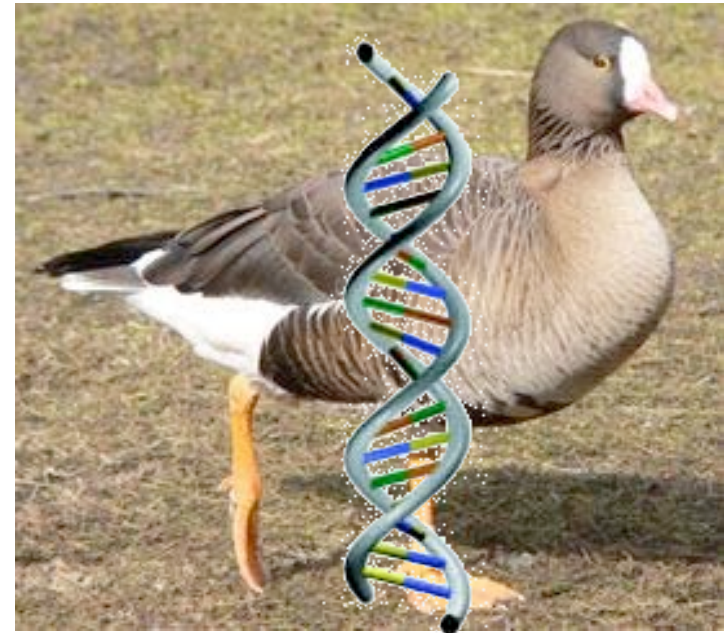




## Genetic analysis of breeding stocks Of LWFG (*Anser erythropus*)



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Aims & Scope: to determine:

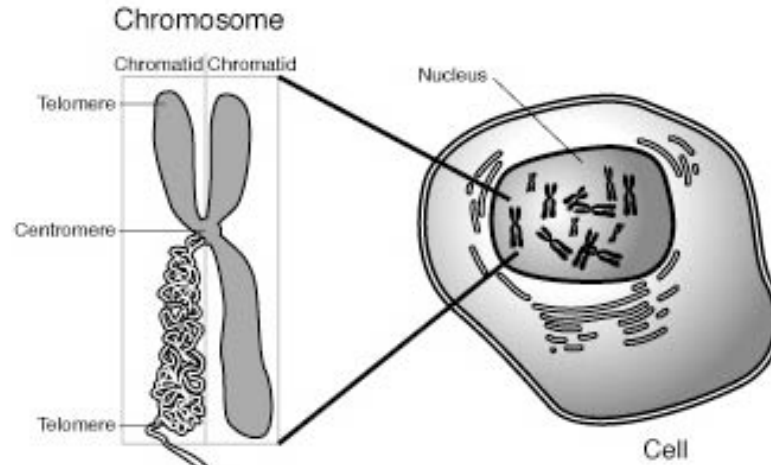
Genetic composition and variability  
of LWFG breeding stocks kept in Germany,  
Sweden and Finland

samples

- 270 LWFG  
Germany (n=84),  
Sweden and Finland;  
27 wild birds from Russia



# DNA



A C  
T G

1-10 million nucleotide differences between 2 individuals of a species  
Differences are inherited





DNA is a blueprint of evolution, phylogeny & phylogeography

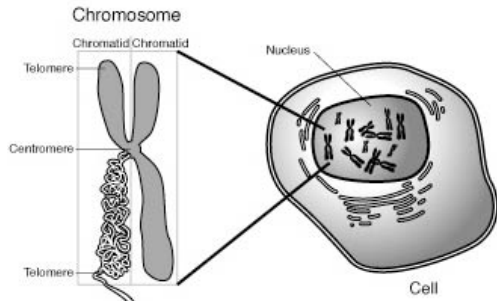


$1 \times 10^9$  Base pairs

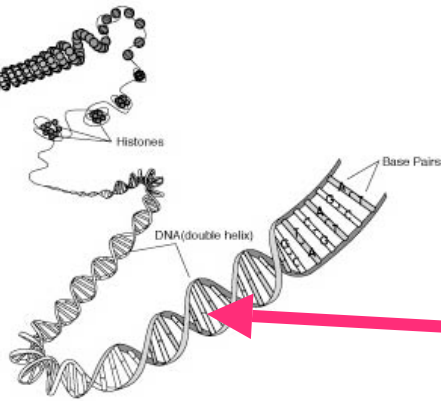
## Methods of molecular systematics and evolution

### DNA

	<b>Sequencing of marker genes</b>	<b>Systematics, phylogeny, phylogeography</b>
	<b>Microsatellite-PCR</b>	<b>Population genetics; Paternity determination</b>
	<b>AFLP-PCR; ISSR-PCR</b>	<b>Population genetics; Gene mapping</b>
	<b>PCR</b>	<b>molecular sexing</b>
	<b>SNP-analysis</b>	<b>paternity analysis, forensic</b>
	<b>DNA-Fingerprinting</b>	<b>Paternity determination Forensics</b>

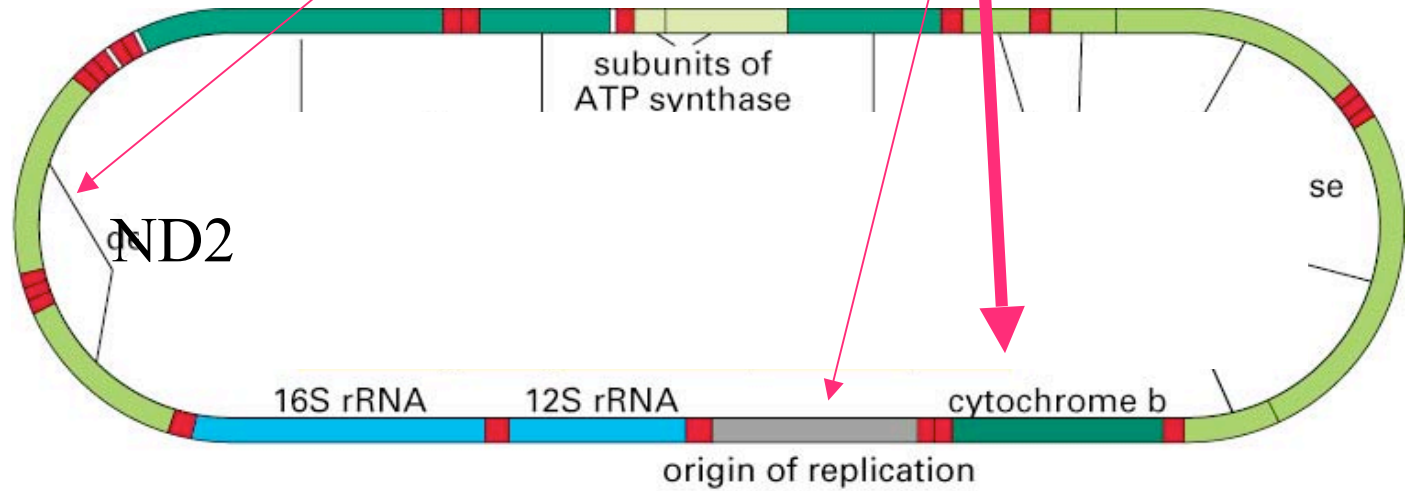


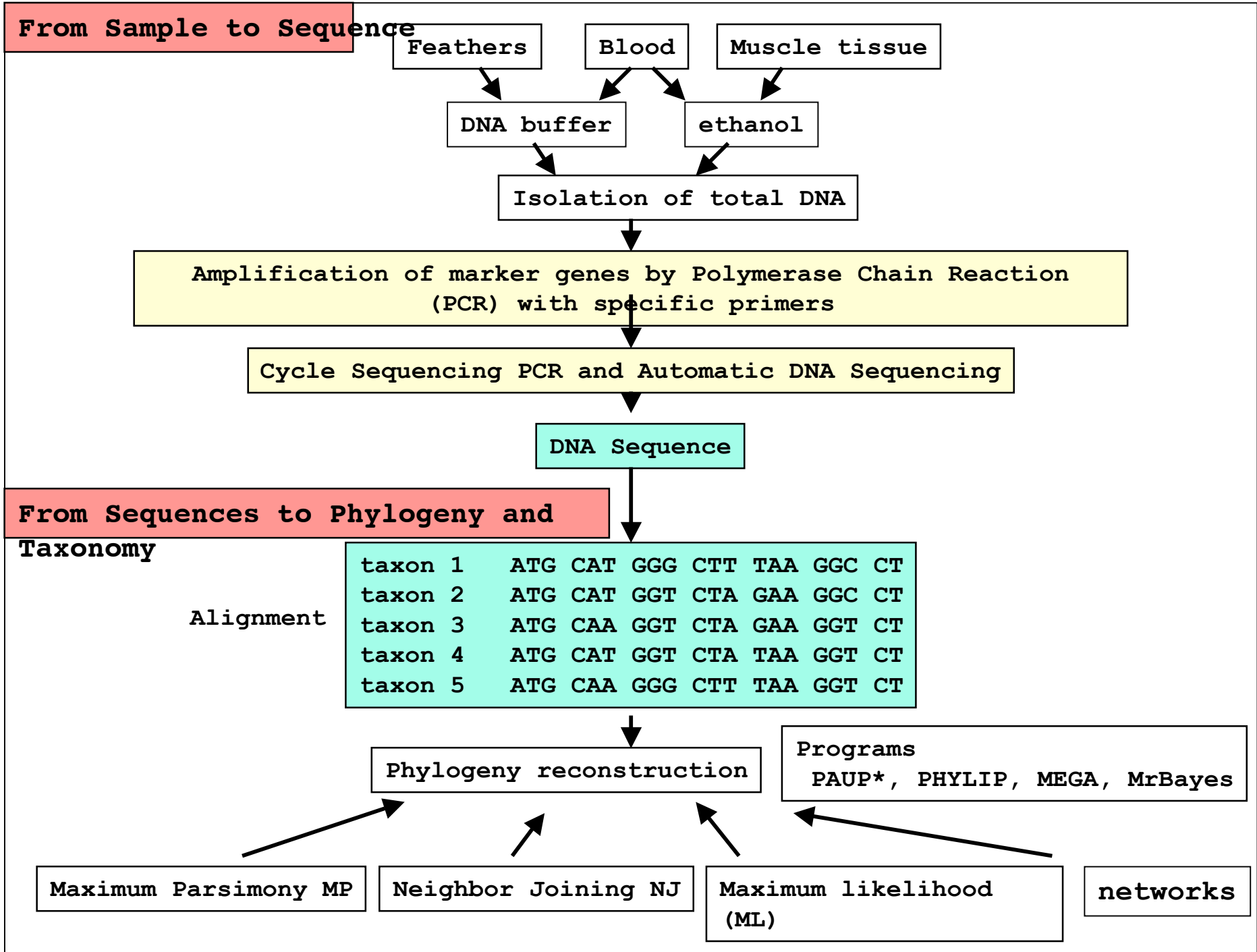
ncDNA



**Genetic Marker**  
-DNA Sequences  
-Length polymorphisms  
(z.B. Microsatellites)

mtDNA  
Maternal  
inheritance

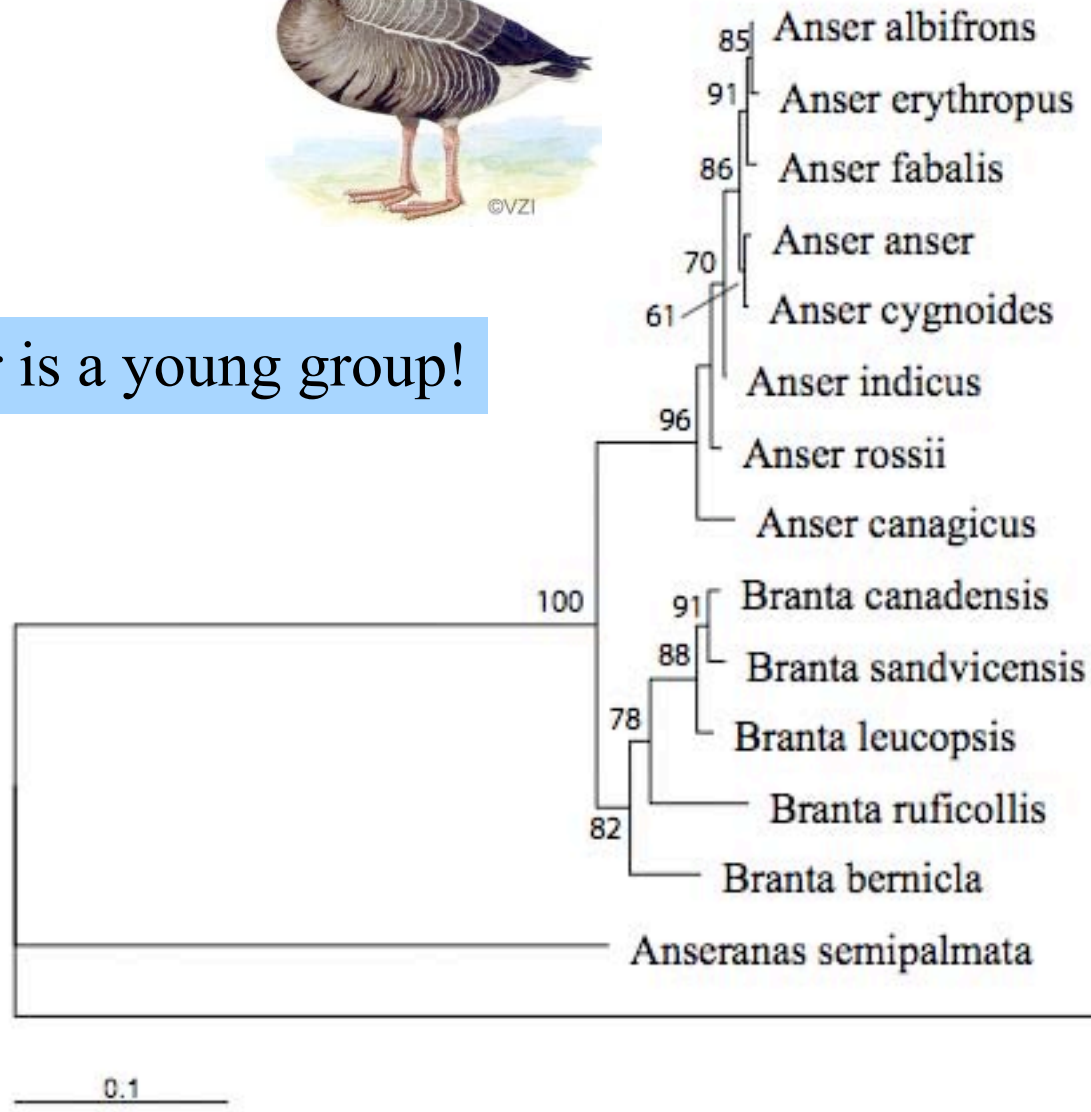








Anser is a young group!

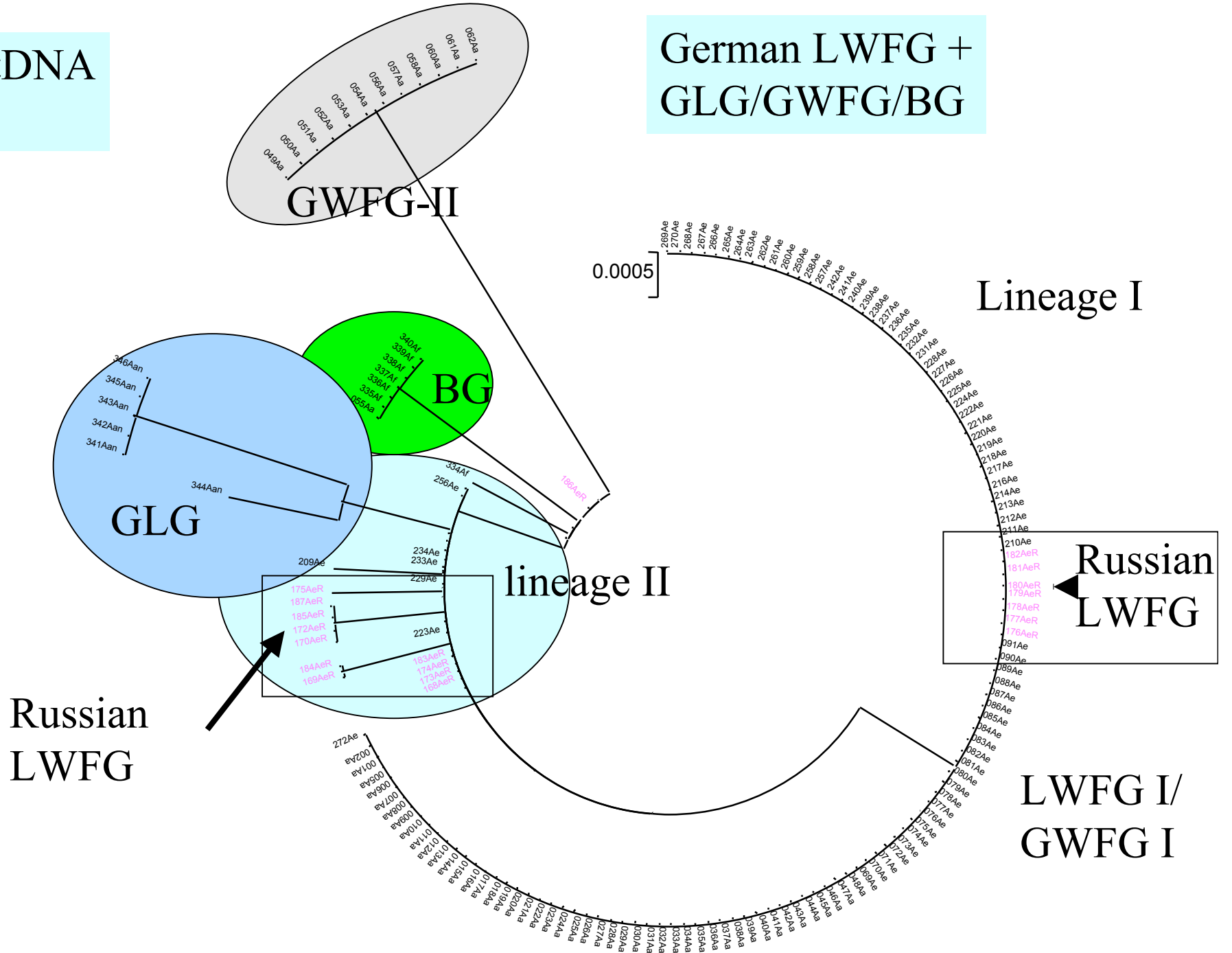


cytochrome b (1,043 bp); nd2 (1,041 bp)

ML

mtDNA

German LWFG +  
GLG/GWFG/BG

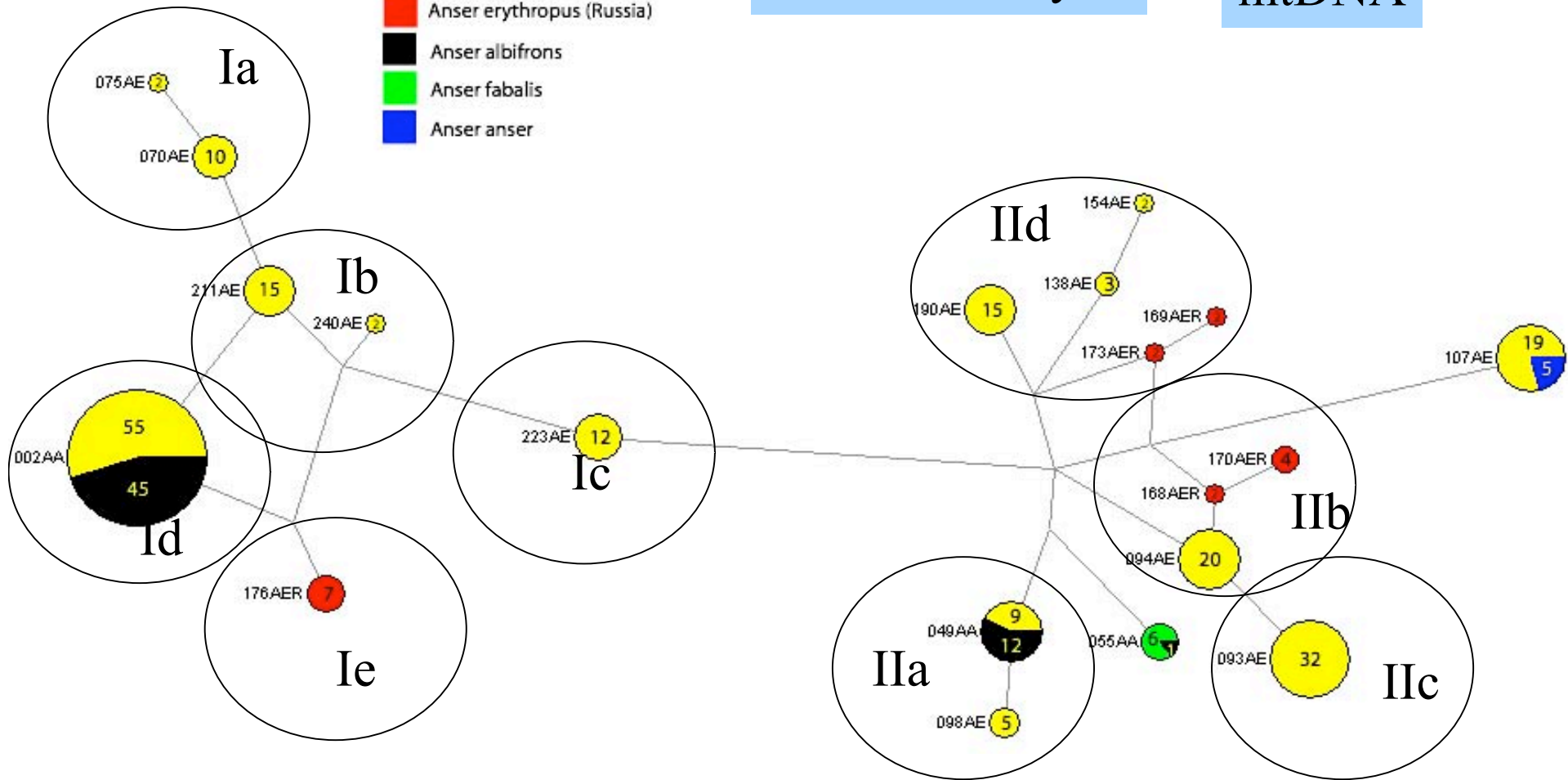




# Network analysis

# mtDNA

- Anser erythropus
- Anser erythropus (Russia)
- Anser albifrons
- Anser fabalis
- Anser anser



Lineage I  
Western

9 Haplotypes

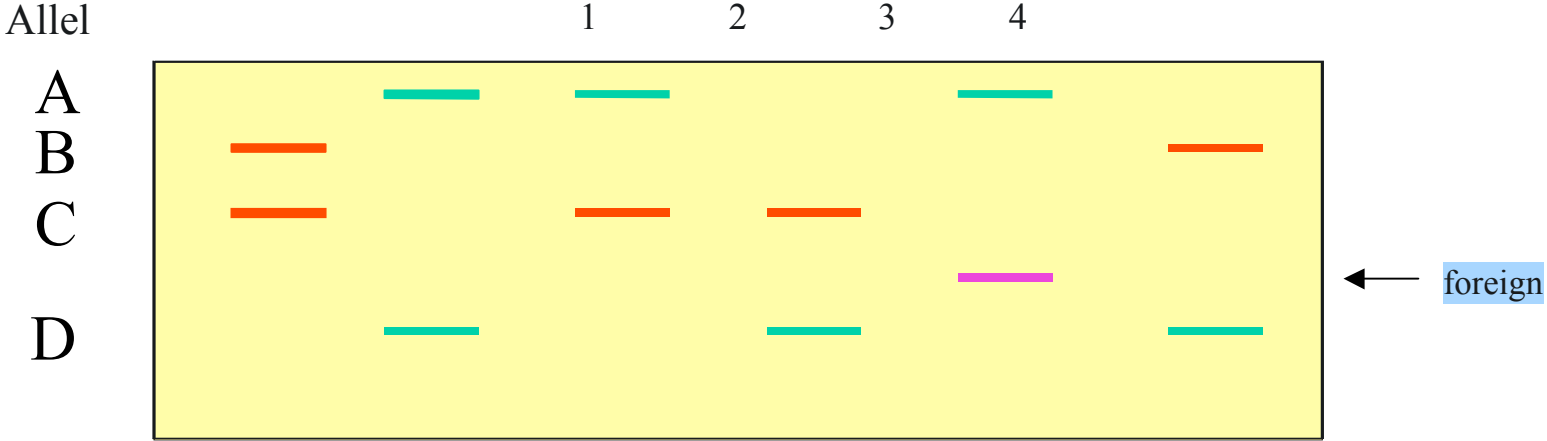
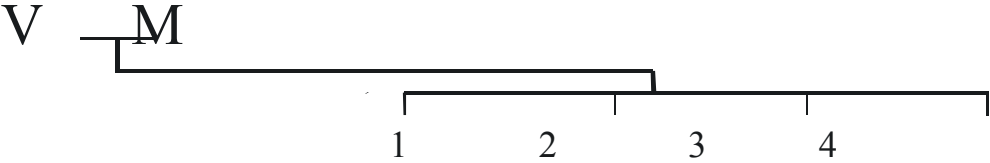
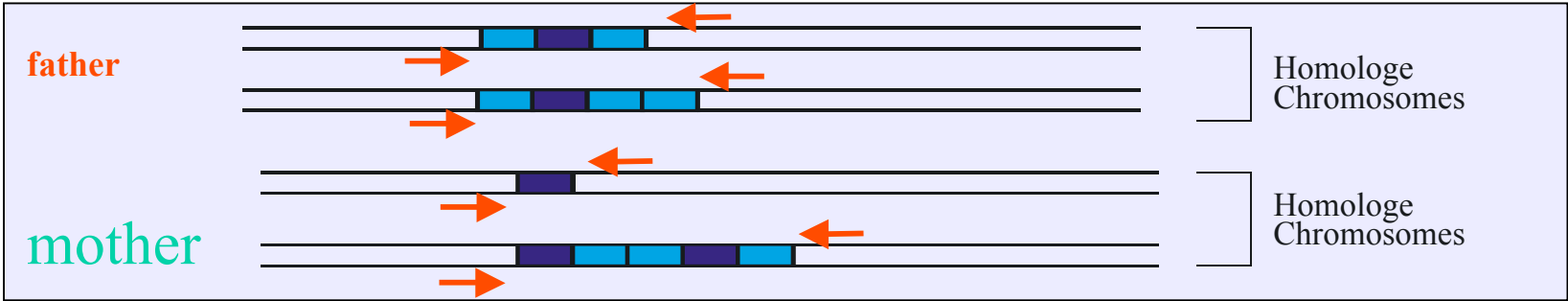
Lineage II  
Eastern

## Results of mtDNA-analysis

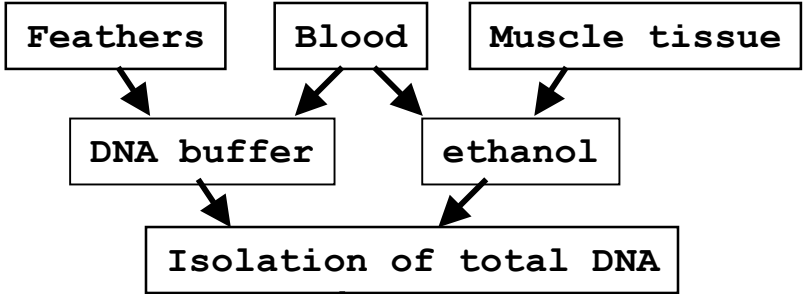
- LWFG show 2 main genetic lineages with 9 haplotypes
- German LWFG: no evidence for maternal hybridisation with greyleg, barbacle, bean, brent, or Canada geese
- 20% of Swedish and Finnish birds are hybrids with greylegs
- In both lineages LWFG 2 haplotypes are present that are shared with White fronts

# STR (microsatellite analysis)

CACACACACACANNNNNNNNNCACACACACACACANNNNN

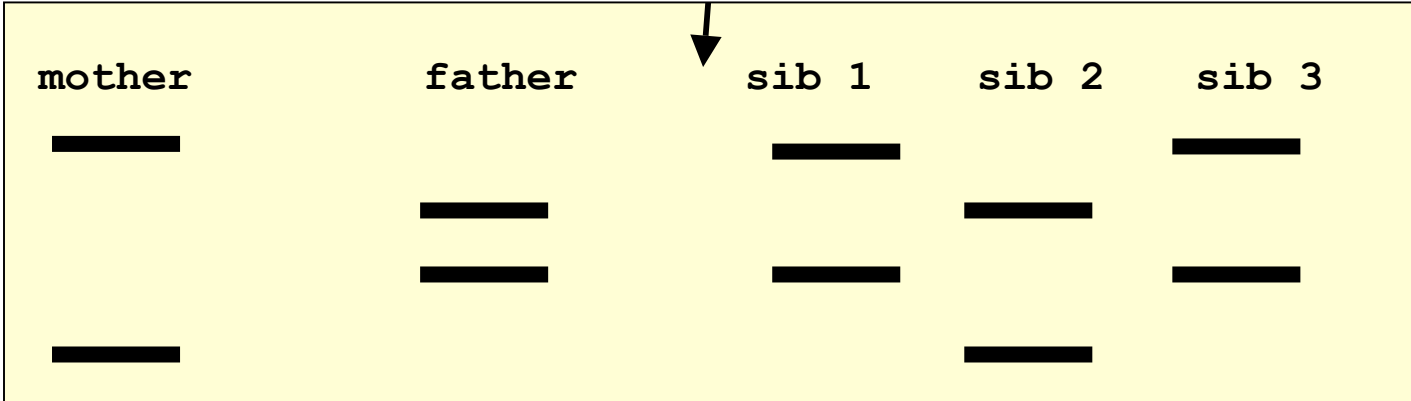


**From Sample to STR analysis**

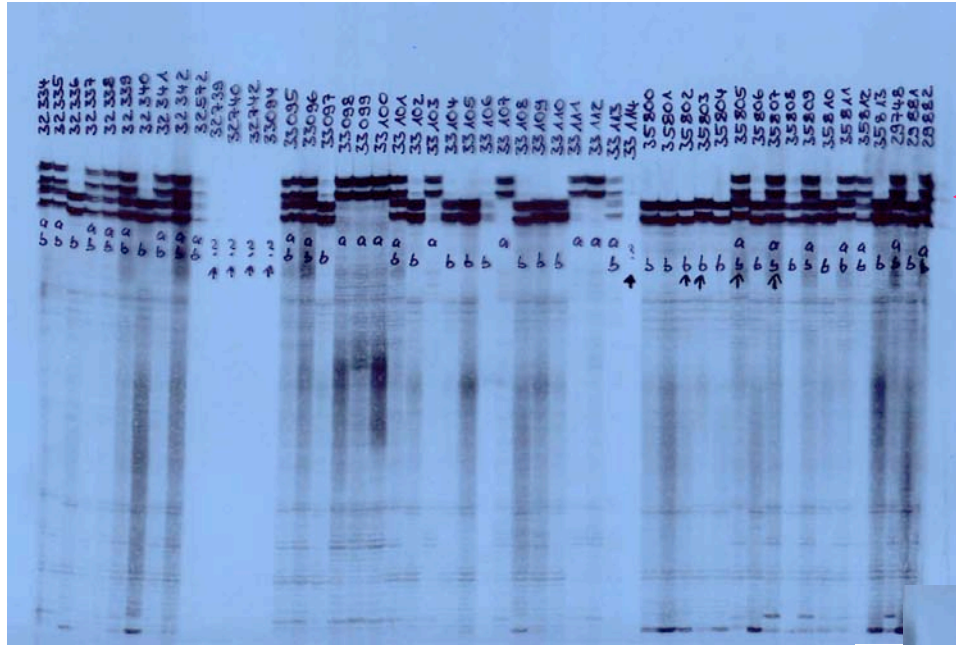


**Amplification of STR marker by Polymerase Chain Reaction (PCR) with specific primers**

**High resolution PAGE or Automatic DNA Sequencing**

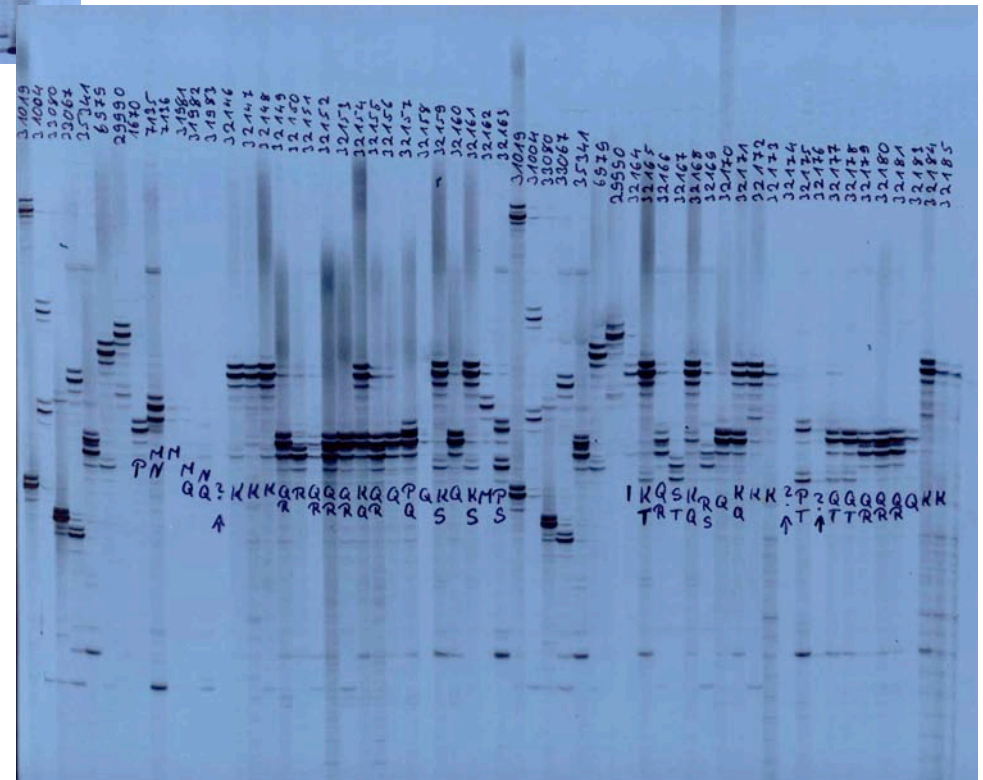
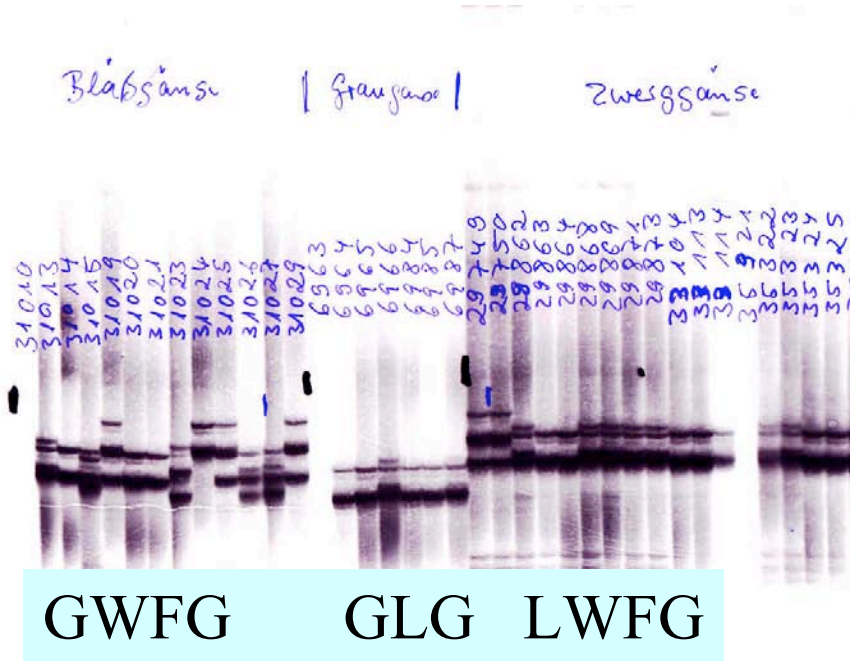


Bird	Locus 1						Locus 2					
	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6
1a	0	1	0	0	1	0	0	0	1	1	0	
1b	1	0	1	0	0	0	1	0	0	1	0	0



## Microsatellite-Analysis

8 polymorphic Gene-Loci







## **Results of microsatellite analysis**

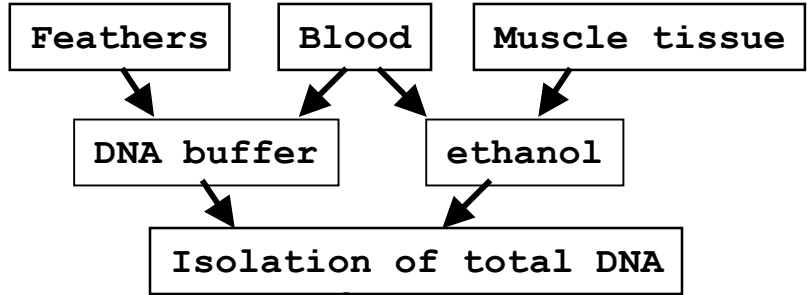
LWFG, GWFG and GLG alleles cluster in distinct clades

No general hybridisation!

GWFG and LWFG are separated

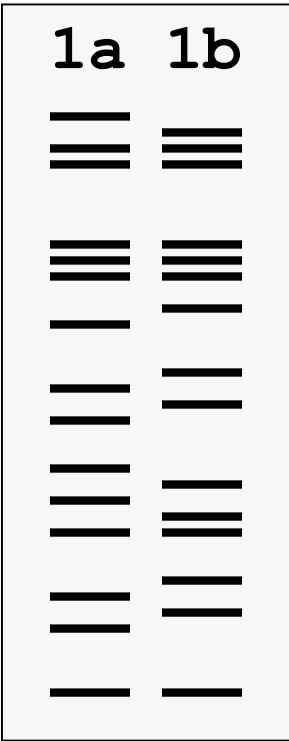
But some birds are obvious hybrids with GWFG or GLG

**From Sample to ISSR analysis**



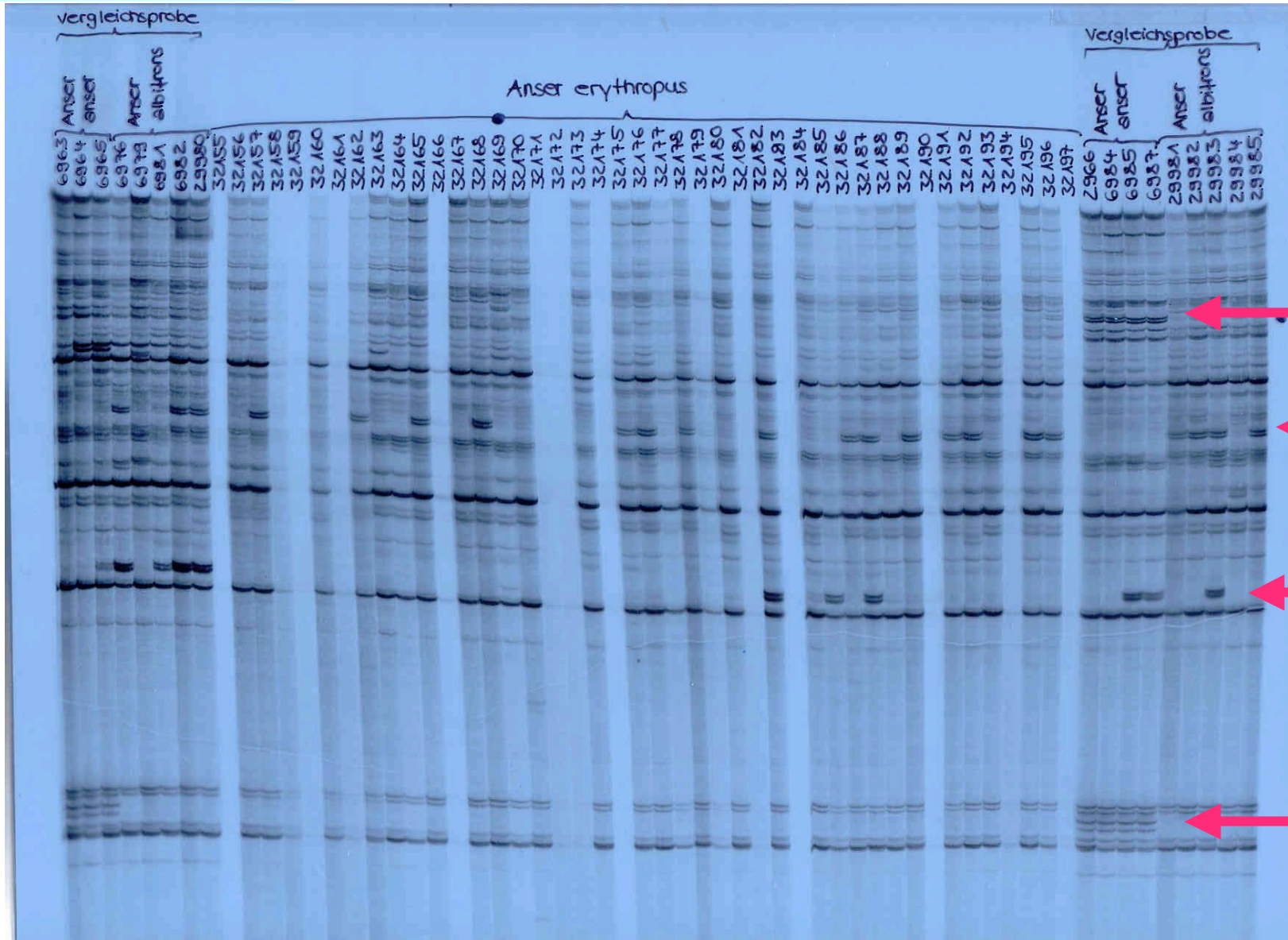
Amplification by Polymerase Chain Reaction (PCR) with a specific single ISSR primer

High resolution PAGE or Automatic DNA Sequencing



Bird	A1	A2	A3	A4	A5	A6	A7	A8	A9	B1	B2	B3	B4
1a	1	0	1	1	1	1	1	0	1	0	1	0	1
1b	0	1	1	1	1	1	1	1	0	1	0	1	0

# ISSR-Analysis



GLG WFG

LWFG

GLG WFG

**Results of ISSR-fingerprinting  
Similar as STR-analysis**

# Conclusion

- Genetic methods provide evidence for the genetic structure and evolutionary history of LWFG
- They identify most hybridisation events
- Breeding stocks can be optimised according to the genetic data (i.e. hybrids and birds with doubtful genetic composition will be excluded from breeding & reintroduction programs)
- Genetic diversity is relatively high.
- Genetically, breeding stocks of LWFG are suitable for the reintroduction project after reorganisation

**Thanks for your attention**

## **Acknowledgements**

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Aktion Zwerggans  
Friends of LWFG  
Swedish Environmental Protection Agency





- Anser erythropus
- Anser erythropus (Russia)
- Anser albifrons
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- Anser anser

