



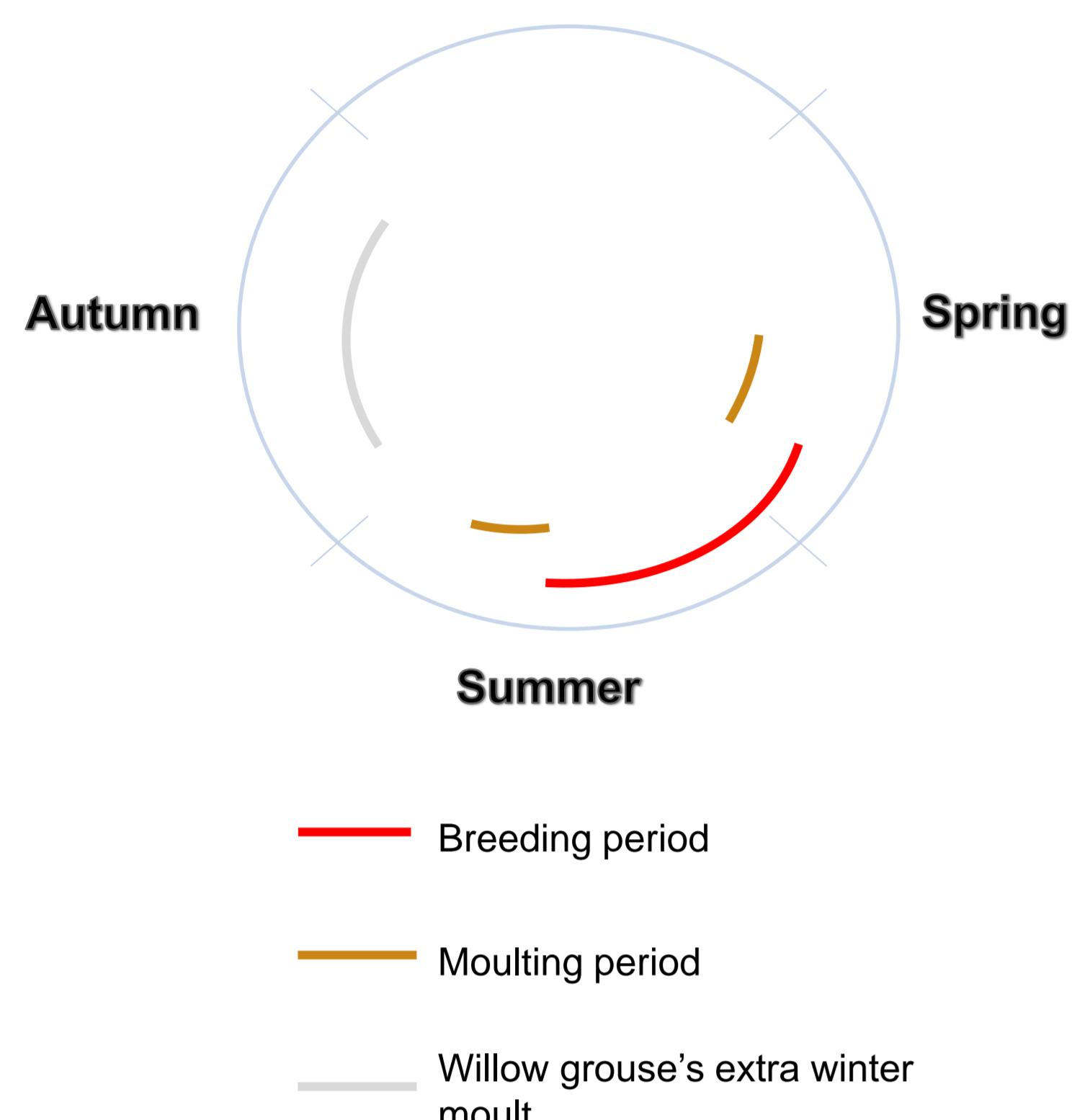
A genomic approach to the plumage colour differences in the willow grouse

Radoslav Kozma¹ & Jacob Höglund¹

Willow grouse in winter



Winter



The story so far:

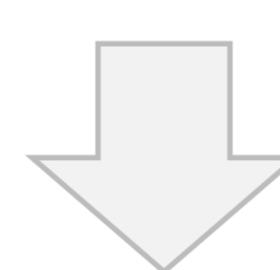
- The **willow grouse** (*Lagopus lagopus lagopus* – left) endures snowy winters in Scandinavia and the tundra of subarctic regions
 - Acquires white plumage during winter
- Its subspecies, the **red grouse** (*Lagopus lagopus scotica* – right) occurs only in the UK and experiences mostly snow-free winters
 - Retains pigmented plumage throughout the year
- In a pilot study, Höglund lab found no segregating differences between the two subspecies in key genes of melanin forming pathway.

So how did this local adaptation come about??

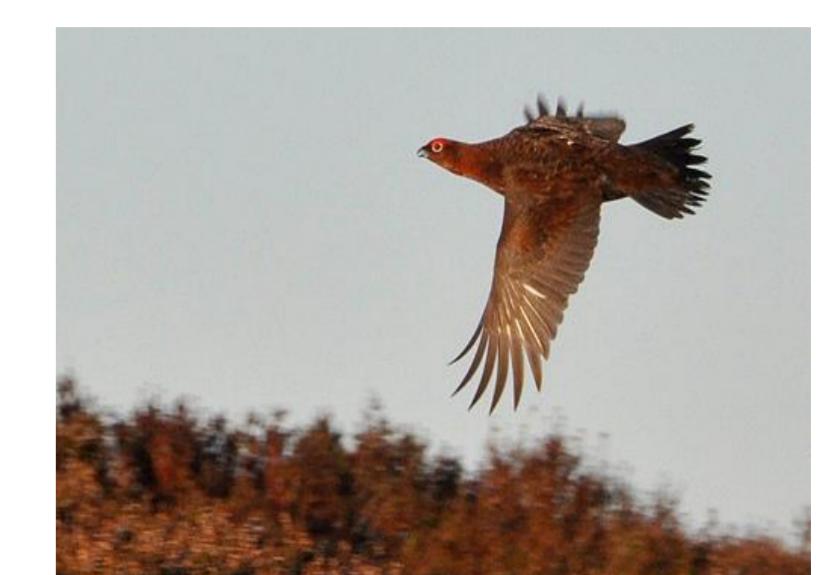
Why bother in the first place?

Adaptation of an organism to a specific environment plays a vital role in the evolution of the species and as such, studying the mechanisms of local adaptation has the potential to shed light on the mechanism of evolution.

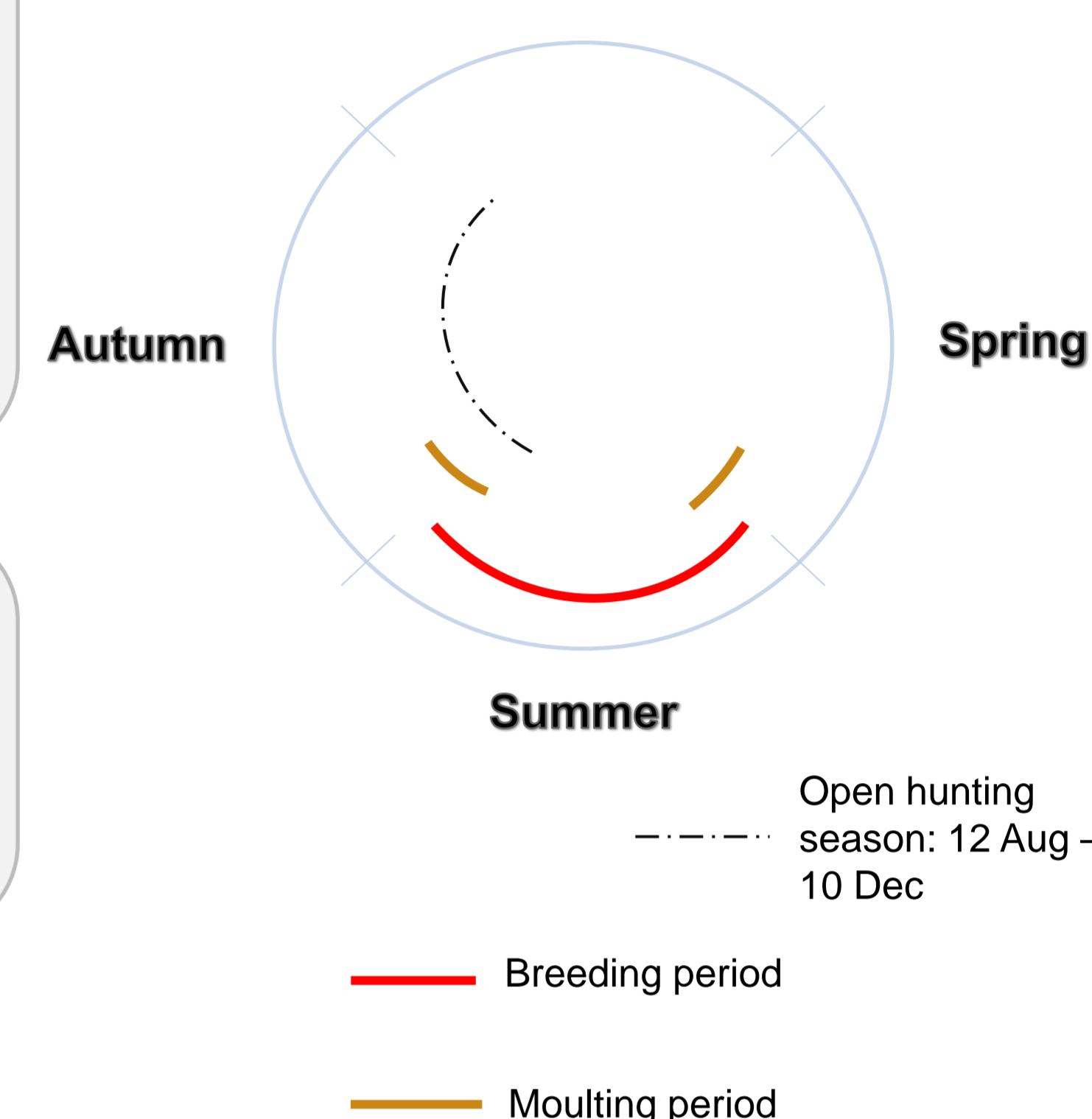
The three approaches



Red grouse in winter

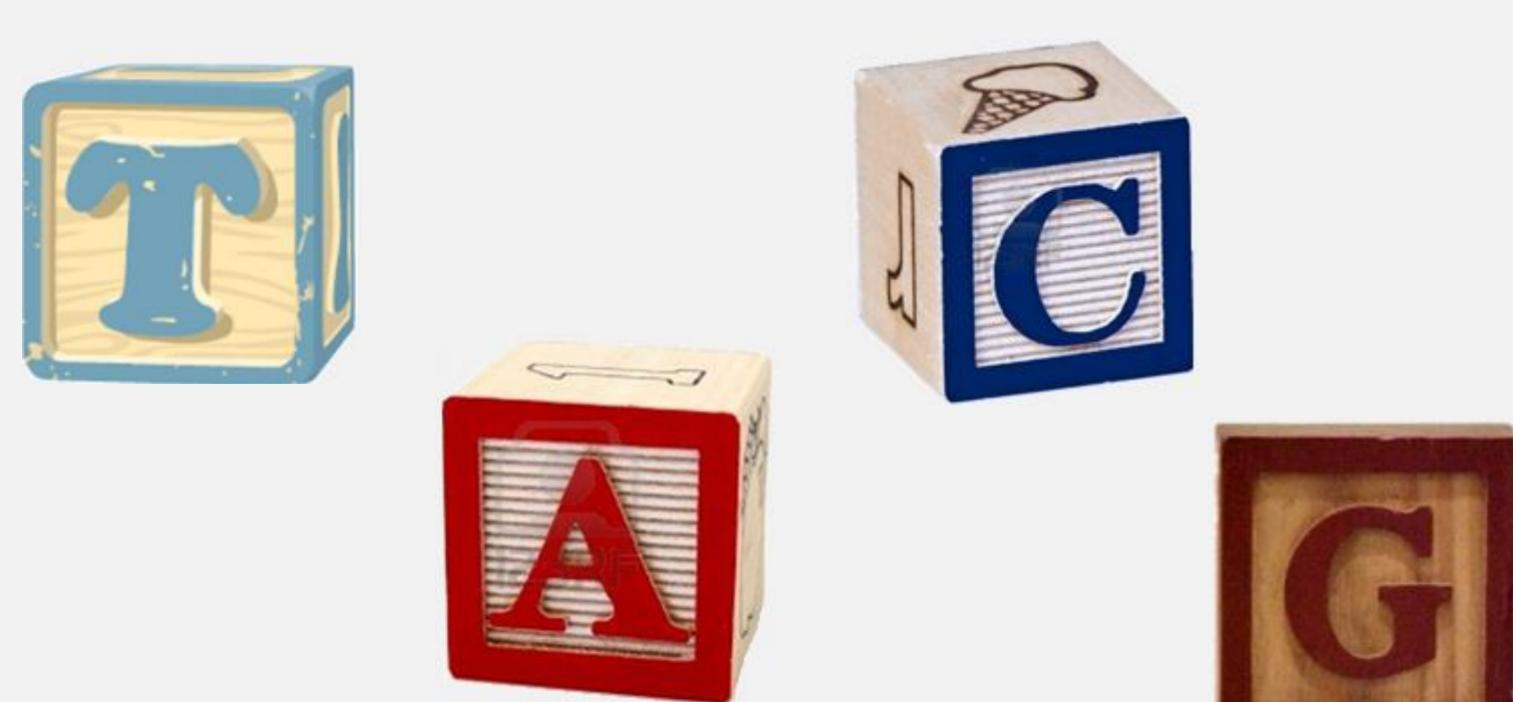


Winter



1. Transcriptome analysis

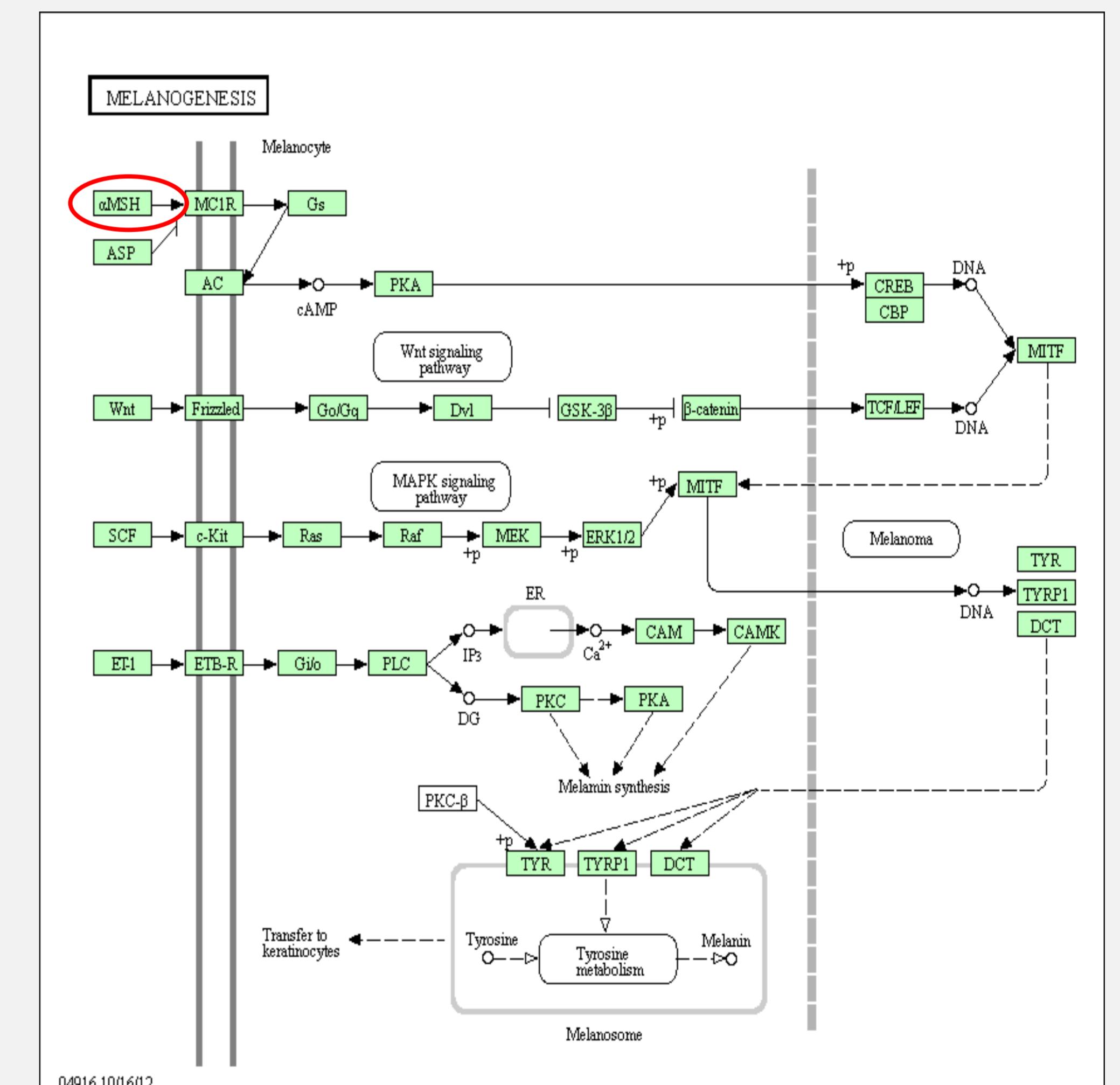
- Gather skin samples from 10 individuals from Scandinavia and the UK during the winter moult (beginning of autumn). Have liver and spleen samples as control.
- Differential gene expression analysis according to Vijay *et al.* pipeline:
 - I. Reference guided assembly using the chicken genome and STAMPY (even relatively high sequence divergence between the sample and reference genomes seem to outperform *de novo* assembly)
 - II. Differential gene expression using EdgeR
 - III. Gene ontology using BLAST
- As a result, more in-depth look into the differences in melanin forming pathway. But also look into possible differences in moultling → Clock genes.



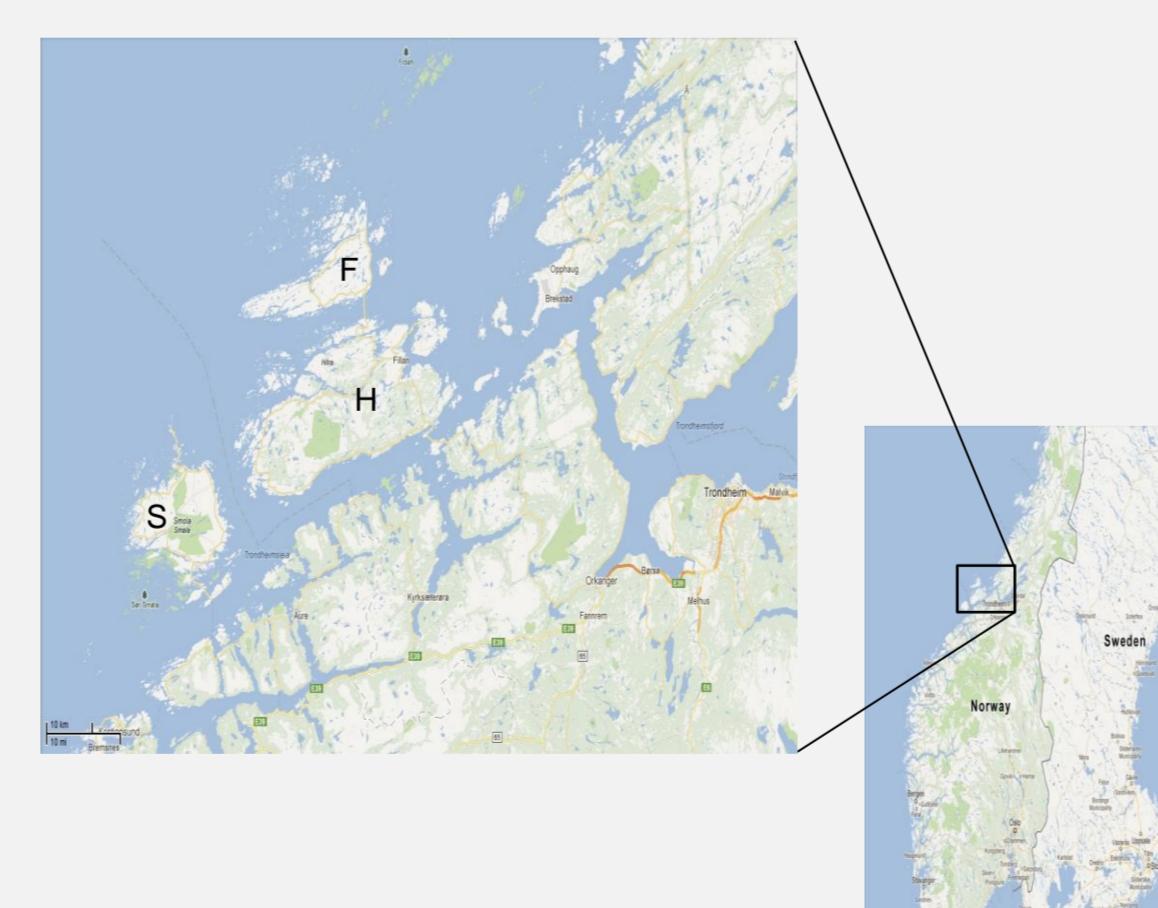
2. Hormonal analysis

Melanocyte-stimulating hormone (MSH) is responsible for regulating melanin pigmentation in most vertebrates and is thus a nominate candidate to see if there is a difference in *hormonal* control of melanogenesis between the two species.

- Acquire the hormonal spectrum of the two species during the winter moult. The spring moult would act as a control, since following this moult, both species acquire a pigmented plumage.



3. Norwegian islands (Smøla, Frøya and Hitra)



Investigate:

- I. the extent of migration (= gene flow) among the islands and mainland [→ F_{ST} study]
- II. If the moultling in island populations is delayed [plumage 'whiteness' comparisons between mainland & islands]

These three islands off the coast of Trondheim have mainly snow free winters but the willow grouse population is supplied by mainland Scandinavia individuals. These are seemingly maladapted, with their white winter plumage.



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REFERENCES

- Vijay N., Poelstra J.W., Künstner A., Wolf J.B.W. (2013) Challenges and strategies in transcriptome assembly and differential gene expression quantification. A comprehensive *in silico* assessment of RNA-seq experiments. *Molecular Ecology* **22**, 620-634

Red grouse photo: <http://www.flickr.com/photos/timmeling/6531565743>