

# Genotyping sheep for scrapie resistance

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# Overview - history

- Scrapie came to Iceland 1878
  - From 1980 has eradication of flock, cleaning and no sheep for 2 years been the tool against scrapie
  - Cost a lot – average eradication around 850.000 €/farm
- Discussion about import of sheep with ARR genotype to start breeding scrapie resistance sheep
  - First - genotype more of sheep in Iceland
  - Looking to Greenland for sheep of Icelandic origin there
- More scientist interested in few European countries
  - Gesine Lühken, University of Gießen, Germany



# Scrapie resistance and prion protein (PrP)

- Polymorphism of the three codons, 136, 154 and 171 important for scrapie resistance
  - Wildtype genotype is ARQ//ARQ – no special resist to scrapie
  - Rare PrP alleles on codon 138 and 151 – unclear relevance
  - Codon 137 has polymorphism that show resistance to scrapie
    - Sarda sheep, Italy



# Scrapie resistance and prion protein (PrP)

Codon	Wildtype	More resistance	Less resistance
136	A		V
154	R	H	
171	Q	R	
137	M	T	
138	S	N	
151	R	C	

More resistance type on codon 137, 138 and 151 now in research with PMCA test in France and compared to former result of codon 136, 154 and 171



# Why looking at more codons

- ARR genotype was not known in Iceland
  - Therefore looking for more genotype to work with in breeding
  - Using AHQ in breeding for few years but not common with farmers
- T137, N138 and C151 are found in Icelandic sheep
  - Frequency very low



# Search of genotype in 6 codons

- Search started in September 2021
  - Small groups on every farm
    - $\approx$  20 sheep on each farm
- We thought we would not find ARR until
  - Þernunes, January 2022



Þernunes, Reyðafjörður, East Iceland



# Pernunes – the only ARR farm in Iceland

- Found 1 ram (Gimsteinn)
  - In total 14 adult sheep
  - 19 ram and 22 ewe lambs sired with Gimsteinn with ARR born this spring
- Pernunes one of few farms in east Iceland where eradication was not done after 1980
  - Scrapie case in one sheep on the farm before 1980 at the farm, never after that



# Genotyping initiative project

- Last winter big project to genotype sheep started
  - 25.000 animal genotype today or  $\approx 6,5\%$  of the sheep population
- The goal of the project
  - Better search for scrapie resistance sheep
  - Find the farms with „good“ gene for the breeding work
  - Encourage farmers to breed sheep with resistance sheep
    - Will be part of the breeding work in next year
      - Gimsteinn will hopefully be AI ram next winter





# Proportion of genotypes – July 2022

## Results of 25.000 sheep

Codon	Proportion in 25.000 animals so far
136	AA 92% ; AV 7,6% ; VV 0,4%
137	MM 99,7% ; MT 0,3%
138	SS 88,6% ; SN 10,7% ; NN 0,7%
151	RR 98,8% ; RC 1,2%
154	RR 85,7% ; RH 13,3% ; HH 1%
171	QQ 99,8% ; RQ 0,2%



# The project in next years

- Make genotyping replacement ram lambs common
  - Don't use rams with VA or VV in codon 136
    - AI rams not allowed from 2004 with those genotype
- Implement more use of scrapie resistance genotype
  - Using R171, H154
- After PMCA test France
  - Will we hopefully have lot of scrapie resistance genotype to work with
  - This gives farmers on high-risk area more hope for future sheep farming



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# RAMS

A FILM BY GRÍMUR HÁKONARSON

- Why more hope on high-risk area
- The Icelandic Film “Rams” is dramatic film about eradication of sheep flocks
  - If you want to watch good movie

# The origin of R171 in Icelandic sheep

- Probably was the codon in the sheep population in previous years
  - A lot of eradication from 1930 to 1955
    - Mainly do to Mæði-visna
- In Greenland is R171 found on 11 farms of 38 at least
  - The origin of Greenland sheep today is export of sheep from Iceland in 1915
    - 175 ewes from few farms in the north Iceland
    - Then rams from two farms 1921 and 1934
  - The Greenland sheep today is similar to the old Icelandic breed – before we started to breed for more meat on each animal



# More research

- Gesine Lühken, University of Gießen, Germany
  - Working with a lot of sample from Iceland and making SNP comparison of the origin of ARR animal in Þernunes to other sheep
    - As well to other European sheep breeds
  - First results hopefully by end of this year

**• Thank you for your attention!**

