

# BREEDING A SCRAPIE RESISTANT INTERNATIONAL SHEEP FLOCK



Scrapie has a significant effect on the farming industry

Pioneering work by Professor Nora Hunter and Dr Wilfred Goldmann of the University's world-class Roslin Institute has had an international impact on a disease that causes considerable economic hardship to the small ruminant farming industry.

## Successful selection for scrapie resistance

Scrapie is a transmissible spongiform encephalopathy (TSE) of sheep and goats. In the EU, scrapie is a notifiable disease with affected farms facing severe trading restrictions and loss of animals. It is also a listed disease in the OIE Terrestrial Animal Health Code (2008) and as such affects wider international trade.

Professor Hunter and Dr Goldmann's research has enabled the selection of sheep for classical scrapie resistance. The pair demonstrated a strong association between prion protein (PrP) genotype (PRNP) and scrapie susceptibility. They showed that sheep with PRNP genotype VRQ/VRQ are highly susceptible to classical scrapie, whereas ARR/ARR animals are resistant.

The findings led directly to the implementation of the UK National Scrapie Plan, which ran from 2001 to 2009 and to similar programmes throughout the EU.



## ECONOMIC IMPACT

UK sheep meat exports were worth more than £380 million in 2011. The Roslin Institute researchers made breeding for resistance to scrapie and BSE possible, an innovation that undoubtedly protected the sheep industry from similar damage to that inflicted by BSE on cattle and the UK economy in the 1980s and 90s. The World Health Organization (WHO) estimates that the disease caused US\$6 billion in losses to the UK, as well as 4.7 billion Euros in control measures for cattle BSE paid by the EU.

In June 2013, the United States Department of Agriculture followed the example of the UK and the EU by implementing a Scrapie Free Flock Certification Program.



Farms throughout the world are affected





Instances of scrapie have lessened dramatically



By establishing the genetic basis of scrapie resistance, the Edinburgh team has ensured continuous maintenance of the UK (and international) sheep flocks in the face of potential disease outbreaks. The National Scrapie Plan, funded by the UK government, provided free genotyping of 1.8 million sheep in 11,000 flocks in an effort to control all TSEs. Sheep breeders both within and outside the EU require genotyping and health certificates in order to trade their sheep; trade in affected animals or animals coming from a flock known to have had scrapie in the last two years is prohibited.

The research findings have had a profound impact on the genetic structure of the entire UK sheep industry. The reported prevalence of sheep with scrapie has decreased from 0.22 per cent in 2003 to 0.04 per cent in 2008. Voluntary PRNP genotyping continues, through the industry-funded Scrapie Monitoring Scheme (begun in January 2009), which issues certificates of sheep genotype for trading purposes.

Sheep welfare has been improved by selection against PRNP genotypes linked to susceptibility to scrapie and subsequent reduction in incidence of disease. There is under-reporting of scrapie but nevertheless, statistics provided by the Department for Environment, Food and Rural Affairs (Defra) indicate that, while more than 200 classical scrapie sheep were reported to them in 2002, only three were reported in 2011.



Professor Hunter and Dr Goldmann's findings are now being extended to other ruminant species. Based on the successful implementation of sheep breeding strategies based on the pair's work, EU and UK research effort in ruminant TSEs since 2006 has focused on goat scrapie genetics.

This has led recently to the discovery of new resistant goat PRNP alleles (such as IRK), which are currently being tested in collaboration with the goat industry for their potential in breeding programs on commercial farms. Dr Goldmann is a member of the EU (UK) management team overseeing the goat scrapie genetics research.



Scrapie affects goat herds as well

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