

Study discovers secret of Scottish sheep evolution

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Researchers from the University of Sheffield, as part of an international team, have discovered the secret of why dark sheep on a remote Scottish Island are mysteriously declining, seemingly contradicting Darwin's evolutionary theory.

Dr Jacob Gratten and Dr Jon Slate, from the University's Department of Animal and Plant Sciences, led the team, which found that the gene responsible for dark coat colour is linked to other genes that reduce an animal's fitness.

The researchers looked at coat colour in a feral population of Soay sheep on Hirta in the St Kilda Archipelago. On Hirta about three quarters of sheep have dark brown coats, while the remaining quarter have light sandy coats. However, despite the fact that the dark-coated Soay sheep are larger, which is usually linked to survival and reproductive success, the frequency of light-coated sheep has increased over the last 20 years.

Darwin's theory would have predicted that because dark-coated sheep appear fitter that they would do better than light-coated sheep, until only dark-coated sheep remained in the population. However, this study shows that the process of evolution by natural selection in Soay sheep, although still evident, is actually more complex than this.

Dr Gratten and colleagues used a statistical genetics approach similar to that used by medical geneticists, when trying to map genes for human disease such as heart disease or diabetes. They found that the dark coat



trait is usually co-inherited with a set of genes that increase size but decrease reproductive success. The light coat trait is usually co-inherited with a set of genes that decrease size but increase reproductive success.

This discovery means that sheep with one copy of the dark gene and one copy of the light gene are quite large and also have quite high reproductive success. Sheep with two copies of the dark gene are larger still, but have poor reproductive success. Sheep with two copies of the light gene are small, but still have quite high reproductive success. This means that the two types of dark sheep although indistinguishable visually, vary in Darwinian fitness.

The study was based on over 20 years of field data, and involved researchers from the University of Edinburgh and the Queensland Institute of Medical Research in Brisbane, as well as members of the University of Sheffield.

Dr Jacob Gratten said: "The aim of this study was to improve understanding of how evolution by natural selection operates. The study addresses an important problem in evolutionary biology. It shows that predicting the evolutionary response to selection is difficult without knowledge of which genes are in close proximity to each other. It also highlights that an understanding of the underlying genetic basis of a highly visible trait was necessary in order to understand its evolution."

This research - 'A Localised Negative Genetic Correlation Constrains Microevolution of Coat Colour in Wild Sheep' will be appear in the journal *Science*.

Source: University of Sheffield



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