Learning through international collaboration

In addition to the funding offered under the Walsh Fellowship Scheme, TEAGASC offers a small number of overseas training awards for students to travel to laboratories in universities and research institutes abroad to develop international collaborations, as well as furthering their science education and training.

In 2018, Megan O'Brien received a Teagasc Overseas Training Award to conduct research in the Institute of Agriculture at the University of Tennessee (UT) in Knoxville, USA. Gina Pighetti, the head of the laboratory, has an international reputation in mammary physiology and immunology, and has conducted extensive research on bovine mastitis. As a second-year PhD student, Megan was ideally placed to take the results she has generated in Teagasc and develop them in line with the findings from the US lab.

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Interleukin 8

Megan's PhD is focused on a critical gene, which, when turned on, calls in immune cells, known as neutrophils, to fight infection. In agricultural terms, when these neutrophils are called into the mammary gland, the cow develops a high somatic cell count (SCC). However, neutrophils are important in all infections, including those outside the mammary gland, such as in the uterus, lungs and digestive tract. It is all the more relevant, therefore, that Megan's work focuses on characterising two different versions of this gene that were discovered in earlier work by the research group in Teagasc.

This work dovetails with the work done in the US lab, as the gene that Megan works on, known as interleukin 8, activates an immune response by binding to a receptor that has been characterised by Pighetti.

The proteins produced by these two genes orchestrate the immune response and determine if a cow can efficiently fight infection. Changes (or mutations) in these genes can contribute to a changed immune response, resulting in cows with a higher (or lower) SCC.

Megan is a member of Kieran Meade's research group in Teagasc, Grange, which has shown that mutations in the interleukin 8 gene result in two distinct versions (called haplotypes), and these versions are carried in approximately equal frequencies by Holstein-Friesian cattle. Interestingly, the Jersey breed only carries haplotype two of this gene.

Mastitis research at the University of Tennessee

The Teagasc training award presented Megan with the opportunity to conduct an experiment to investigate what combination of these genes may improve the outcome of a mastitis infection.

Over 120 cows from the herd at UT's dairy farm in Little River were genotyped for both genes. Blood samples were then taken

FIGURE 1: Megan taking a blood sample for genotyping from the tail of a Holstein-Friesian cow of the dairy herd at the University of Tennessee's Little River Farm.

FIGURE 2: Poster presentation at the Conference of Research Workers in Animal Disease 2018 held at the Marriott Downtown Magnificent Mile in Chicago, Illinois.

(**Figure 1**) and stimulated with a bacterial ligand known as LPS to imitate a bacterial infection and elicit an innate immune response. Megan has now shipped these samples back to Ireland for detailed analysis in Teagasc, Grange. A dataset, previously collected by Pighetti's group, also allowed Megan to link her version two of the interleukin 8 gene to more severe clinical outcomes during mastitis infection.

While in the US, Megan also presented a poster on her work at the Conference of Research Workers in Animal Diseases (CRWAD) held in Chicago, Illinois (**Figure 2**) and met with leaders in the field in the US dairy industry.

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Thanks to the Teagasc Overseas Training Award, Megan has enhanced our collective scientific knowledge on the genetics underlying the immune response to mastitis, a disease that requires a collaborative, global partnership approach to overcome. Ultimately this work will contribute toward the selection of cattle with a superior immune response to better fight infection.

Acknowledgements

Work in Ireland is funded under the Teagasc Walsh Fellowship Programme with additional funding for the US trip from a Teagasc Overseas Training Award. The authors wish to thank Gina Pighetti and the University of Tennessee for hosting and assisting Megan.

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