

McMEEKAN MEMORIAL AWARD

Kenneth G. Dodds

Dr Ken Dodds is a statistician located at Invermay Research Centre and is part of AgResearch's Bioinformatics, Mathematics and Statistics Group. Ken has made a massive contribution to the New Zealand sheep industry in that he has almost single-handedly provided analytical and statistical leadership to the gene discovery programmes run at Invermay. This has led onto world-leading industry applications of marker assisted selection in sheep over the last 20 years. He is widely recognised for his work in the application of DNA information in the estimation of animal breeding values. It is in his outstanding contribution to animal production in the development of the fractional-parentage DNA pedigree system for which Ken is recognised with the 2007 McMeekan Memorial Award.



The fractional-parentage system uses DNA marker information to calculate the pedigree of animals in a breeding programme. This procedure forms the basis of the Catapult Shepherd product. Traditionally, pedigree information in the sheep industry has been recorded by tagging lambs as soon as possible after birth and associating the lamb with the ewe which is mothering it. Sire is inferred from the ewes mating mob because the ewes are single sire mated. The process is time consuming, labour intensive, and pedigree errors can occur due to cross suckling or mismothering. Errors in pedigree reduce the accuracy of breeding values. These factors combine to limit the scale of a stud operation that can be recorded with high levels of accuracy.

The concept of using DNA to determine parentage has been around for some time, and has promised a reduction in both labour costs and pedigree errors. However, the cost of DNA parentage has been prohibitive due to the number of DNA markers that need to be measured in each animal to give unique identification of sire and dam. This has been a particular problem in stud flocks in that many sires and dams within the flock are likely to be closely related. The fractional-parentage DNA pedigree system that Ken developed uses the molecular information from a smaller number of DNA markers to calculate the probabilities of all potential parental combinations for each animal within a flock. The pedigree data set is sampled multiple times according to the probabilities for each possible sire and dam combination for a given animal using the DNA information. Breeding values

are estimated for each set of pedigree samples and the breeding values across all of the runs averaged to give the final estimated breeding value for each animal. This has the effect of taking into account differences in breeding value for an individual depending on the possible parental combinations, but weighting them for the probability that each parental combination is the true one.

This statistical development has made the use DNA parentage cost effective in the New Zealand sheep industry through allowing relatively low numbers of DNA markers to be used while maintaining the high rates of genetic progress associated with the more costly full DNA pedigree methods. In short, Ken has been successful in making the use of DNA pedigrees applicable in a commercial setting in sheep. In doing so he has improved the accuracy of breeding information and removed traditional barriers to scale in the ram breeding industry.

In addition to his achievements in developing the fractional-pedigree system, Ken's innovative statistical programming has provided the bedrock that underpins the activities of many other scientists and industry programmes. He has provided statistical leadership in the discovery of the Inverdale and Booroola genes, and in the discovery and commercialisation of the LoinMAX, MyoMAX and I-Scan DNA marker tests. He is current working on how to use the information being derived from single nucleotide polymorphism (SNP) chips in the sheep industry. He has also contributed to the development of genetic improvement software including the Sheep Improvement Ltd Genetic Engine, a genetic evaluation system for salmon, and InnerVision's CT Scan genetic evaluations to name a few.

Dr Ken Dodds has made a substantial contribution to animal production in New Zealand, both at the research and applied ends of the spectrum. His work has been the key factor underpinning a major transformation in the areas of DNA parentage and marker assisted selection within the New Zealand sheep industry. As such, he is a worthy recipient of the McMeekan Memorial Award.

Neville Jopson and John McEwan