

## **MLA – AWI Sheep Genomics Program**

### **Landmark R&D collaboration**

The \$30 million investment by MLA and AWI over five years is one of the largest collaborative ventures between research organisations in the Australian rural industry and the largest in the livestock sector. This investment in sheep functional genomics includes contributions from sheep producer levies and from the Federal Government.

A collaborative research approach is being taken to create critical mass and to focus R&D investment in the key areas that drive profitability in the Australian sheep industry.

Most importantly, a collaborative approach ensures the most effective and efficient use of producer levy money and will optimise the return on investment to industry.

### **Why?**

Building competitive advantage through R&D innovation is vital to the longterm sustainability and profitability of wool and sheepmeat producers. The need for productivity growth and cost efficiency is ongoing.

Unlocking the secrets to sheep genes and their functions will give producers the tools to develop new ways for managing internal and external parasites, new technologies such as the introduction of vaccines to combat diseases, and will allow producers to more accurately select animals for production efficiency, wool quality, carcase type, meat eating quality and a range of other desirable characteristics.

Doing this will provide producers with the tools and technologies to increase productivity and profitability, building competitive advantage at individual enterprise level and overall for the wool and sheepmeat industries.

## **Benefits**

Conservative estimates<sup>1</sup> place the expected benefits at more than \$25 million per year to sheep producers and industry through increased meat and wool yield, reduced chemical treatment costs and reduced disease incidence through the development of new vaccines.

As a major export earner and important rural industry, a more profitable and sustainable sheep industry has flow-on benefits for the national economy and for rural and regional economies. In addition, there are expected to be wider community benefits through better quality wool and sheepmeat products. The reduced use of chemicals will also enhance Australia's reputation as a clean, green supplier of high quality wool and sheepmeat.

In keeping with the Federal Government's R&D priorities, the MLA-AWI Sheep Genomics Program will foster creativity and drive innovation both in research providers and in the sheepmeat and wool industries generally.

## **The research**

The MLA – AWI Sheep Genomics Program will bring together leading scientists in the fields of genetics, genomics, animal and cell biology and bioinformatics from major Australian universities and research organisations.

Potential participating research organisations include the University of Sydney, The University of Melbourne, Victorian Department of Primary Industries, University of Adelaide, South Australian Research and Development Institute, University of Western Australian, University of Western Sydney and CSIRO.

The Program will harness the new technology, developed largely through the mapping of the human genome, to address problems in the sheep industry.

R&D priorities for the Program include:

- gene markers to identify animals resistant to internal parasites, allowing producers to breed healthier sheep and lambs, improve productivity and reduce chemical treatments;
- gene markers that will allow producers to selectively breed sheep and lambs for improved meat and wool quality;
- gene markers to identify more efficient animals, allowing producers to breed sheep and lambs that produce more meat and wool from less pasture;
- new products such as vaccines that can improve meat and fibre characteristics and reproductive capability.

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<sup>1</sup> One tenth of the predicted benefit p.a. achieved through effective sheep internal parasite control – Campbell and McGuirk (December 2001) Review of Strategic Factors and Australian-New Zealand Capabilities in Animal Genomics Related to Sheep Industry Requirements, and a Recommended Framework to Guide R&D Investment.

The first project underway is the mapping of the sheep genome. This is an essential part of the Program as it will be the platform for all further work.

Projects within the proposed R&D program have been split into key categories.

- Muscle (meat)
- Host resistance to internal parasites
- Wool
- Reproductive success
- Enabling technologies and flock resources

### Muscle

The objective of this sub-program is to investigate genomic and proteomic basis of variation in site, rate and efficiency of muscle growth to develop new products and tools to improve productivity and meat quality of sheep. The outcomes of this research will be new tools (gene markers, vaccines, protein bioactive treatments) that improve productivity and product quality.

For example, by comparing animals known to have larger and leaner muscle with average sheep, a connection between particular genes and muscle characteristics can be made. Animals with the desired genes can therefore be more easily identified and selected to increase productivity and profitability.

### Host resistance to internal parasites

This work focuses on increasing (animal) host resistance to internal parasites through identification of genes and gene markers for either direct selection or marker assisted selection (MAS). For example, it will lead to the identification of those genes increasing sheep resistance to internal parasites, leading to the ability to screen key breeding animals for the presence or absence of these beneficial genes or gene markers. These studies will also identify novel targets in the host to enhance immunity against parasitic infection.

Understanding the host parasite response is likely to lead to development of more effective adjuvants capable of boosting the sheep immune response so that it becomes more effective in dealing with internal parasites. Ultimately this research will lead to healthier, more productive sheep with reduced need for chemical treatment.

### Wool

The Wool sub-program aims to identify genes and gene expression patterns associated with wool traits of economic importance, including follicle efficiency, fibre length, fibre diameter and accessory gland-related susceptibility to diseases such as fleece rot, dermatitis and fly strike.

The outputs will be new genetic selection tools such as gene markers and the ability to alter certain fibre and accessory gland traits within one generation using therapeutics (such as vaccines). For example, in pursuing genetic markers for desirable wool fibre characteristics, molecules that are capable of reducing fibre diameter by increasing follicle density may be discovered and used to develop production treatments.

#### Reproductive success

The objective of this sub-program is the discovery of new genetic and non-genetic technologies that reliably increase the number of lambs weaned per ewe. The anticipated outcomes from this research are new gene markers and biological treatments that increase the number of eggs, fecundity, mothering ability and survival of offspring to adulthood in sheep.