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PROCEEDINGS

RSPCA AUSTRALIA ANIMAL WELFARE SEMINAR

FARM ANIMAL WELFARE & GENE TECHNOLOGY:

the good, the bad and the ugly

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RSPCA AUSTRALIA ANIMAL WELFARE SEMINAR

FARM ANIMAL WELFARE & GENE TECHNOLOGY: the good, the bad and the ugly

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BIO

Gary Humphries

Chair, RSPCA Australia

Gary Humphries was appointed Chair of the RSPCA Australia Board in 2015.

Gary is Deputy President of the Administrative Appeals Tribunal. He heads the Canberra Registry of the Tribunal.

Prior to that appointment, Gary enjoyed a long career in politics. He was a Member of the Legislative Assembly for the Australian Capital Territory from 1989 to 2003, during which time he served in many ministerial roles, including Minister for Health, Education and the Arts, Treasurer and Attorney-General.

He was Chief Minister from 2000 to 2001.

From 2003 to 2013 he was the Liberal Senator for the ACT. During this period, he held various responsibilities in the Federal Opposition, including Shadow Parliamentary Secretary for Families, Housing and Human Services and Shadow Parliamentary Secretary for Defence Materiel.

He is presently chair of the ANZAC Centenary Public Fund Board.

Gary has a long connection with the RSPCA. While in Parliament, he hosted the annual Hounds on the Hill, a popular event with Members of Parliament and Senators where dogs and puppies available for adoption from RSPCA ACT visited Parliament House, has been quizmaster at many RSPCA ACT trivia nights and was Co-chair of the Parliamentary Friends of the RSPCA.

Gary is married with two adult sons and lives in Canberra.

BIO

Eileen Thumpkin

Director, RSPCA Australia

A member of RSPCA Queensland's Board, Eileen Thumpkin became a Director of RSPCA Australia in 2006, as the RSPCA Queensland nominee, and is also a past President of RSPCA Queensland and RSPCA Australia.

Eileen has completed studies across several disciplines including education, arts, governance and animal welfare. She has a Masters degree in social planning and is currently pursuing further studies in animal science and welfare.

Eileen has worked in a range of senior positions in the Queensland public service and has extensive experience in project planning and management at a statewide and national level.

Animals, their care and welfare is a lifelong passion for Eileen which is why she has been an active volunteer for RSPCA and a carer of many animals.

BIO

Mark Tizard

CSIRO

Mark began his career at the Wellcome Research Laboratories in the United Kingdom in the early days of gene cloning as part of the team that was first to identify and produce a candidate vaccine for malaria (Holder et al, 1984, Nature). Completing a PhD and postdoctoral project in microbiology and gene technology he came to Australia to work at CSIRO using molecular techniques to detect and control Johne's disease, an insidious wasting disease impacting the Australian cattle and sheep industries.

Following new trends in gene technology, particularly the emerging field of RNA interference and microRNA biology, Mark turned his attention to poultry. His group was the first to catalogue the microRNA repertoire of the chicken (Glasov et al, 2009, Genome Research). This quickly lead to them beginning to apply tools from another emerging field - gene editing. The CSIRO group soon developed improvements in these techniques leading to very efficient methods to edit the chicken genome. A significant spin-off of this technology is a new method to remove males from the egg-layer industry without having to hatch and cull day-old chicks (the current practice) – this is currently under commercial evaluation for its potential translation into industry practice.

ABSTRACT

Animal breeding technology: past, present and future

Mark Tizard, Kristie Jenkins, Caitlin Cooper, Mark Woodcock, Arjun Challagulla and Tim Doran
CSIRO Health & Biosecurity,
Australian Animal Health Laboratory, Geelong

Mark Tizard | mark.tizard@csiro.au

Around 10,000 years ago humans began to domesticate animals both as companions and for farming. Contemporary animals, with their diverse physical and behavioural characteristics differing significantly from the species originally tamed, were obtained through a process of selectively breeding to gather together desirable traits. It is only in the last 60 years that these valuable traits have been recognised to be encoded by DNA in the form of genes – selective breeding is effectively a process engineering the genetic content of an animal. Examples of these outcomes are breeds of cattle selected to provide either milk or beef and poultry to provide eggs or meat. But there are issues of concern in husbandry and welfare for which selective breeding has not yet provided effective solutions.

Modern gene technology can offer solutions, beyond improving selection, but these are not yet in practice. The translation into practice of gene technologies needs refinement but the foremost issue is public and industry readiness for these solutions. Selective breeding has taken place over thousands of years, accelerated in the past several hundred years through understanding heredity and has most recently been boosted by genome sequencing and DNA markers, but still key issues remain. The most recent advance in gene technology has radically changed what can be achieved in livestock, enabling beneficial changes to be introduced from within the species (e.g. only cow genes in cows), to bring the best characteristics together effectively and to remove bad characteristics. This fundamental difference of gene editing technology distinguishes it from the older techniques of transgenesis that generate “genetically modified organisms”. The solutions it could offer to important welfare issues demand that we all take a closer look at the purpose, the safety and the effectiveness to ask is this “the good, the bad or the ugly”?

BIO

Peter Howe

SRS Merino

(on behalf of Jim Watts, MVSc, PhD, AM)

Peter Howe graduated from The University of Sydney in Veterinary Science with Jim Watts in 1971. Peter spent most of his working life as a country veterinarian with a special interest in, and practice of, the Assisted Breeding Technologies for farm animals. Peter was also a veterinary consultant to the Department of Primary Industries on their quarantine stations for a number of years before a sojourn into the biotechnology industries in the mid-1980s. There, he worked as a Senior Research Scientist on recombinant DNA technologies with a particular focus on reproductive hormones, superovulation, and oestrus control.

Bitten by the research bug, Peter proceeded to work towards his PhD in molecular biology, again focusing on reproductive physiology but this time looking at embryonic and foetal survival and the role of the male in the process, along with gene expression variation in seasonally breeding animals. Peter soon returned to private practice and, along with Jim Watts, applied what they had learned to developing Merino sheep which were better suited to our Australian environments.

In 2007, Peter returned to research and worked on a project on semen quality and its relationship to the outcomes from Intracytoplasmic Sperm Injection and in-vitro fertilisation technologies in humans. This lead to Peter being awarded an MSc Med degree in Human Reproductive Health and Human Genetics.

Soon after, Peter returned to again work with Jim Watts to apply what they had learned to their ongoing development of the SRS Merino.

ABSTRACT

Genetic solutions to mulesing and tail docking of Merino sheep

Jim Watts, MVSc, PhD, AM, and Peter Howe
SRS Merino

Peter Howe | pandh@tac.com.au

SRS ("soft rolling skin") Merino sheep are smooth bodied (wrinkle-free) animals bred for loose and supple skins with high density and length of wool fibres. The sheep are naturally resistant to all forms of fly strike and do not need to be mulesed or treated with insecticides for fly strike control. The sheep excel for fleece weight, fibre fineness, fibre quality and processing performance. Within this sheep type, naturally short-tailed Merinos have been bred which do not need tail docking.

Jim Watts developed and implemented this genetic solution to mulesing and fly strike in SRS Merino studs in Australia during the 1990s. The first SRS Merino stud stopped mulesing in 2001 whilst most had stopped by 2004. However, the sheep and wool industry at large has studiously ignored this genetic solution to mulesing during all these years.

The genetic transition to no mulesing of Merino sheep takes only three to five years. Approximately 10,000 rams per year can be produced by the 25 SRS-accredited Merino studs currently operating in Australia. These rams allow about 500,000 Merino ewes per year to have their progeny shifted rapidly to being smooth-bodied sheep that no longer need to be mulesed. And, in the working lives of these rams, two million Merino ewes, or approximately 5% of the national flock, can be moved towards this genetic solution. And this effect is cumulative, with the same level of production of new rams becoming available each year. Other Merino studs could get involved. The breeding methods required, although very different to traditional ways, are easily learnt.

Simply selecting Merino sheep to reduce wrinkle may not solve the mulesing issue. There are two obstacles. Firstly, the sheep's skin must be loose and supple, and not simply plain, to be mules-free. Secondly, most sheep in Australia are conceived "out of season" (spring-summer) rather than "in season" (autumn), a breeding practice which hides the wrinkle genes in the progeny.

The breeding of naturally short-tailed Merino sheep is based on research work done in New Zealand. A dedicated stud flock has been developed in Australia to supply other Merino stud flocks with short tail genetics so that this highly desirable trait can be made available to the general Merino industry.

BIO

Susanne Hermesch

Animal Genetics and Breeding Unit
University of New England

Susanne Hermesch is a Principal Research Fellow at the Animal Genetics and Breeding Unit (AGBU) in Armidale, Australia. Susanne has conducted extensive national and international research for genetic improvement of pork. The current research focus includes genetic improvement of health, disease resilience, seasonal infertility as well as welfare of sows and growing pigs.

Susanne is committed to fostering the training and education of postgraduate students and coordinates the support of High Degree Research students at AGBU.

Susanne is in charge of the genetic services at AGBU for pigs and as such responsible for initiating and guiding new developments for genetic evaluation systems used in Australia and overseas. Further, Susanne has established an extension and adoption framework to foster adoption of genetic principles.

Susanne is the President of the Permanent Committee of the World Congress on Genetics Applied to Livestock Production and she is a member of the Advisory Board of the European Master in Animal Breeding and Genetics, a recognised Erasmus Mundus course.

ABSTRACT

Opportunities to improve the welfare of sows and pigs further through selection

Susanne Hermesch and Kim L. Bunter
Animal Genetics and Breeding Unit, a joint venture of NSW Department of Primary Industries and University of New England, Armidale

Susanne Hermesch | Susanne.Hermesch@une.edu.au

Genetic improvement is regarded as a key tool to improve the welfare of farm animals. Information about piglet survival, structural soundness and sow longevity are often available on farms and pig breeding programs aim to balance survival, longevity or pork quality with productivity and efficiency.

Performance and survival traits are a first indication of the welfare of pigs. More specific measures of welfare include behavioural and physiological traits. Several behaviour traits are heritable, however, the exact implications of individual behaviour traits for specific welfare aspects need to be defined. For example, fight lesion scores can be used to select less aggressive pigs and sows that are better suited to group housing. Tail biting is an undesirable behaviour and simple scores identifying victims of tail biting are heritable. These scores may be based on medication records or observation of tail damage. Fight-lesion and tail-biting scores have no genetic associations with performance of sows and pigs.

New selection strategies can identify the effects of one animal on others which were related to biting behaviour in pigs. Information from automated recording procedures or technologies developed for human medicine provide new opportunities to improve welfare. For example, haemoglobin can be easily recorded with a hand-held device on farm. Genetic associations between haemoglobin and pork quality, piglet survival and sow performance can be used for genetic improvement of these welfare attributes. Feeding behaviour of sows during gestation available from electronic feeders is heritable. Genetic associations between feeding behaviour traits and specific farrowing and welfare outcomes of sows are currently being investigated.

This overview provides some examples of genetic improvement for welfare traits in sows and pigs. Development or application of new genetic models and new technologies available from precision agriculture, veterinary practice and human medicine will provide new opportunities to improve welfare of sows and pigs further.

BIO

Imtiaz Randhawa

University of Queensland

Imtiaz graduated in Animal Husbandry (2003) and then obtained MSc (Hons) in Animal Breeding and Genetics (2005) from the University of Agriculture, Faisalabad, Pakistan. Later, in his PhD in Animal Genomics (2015) from The University of Sydney, he developed bioinformatics tools - Meta Selection Scores (MSS) and Composite Selection Signals (CSS) – to investigate the core traits influenced by the historical selection events in worldwide cattle breeds and presented novel insights about the hot spots of positive selection in the bovine genome. Imtiaz has been working at various teaching and research positions at the University of Agriculture Faisalabad, University of Veterinary and Animal Sciences Lahore, University of Sydney, James Cook University and The University of Queensland.

Imtiaz is a motivated geneticist, conducting research in the fields of molecular genetics, genomics, bioinformatics, breeding and evolutionary biology to understand and analyse the phenotypic and genomic data of various species (buffalo, cattle, chicken, dog, dingo, goat, horse, sheep) using high-performance computational and big-data analysis facilities and programming languages (R, Plink, Python); and to characterise the genetic architecture (gene variation, expression and regulatory networks) related to various complex traits of agricultural, clinical, environmental and economic importance for adaptation, appearance, production and welfare.

ABSTRACT

Improving poll gene testing in Australian cattle

Imtiaz Randhawa[1], Laercio Porto-Neto[2], Ben Hayes[3], Michael McGowan[1], Brian Burns[4] and Russell Lyons[1]

[1] University of Queensland, School of Veterinary Science, Gatton

[2] CSIRO Agriculture and Food, St Lucia

[3] Queensland Alliance for Agriculture and Food Innovation, Centre for Animal Science, University of Queensland, St Lucia

[4] Department of Agriculture and Fisheries, Rockhampton

Imtiaz Randhawa | i.randhawa@uq.edu.au

Welfare and economics are key components of recent progress in modern livestock farming. Animal welfare demands a balance between production and care of the animals, especially minimising or eliminating the undesired characteristics such as the presence of horns. Most modern cattle are naturally horned. A large part of the Australian cattle industry has adopted the non-invasive approach of breeding hornless cattle through genetic selection.

Genotype-phenotype relationships of horn growth are complex. Early detection for horn status, i.e. presence or absence (polledness) of horns, has been a long-time challenge in the cattle industry. Testing for polledness has evolved through different genetic markers including microsatellites (MSAT) and single nucleotide polymorphism (SNP). Given the varying nature of each marker's types and their unique characteristics in different populations, poll gene testing has been complex. Rapidly adopted commercial testing has been pivotal in poll cattle breeding, however, investigation of tested animals suggests compromised accuracy in both test types in some breeds. This presentation will give an overview of an ongoing research project funded by Meat & Livestock Australia for the improvement of poll gene testing.

The available poll testing assays rely on predictions based on unique marker haplotypes of 7-10 MSAT or 5-8 SNPs. As genome sequencing technologies become more accessible and cost effective, SNP-based testing is replacing MSAT. By using the recently identified SNPs associated with Celtic and Friesian mutations through prior genomic sequencing of poll-associated regions, and also a resource herd with accurate phenotypic and genotypic recording across generations, some of the testing complexity has been resolved. Preliminary analyses have demonstrated that a robust set of 5 SNPs can almost eliminate the ambiguous and uncertain results of current poll gene testing. The project also seeks to further refine testing accuracies by investigating the scur locus. Overall, we aim to minimise animal welfare issues with the help of low cost, accurate testing.

BIO

Tad Sonstegard

Chief Scientific Officer
Acceligen, USA

Dr Tad Sonstegard is currently Chief Scientific Officer of Acceligen, a Recombinetics company, where he leads both business development and research efforts dedicated to discovery of new traits and precision breeding of food animals. A main goal is to apply genome editing for livestock genetic improvement that promotes sustainability and animal well-being.

Previously at the USDA-ARS Beltsville, Tad led genomics research to develop applications in germplasm conservation and genetic improvement that included the first commercially successful, ag-based SNP tool. Tad also identified causative variation affecting fertility and thermo-tolerance in cattle and has led consortia to generate genome assemblies of the water buffalo, goat, Zebu cattle, and an expression atlas of cattle.

Dr Sonstegard received his undergraduate degree from Iowa State University and his PhD from the University of Minnesota. Tad has published 200 peer-reviewed articles and has received award recognition for his work in genomic research for livestock genetic improvement.

ABSTRACT

Keynote Part One

Naturally Polled – A pain-free solution to dehorn animals using advanced breeding methods

Tad Sonstegard | Tad@recombinetics.com

Gene editing based on site-directed nucleases is recognised as a breeding method best suited to introduce alleles for better animal welfare management into naïve populations of food animals. However, to date, very few naturally occurring traits with major effects on animal well-being have been identified from food animal species. Four natural mutations for hornlessness (polled) have been identified in domesticated cattle using genomic approaches; all residing in non-genic mutations on Chromosome 1. One of these alleles, usually found in Angus cattle, was introgressed into a "horned" crossbred dairy cell line to prove that gene editing could genetically dehorn animals in a risk-free and painless way.

Since the birth of the first clones from the edited cells, we have demonstrated genetic dehorning is identical to natural breeding and are seeking regulatory approval to enable commercial deployment on a global scale to the cattle industry. These methods provide producers new breeding options to ultimately end the practice of dehorning without creating biosafety risks falsely associated with this technology. However, there have been only a few privately funded initiatives attempting to bring edited animals to market; suggesting commercial providers of elite genetics are still reticent to apply this technology as a method for animal improvement.

BIO

Caitlin Cooper

Select-EggZ Incorporated

Caitlin Cooper's background is in genome engineering in agricultural species and pest animals. Caitlin's PhD research focused on using milk from transgenic goats and cows which contained recombinant human antimicrobial proteins to improve food safety and decrease intestinal infections in developing countries.

Caitlin continued working in the food safety space after her PhD, taking a post-doctoral position at the CSIRO Australian Animal Health Laboratory on a project aimed at decreasing the spread of pathogens from poultry products. Caitlin developed two lines of transgenic chickens which overexpress native chicken antimicrobial proteins and in the transgenic eggs growth of *Salmonella enterica, E. coli, and Listeria monocytogenes* is inhibited. During this time, Caitlin also spearheaded a project looking at novel ways of delivering gene editing tools to the single cell zygote in chickens, which lead to the development of sperm transfection assisted gene editing, or STAGE.

During her second post-doctoral fellowship, Caitlin expanded her focus to include not only poultry but also genome engineering in to invasive species such as the cane toad, as well as aquatic species including salmon and tilapia. Currently, Caitlin is focused on developing poultry gene editing and genome engineering technologies and transitioning them from the lab into industry practice to improve animal outcomes.

ABSTRACT

In ovo sex selection for the layer industry

Caitlin Cooper[1], Mark Woodcock[2], Arjun Challagulla[2], Kristie Jenkins[2], Tim Doran[2] and Mark Tizard[1,2]

[1] Select-EggZ Incorporated

[2] CSIRO Health & Biosecurity, Australian Animal Health Laboratory, Geelong

Caitlin Cooper | caitlin.cooper@selecteggz.com

Estimates indicate that each year in Australia 23 million day-old male chickens, from the egg layer industry, are culled as they do not lay eggs and are not an economically or environmentally sustainable option for meat production. Chicken breeds in the livestock sector are one of two types, broilers for meat production and layers (hens) for egg production. Dual-use breeds are available, however they are only grown in small numbers for niche products which have higher costs since they are not very efficient at producing either meat or eggs. Decades of searching for alternatives to the culling of day old males by the layer industry has yet to yield a viable solution which can be effectively integrated with industry practices.

Gene technology and a fundamental aspect of sexual reproduction provide an opportunity for an inventive solution. During the reproductive process the sex chromosomes (X and Y in humans, Z and W in chickens) segregate so that the sperm and the egg provide only one of each. The Select-EggZ concept uses precision gene technology to generate a line of chickens that carry a simple, safe and detectable marker on one sex chromosome. That marked chromosome only ends up in the male fertilised eggs and not the female fertilised eggs that will eventually be hatched and grow in layer chickens. Laser detection is being developed to light up and detect the male eggs, enabling their removal at point-of-lay. They no longer need to be incubated, hatched, and culled. The hens that hatch and the eggs they lay for consumption are the same as todays - the marker was only ever on the males and they have been removed. The overall success of this alternative will depend on the response of the public, the regulators and industry.

BIO

Tad Sonstegard

Chief Scientific Officer
Acceligen, USA

Dr Tad Sonstegard is currently Chief Scientific Officer of Acceligen, a Recombinetics company, where he leads both business development and research efforts dedicated to discovery of new traits and precision breeding of food animals. A main goal is to apply genome editing for livestock genetic improvement that promotes sustainability and animal well-being.

Previously at the USDA-ARS Beltsville, Tad led genomics research to develop applications in germplasm conservation and genetic improvement that included the first commercially successful, ag-based SNP tool. Tad also identified causative variation affecting fertility and thermo-tolerance in cattle and has led consortia to generate genome assemblies of the water buffalo, goat, Zebu cattle, and an expression atlas of cattle.

Dr Sonstegard received his undergraduate degree from Iowa State University and his PhD from the University of Minnesota. Tad has published 200 peer-reviewed articles and has received award recognition for his work in genomic research for livestock genetic improvement.

Keynote Part Two

ABSTRACT

Stolen Kiss & Naturally Cool - Two advanced breeding solutions for the animal welfare traits of castration and heat stress

Tad Sonstegard | Tad@recombinetics.com

Gene editing based on site-directed nucleases is recognised as a breeding method best suited to introduce animal health, well-being, and climate adaptive alleles into naïve populations of food animals. We have devised two different solutions based on gene editing methods to ameliorate bovine heat stress and surgical castration, respectively. In the first example, we can adapt cattle to withstand the stress caused by tropical production conditions by only changing a single base pair in prolactin receptor. This change induced by gene editing is identical to naturally occurring alleles found in Criollo cattle of the New World and is known as the phenotype named SLICK. In the second example, we mimic mutations found in humans which do not allow pubertal development. By blocking puberty in swine, male animals do not need to undergo surgical castration practices used to reduce animal aggression and block production of boar taint (off-taste) in pork. Currently, our second generation of castration-free swine are in production, and the challenges of implementing this technology into a commercial production system will be discussed.

BIO

Simon Coghlan

Deakin University

Simon Coghlan is a philosopher and veterinarian. Currently he works as a Research Fellow at University of Melbourne. Previously, he held lecturing positions at Deakin University (in the School of Medicine) and the Australian Catholic University. He researches and publishes in animal ethics, amongst other ethical topics. Simon has also worked in small animal veterinary practice for many years.

ABSTRACT

Featherless chickens and Insentient pigs: Gene technology & ethics

Simon Coghlan | simon.coghlan@deakin.edu.au

Is it morally acceptable to bioengineer pigs with a limited ability to feel and be aware of their surroundings and their fellows? Or ethically right to make chickens that are without feathers? Is it even ethical to make less radical modifications to animals using new or experimental genetic techniques, such as CRISPR? For some, these new kinds of biotechnology represent a dangerous and unethical interference with nature. Others worry about the potential harms to animals and their welfare, while still others are critical of the circumstances surrounding the drive to apply these modern genetic techniques to animals so that they suffer less and/or become more productive.

Those who are more sanguine about these emerging techniques, however, may argue that such modifications are a legitimate extension of existing breeding practices. Proponents contend that the modifications hold the promise of improving both animal and human wellbeing. Clearly, modern genetic alteration of animals raises complex and controversial ethical and philosophical questions. In addressing some of these questions, this presentation will touch on a range of ethically relevant notions, such as animal welfare, telos, agency, rights, integrity, and dignity.

BIO

Louisa Matthew

Office of the Gene Technology Regulator

Louisa received a PhD in plant molecular biology from the University of Queensland in 2003 and was then a researcher at CSIRO, working on RNA interference and microRNAs in plants. Louisa joined the Office of the Gene Technology Regulator (OGTR) in 2008.

The Gene Technology Regulator, supported by the OGTR, regulates activities with genetically modified organisms (GMOs) to protect the health and safety of people and protect the environment. Louisa directs OGTR's Regulatory Practice Section, which provides technical support, delivers operational policies, serves as a contact point for other Australian Government agencies and national and international organisations involved in regulating GMOs, and supports two expert advisory committees. A current focus is the ongoing technical review of the Gene Technology Regulations 2001, which aims to bring the gene technology legislation up to date with recent scientific developments.

ABSTRACT

Australian gene technology regulatory framework and community attitudes

Louisa Matthew | Louisa.Matthew@health.gov.au

Activities with genetically modified plants, animals and microbes in Australia, ranging from research in contained laboratories through to commercial production in the open environment, are regulated under the national gene technology legislative scheme. The object of the *Gene Technology Act 2000* is:

> *to protect the health and safety of people, and the environment, by identifying risks posed by or as a result of gene technology, and by managing those risks through regulating certain dealings with genetically modified organisms (GMOs).*

Gene technology is regulated using a risk-based approach, where higher risk work with GMOs and work involving intentional release to the environment is subject to greater regulatory oversight. Activities with GMOs are prohibited unless they are licensed by the Gene Technology Regulator or otherwise authorised under the Act. An ongoing challenge is keeping the gene technology legislation up to date with advances in gene technology, and improved understanding of risks posed by GMOs.

The gene technology regulatory scheme was developed from the late 1990s because of a need to provide regulatory coverage for GMOs not subject to existing regulatory schemes. The regulatory scheme also supports public confidence in the technology, given ongoing public concern about the safety of GMOs. OGTR has commissioned surveys of community attitudes to gene technology that continue a series of studies initiated 1999. These studies have shown that Australians are still more in support of genetically modified organisms than opposed, although this depends on the application of the technology.

BIO

Mark Post

University of Maastricht

Professor Mark Post first got involved in a Dutch government-funded program investigating “in vitro meat” in 2008, when he was a professor of tissue engineering at the Eindhoven University of Technology. The program had been initiated by Wilem van Eelen, an 86-year-old entrepreneur who held a long-time fascination for the possibility of culturing meat.

When the director of the program fell ill, about mid-way through the program, Post took over supervision of the PhD students. Motivated by the potentially high societal impact, he continued research even after the funding had ended in 2010.

Renewed funding by a private partner enabled the realisation of a project to create a processed meat product using muscle cells from a cow.

Professor Post received his medical degree from the University of Utrecht in 1982 and trained for a PhD in Pulmonary Pharmacology, graduating from the University of Utrecht in 1989.

He joined the KNAW Interuniversity Cardiology Institute of the Netherlands before being appointed full-time Assistant Professor in Medicine at Harvard Medical School, Boston, MA in 1996. Five years later, he moved with his lab to Dartmouth Medical School, Hanover, NH, and was appointed Associate Professor of Medicine and of Physiology.

In July 2002, Dr Post returned to the Netherlands as a Professor of Vascular Physiology at Maastricht University and Professor of Angiogenesis in Tissue Engineering at the Technical University Eindhoven. Since January 2004, he has been Chair of Physiology and Vice Dean of Biomedical Technology at Maastricht University.

In addition to his academic appointment, Dr Post is also Chief Scientific Officer of MosaMeat BV and Qorium BV, two spin-offs that aim to commercialise cultured meat and cultured leather, respectively.

ABSTRACT

Cultured meat: An alternative to livestock?

Mark Post | m.post@maastrichtuniversity.nl

In the coming 35 years, it is anticipated that meat demand will rise by 70% due to the global population growth and increase in wealth of India and China. To ensure food security and to diminish the environmental and animal welfare burden of current beef production in some production regions, we envision an alternative by culturing meat from bovine muscle-specific stem cells. In August 2013, we presented the proof of concept by producing, cooking and eating a hamburger from cultured beef. It is clear that the product was not perfect and further research is necessary to improve the product and provide conditions for scaling up production.

For cultured beef to be successful, four requirements need to be met. Production has to be resource efficient and sustainable; the eventual product has to be meat and not a substitute and the consumer needs to accept it. For realistic market appeal, production has to be scaled to an industrial scale, which will be a huge enterprise. Technical aspects and current state of technology with an estimated path to market introduction will be discussed.

With more than 30 start-up companies world-wide, hundreds of millions of dollars of funding, investment by traditional meat companies and an estimated 1000 scientists working on this subject, cultured meat will become a realistic proposition, with the possibility to vastly reduce livestock numbers in equal measure for cattle, pigs, chicken, lamb and fish.

Cultured meat is a multifaceted technology that will provide insight into many fascinating biological and psychological questions. At the same time, we urgently need to find solutions for the upcoming surge in meat consumption.

RSPCA Australia
PO Box 265, Deakin West ACT 2600
02 6282 8300 · seminar@rspca.org.au

Australian Government

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