



**Massey University**

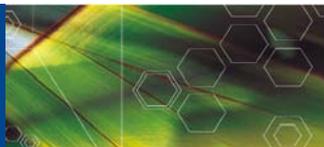
Institute of Food, Nutrition and Human Health

## **Examples of Meat-Industry Related Research Activity and Expertise at Massey University**

Roger Purchas

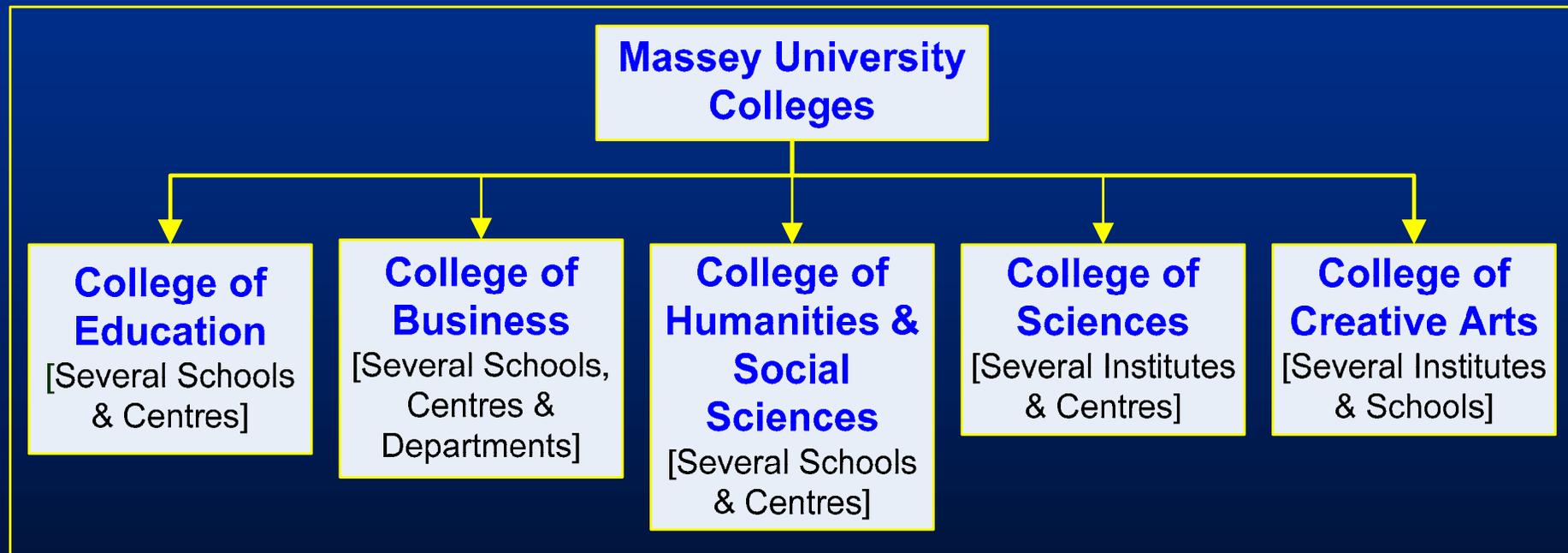
Institute of Food, Nutrition & Human Health,  
Massey University, Palmerston North.

<http://ifnhh.massey.ac.nz/>



**Te Kunenga  
ki Pūrehuroa**

# Colleges within Massey University

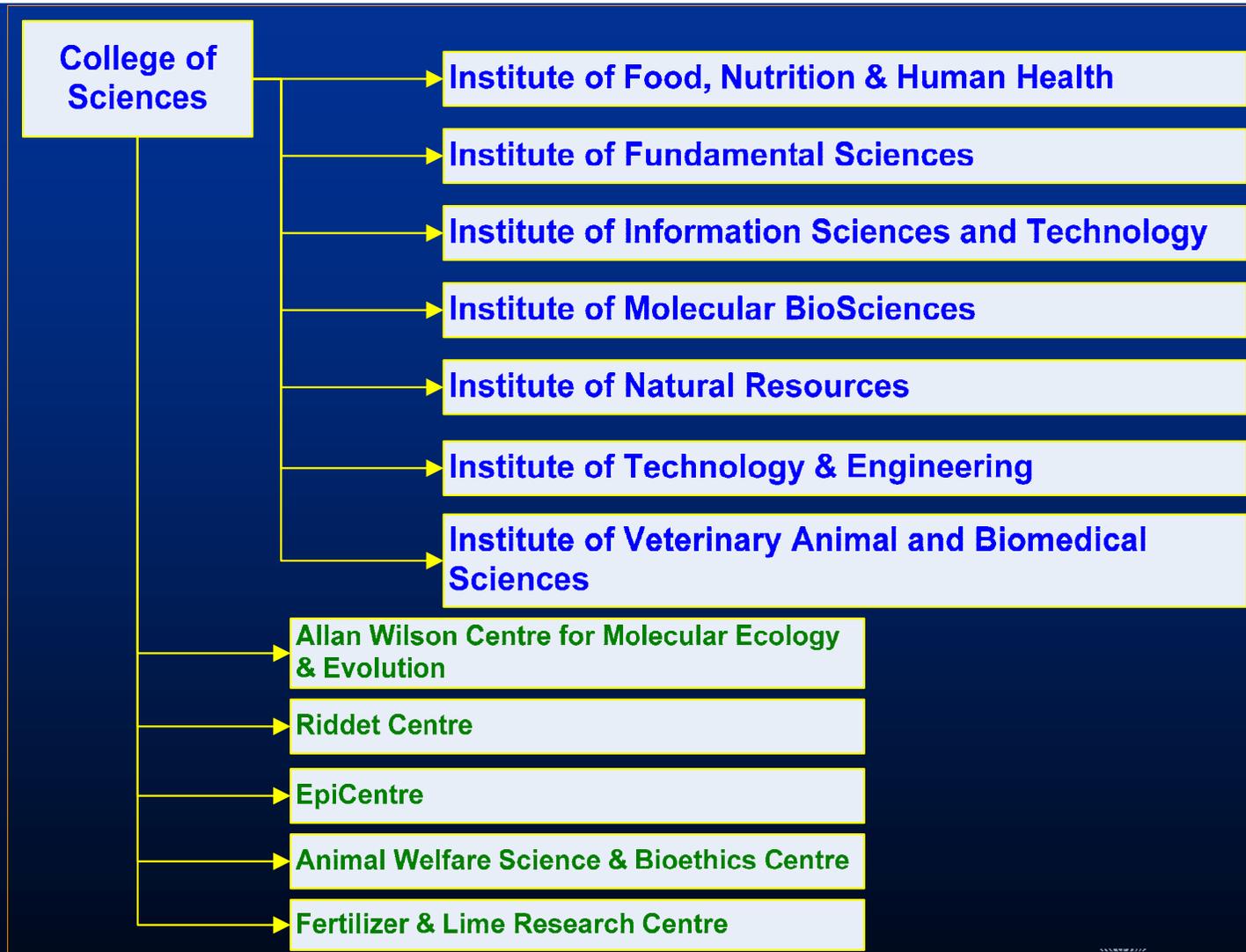


<http://www.massey.ac.nz>



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# Institutes within the College of Sciences and examples of Research Centres



# The Riddet Centre

- A research centre devoted to food-industry research at both the fundamental and applied levels.
- Established in 2003, and achieved CoRE status in 2007 with \$41m in Government funding over the next 6 years.
- An example of a meat-related project involves using low-quality waste products from the meat industry as a basis for producing high-value hydrolysates with specific health-enhancing properties.
- The Centre has a staff of about 40 and is co-directed by Professors Paul Moughan and Harjinder Singh [H.Singh@massey.ac.nz].
- <http://riddetcentre.massey.ac.nz>



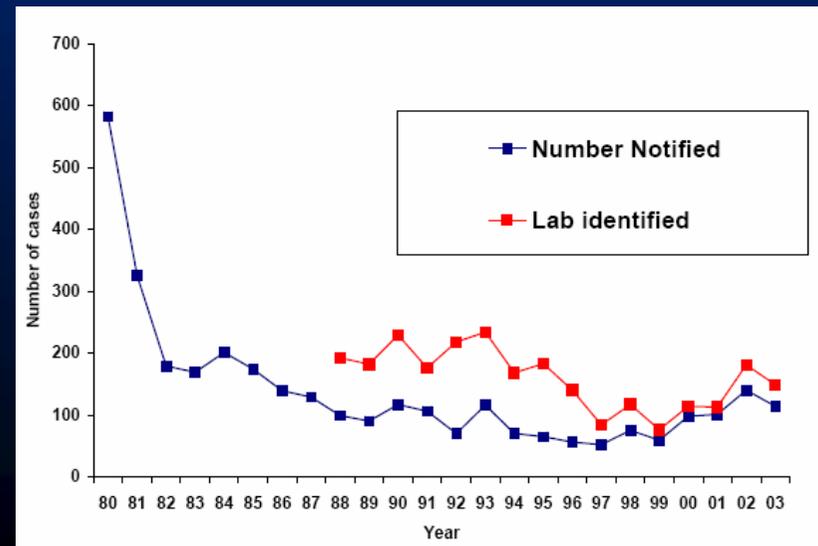
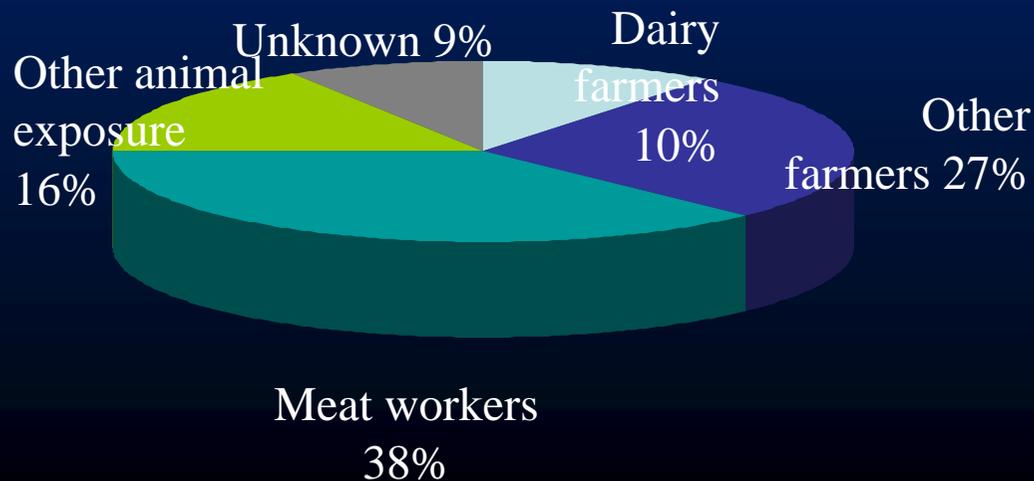
# The EpiCentre

- A research centre devoted to epidemiological, food safety, and veterinary public health research.
- It is closely integrated with the AgResearch Hopkirk Institute that is located on the Massey campus.
- Examples of meat-related research/consultancy activities include:
  - Development of animal health software (eg DairyWIN PigWin, etc)
  - Projects involving specific pathogens and zoonoses including campylobacter spp.
  - Participation in the food safety aspects of the EU-funded FoodFrenz program (<http://www.foodfrenz.com>).
  - Consultancies regarding disease outbreaks in many parts of the world (BSE, F & M, etc)
- The Centre is co-directed by Professors Roger Morris and Nigel French [N.P.French@massey.ac.nz].
- <http://epicentre.massey.ac.nz>



# An example of EpiCentre research: Leptospirosis in NZ

- Leptospirosis has been increasing in meat workers in NZ
- Kidney cultures from lambs: 20%
- Rural Women NZ have been involved in fundraising for this research



# Animal Welfare Science and Bioethics Centre

- A research centre for practical science-based and ethical advice, education and solutions to animal welfare problems and bioethical analysis.
- A Collaborating Centre for OIE (World organisation for Animal Health) (<http://www.oie.int/eng/>).
- Examples of a meat-industry related projects:
  - Evaluation of painful husbandry procedures (castration, etc).
  - Research into slaughter procedures.
  - Promotion of the 3-Rs approach (Replacement, Reduction, Refinement).
  - Alternative means of assessing animal stress.
- The Centre is co-directed by Professors David Mellor [D.J.Mellor@massey.ac.nz] and Kevin Stafford [K.J.Stafford@massey.ac.nz].
- <http://animalwelfare.massey.ac.nz>



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# Groups in the College of Business

- Two examples of relevance to the meat industry:
  - Professor Phillip Gendall heads the Dept of Marketing, which is concerned mainly with studies at the consumer end of the marketing chain.
  - Professor Allen Rae heads the Centre for Applied Economics and Policy Studies (CAPS) where examples of research have included:
    - Analysis of proposals submitted to the WTO DOHA round.
    - Work for FAO on global trends in consumption & production.
    - Comparisons of N emissions from NZ agriculture with that of other OECD countries.
    - Impacts of quotas on NZ exports of sheep-meat and beef.

<http://econ.massey.ac.nz/caps/>



# IVABS - Research programme areas of particular relevance to the meat industry

HOI: Professor Grant Guilford.

- Emerging Diseases Affecting Biosecurity, Trade and Public Health
- Food Safety and Quality
- Mycobacterial diseases (eg Johnes disease)
- Animals and Society
- Pastoral Animal Production and Health
- Reproductive Management and Diseases
- Epidemiology (EpiCentre)



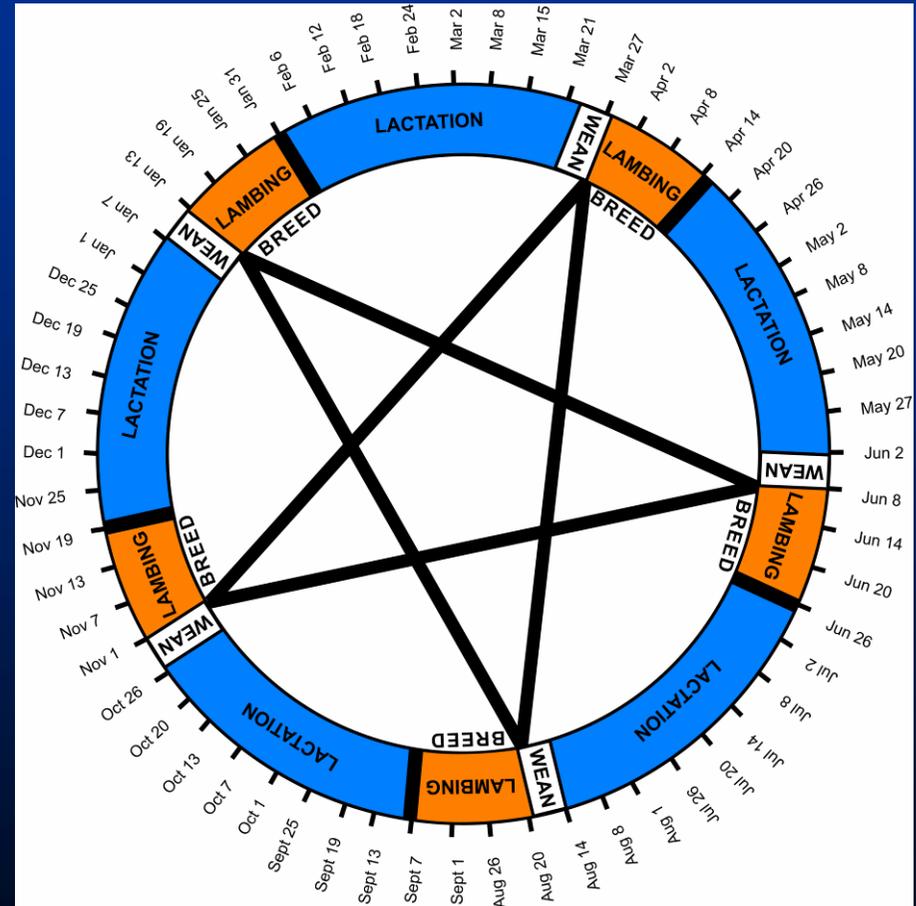
## Example 1: Effects of dam size and feeding during pregnancy on foetal growth

- Run by Professor Hugh Blair [H.Blair@massey.ac.nz] as part of the “*National Research Centre for Growth & Development*” based in Auckland.
- Sheep are being used, but the results will be of relevance for other farm animals and humans.
- A current trial involves dams of 2 different sizes, 2 different feeding levels during pregnancy, and 2 birth ranks.
- Intensive measurements are being made on the developing foetuses, the dams, and the subsequent productivity of the offspring.



## Example 2: Year-round lambing to produce out-of-season lamb using the “Star” system

- Professor Steve Morris [S.T.Morris@massey.ac.nz], runs this project where there are 5 lambings each year.
- Each ewe lambs 5 times every 3 years at intervals of 7.2 mo.
- A 2-year trial at Massey showed a 40% increase in number of lambs, with lamb growth rates similar to a control system.
- Special management strategies need to be employed.



# ITE - Research areas of particular relevance to the meat industry

HOI: Professor Don Cleland.

- Studies into the energy efficiency and other aspects of refrigeration systems
- Investigations into the thermal properties of foods (including meat).
- Automation in the meat industry through mechatronics.
- Development of a chewing model to assist in studying ways in which foods are processed in the mouth.
- Factors affecting the effectiveness of waste-water processing systems.



# IFNHH - Research areas of particular relevance to the meat industry

HOI: Professor Richard Archer.

- Meat processing
- Product development
- Food microbiology and safety
- Process development
- Meat characterisation
- Evaluation of on-farm practices on carcass and meat quality
- Human nutrition



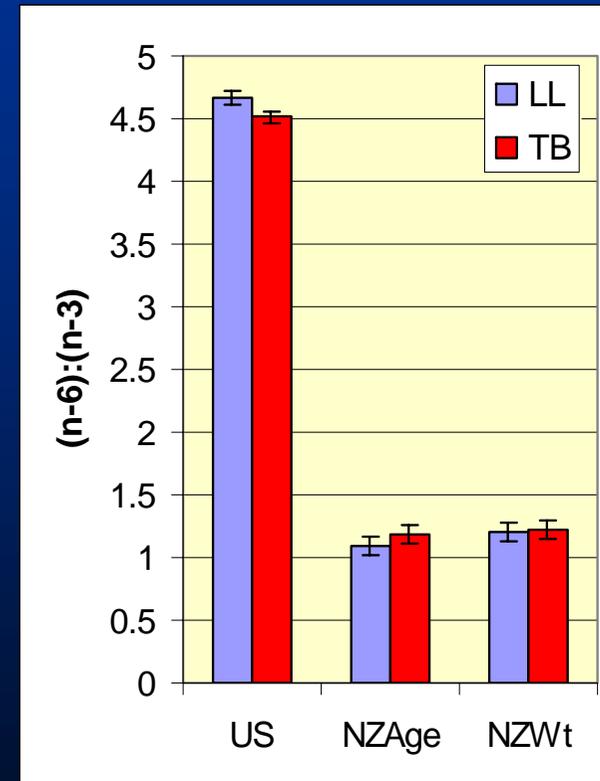
## Example 1: Does meat contain useful quantities of compounds with bioactive properties?

- A food component is said to have bioactive properties if it provides the consumer with some health benefit over and above any value it may have as a nutrient.
- Meat has been included in some lists of functional foods due to the presence of certain fatty acids such as the omega-3 group and CLAs.
- Examples of meat components with bioactive properties that have been investigated in Massey research are illustrated in the next few slides.



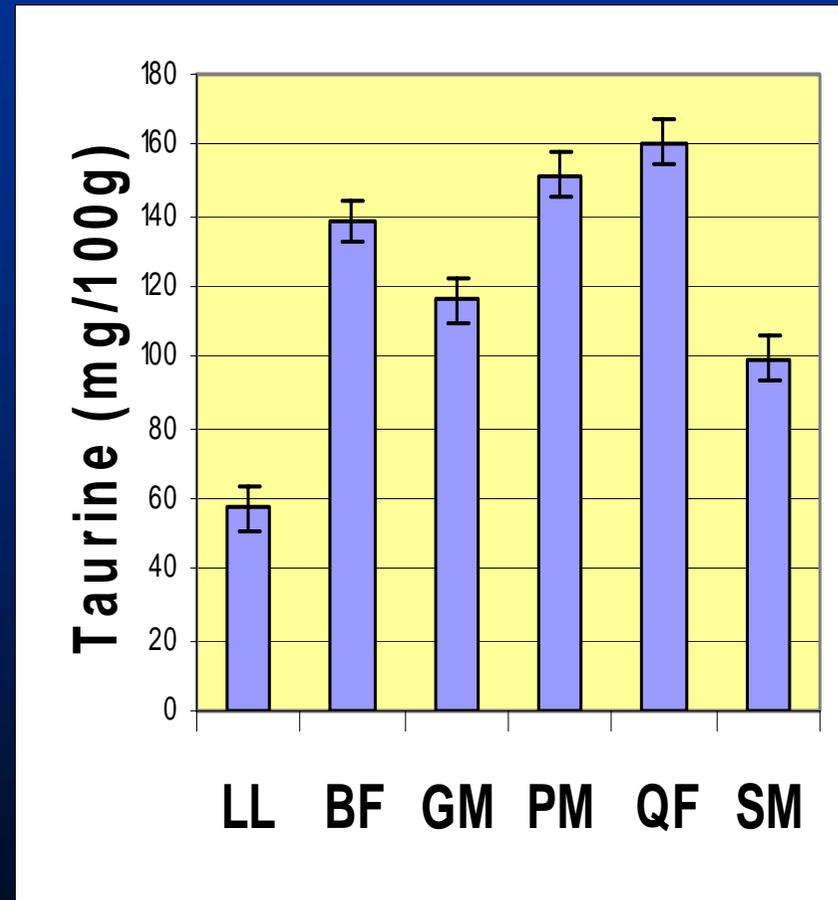
## Omega-3 (n-3) fatty acids in beef from pasture vs feedlot-finished cattle.

- For most people lower levels of the n6:n3 ratio are beneficial because of health benefits.
- A very clear, almost 4-fold difference in favour of the pasture-finished NZ cattle was shown in this study.
- The pattern was similar for both muscles, and the ratio increased with increasing fat levels (\*\*\*)
- This pattern is consistent with that shown in several other trials.



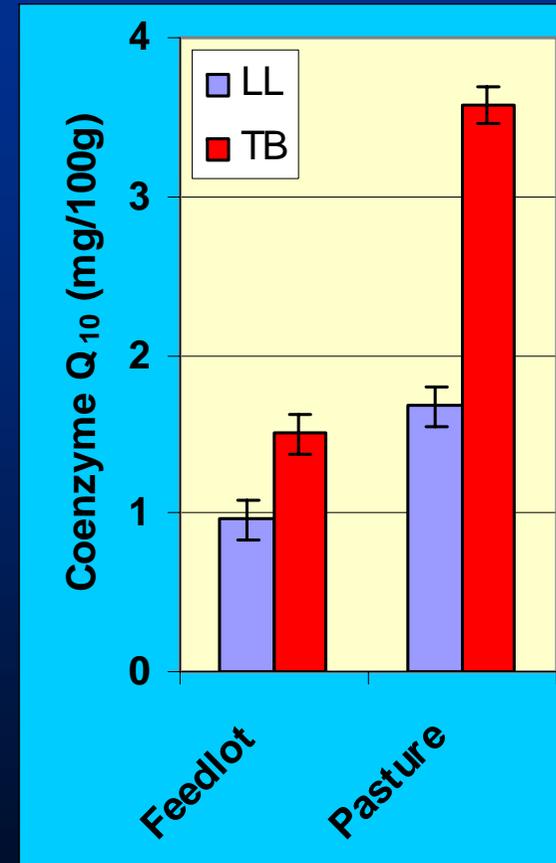
# Between-Muscle Differences in Levels of Taurine for Lamb

- Taurine has numerous physiological functions including some associated with eye and heart health.
- There were 2-fold differences between lamb muscles in levels of taurine (n=8).
- Levels tended to be higher in type I (aerobic) muscles.
- Taurine is available as a dietary supplement in 500 mg capsules.
- Cooking reduced taurine levels somewhat.



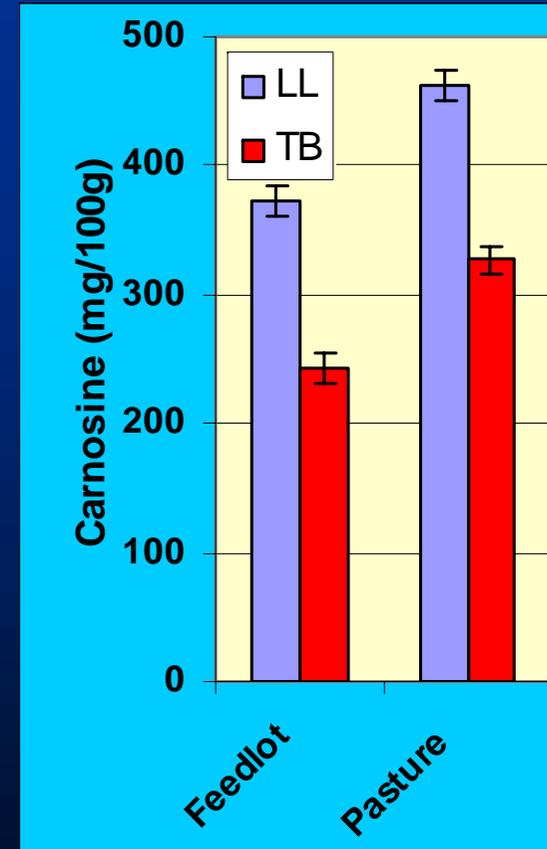
## Coenzyme Q<sub>10</sub> as a potentially bioactive compound in meat

- Levels were higher in the TB muscle, as expected based on its metabolism.
- For both muscles levels were higher for beef from pasture-fed animals, but significant muscle differences also existed.
- Levels were low compared with the amount commonly taken as supplements (e.g 30 to 100 mg per day).
- There was some loss of coenzyme Q<sub>10</sub> from muscle when it was cooked.



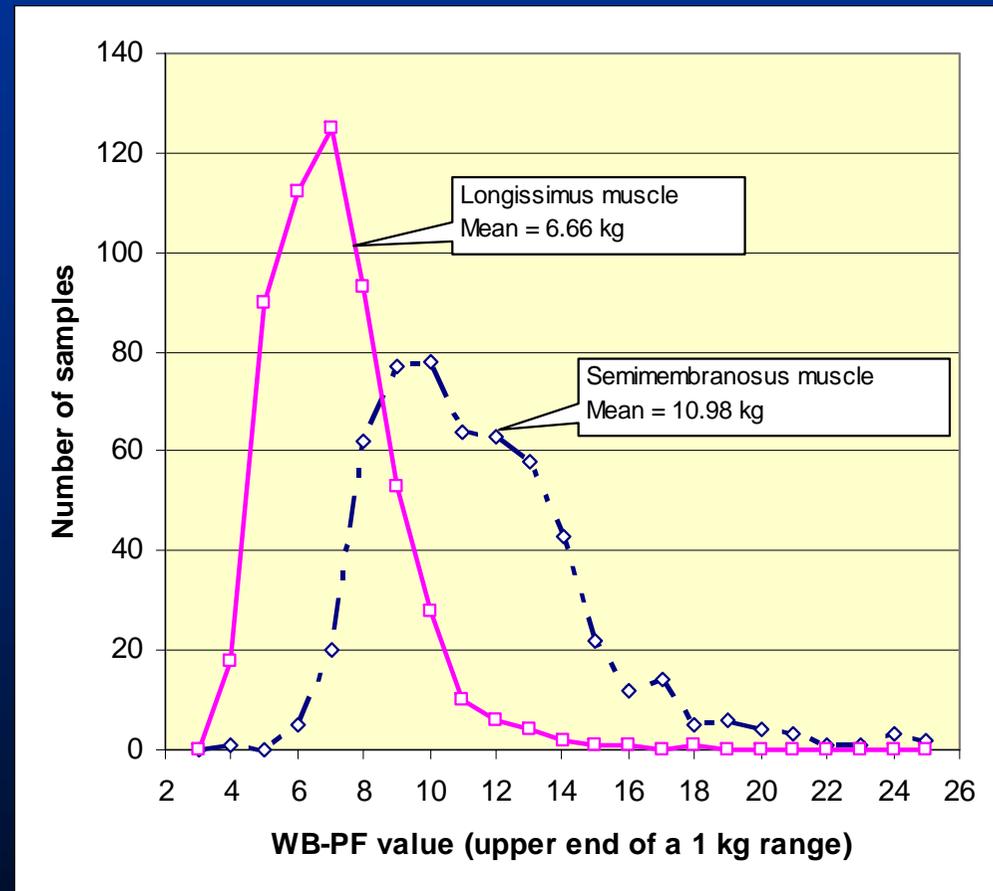
# Carnosine, a putative bioactive with antioxidant and “anti-ageing” properties

- Carnosine levels differed significantly between muscles.
- Beef from pasture-finished cattle contained more carnosine.
- Dietary supplements are commonly in the form of 500 mg capsules, which is not a lot more than in 100 g of meat.
- Being soluble in water, some carnosine may be lost during cooking.



## Example 2: Factors responsible for variation in meat tenderness

- Data for 544 Texel-X lambs showing the wide distribution of shear-force values.
- Samples were cooked to 70°C, and 12 shears were made for each muscle of each lamb.
- Most of the variation within muscles could not be explained.



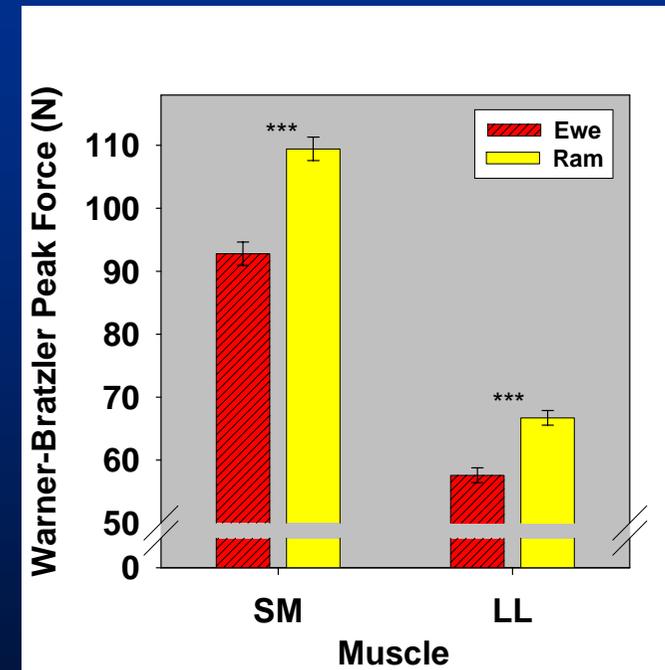
Based on data from: Johnson et al. (2005) Meat.Sci. 71: 383-391.



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## Meat from ram lambs was slightly tougher in one trial

- For both muscles the ram-lamb meat was slightly tougher.
- The reasons for the differences are not known.
- The size of the effects are probably not a reason for major concern, and were small compared with muscle differences.

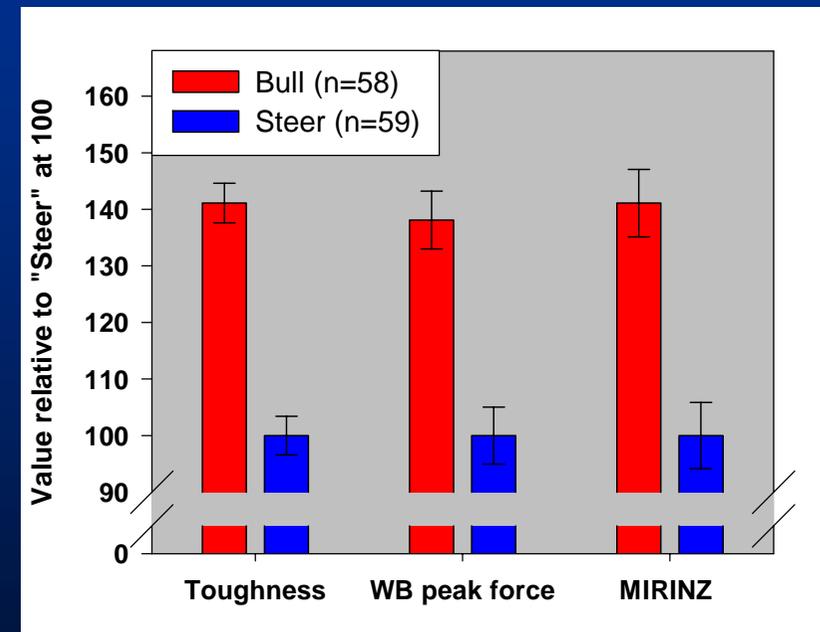


275 ram lambs  
269 ewe lambs



## Bulls have also produced less tender beef in some trials

- Rib-eye roll steaks from Angus bulls and steers showing a clear advantage for steers in terms of beef tenderness.
- This contrasts with some other studies showing little difference in tenderness.
- The 3 separate measures of tenderness shown here produced similar patterns.



[From: J.Anim.Sci (2002) 80: 3211]



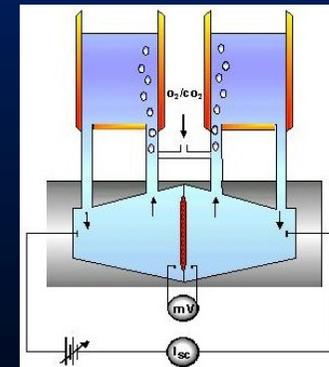
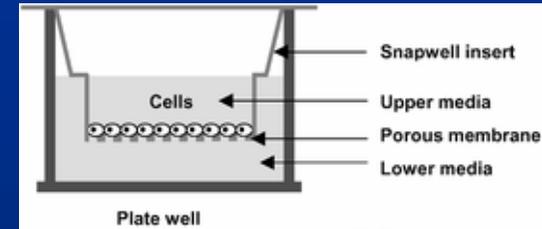
# Tenderness & texture measurements of venison

- This is a current study being conducted by a student from Norway.
- Within NZ, venison from stags and hinds is being compared, but comparisons will also be made with Reindeer meat.
- The picture shows measurements being made of compression characteristics of cooked venison samples.



# Example 3: Factors responsible for variation in the bioavailability of iron in meat

- Iron in meat is known to have a high bioavailability because much of it is as haem-Fe and because of the “meat factor”.
- Several techniques have been employed to evaluate iron bioavailability including:
  - Haem Fe as a % of total iron.
  - Caco-2 cells to measure Fe uptake.
  - Semi-anaemic piglets as a model for humans.
  - Mouse intestinal walls set up in Ussing chambers
- Variation between muscles, and effects of cooking and digestion are being assessed.



## Example 4: Development of a feed supplement for dogs based on a meat extract

- A product based on a meat extract available from corned beef production.
- Dr Brian Wilkinson of IFNHH was closely involved with its early development and more recently physiologists in IFNHH have evaluated its effect on the performance and immune status of dogs.
- Modified versions have also been shown to be effective for cats, horses, and calves.

<http://www.palamountains.com>



## New facilities at IFNHH will expand current capabilities



A key feature of the new building will be the pilot plant that will be fully accredited to full export food requirements.

Contact: Assoc. Prof Charles Brennan  
[C.S.Brennan@massey.ac.nz](mailto:C.S.Brennan@massey.ac.nz)



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