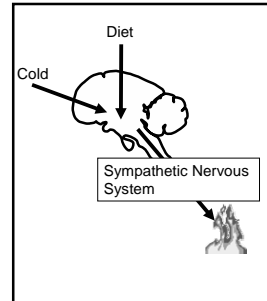


Genetic selection for temperament impacts on post-prandial thermogenesis and core body temperature in sheep

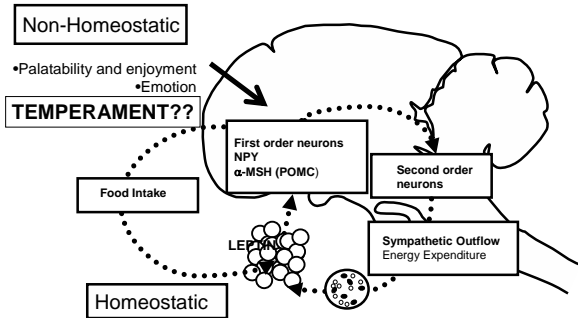
Belinda A. Henry, Dominique Blache, Alexandra Rao, Iain J. Clarke and Shane K. Maloney

Thermogenesis and Energy Expenditure



- Contributes to around 15% of total daily energy expenditure
- In rodents, known to occur in specialised brown adipose tissue (BAT)
- Recent studies have demonstrated functional brown fat in humans (NEJM 2009; 360: 1500-8; 360:1509-17; 360:1518-25, FASEB J 23: 1-23 Diabetes 58:1526-1531)
- Sheep are similar to humans in that this species has adipose regions that are particularly rich in BAT

Homeostatic versus non-homeostatic regulation of appetite and energy expenditure



Temperament and Non-exercise activity thermogenesis (NEAT)

- Human subjects that are resistant to diet-induced obesity display greater NEAT (maintenance of posture, talking, fidgeting) Levine et al., 1999.
- Similar behaviours and observations have also been reported in people with a high activity temperament.

Nervous and Calm sheep

- Sheep have been selected for Nervous or Calm traits for 16 years
- Selection was based on the arena and box tests-animal to human avoidance tests
- Does temperament cause changes in thermogenesis?

AIM: To determine the effect of inherent differences in temperament on adipose thermogenesis and thermoregulation in sheep.

- Exp 1. Effects of maintenance feeding and high or low energy intake on post-prandial temperature responses.
- Exp 2. Effects of meal anticipation on temperature profiles.
- Exp 3. Gene profiling of UCP 1, 2 and leptin mRNA in retroperitoneal and subcutaneous fat depots.


Effects of maintenance and high/low energy diets on post-prandial thermogenesis in Nervous and Calm sheep.

- Thermistor in carotid artery for measurement of core body temperature
- Temperature probe (button) in retroperitoneal fat
- Recordings @ 5min

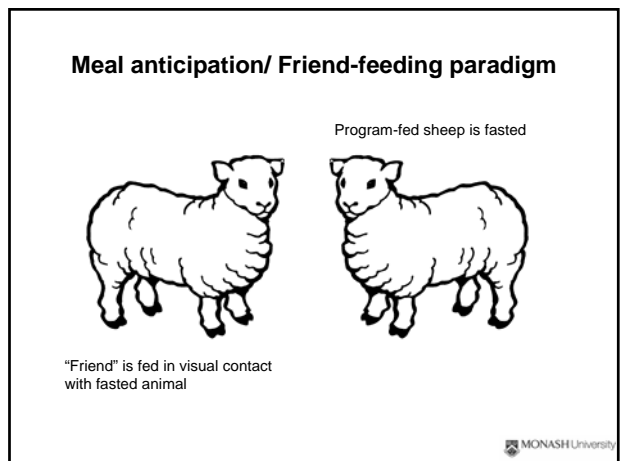
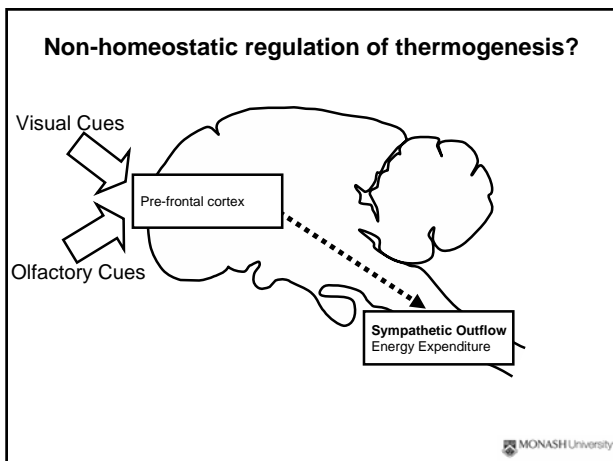
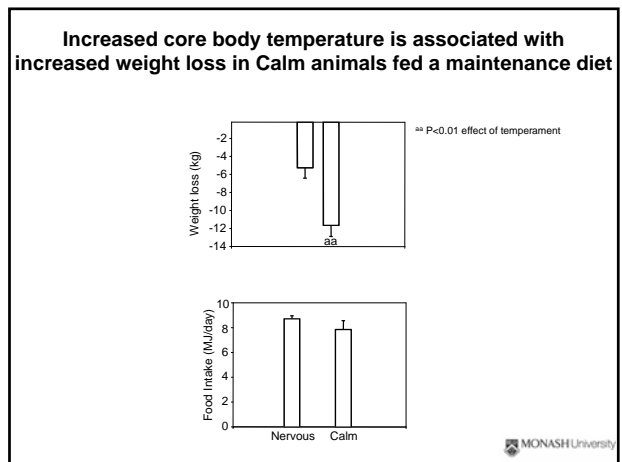
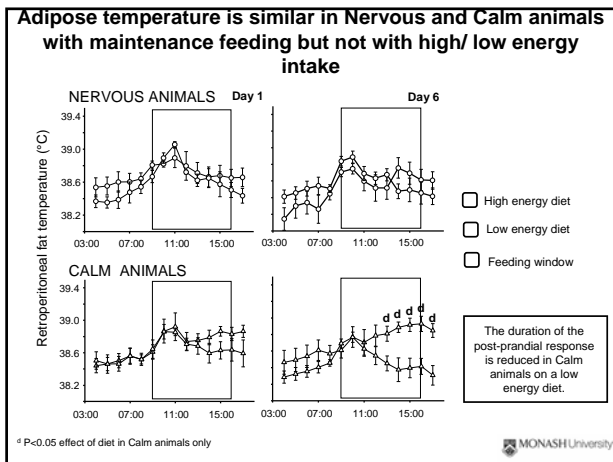
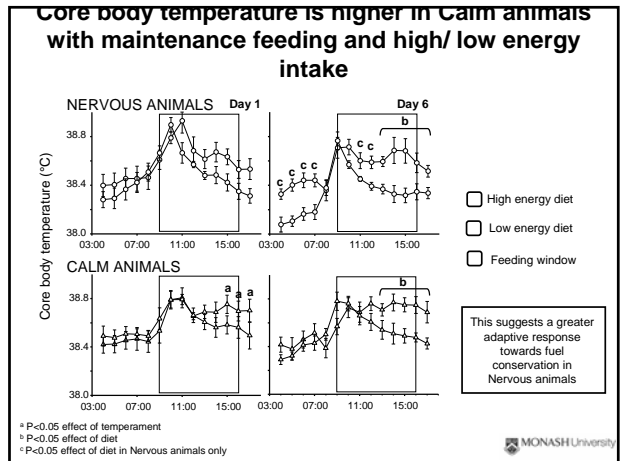
Feeding window 0900-1600h

1. Maintenance Feeding
2. High energy diet (1.5x)
3. Low energy diet (0.7x)

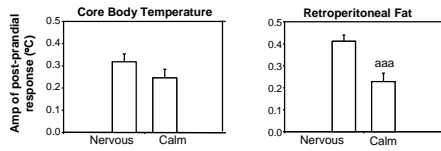
Each for 12 days



MONASH University

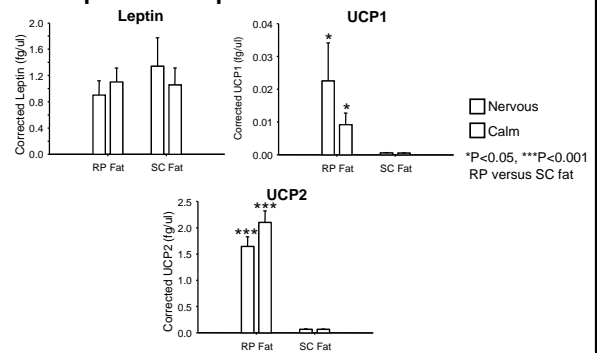


The amplitude of response to meal anticipation in adipose tissue is greater in Nervous compared to Calm animals



aaaP<0.001 effect of temperament

Effect of temperament on the expression of UCP 1, 2 and leptin in retroperitoneal and subcutaneous fat



Conclusions

- **Under homeostatic conditions,** Calm animals exhibit higher core body temperature, which appears to translate to increased energy expenditure
- Both gene (measurement of UCP1 mRNA) and temperature profiling of the retroperitoneal fat indicate that increased core body temperature in Calm animals is not due to a higher rate of putative thermogenesis.
- Other sites important for thermogenesis- skeletal muscle?
- **Under non-homeostatic conditions,** such as meal anticipation, Nervous animals exhibit a more robust thermogenic response than Calm animals.