

KEY FINDINGS OF MARBLING RESEARCH

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To make the most of export opportunities for high quality beef, Australia needs to know how to maximise marbling in the short term. The Beef CRC has given us a blueprint for now, but current research hopes to unlock new ways to produce high quality beef more efficiently.

A team of international researchers including the Beef CRC's Professor Dave Pethick has been studying the basic biology of intramuscular fat (marbling). Their work includes the intimate details of how marbling cells are formed, how genes control their development and the environmental triggers that modify how genes are expressed.

These studies are part of a network of linked projects in the CRC discovering the genes that govern how the animal uses its nutrients to grow and develop carcass tissues.

In a recent paper, the team outlined its present knowledge of the biology of marbling. The following is a summary:

- Intramuscular fat content (IMF%) or marbling score is "late maturing", meaning that marbling is usually seen later in life, as the animal matures.
- Fat is made (synthesised) within muscle throughout life when nutrition is adequate and does not only occur as animals get older. The growth of muscle slows as animals get older, and if good nutrition allows fat synthesis to continue, intramuscular fat, and therefore marble score, will increase.
- IMF% develops in three stages. There is no increase up to about 200kg carcass weight, a steady increase from 200 to 450kg and it peaks around mature body

size (about 500kg carcass weight, depending on genotype). Carcass weights rarely reach mature size in commercial systems.

- Expression of marbling after extended grain finishing is driven by three main genetic influences:
 - (i) overall fatness, i.e. fatter cattle tend to have more marbling
 - (ii) the degree of muscle development, i.e. cattle with thicker muscling (and later maturing types) tend to have less marbling
 - (iii) marbling genetics, i.e. some cattle deposit more fat as marbling rather than in their other fat depots (subcutaneous, between muscles or internal).

There is not enough yet known about how genetic factors (including new gene markers) affect the final marble score.

- The level of intramuscular fat at feedlot entry is the main factor that determines marble score after finishing. This suggests that ultrasound scanning could be used at feedlot entry to identify animals that will develop superior marbling (and those that won't).
- Intramuscular fat cells are not the same as fat cells in other depots. Their development is determined relatively early in life (3-8 months of age) which is consistent with the conclusions of CRC growth and development studies. Beef CRC scientists are now exploring the possibility that intramuscular fat can be controlled separately from fat in other depots.
- The best nutritional and/or management tool for increasing marbling is to finish cattle on a highly digestible, grain-based diet.

This provides the highest level of net energy (leading to high blood glucose levels) and promotes fat synthesis.

- Grain feeding (compared to grass) results in a higher marble score at equal carcass weights. This is probably because grain provides a higher level of available net energy.
- Heavier British type cattle (over 540kg live and 12mm P8 fat) have a low need for protein. Adding extra protein makes the ration more expensive but doesn't promote extra marbling.
- Increased processing of the grain ration (by steam flaking compared to dry rolling) improves digestion of starch and this produces better marbling.

Further reading

- Marbling biology – what do we know about getting fat into muscle? D.W. Pethick, G.S. Harper, J.F. Hocquette and Y.H. Wang. Proceedings Australian Beef - the Leader! Conference. Beef CRC Armidale, March 2006 (Full proceedings available from Beef CRC)

