CRC for Premium Quality Wool

Intrinsic Control of the Follicle Cycle

Produced for the CRC for Premium Quality Wool undergraduate program by;
Dr. Graham Cam, CSIRO Animal Production.

Chalone Hypothesis

- **The hair cycle is controlled by a locally active inhibitor that accumulates during anagen, causing the follicles to regress into catagen when a critical level of the inhibitor is reached.**
  - **this theory covers the autocrine and paracrine regulation of growth and differentiation**

CRC for Premium Quality Wool

Growth factors present during the follicle cycle and in adult sheep

- In the follicle cycle
  - Most of the TGF family do not change during the cycle
  - TGFß-3 and FGF-2 decrease during the cycle
  - EGF varied and displayed no obvious pattern

  But
  - doses of EGF cause follicles to enter telogen
- In the adult sheep
  - EGF and FGF-2 are present in ORS
  - the dermal papilla does not contain EGF or FGF-2

CRC for Premium Quality Wool

Molecules involved in the follicle cycle, initiation and development

- BMP-2 & 4
  - inhibits proliferation of bulb cells
- KGF/FGF-7
  - present in developing follicles and the papilla
  - less follicles and abnormal follicles develop if the FGF-7 receptor is altered
  - administration of FGF-7 increases fibre density
- TGF-α
  - deletion of TGF-α affects the shape of the fibres and follicles
  - present in IRS above the bulb
  - EGF receptor (EGFR; which TGF-α can use) is present in ORS
  - hair growth may be controlled by interactions with TGF-α and EGFR

Future Directions

- Follicle culture
- *In-vivo* test system
- Mapping of genes
- Strategies for gene identification which involves identifying genes that:
  - are known to be critical to fibre production, such as the keratins and cell proliferation,
  - have been shown to affect skin and/or follicle function in other species,
  - have been implicated in developmental systems with similarities to the development of the wool or hair follicle.

CRC for Premium Quality Wool

Summary

- There are many molecules that have been implicated in follicle initiation, development and the follicle cycle.
- It is likely that some molecules perform similar functions (e.g. multigene families, EGF/TGFα), so if one is missing, the follicle may still function.
- It appears that gene cascades can be recyled throughout development for the construction of different appendages (e.g. limbs and follicles)
- The interaction between molecules may modulate follicle function.