# Discovering pieces of the puzzle

**Each year we witness the dramatic process of antler regeneration. The antler can increase in length at up to 2 cm a day and some deer farmers may even suggest that on a good day you can actually see it growing.**

**By Jimmy Suttie, Dawn Clark and Stephen Haines of AgResearch Invermay**

The growth occurs from the tip of the antler which, when examined microscopically, is a series of highly organised tissue types. Certain cells within the region at the tip known as the mesenchyme divide at a tremendous rate to give rise to the new antler.

We know only a little about what controls this complex growth process.

A better understanding may not only allow us to control such factors as antler size and branching, but will give real insights into the mechanisms behind the medicinal applications of velvet. It may even allow the development of new therapies based on extracts of velvet.

We can glean information that is applicable to antler growth from other areas of scientific research.

In particular there is now a large body of information relating to the growth of cancer. Cancer shares the rapid growth rate of antler but without the programmed order observed in the antler.

Another model, which is of real interest, is the rapid growth seen during foetal and placental development. Tissues undergoing wound repair also combine the attributes of rapid and controlled growth.

Clues as to which substances might control antler growth have already come from examining what is known about the fast growth seen in these systems.

Research at Invermay has used modern molecular biology techniques to identify substances contained in antler known as growth factors and which direct different aspects of antler growth.

These growth factors are extremely potent in very low doses and, when found in certain combinations, could explain some of the growth attributes displayed by antler.

One example of these discoveries is the recent finding of a nerve-stimulating factor in antler.

This small protein has been shown to be involved in both the growth and survival of nerves in other systems and its localisation and level of expression in antler suggest it may also play an important role in the antler.

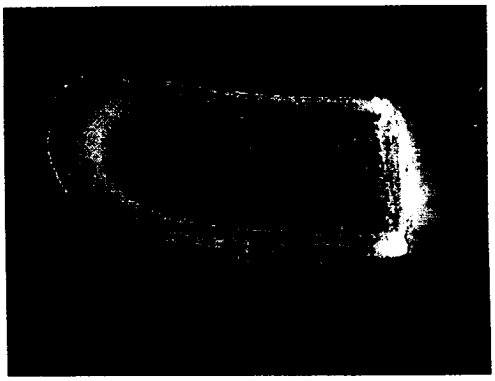
Understanding nerve growth in antler may well provide very useful information on how nerves re-grow after damage as well as how to maintain healthy nerves in other tissues.

Like nerves, the blood vessels within the antler also grow at a tremendous rate.

One substance we have found in the antler is an angiogenic growth factor and, based on its known activity in other tissues, this is likely to contribute to the process of blood vessel growth.

In human health, both too much and too little blood vessel growth can result in serious disease conditions. We are interested in what the antler can teach us about how this process is regulated.

Other factors we have found include bFGF (basic Fibroblast Growth Factor). This has been identified around the hair follicles and may be important for their growth. IGF-I and IGF-II (Insulin-like Growth Factors I and II) are also present in significant concentrations in the antler and are likely to be involved in its general growth rate. Members of the TGF family (Transforming Growth Factor) have also been identified and these factors are known to be involved in the development of bone tissue.



***Velvet antler – on a good day you can almost see it growing***

Knowing that these factors are present is only the first part to unravelling the puzzle. The real objective is to understand their precise role in antler growth and how an increase or decrease in these growth factors will affect the final shape and size of antler.

There is also much interest in investigating different ways of preserving these factors after velveting so that they can be used in new medicinal preparations.

These are some of the exciting challenges facing the velvet programme at Invermay as it heads into the new millennium. ■