THE EXPRESSION OF GROWTH FACTOR GENES IN THE TIP OF THE GROWING DEER ANTLER

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Antler growth, which begins in spring immediately after the casting of the previous year's hard antler, coincides with low plasma levels of testosterone and high levels of insulin-like growth factor I (IGF-I). The seasonal cycle of testosterone is thought to be responsible for the timing of antler growth, while IGF-I probably supports the actual growth. The antler grows very rapidly, at up to one cm per day, from the tip. To support the rapid tissue growth and differentiation, locally produced growth factors may be required to act in a paracrine manner, as has been shown in foetal bone (1). To investigate this hypothesis, the expression of known growth factor genes was analysed using the reverse transcriptase polymerase chain reaction (RT-PCR) protocol.

Antler tissue was obtained after 60 days of growth, which is about midway through the growth process. The top 2 cm was removed, dissected into four zones: Epidermis and Dermis, Reserve mesenchyme, Precartilagenous and Cartilagenous tissues and frozen in liquid nitrogen. Total RNA was prepared in guanidium isothiocyanate, followed by extraction in phenol/chloroform and DNase treatment. 250 ng was reverse transcribed and used in PCR reactions with appropriate primers. IGF-I and IGF-II were both strongly detected in all four zones, indicating that local as well as systemic IGF is important for antler growth. Transforming Growth Factor beta (TGFβ) 1 and TGFβ2, which are involved in bone growth and remodelling, were also detected in the four antler tissues. The proto-oncogenes c-fos and c-myc, which are associated with growth and differentiation of many tissue types, were also expressed in the four zones of the antler tip. This is the first demonstration that multiple growth factors are expressed in the tip of the growing antler. It is likely that they are involved in the rapid growth and differentiation, however the precise roles and regulation of these growth factors require further investigation.

1. Hill, D.J.; Logan, A.; McGarry, M. and De Sousa, D. 1992. *Journal of Endocrinology*, **133**: 363-373.