

## UNIQUE AND CONSERVED CHARACTERS IN SALMON TOOTH DEVELOPMENT

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**INTRODUCTION:** As part of a large scale investigation on the development and renewal of the dentition in Atlantic salmon (*Salmo salar* L.), we have recently analysed patterns of early tooth initiation and of replacement tooth formation throughout nearly all life stages [1,2]. Characters peculiar to salmon teeth include structural features, such as the persistence of atubular dentine even in adult fish, and developmental features, such as the gradual establishment of multiple cell layers between inner and outer dental epithelium. We here term these cell layers middle dental epithelium. Placing the histogenesis of replacement teeth into an evolutionary context, suggests that the formation of replacement teeth is a result of heterochrony and we hypothesise that the middle dental epithelium plays an essential role in the replacement process [3].

**METHODS:** To explore the molecular basis of tooth replacement, we have embarked upon a gene expression study by means of *in situ* hybridisation on cryosections of juvenile salmon, using digoxigenin-labeled antisense riboprobes directed against a number of key regulatory genes such as *bmp2*, *bmp4*, and *sox9* and structural genes such as *coll1a1* and osteocalcin (= *bgp*, Bone Gla Protein). We have compared expression patterns of these genes to those in other skeletogenic cells such as osteoblasts, chondroblasts, and chondrocytes at the animals' lower jaw.

**RESULTS & DISCUSSION:** Our studies reveal both, a localisation of transcripts that is in accordance to studies on mammalian tooth development and a localisation of transcripts that is specific to salmon (respectively specific to teleosts). The epithelial expression of *sox9* and a shift of the expression of *bmp2* from epithelium to mesenchyme have also been observed during mammalian tooth development. Different from previous reports, are the expression of *coll1a1* and *bgp*. Apart from being expressed in odontoblasts, *coll1a1* is strongly expressed in the inner dental epithelium, representing the first report of

ameloblast involvement in collagen type I production. *coll1a1* is also observed in the basal layer of the oral epithelium, in agreement with a previous study reporting collagen type I alpha 2 production in the basal epidermal layer of fish skin [4]. In agreement with studies of *Bgp* expression in mouse bone [5] but in contrast to what has been reported about *bgp* expression in zebrafish [6], *bgp* is not expressed in odontoblasts, nor in the osteoblasts involved in the attachment of the teeth. At the lower jaw, we find *bgp* expression in old and resting osteoblasts only. These unusual findings are discussed in the light of the features particular to salmon teeth.

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