CELL FATE SPECIFICATIONS DURING SUTURE FORMATION: CONSEQUENCES FOR CRANIOSYNOSTOSIS

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INTRODUCTION: At a molecular level we have a good understanding of what regulates the commitment of undifferentiated mesenchymal cells into osteoblasts. However, we know surprising little about the cellular processes that control intramembranous bone growth which accounts for the majority of the growth of the face and calvaria and in the surface periosteum of most bones during modeling and remodeling.

METHODS & RESULTS:: : In this study we have addressed the fundamental question of what cellular mechanisms control the growth of the calvarial bones and conversely, what is the fate of the sutural mesenchymal cells when calvarial bones approximate to form a suture. There is evidence that the size of the osteoprogenitor cell population determines the rate of calvarial bone growth. In calvarial culture we reduced osteoprogenitor cell proliferation by 50%; however, we observed a reduction in parietal bone growth of only 19%. This discrepancy prompted us to study whether suture mesenchymal cells participate in the growth of the parietal bones. We found that proliferation and subsequent differentiation of osteoprogenitors at the osteogenic fronts, although important, is not the only cellular mechanism that contributes to calvarial bone growth. Sutural mesenchymal cells can differentiate into osteoblasts and become incorporated into the growing parietal bones, but only if adjacent to the osteogenic fronts.

DISCUSSION & CONCLUSIONS: The fate of calvarial mesenchymal cells varies depending on their position within the suture. Under normal conditions we demonstrate that a small percentage of sutural mesenchymal cells are incorporated into the growing bones. We can hypothesize that during pathological conditions such as craniosynostosis the relative contribution of recruitment from the mesenchyme into the calvarial bones may be altered.

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