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Lizards as model for organ regeneration in amniotes: results and perspectives

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Lizards represent ectotherm amniotes with the broader tissues and organ regeneration, in the tail, and more limited recovery capabilities present in vertebrae, knees, and spinal cord. After lumbar spinal cord injury and initial paralysis, a limited and weak hindlimbs movement is often re-gained. While in the tail numerous tissues are reformed, the amputated limb incurs in a strong inflammation and eventually gives rise to a scarring outgrowth, like in mammals. The cellular processes of tail and limb regeneration are presented, indicating that FGFs and other growth factors sustain the process of tail regeneration in conjunction with the formation of an apical epidermal cap in the blastema, a leading microregion that is missing in the scarring limb. Administration of FGFs however improves limb regeneration in lizards, allowing tibia and fibula regeneration but no regeneration of the autopodium. Recent transcriptome data have indicated that the regenerating tail blastema is largely sustained by Wnt and snoRNAs that are expressed in an immuno-depressed environment while in the limb blastema an intense activation of inflammatory genes and no immuno-depression occurs, leading to scarring. The tail blastema appears as a temporary proliferating front with a strict control of cell division where no immune-reactivity and organ rejection occurs. The evolution of the mechanism of immuno-evasion in lizards remains to be analysed. In conclusion, the lizard model provides important clues to improve organ regeneration in amniotes, including mammals, providing that pharmacological therapies depressing immunity and controlling cell proliferation are utilized in concert.

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