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COMPARED PATTERNS OF ARM REGENERATION IN DIFFERENT TAXA OF ARMED ECHINODERMS

Regeneration is a post-embryonic developmental process common in Metazoa, although it tends to be less widespread in the more complex-bodied phyla. An exception to this rule are echinoderms, which are known for phylum-wide and extremely advanced regenerative abilities, being able to regrow all appendages, and often large parts of the central body and viscera (CANDIA CARNEVALI, 2006).

Armed echinoderms (Crinoidea, Asteroidea, and Ophiuroidea) are especially practical models as their arms are easy to amputate, and their proximo-distal extension provides a useful reference point to describe the regenerative processes.

Samples of four species from these taxa – the crinoid *Antedon mediterranea*, the asteroids *Echinaster sepositus* and *Coscinasterias tenuispina*, and the ophiuroid *Amphipholis squamata* – were subjected to arm amputation to study the progression of arm regeneration from a morphological point of view by means of different microscopy analyses. Particular attention was given to the "axial structures", defined as the continuous elements running along the proximo-distal axis of each arm, namely the radial water canal, the radial nerve cord, and the arm coelom, as they are believed to be fundamental for the re-organization of the regenerating arm.

The comparison highlighted commonalities and differences of arm regeneration in the different taxa. Distal structures, represented in crinoids by the apical blastema and in asteroids and ophiuroids by the terminal ossicle and tube foot, form very quickly, whereas the proximal region develops later, in proximal-to-distal direction. This is in accordance with previously published models of echinoderm regeneration (MOOI *et al.*, 2005; BEN KHADRA *et al.*, 2018). These similarities suggest that the mechanism of regeneration has ancient origins and is extremely conserved through echinoderm evolution. Within the proximal region, the axial structures themselves develop earlier than the nearby discrete structures (e.g. ossicles and tube feet), and seem to have a crucial role in their organization, providing material and possible signalling molecules for the growing tissue. The cellular component of the nerve grows before any other structure, including its own fibres, thus confirming a primary role of the nervous system in the whole process.

Molecular analyses must be combined to morphology data to improve our understanding of similarities and differences of the regenerative process as it occurs in the different echinoderm taxa, as well as in different animal phyla, and to identify related processes in both regeneration-competent and non-competent species.

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