Recovery process in sponges: morphogeneses and cell sources

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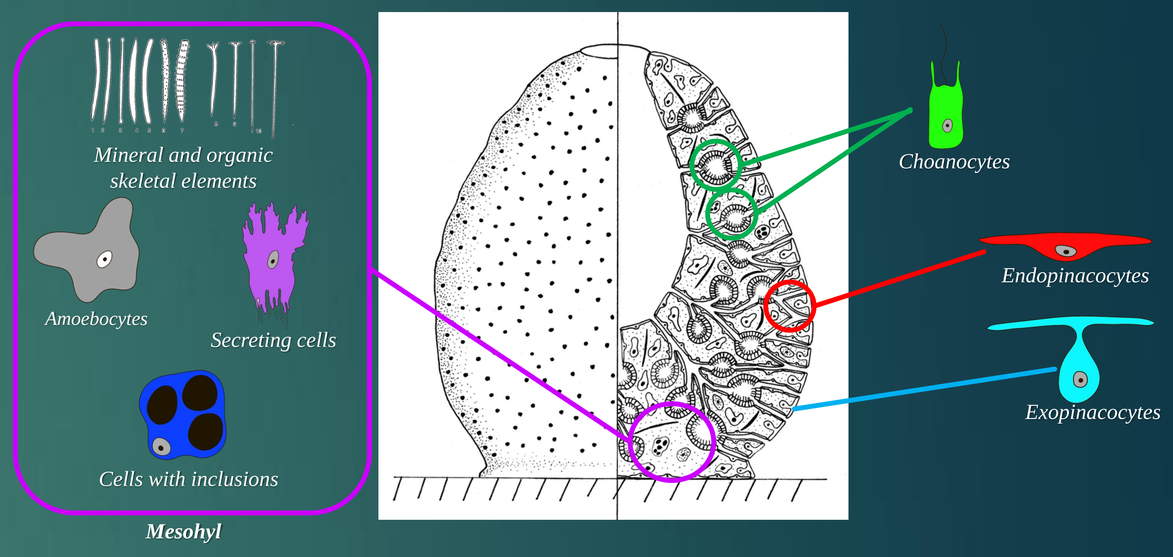
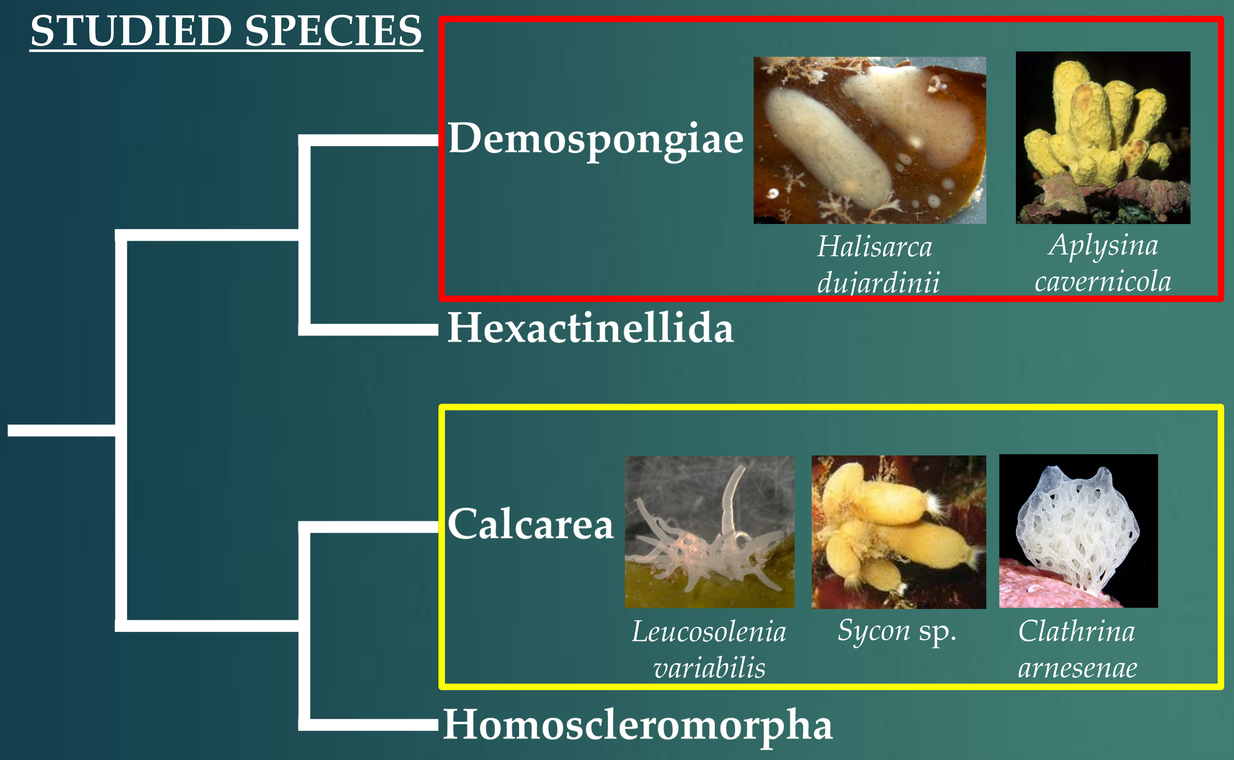
INTRODUCTION

Sponges (phylum Porifera) are one of the most ancient multicellular animals, which have the peculiar histological structure. They demonstrate a high plasticity and mobility of all tissues and cells in their body. One of the forms of manifestation of such plasticity is outstanding recovery abilities of sponges, ranging from wound healing to re-building of a functional body from dissociated cells. Sponges show a wide diversity of regeneration mechanisms and, thus, are exceptionally important for understanding the evolution of animal regeneration mechanisms. However, only a few reliable data on the mechanisms (morphogenesis, cell behavior, and regulation) of sponge regeneration and its distribution among sponge clades exists for now.

GENERAL ORGANIZATION OF SPONGE

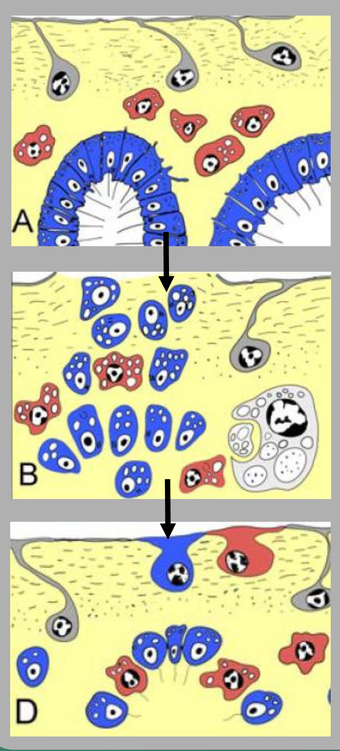


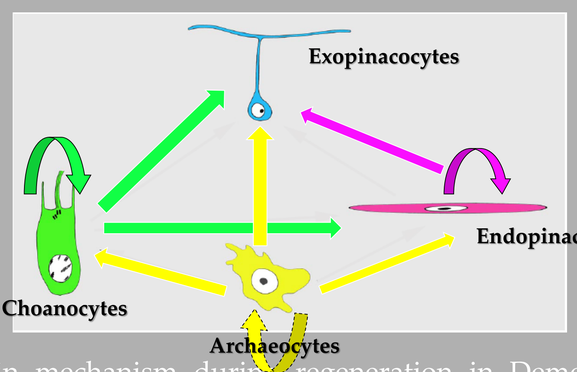
STUDIED SPECIES



REPARATIVE REGENERATION

Demospongiae (H. dujardinii, A. cavernicola)

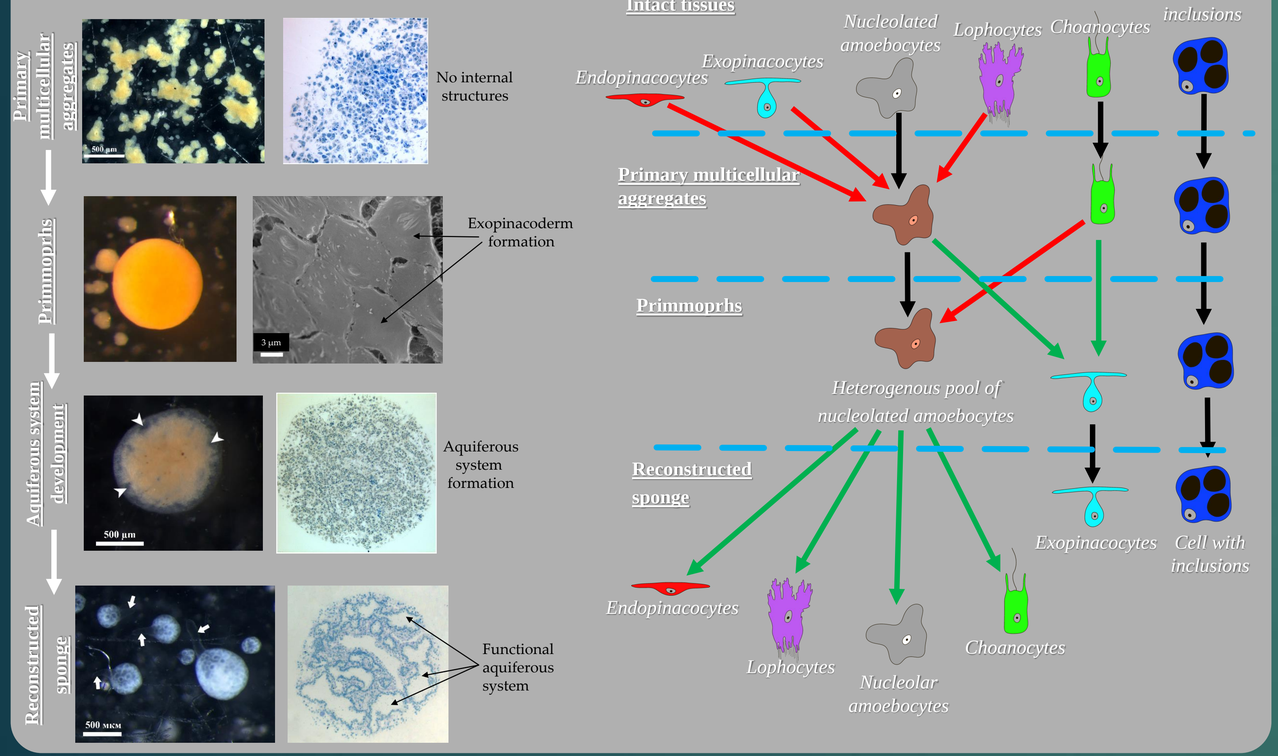




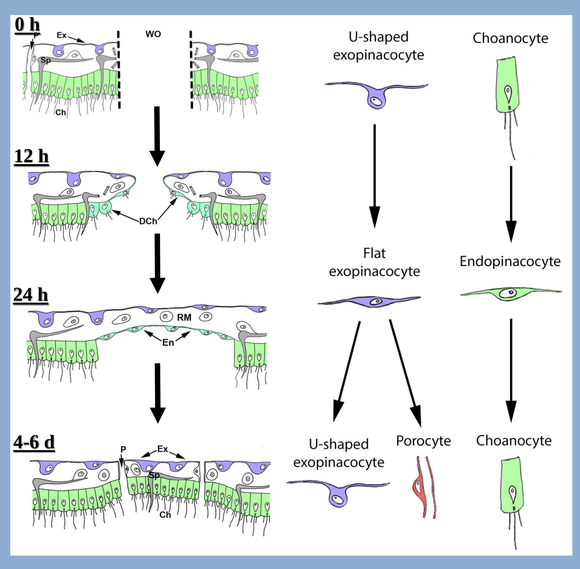
1) The main mechanism during regeneration in Demospongiae is a mesenchymal morphogenesis by mesenchymal-epithelial transformations.
2) This regeneration involves intervention of polypotent cells - *archaeocytes* and *choanocytes* - that migrate to the injured area where form a blastema with dedifferentiated cells.
3) The regeneration in *Halisarca* has epimorphosis features that require blastema formation, active cellular dedifferentiation and proliferation prior to the replacement of the lost body part.
4) There are three main sources of the new exopinacoderm during regeneration: choanocytes, archaeocytes and (rarely) endopinacocytes.

CELL REAGGREGATION

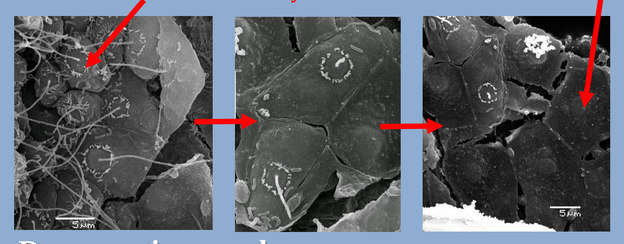
Demospongiae (H. dujardinii)



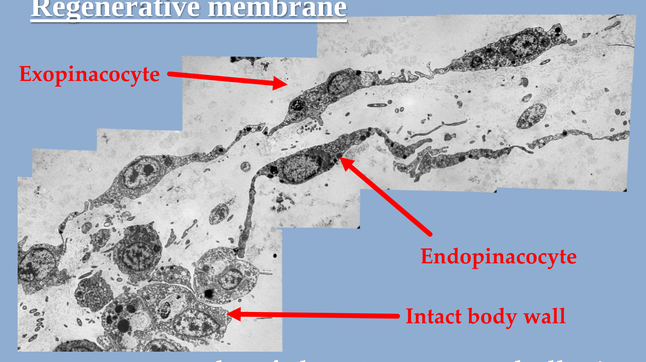
Calcarea (L. variabilis)



Choanocyte flattening

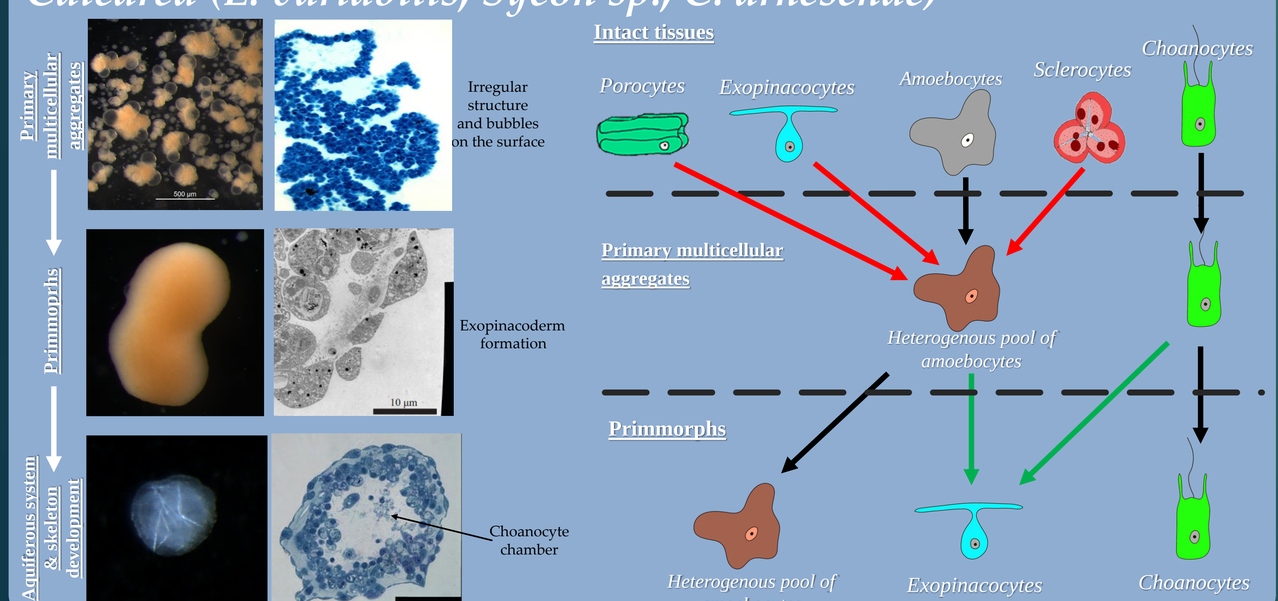


Regenerative membrane



The regeneration in *Leucosolenia* represents a rare example of the «true» morphallaxis. All processes occur solely through spreading and fusion of the epithelia surrounding the wound, accompanied by the transdifferentiation of the choanocytes and exopinacocytes. There are no changes in activity and distribution pattern in the proliferating cells, in both tissues, adjacent and distant from the wound. There are also no blastema nor any elements of mesenchymal-epithelial transitions. The transdifferentiation capacity of choanocytes and their involvement in regeneration supports the hypothesis that these cells combine features of somatic and stem cells.

Calcarea (L. variabilis, Sycon sp., C. arnesenae)



CONCLUSION

During recovery processes, sponges utilize diverse and complex morphogenetic mechanisms, with a particular importance of cell transdifferentiation. While all sponges demonstrate high recovery abilities, the morphogeneses and cell sources for the recovery of lost structures varies in different clades.

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