

Preface

Why publish a new book on invertebrate stem cells—and particularly one with a focus on aquatic invertebrates? The answer lies in a rapidly evolving stem cell discipline, driven by ever-advancing molecular tools and imaging techniques, today being one of the most dynamic areas in biology and biomedicine. This inevitably influences the research on invertebrates, with a noteworthy reference to aquatic organisms. Indeed, aquatic invertebrates represent the greatest majority of animal biodiversity. They exhibit various biological features that are of vast interest to stem cell researchers and biologists in general. These include the high regenerative power displayed by a broad range of taxa, the lack of early germ cell sequestering, and a widespread presence of asexual reproduction, dormancy, postponed aging and rejuvenation. All of these phenomena are associated with the action of pools of adult stem cells throughout the animals' life cycles (Ballarin et al. 2018).

Current research on aquatic invertebrate stem cells takes advantage from new experimental approaches and an increasing number of sequenced animal genomes and transcriptomes available in databases. The accumulated results reveal that aquatic invertebrate stem cells have unique features not recorded in the vertebrates and model terrestrial invertebrates, such as their high abundance (up to 40% of the entire body cells in some taxa) and their often indeterminate capacity for growth. They further express typical stemness genes, previously considered an attribute of germ cells, including *piwi*, *vasa*, *nanos*, and more (Rinkevich et al. 2022), and they are directly involved in the control and modulation of innate immune responses (Ballarin et al. 2021). Finally, aquatic invertebrate stem cells challenge the concept of the stem cell niche as defined in vertebrates and ecdysozoans (Martinez et al. 2022). The following chapters elaborate on several of these aspects.

This book stems from the activities within the COST Action 16203 MARISTEM Stem cells of marine/aquatic invertebrates: from basic research to innovative applications, which will end on 1 April 2022. It represents one of the final deliverables of four years of interaction and collects the contributions of a relevant part of its members. It holds 11 chapters dealing with sponges, cnidarians, flatworms, echinoderms and tunicates, highlighting the best-studied adult stem cell lineages among aquatic invertebrates. Four chapters review stem cell dynamics in regeneration, development, tissue homeostasis, and symbiosis. Another four chapters discuss profiles of stem cell-specific gene expression and the action of glycoproteins and fatty acids. Three chapters describe efforts to approach the long-term goal of establishing invertebrate stem cell cultures.

We thank all the contributors to this volume and Oliva Andereggen and Jelena Milojevic for their friendly support and for cautiously handling all editorial issues. Our hope is that this book can stimulate researchers to pay closer attention to

organisms from aquatic environments, as those—due to their simple Bauplan and to the high potentialities of their stem cells—will advance our knowledge in basic biological processes.

References

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