

# METHODS IN MOLECULAR BIOLOGY

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# **Salamanders in Regeneration Research**

## **Methods and Protocols**

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## Preface

Many of the most fundamental discoveries in experimental biology, such as the embryonic organizers, neuronal specificity, nerve guidance, and units of DNA transcription, originate from salamander research. Salamanders are the only tetrapods capable of repeatedly regenerating entire limbs as adults, and they also display the widest range of regeneration capacities of other complex tissues and organs. These animals constitute unique models for understanding critical processes underlying morphological and functional restoration of lost or damaged structures in vertebrates. The present volume focuses on this particular aspect of salamander biology, which has gained new momentum during the past 10–15 years, partly due to the general interest in stem cells and regenerative medicine. A combined search on *Google scholar* using the terms “salamander” and “regeneration” shows a steady growth in the number of yearly publications with a 140 % increase between 2001 and 2013, resulting in more than 10,000 published articles during this period.

There are considerable variations among the most commonly studied salamanders in the laboratory in terms of their general physiology, life cycle, regeneration spectrum, and also mechanisms by which replacement structures form. The first part of the book outlines the best practices and conditions for maintaining the most commonly used salamander species in the laboratory. The chapters of the two following parts describe experimental manipulations *in vivo* and *in vitro*, respectively. These include methods targeting a wide variety of structures, ranging from the limb to the heart and to the brain. The two final sections deal with genetically modified organisms and tools for mining in the genomic databases. These chapters illustrate the boom of recent technical developments, which provide new platforms for understanding salamander regeneration using the most modern molecular tools. The methods chapters of this book are preceded by an inspiring essay on salamander regeneration from phylogenetic and evolutionary perspectives by Jeremy Brockes, who has greatly contributed to revitalize this research field.

Finally, we thank all the colleagues for their invaluable time and efforts to provide with all the finer details to produce this comprehensive collection of methods chapters. We hope that this collection will be useful to all, who already are devoting our activities to salamander regeneration, as well as for those who are just considering to dwell on to this intriguing problem.

*London, UK*  
*Stockholm, Sweden*

*Anoop Kumar*  
*Andr as Simon*



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