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## Preface

*It is for the science of the future to change, if possible, this harsh decree. Inspired with high ideals, it must work to impede or moderate the gradual decay of the neurons, to overcome the almost invincible rigidity of their connections, and to re-establish normal nerve paths, when disease has severed centres that were intimately associated.*

Santiago Ramon y Cajal,  
Degeneration and Regeneration of the Nervous System, 1913.

Around 100 years ago, Cajal wrote of how science of the future needed to be able to reestablish normal nerve paths after they had been severed. Today, there has been a great deal of progress in terms of our scientific understanding of how and why the mature mammalian central nervous system (CNS) does not regenerate after injury. However, an effective clinical therapy to repair the damaged CNS still eludes us. Over many years of dedicated and remarkable research, great strides have been made to reveal the physical, cellular, and molecular mechanisms underlying axon growth and why this is prevented in the mature CNS. It now seems clear that this failure is a combination of both an extrinsic inhibitory barrier in the CNS environment and an intrinsic inability of mature neurons to overcome this obstacle.

In this volume, *Axon Growth and Regeneration: Methods and Protocols*, I have aimed to bring together a diverse set of techniques that can be used to study the mechanisms underlying CNS axon growth and consequently, hopefully, provide a resource that will aid in the development of repair strategies. The first part provides a brief perspective outlining some of the current understanding in the field. Parts II and III focus on axon growth in vitro, providing a range of protocols that can be used to examine intracellular signaling pathways, axonal responses to extracellular factors, and methods for quantifying outgrowth. Part IV provides protocols for inducing experimental injury in vivo as well as some highly promising protocols for promoting regeneration. Finally, Part V provides a series of protocols that can be used to monitor the extent of axon regeneration in vivo, ranging from tract tracing to in vivo imaging and functional recovery.

While intended to be extensive, the volume is by no means all inclusive, due to the vastness of the field. However, the range of protocols provided in this volume will hopefully provide a significant set of diverse tools for researchers studying axon regeneration, and I am personally eager to see them used in the next generation of exciting new discoveries in the field. I would like to thank all of the contributors who invested their time and energy in this volume allowing this collection to come to light. I very much hope you enjoy this volume of *Methods in Molecular Biology*.

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Axon Growth and Regeneration

Methods and Protocols

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