

NEUROMETHODS

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Gene Delivery and Therapy for Neurological Disorders

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Series Preface

Experimental life sciences have two basic foundations: concepts and tools. The *Neuromethods* series focuses on the tools and techniques unique to the investigation of the nervous system and excitable cells. It will not, however, shortchange the concept side of things as care has been taken to integrate these tools within the context of the concepts and questions under investigation. In this way, the series is unique in that it not only collects protocols but also includes theoretical background information and critiques which led to the methods and their development. Thus it gives the reader a better understanding of the origin of the techniques and their potential future development. The *Neuromethods* publishing program strikes a balance between recent and exciting developments like those concerning new animal models of disease, imaging, in vivo methods, and more established techniques, including, for example, immunocytochemistry and electrophysiological technologies. New trainees in neurosciences still need a sound footing in these older methods in order to apply a critical approach to their results.

Under the guidance of its founders, Alan Boulton and Glen Baker, the *Neuromethods* series has been a success since its first volume published through Humana Press in 1985. The series continues to flourish through many changes over the years. It is now published under the umbrella of Springer Protocols. While methods involving brain research have changed a lot since the series started, the publishing environment and technology have changed even more radically. Neuromethods has the distinct layout and style of the Springer Protocols program, designed specifically for readability and ease of reference in a laboratory setting.

The careful application of methods is potentially the most important step in the process of scientific inquiry. In the past, new methodologies led the way in developing new disciplines in the biological and medical sciences. For example, Physiology emerged out of Anatomy in the nineteenth century by harnessing new methods based on the newly discovered phenomenon of electricity. Nowadays, the relationships between disciplines and methods are more complex. Methods are now widely shared between disciplines and research areas. New developments in electronic publishing make it possible for scientists that encounter new methods to quickly find sources of information electronically. The design of individual volumes and chapters in this series takes this new access technology into account. Springer Protocols makes it possible to download single protocols separately. In addition, Springer makes its print-on-demand technology available globally. A print copy can therefore be acquired quickly and for a competitive price anywhere in the world.

Saskatoon, Saskatchewan, Canada

Wolfgang Walz

Preface

Gene therapy, once labeled as a hype by skeptics, is now becoming a reality due to the development of safer and more efficient viral vectors. Three gene therapy drugs, two for cancer and one for lipoprotein lipase deficiency, have been approved in China and the European Union, and hundreds of clinical trials of gene therapies are in progress. Gene therapy can be used to treat not only the diseases caused by genetic defects but also medical conditions such as nerve injury and pain by manipulating gene expression. For most types of neurological disorders, there are currently no effective treatments based on conventional pharmaceuticals and surgical practice to slow or stop disease progression and regain normal neurological functions. Gene therapy is emerging as a powerful approach with potential to treat and perhaps even cure many neurological disorders. Better understanding of the underlying genetic and molecular mechanisms for neurological disorders and the development and improvement of gene delivery vectors and methods has made gene therapy clinically applicable. Development of gene therapy for different neurological disorders is at various stages, from lab-based research only to Phase II clinical trials. More and more neuroscientists and neurologists have employed or intend to employ gene-targeting techniques for the development of potential gene therapies for neurological disorders.

The chapters in this volume provide a brief overview of the latest developments in adeno-associated viral and lentiviral vectors as well as the gene therapy strategies for the most common neurological disorders, followed by a step-by-step guide on viral vector-based gene delivery in animal models used in the authors' laboratories. We hope this book will serve as a guide for researchers to explore the potentials of gene therapy for neurological disorders. Although safe gene manipulation in neural cells can be achieved, it may still be years away from efficacious gene-based treatment of neurological disorders such as Parkinson's and Alzheimer's diseases due to the complexity of the underlying genetic/molecular mechanisms and the lack of reliable animal models. However, such obstacles are being and will be overcome, and gene therapy will revolutionize medicine in the future.

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Joost Verbaagen

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