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Neurodegenerative Diseases Biomarkers

Towards Translating Research to Clinical Practice

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 **Humana Press**

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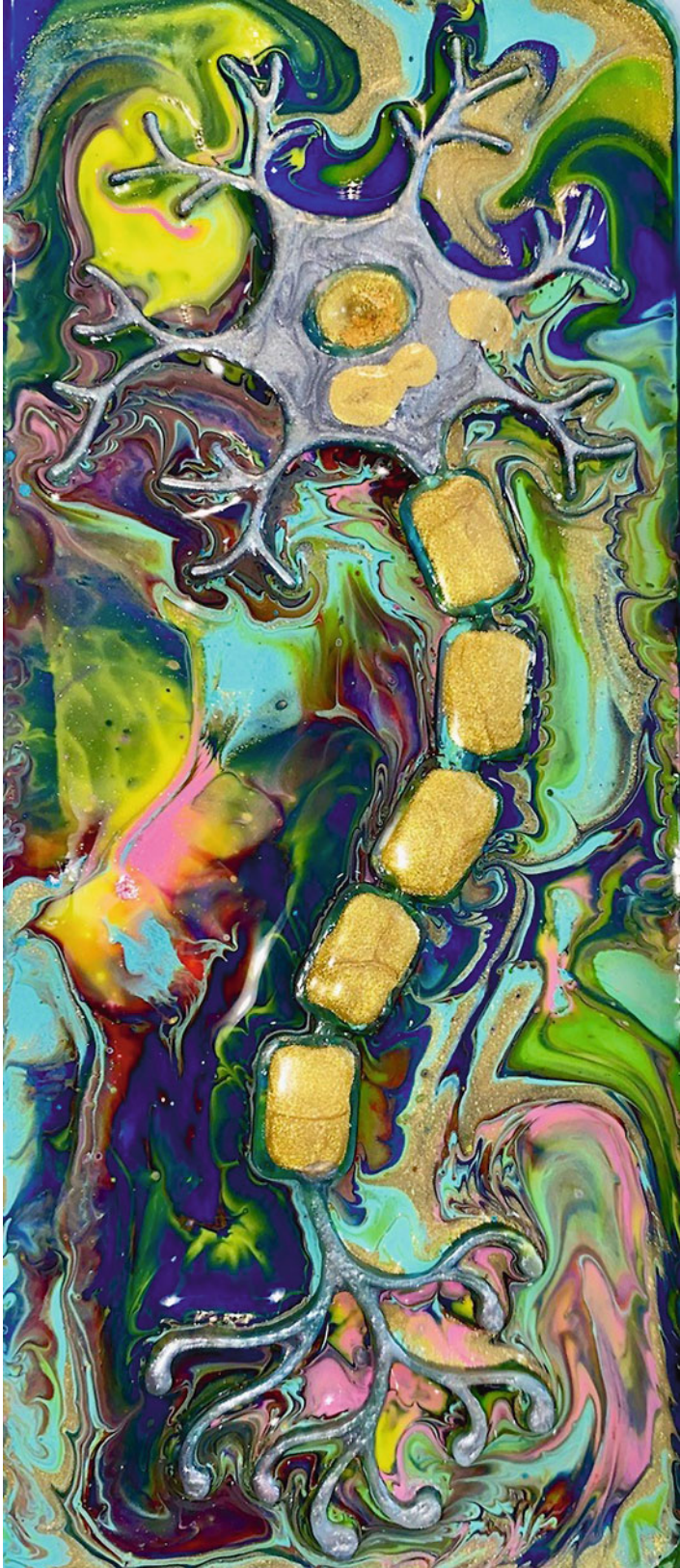
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Cover Caption: This custom piece was created by Dr. Bridget Martinez and Dr. Donald Mario Robert Harker using acrylic paint on canvas with the addition of graphic design. This artistic rendition encapsulates the cognitive abilities that machines seek to recreate – an unparalleled, beautiful assembly - Bridget Martinez, MD, PhD

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Dedication

The COVID-19 virus has affected so many families in different parts of the world, and for some life will never be the same again. A few countries have done well in containing the virus, but in others the virus is/has been rampant with huge loss of lives. While we may never know the origin of the virus, we must be vigilant to ensure that nothing like this happens again. Many medical researchers, frontline hospital workers, and first responders have lost their lives in fighting the virus, and we pay tribute and dedicate this book to them. We look forward to the world slowly recovering from the effects of the pandemic and remember the words of Captain Sir Thomas Moore who valiantly fundraised for the NHS in Britain “Tomorrow will be a good day.”

With all its sham, drudgery and broken dreams, it is still a beautiful world. Be cheerful. Strive to be happy.

(Desiderata, Max Ehrmann)

Philip V. Peplow
Bridget Martinez
Thomas A. Gennarelli
31 May 2021

Preface to the Series

Experimental life sciences have two basic foundations: concepts and tools. The *Neuro-methods* 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 *Neuro-methods* 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 *Neuro-methods* 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. *Neuro-methods* 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, SK, Canada

Wolfgang Walz

Preface

Neurodegenerative diseases (NDs) are increasing in incidence in adults, and this increase is expected to continue. The increase is exacerbated by extended life expectancy from improved health care in many developed and developing countries. Considerable effort is being given to developing reliable and validated biomarkers for NDs so as to dramatically accelerate research on the etiology, pathophysiology, and disease progression of a number of prevalent and devastating NDs.

It is the goal of this book to provide a forum for both experimental and clinical international experts in the field of ND research to present recent data on the latest achievements in new and emerging technologies for biomarkers and for innovations in their assessment. Theoretical backgrounds together with tested protocols that reproduce experimental, clinical laboratory, and instrumental methods for educational purposes are presented. It is hoped that the topics covered herein will extend knowledge on the role of novel biomarkers in different types of NDs and that this will lead to a more effective approach to clinical management and ultimately to benefit patient care.

We wish to express our deep appreciation and gratitude to each of the chapter authors for the time and effort spent on writing informative reviews on their respective areas of clinical and research interest. This task was complicated by the national lockdowns in many countries during the global COVID-19 pandemic. Also we wish to thank Professor Wolfgang Walz, Series Editor, Springer *Neuromethods* series, and Anna Rakovsky, Assistant Editor, Springer Protocols, for their help, encouragement, and advice in putting together this book.

Dunedin, New Zealand
Reno, NV, USA
West Chester, PA, USA
27 March 2021

Philip V. Peplow
Bridget Martinez
Thomas A. Gennarelli

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