Foreword

In the last century, biologists have elucidated the fundamental basis of the simplest phenomena and mechanisms underlying life. We now know what the genetic material, the genetic code is and what are the mechanisms for its replication and expression in the living cells. We have also gained a high amount of knowledge on how molecules serve to cell differentiation and function, and on how cells interact to create organized tissues and organs. We also have started to have a glimpse on how these cellular phenomena lead to tissue and organ function and, finally, to animal behavior. Yet, a better understanding of the processes underlying the harmonized coordination of multiple cells to perform appropriate biological responses is one of the great challenges faced by current science. The nervous system function is probably the best paradigmatic example. It is an organized assembly of cells whose function in the organism is to receive, process and transmit information from the environment and from itself and to develop a biologically appropriate response. While a great amount of effort has been done to elucidate the function and behaviour of molecules and cells of the nervous system, we are far away from a clear understanding of how these events lead to the function of the nervous system as a whole.

There is no doubt that to solve such complex biological problems requires multidisciplinary approaches from different scientific disciplines. Artificial intelligence is one of these disciplines that, imitating some key and simplified features of biological process and implementing computational models, attempts to provide some key clues on the function of complex biological systems and to provide technical background to solve real world problems.

In this book, authors present and discuss recently reported experimental biological evidence regarding information processing. The book also presents novel artificial intelligence models based on biological process, and finally explores the benefits of these new models not only to artificial intelligence but also to other sciences, to propose examples of applications to solve real-life problems.

This book is organized in three main sections describing new advances in experimental biology about neuronal information processing, new biologically inspired artificial intelligence models and real-life applications of these models. Several aspects of the book will make it and important reference text. It provides a multidisciplinary vision, from biology to artificial neural network models, to finally present applications of models to solve real-life problems. Contributors are international experts in their respective field. This book will serve not only to students and postgraduates but also to senior researches in many different disciplines. Indeed, because the wide multidisciplinary fields covered, it will be of interest

to experimental biologists, neuroscientists interested in information processing at cellular and systems levels as well as researchers in artificial intelligence and computational sciences.

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Alfonso Araque Almendros was born in Madrid, Spain in 1965. He received an MS and PhD in biology from "Complutense" University of Madrid (1988 and 1993, respectively). Since 1990, he has worked with several research groups: "Laboratoire de Neurosciences Fonctionnelles" Unité de Sensori-Motricité Comparée et Comportements - Centre National de la Recherche Scientific, Marsella (France), Dept. of Zoology and Genetics, Iowa State University, Ames (Iowa), "Unidad de Neurofisiología del Instituto de Investigaciones Biológicas Clemente Estable" and Depto. of Phisiology of the Faculty of Medicine in Montevideo (Uruguay), etc. He is currently a "Titular" scientific of the "Consejo Superior de Investigaciones Científicas (CSIC)" in the Neural Plasticity Department, Cajal Institute in Madrid. His research interests covers neurophysiology, neural plasticity, glial system, etc. Dr. Araque is the author of more than 40 published papers from 1991 and is a member of honour societies including the Society for Neuroscience (EE.UU.), European Neuroscience Association, "Sociedad Española de Neurociencias", etc.