PREFACE

This volume contains selected chapters from the *New Encyclopedia of Neuroscience* that address key features of the development of nervous systems. They are organized to cover events in neural development that occur from early to late – from the first induction and segregation of neural cells and tissues from non-neural epithelia, through the axial patterning of neural anlagen and the specification of neural cell types, to axon guidance and the organization of axonal connections, adult versus embryonic neurogenesis, and nervous system degeneration and repair.

The 93 chapters are loosely grouped into three sections – *Neural Induction, Pattern Formation, and Cell Specification*, *Axon Guidance and Synaptogenesis*, and *Neurogenesis, Neurotrophism and Regeneration*. These groupings notwithstanding, there are often important connections between chapters in different sections, in keeping with the frequent use of the same molecular and cellular strategies by neural cells at different times and for different purposes in development.

There has been an explosion of knowledge in developmental neuroscience over the last two decades. In general, this explosion has been driven by (a) the increasingly prominent application of genetics and molecular biology to longstanding developmental questions; and (b) the development and application of new cell labeling and imaging methods, many of which exploit a cornucopia of fluorescent proteins. These methodological advances, together with the conceptual integration of experimental models across *Drosophila*, *C. elegans*, zebrafish, mice, and humans, have allowed us to answer a variety of longstanding ('classical') questions. These include the molecular mechanisms underlying the formation of the retinotectal and other topographic maps, the composition and interaction of the sets of transcription factors that specify distinct subsets of neurons and glia, the molecules that attract axons to appropriate targets and repel them from inappropriate sites, the mechanisms by which synapses are established and consolidated, and the events that promote neurogenesis in the adult rain. At the same, this new work has, in several instances, raised unanticipated scientific questions that now must be answered.

Many different phenomena are addressed in the chapters of *Developmental Neuroscience*, by authors who have made important contributions to our current understanding of these phenomena. For example, the volume begins with discussions of neurulation by G. C. Schoenwolf and A. Lawson, and neural induction by C. D. Stern and C. Linker. It also contains chapters on the history of morphogens by L. Wolpert, on the role of Hox genes in neural development by R. Krumlauf, M. Parrish, and C. Nolte, and on arealization of the neocortex by D. D. M. O'Leary and T. T. Kroll. The molecules and mechanisms underlying Notch-Delta signal transduction are addressed by G. Weinmaster and A. Miyamoto, motor neuron specification is discussed by S. L. Pfaff and M.-R. Song, and dopaminergic neuron differentiation by A. Rosenthal and J. C. Lin. Advances in our understanding of topographic mapping are summarized by C. E. Holt and A. C. Lin, of growth cone dynamics by J. A. Raper, and of dendrite development by H. Cline. Netrins are addressed by M. Tessier-Lavigne, T. E. Kennedy, and S. W. Moore, Drosophila neuromuscular junction formation by H. Keshishian and B. Berke, programmed cell death by R. Oppenheim and C. Milligan, and adult neurogenesis by F. H. Gage and C. Zhao. Since the authors of these and many other chapters have pioneered the science under discussion, readers of *Developmental Neuroscience* will very much benefit from the perspectives of the people who have made the science happen.

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