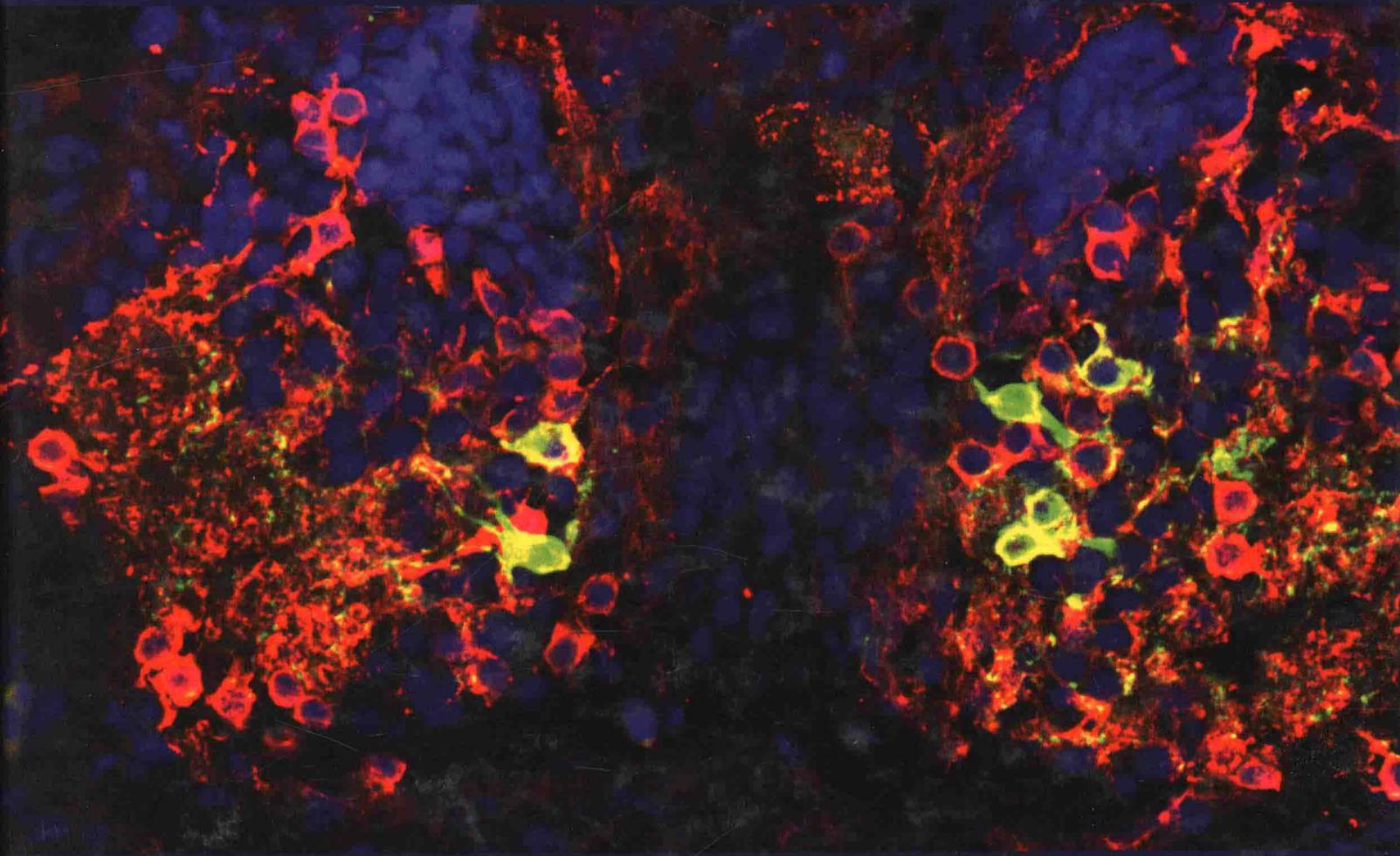


Fundamental Neuroscience



FOURTH EDITION

Larry R. Squire ■ Darwin Berg ■ Floyd E. Bloom
Sascha du Lac ■ Anirvan Ghosh
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FUNDAMENTAL NEUROSCIENCE

FOURTH EDITION

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Cover Image: The confocal image shows dopaminergic (green) and GABAergic (red) neurons in the developing *Xenopus* accessory olfactory bulb that mediate kinship recognition among siblings. The number of dopaminergic and GABAergic neurons changes in response to sustained exposure to olfactory stimuli. *Courtesy of Davide Dulcis and Nicholas Spitzer.*

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FUNDAMENTAL NEUROSCIENCE

Fourth Edition

Preface to the Fourth Edition

In this fourth edition of *Fundamental Neuroscience*, we have tried to improve on the third edition with a volume that effectively introduces students to the full range of contemporary neuroscience. Neuroscience is a large field founded on the premise that all of behavior and all of mental life have their origin in the structure and function of the nervous system. Today, the need for a single-volume introduction to neuroscience is greater than ever. Toward the end of the twentieth century, the study of the brain moved from a peripheral position within both the biological and psychological sciences to become an interdisciplinary field that is now central within each discipline. The maturation of neuroscience has meant that individuals from diverse backgrounds—including molecular biologists, computer scientists, and psychologists—are interested in learning about the structure and function of the brain and about how the brain works. In addition, new techniques and tools have become available to study the brain in increasing detail. New genetic methods have been introduced to delete or overexpress single genes with spatial and temporal specificity. Neuroimaging techniques such as functional magnetic resonance imaging (fMRI) have been developed that allow study of the living human brain while it is engaged in cognition.

This fourth edition attempts to capture the promise and excitement of this fast-moving discipline. All the chapters have been rewritten and updated. The volume begins with an opening chapter that provides an overview of the discipline. A second chapter presents fundamental information about the architecture and anatomy of nervous systems. The remainder of the volume (Sections II–VII) presents the major topics of neuroscience. The second section (Cellular and Molecular Neuroscience) considers the cellular and subcellular organization of neurons, the physiology of nerve cells, and how signaling occurs between neurons. The third section (Nervous System Development) includes discussion of neural induction, cell fate, migration, pathfinding, synapse formation, programmed cell death, synapse elimination, development of dendrites, and early experience,

including critical periods. The fourth and fifth sections (Sensory Systems and Motor Systems) describe the neural organization of each sensory modality and the organization of the brain pathways and systems important for locomotion, voluntary action, and eye movements. The sixth section (Regulatory Systems) describes the variety of hypothalamic and extra-hypothalamic systems that support motivation, reward, and internal regulation, including respiration, food and water intake, neuroendocrine function, circadian rhythms, and sleep and dreaming. The final section (Behavioral and Cognitive Neuroscience) describes the neural foundations of the so-called higher mental functions, including perception, attention, memory, language, spatial cognition, and executive function. Additional chapters cover human brain evolution, cognitive development and aging, and consciousness. The chapters contain more than 100 Boxes that describe clinical conditions, techniques, and special topics related to chapter content. The volume is also accompanied by companion websites for students and instructors, which present all the Figures and Boxes. In addition, the instructor's website includes sample test questions for each chapter that draw attention to the key facts and concepts in the chapters.

The authors of the chapters and boxes are working scientists, experts in the topics they cover. The Editors edited the chapters to achieve consistency of style and content. At Academic Press/Elsevier Science, the project was coordinated by Mica Haley (Acquisitions Editor), and we are grateful to her for her leadership and advice throughout the project. In addition, April Graham (Editorial Project Manager) very capably and efficiently supervised the development of the book, and Lisa Lamenzo (Project Manager) expertly coordinated its production.

The Editors of *Fundamental Neuroscience* hope that users of this book, and especially the students who will become the next generation of neuroscientists, find the subject matter of neuroscience as interesting and exciting as we do.

The Editors

About the Editors

Larry R. Squire is Distinguished Professor of Psychiatry, Neurosciences, and Psychology at the University of California School of Medicine, San Diego, and Research Career Scientist at the Veterans Affairs Medical Center, San Diego. He investigates the organization and neurological foundations of memory. He is a former President of the Society for Neuroscience and is a member of the National Academy of Sciences and the Institute of Medicine.

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