

# From Neuron to Brain

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From Neuron to Brain, Fifth Edition, provides a readable, up-to-date book for use in undergraduate, graduate, and medical school courses in neuroscience. As in previous editions, the emphasis is on experiments made by electrical recordings, molecular and cellular biological techniques, and behavioral studies on the nervous system, from simple reflexes to cognitive functions. Lines of research are followed from the inception of an idea to new findings being made in laboratories and clinics today.

A major change is that this edition begins with the anatomy and physiology of the visual system, from light receptors in the retina to the perception of images. This allows the reader to appreciate right away how nerve cells act as the building blocks for perception. Detailed mechanisms of signaling are then described in later chapters. All chapters have been rewritten, and new chapters added.

From Neuron to Brain will be of interest to anyone, with or without a specialized background in biological sciences, who is curious about the workings of the nervous system.

## RESOURCES

The From Neuron to Brain Instructor's Resource Library includes all of the figures (including photographs) and tables from the textbook, sized and color adjusted for optimal legibility when projected.

### John G. Nicholls

is Professor of Neuroscience at the International School for Advanced Studies in Trieste (known as SISSA). He was born in London in 1929 and received a medical degree from Charing Cross Hospital and a Ph.D. in physiology from the Department of Biophysics at University College London, where he did research under the direction of Sir Bernard Katz. He has worked at University College London, at Oxford, Harvard, Yale, and Stanford Universities, and at the Biocenter in Basel. With Stephen Kuffler, he made experiments on neuroglial cells and wrote the first edition of this book. He is a Fellow of the Royal Society, a member of the Mexican Academy of Medicine, and the recipient of the Venezuelan Order of Andres Bello. He has given laboratory and lecture courses in neurobiology at Woods Hole and Cold Spring Harbor, and in universities in Asia, Africa, and Latin America. His work concerns regeneration of the nervous system after injury and mechanisms that give rise to the respiratory rhythm.

### A. Robert Martin

is Professor Emeritus in the Department of Physiology at the University of Colorado School of Medicine. He was born in Saskatchewan in 1928 and majored in mathematics and physics at the University of Manitoba. He received a Ph.D. in Biophysics in 1955 from University College London, where he worked on synaptic transmission in mammalian muscle under the direction of Sir Bernard Katz. From 1955 to 1957 he did postdoctoral research in the laboratory of Herbert Jasper at the Montreal Neurological Institute, studying the behavior of single cells in the motor cortex. He has taught at McGill University,

the University of Utah, Yale University, and the University of Colorado Medical School, and has been a visiting professor at Monash University, Edinburgh University, and the Australian National University. His research has contributed to the understanding of synaptic transmission, including the mechanisms of transmitter release, electrical coupling at synapses, and properties of postsynaptic ion channels.

## Paul A. Fuchs

is Director of Research and the John E. Bordley Professor of Otolaryngology-Head and Neck Surgery, Professor of Biomedical Engineering, Professor of Neuroscience and co-Director of the Center for Sensory Biology at the Johns Hopkins University School of Medicine. Born in St. Louis, Missouri in 1951, Fuchs graduated in biology from Reed College in 1974. He received a Ph.D. in Neuro- and Biobehavioral Sciences in 1979 from Stanford University where he investigated presynaptic inhibition at the crayfish neuromuscular junction under the direction of Donald Kennedy and Peter Getting. From 1979 to 1981 he did postdoctoral research with John Nicholls at Stanford University, examining synapse formation by leech neurons. From 1981 to 1983 he studied the efferent inhibition of auditory hair cells with Robert Fettiplace at Cambridge University. He has taught at the University of Colorado and the Johns Hopkins University medical schools. His research examines excitability and synaptic signaling of sensory hair cells and neurons in the vertebrate inner ear.

## David A. Brown

is Professor of Pharmacology in the Department of Neuroscience, Physiology, and Pharmacology at University College London. He was born in London in 1936 and gained a B.Sc. in Physiology from University College London and a Ph.D. from St. Bartholomew's Hospital Medical College ("Barts") studying transmission in sympathetic ganglia. He then did a post-doc at the University of Chicago, where he helped design an integrated neurobiology course for graduate medical students. He has since chaired departments of Pharmacology at the School of Pharmacy and at University College in London, and has also worked in several labs in the United States, including the Department of Physiology and Biophysics at the University of Texas in Galveston, and as Fogarty Scholar-in-Residence at NIH in the labs of Mike Brownstein, Julie Axelrod, and Marshall Nirenberg. At Galveston, he and Paul Adams discovered the M-type potassium channel, which provided new insight into how neurotransmitters could alter nerve cell activity by regulating a voltage-gated ion channel. He continues to work on the regulation of ion channels by G protein-coupled receptors. He is a Fellow of the Royal Society, a recipient of the Feldberg Prize, and has an Honorary Doctorate from the University of Kanazawa in Japan.

## Mathew E. Diamond

like John Nicholls, is Professor of Cognitive Neuroscience at the International School for Advanced Studies in Trieste (SISSA). He earned a Bachelor of Science degree in Engineering from the University of Virginia in 1984 and a Ph.D. in Neurobiology from the University of North Carolina in 1989. Diamond was a postdoctoral fellow with Ford Ebner at Brown University and then an assistant professor at Vanderbilt University before moving to SISSA to found the Tactile Perception and Learning Laboratory in 1996. His main interest is

to specify the relationship between neuronal activity and perception. The research is carried out mostly in the tactile whisker system in rodents, but some experiments attempt to generalize the principles found in the whisker system to the processing of information in the human tactile sensory system.

## David A. Weisblat

is Professor of Cell and Developmental Biology in the Department of Molecular and Cell Biology at the University of California, Berkeley. He was born in Kalamazoo, Michigan in 1949, studied biochemistry as an undergraduate with Bernard Babior at Harvard College, where he was introduced to neurobiology in a course led by John Nicholls, and received his Ph.D. from Caltech for studies on the electrophysiology of *Ascaris* in 1976 with Richard Russell. He began studying leech development with Gunther Stent in the Department of Molecular Biology at Berkeley and was appointed to the Zoology Department there in 1983. As a postdoc, he developed techniques for cell lineage tracing by intracellular microinjection of tracer molecules. Current research interests include the evolution of segmentation mechanisms, D quadrant specification, and axial patterning. Work from his laboratory has helped to establish the leech *Helobdella* as a tractable representative of the super-phylum Lophotrochozoa, for the study of evolutionary developmental biology. He has assisted or organized courses in Africa, India, Latin America, and at Woods Hole, Massachusetts.

### Other Books

*Neuronal Dynamics*. This solid introduction uses the principles of physics and the tools of mathematics to approach fundamental questions of neuroscience.

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