From Neuron To Brain A Cellular And Molecular Approach To The Function Of The Nervous System Fourth Edition

In the 25 years since From Neuron to Brain was first published, the author's aim has remained constant: to describe how nerve cells go about their business of transmitting signals, how the signals are put together, and how, out of this integration, higher functions emerge. The fourth edition, while maintaining this focus, has been completely reformatted and updated.

Mathematics for Neuroscientists, Second Edition, presents a comprehensive introduction to mathematical and computational methods used in neuroscience to describe and model neural components of the brain from ion channels to single neurons, neural networks and their relation to behavior. The book contains more than 200 figures generated using Matlab code available to the student and scholar. Mathematical concepts are introduced hand in hand with neuroscience, emphasizing the connection between experimental results and theory. Fully revised material and corrected text Additional chapters on extracellular potentials, motion detection and neurovascular coupling Revised selection of exercises with solutions More than 200 Matlab scripts reproducing the figures as well as a selection of equivalent Python scripts

“Fascinating. Doidge’s book is a remarkable and hopeful portrait of the endless adaptability of the human brain.”—Oliver Sacks, MD, author of The Man Who Mistook His Wife for a Hat What is neuroplasticity? Is it possible to change your brain? Norman Doidge’s inspiring guide to the new brain science explains all of this and more An astonishing new science called neuroplasticity is overthrowing the centuries-old notion that the human brain is immutable, and proving that it is, in fact, possible to change your brain. Psychoanalyst, Norman Doidge, M.D., traveled the country to meet both the brilliant scientists championing neuroplasticity, its healing powers, and the people whose lives they’ve transformed—people whose mental limitations, brain damage or brain trauma were seen as unalterable. We see a woman born with half a brain that rewired itself to work as a whole, blind people who learn to see, learning disorders cured, IQs raised, aging brains rejuvenated, stroke patients learning to speak, children with cerebral palsy learning to move with more grace, depression and anxiety disorders successfully treated, and lifelong character traits changed. Using these marvelous stories to probe mysteries of the body, emotion, love, sex, culture, and education, Dr. Doidge has written an immensely moving, inspiring book that will permanently alter the way we look at our brains, human nature, and human potential.

Your Own Neuron is a daring adventure of parapsychology through the darkest and most enigmatic regions of the human mind. The human mind possesses various mysterious abilities that are often considered as science fiction. In this book the author investigates the foggy world of paranormal activities with the tools of modern neuroscience. International bestselling author, Neuroscientist Abhijit Naskar elucidates how the bizarre parapsychological phenomena such as telepathy, clairvoyance, precognition, premonition, afterlife do not possess any kind of paranormal element after all. The book illustrates the hardcore biological foundation behind all kinds of paranormal experiences. These fascinating experiences are the gift from Mother Nature that make human beings the most inexplicable species on planet earth.

Linden sets the record straight about the construction of the human brain; rather than the “beautifully-engineered optimized device, the absolute pinnacle of design” portrayed in many dumbed-down text books, pop-science tomes, and education televisions programs, Linden’s organ is a complicated assembly of cobbled-together functionality that created the mind as a by-product of ad-hoc solutions to questions of survival. His guided tour of the glorious amalgam of “crummy parts” includes pit-stops in the histories and fundamentals of neurology, neural-psychology, physiology, molecular and cellular biology, and genetics.

A highly original theory of how the mind-brain works, based on the author's study of single neuronal cells. In I of the Vortex, Rodolfo Llinas, a founding father of modern brain science, presents an original view of the evolution and nature of mind. According to Llinas, the "mindness state" evolved to allow predictive interactions between mobile creatures and their environment. He illustrates the early evolution of mind through a primitive animal called the "sea squirt." The mobile larval form has a brainlike ganglion that receives sensory information about the surrounding environment. As an adult, the sea squirt attaches itself to a stationary object and then digests most of its own brain. This suggests that the nervous system evolved to allow active movement in animals. To move through the environment safely, a creature must anticipate the outcome of each movement on the basis of incoming sensory data. Thus the capacity to predict is most likely the ultimate brain function. One could even say that Self is the centralization of prediction. At the heart of Llinas's theory is the concept of oscillation. Many neurons possess electrical activity, manifested as oscillating variations in the minute voltages across the cell membrane. On the crests of these oscillations occur larger electrical events that are the basis for neuron-to-neuron communication. Like cicadas chirping in unison, a group of neurons oscillating in phase can resonate with a distant group of neurons. This simultaneity of neuronal activity is the neurobiological root of cognition. Although the internal state that we call the mind is guided by the senses, it is also generated by the oscillations within the brain. Thus, in a certain sense, one could say that reality is not all "out there," but is a kind of virtual reality.

The aim of this new edition is, once again, to provide 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.
When we witness a great actor, musician, or sportsperson performing, we share something of their experience. It become clear just how this sharing of experience is realised within the human brain. This text provides an accessible overview of mirror neurons, written by the man who first discovered them.
Several excellent monographs exist which deal with axons. These, however, focus either on the cellular and molecular biology of axons proper or on network organization of connections, the latter with only an incidental or abstract reference to axons per se. Still relatively neglected, however, is the middle ground of terminations and trajectories of single axons in the mammalian central nervous system. This middle level of connectivity, between networks on the one hand and local, in vitro investigations on the other, is to some extent represented by retrograde tracer studies and labeled neurons, but there have so far been many fewer of the complementary anterograde studies, with total visualization of the axonal arborization. The present volume brings together in one source an interrelated treatment of single axons from the perspective of microcircuitry and as substrates of larger scale organization (tractography). Especially for the former area - axons in microcircuitry - an abundance of published data exists, but these are typically in specialty journals that are not often accessed by the broader community. By highlighting and unifying the span from microcircuitry to tractography, the proposed volume serves as a convenient reference source and in addition inspires further interactions between what currently tend to be separate communities. The volume also redresses the imbalance between in vitro/local connectivity and long-distance connections. Focusing on mammalian systems, Part 1 of this book is devoted to anatomical investigations of connections at the single axon level, drawing on modern techniques and classical methods from the 1990s. A particular emphasis is on broad coverage of cortical and subcortical connections from different species, so that common patterns of divergence, convergence, and collateralization can be easily appreciated. Part 2 addresses mechanisms of axon guidance, as these seem particularly relevant to pathways and branching patterns. Part 3 covers axon dynamics and functional aspects; and Part 4 focuses on tractography, notably including comparisons between histological substrates and imaging. A novel innovative reference on the axon as a connectional unit, encompassing microcircuitry, axon guidance, and function Featuring chapters from leading researchers in the field Full-colour text that includes both an overview of axon function and the multiple underlying molecular mechanisms The only volume to bring together the configuration of individual axons at a circuit level and to relate the histological geometry of axons and axon bundles to in vivo tractography imaging studies
First released in the Spring of 1999, How People Learn has been expanded to show how the theories and insights from the original book can translate into actions and practice, now making a real connection between classroom activities and learning behavior. This edition includes far-reaching suggestions for research that could increase the impact that classroom teaching has on actual learning. Like the original edition, this book offers exciting new research about the mind and the brain that provides answers to a number of compelling questions. When do infants begin to learn? How do experts learn and how is this different from non-experts? What can teachers and schools do-with curricula, classroom settings, and teaching methods--to help children learn most effectively? New evidence from many branches of science has significantly added to our understanding of what it means to know, from the neural processes that occur during learning to the influence of culture on what people see and absorb. How People Learn examines these findings and their implications for what we teach, how we teach it, and how we assess what our children learn. The book uses exemplary teaching to illustrate how approaches based on what we now know result in in-depth learning. This new knowledge calls into question concepts and practices firmly entrenched in our current education system. Topics include: How learning actually changes the physical structure of the brain. How existing knowledge affects what people notice and how they learn. What the thought processes of experts tell us about how to teach. The amazing learning potential of infants. The relationship of classroom learning and everyday settings of community and workplace. Learning needs and opportunities for teachers. A realistic look at the role of technology in education.
Looking beyond the now widely recognized relationships between stress and physical illness, this accessible and engagingly written book suggests that stress and stress-related hormones can also endanger the brain. Strategies to reduce stress and methods to protect neurons from further damage are proposed, and the relevance for humans of the animal research findings are clearly delineated. Sapolsky provides an extensive review of the recent, exciting data on glucocorticoids, the adrenal steroid hormones (hydrocortisone or cortisol in humans) that are released during stress. Excessive exposure to these hormones can damage the brain and make neurons more vulnerable to neurological insults. The findings he reports and ideas he synthesizes may have profound implications for understanding brain aging and resistance of the brain to the damaging effects of strokes, seizures, and possibly Alzheimer's disease. In part I Sapolsky focuses on how the failure of glucocorticoid regulation and subsequent excessive secretion combine to cause a complex cascade of degeneration in the brain during aging. In part 11 he addresses the implications of glucocorticoid neurotoxicity for neurology. Each chapter includes a helpful summary of the major points discussed as well as a capsule review of information from the previous chapters. Robert M. Sapolsky is Associate Professor of Biology and Neuroscience at Stanford University. He is also Research Associate at the Institute for Primate Research, National Museums of Kenya, Nairobi, and a MacArthur Fellow.
Written by one of the world’s leading neuroscientists,Making Up the Mind is the first accessible account ofexperimental studies showing how the brain creates our mentalworld. Uses evidence from brain imaging, psychological experiments andstudies of patients to explore the relationship between the mindand the brain Demonstrates that our knowledge of both the mental and physicalcomes to us through models created by our brain Shows how the brain makes communication of ideas from one mindto another possible
From Neuron to BrainSinauer Associates Incorporated
At the crossroads of art and science, Beautiful Brain presents Nobel Laureate Santiago Ramón y Cajal’s contributions to neuroscience through his groundbreaking artistic brain imagery. Santiago Ramón y Cajal (1852–1934) was the father of modern neuroscience and an exceptional artist. He devoted his life to the anatomy of the brain, the body’s most complex and mysterious organ. His superhuman feats of visualization, based on fanatically precise techniques and countless hours at the microscope, resulted in some of the most remarkable illustrations in the history of science. Beautiful Brain presents a selection of his exquisite drawings of brain cells, brain regions, and neural circuits with accessible descriptive commentary. These drawings are explored from multiple perspectives: Larry W. Swanson describes Cajal’s contributions to neuroscience; Lyndel King and Eric Himmel explore his artistic roots and achievement; Eric A. Newman provides commentary on the drawings; and Janet M. Dubinsky

describes contemporary neuroscience imaging techniques. This book is the companion to a traveling exhibition opening at the Weisman Art Museum in Minneapolis in February 2017, marking the first time that many of these works, which are housed at the Instituto Cajal in Madrid, have been seen outside of Spain. Beautiful Brain showcases Cajal's contributions to neuroscience, explores his artistic roots and achievement, and looks at his work in relation to contemporary neuroscience imaging, appealing to general readers and professionals alike.

Cellular Physiology of Nerve and Muscle, Fourth Editionoffers a state of the art introduction to the basic physical,electrical and chemical principles central to the function of nerveand muscle cells. The text begins with an overview of the origin ofelectrical membrane potential, then clearly illustrates thecellular physiology of nerve cells and muscle cells. Throughout,this new edition simplifies difficult concepts with accessiblemodels and straightforward descriptions of experimentalresults. An all-new introduction to electrical signaling in the nervoussystem. Expanded coverage of synaptic transmission and synapticplasticity. A quantitative overview of the electrical properties ofcells. New detailed illustrations.

This is a thorough revision of the standard text on local circuits in the different regions of the brain. In this fifth edition, the results of the mouse and human genome projects are incorporated for the first time. Also for the first time, the reader is oriented to supporting neuroscience databases. Among the new advances covered are 2-photon confocal laser microscopy of dendrites and dendritic spines, biochemical analyses, and dual patch and multielectrode recordings, applied together with an increasing range of behavioral and gene-targeting methods.

Neuronal Networks in Brain Function, CNS Disorders, and Therapeutics, edited by two leaders in the field, offers a current and complete review of what we know about neural networks. How the brain accomplishes many of its more complex tasks can only be understood via study of neuronal network control and network interactions. Large networks can undergo major functional changes, resulting in substantially different brain function and affecting everything from learning to the potential for epilepsy. With chapters authored by experts in each topic, this book advances the understanding of: How the brain carries out important tasks via networks How these networks interact in normal brain function Major mechanisms that control network function The interaction of the normal networks to produce more complex behaviors How brain disorders can result from abnormal interactions How therapy of disorders can be advanced through this network approach This book will benefit neuroscience researchers and graduate students with an interest in networks, as well as clinicians in neuroscience, pharmacology, and psychiatry dealing with neurobiological disorders. Utilizes perspectives and tools from various neuroscience subdisciplines (cellular, systems, physiologic), making the volume broadly relevant Chapters explore normal network function and control mechanisms, with an eye to improving therapies for brain disorders Reflects predominant disciplinary shift from an anatomical to a functional perspective of the brain Edited work with chapters authored by leaders in the field around the globe – the broadest, most expert coverage available

Up-to-date third edition which presents a coherent description of the nervous system from the perspective of modern work on molecular biology, cellular and developmental biology, biophysics, neurophysiology, neurochemistry and neuroanatomy.

In the 25 years since From Neuron to Brain was first published, the authors' aim has remained constant: to describe how nerve cells go about their business of transmitting signals, how the signals are put together, and how, out of this integration, higher functions emerge. The new Fourth Edition, while maintaining this focus, has been completely reformatted and updated. Intended for use in upper-level undergraduate, graduate, psychology and medical school Neuroscience courses, 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. It presents a readable and coherent account of how cellular and molecular approaches can provide insights into the workings of the brain.

With over 300 training programs in neuroscience currently in existence, demand is great for a comprehensive textbook that both introduces graduate students to the full range of neuroscience, from molecular biology to clinical science, but also assists instructors in offering an in-depth course in neuroscience to advanced undergraduates. The second edition of Fundamental Neuroscience accomplishes all this and more. The thoroughly revised text features over 25% new material including completely new chapters, illustrations, and a CD-ROM containing all the figures from the text. More concise and manageable than the previous edition, this book has been retooled to better serve its audience in the neuroscience and medical communities. Key Features * Logically organized into 7 sections, with uniform editing of the content for a "one-voice" feel throughout all 54 chapters * Includes numerous text boxes with concise, detailed descriptions of specific experiments, disorders, methodological approaches, and concepts * Well-illustrated with over 850 full color figures, also included on the accompanying CD-ROM

How we raise young children is one of today's most highly personalized and sharply politicized issues, in part because each of us can claim some level of "expertise." The debate has intensified as discoveries about our development-in the womb and in the first months and years-have reached the popular media. How can we use our burgeoning knowledge to assure the well-being of all young children, for their own sake as well as for the sake of our nation? Drawing from new findings, this book presents important conclusions about nature-versus-nurture, the impact of being born into a working family, the effect of politics on programs for children, the costs and benefits of intervention, and other issues. The committee issues a series of challenges to decision makers regarding the quality of child care, issues of racial and ethnic diversity, the integration of children's cognitive and emotional development, and more. Authoritative yet accessible, From Neurons to Neighborhoods presents the evidence about "brain wiring" and how kids learn to speak, think, and regulate their behavior. It examines the effect of the climate-family, child care, community-within which the child grows.

“Accessible, witty . . . an important new researcher, philosopher and popularizer of brain science . . . on par with cosmology’s Brian Greene and the late Carl Sagan” (The Plain Dealer). One of the Wall Street Journal’s 10 Best Nonfiction Books of the Year and a Publishers Weekly “Top Ten in Science” Title Every person is unique, but science has struggled to pinpoint where, precisely, that uniqueness resides. Our genome may determine our eye color and even aspects of our character. But our friendships, failures, and passions also shape who we are. The question is: How? Sebastian Seung is at the forefront of a revolution in neuroscience. He believes that our identity lies not in our genes, but in the connections between our brain cells—our particular wiring. Seung and a dedicated group of researchers are leading the effort to map these connections, neuron by neuron, synapse by synapse. It’s a monumental effort, but if they succeed, they will uncover the basis of personality, identity, intelligence, memory, and perhaps disorders such as autism and schizophrenia. Connectome is a mind-bending adventure story offering a daring scientific and technological vision for

understanding what makes us who we are, as individuals and as a species. “This is complicated stuff, and it is a testament to Dr. Seung’s remarkable clarity of exposition that the reader is swept along with his enthusiasm, as he moves from the basics of neuroscience out to the farthest regions of the hypothetical, sketching out a spectacularly illustrated giant map of the universe of man.” —TheNew York Times “An elegant primer on what’s known about how the brain is organized and how it grows, wires its neurons, perceives its environment, modifies or repairs itself, and stores information. Seung is a clear, lively writer who chooses vivid examples.” —TheWashington Post

The brain ... There is no other part of the human anatomy that is so intriguing. How does it develop and function and why does it sometimes, tragically, degenerate? The answers are complex. In Discovering the Brain, science writer Sandra Ackerman cuts through the complexity to bring this vital topic to the public. The 1990s were declared the "Decade of the Brain" by former President Bush, and the neuroscience community responded with a host of new investigations and conferences. Discovering the Brain is based on the Institute of Medicine conference, Decade of the Brain: Frontiers in Neuroscience and Brain Research. Discovering the Brain is a "field guide" to the brain--an easy-to-read discussion of the brain's physical structure and where functions such as language and music appreciation lie. Ackerman examines How electrical and chemical signals are conveyed in the brain. The mechanisms by which we see, hear, think, and pay attention--and how a "gut feeling" actually originates in the brain. Learning and memory retention, including parallels to computer memory and what they might tell us about our own mental capacity. Development of the brain throughout the life span, with a look at the aging brain. Ackerman provides an enlightening chapter on the connection between the brain's physical condition and various mental disorders and notes what progress can realistically be made toward the prevention and treatment of stroke and other ailments. Finally, she explores the potential for major advances during the "Decade of the Brain," with a look at medical imaging techniques--what various technologies can and cannot tell us--and how the public and private sectors can contribute to continued advances in neuroscience. This highly readable volume will provide the public and policymakers--and many scientists as well--with a helpful guide to understanding the many discoveries that are sure to be announced throughout the "Decade of the Brain."

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

Addressing all those interested in the history of American science and concerned with its future, a leading scholar of public policy explains how and why the Office of Naval Research became the first federal agency to support a wide range of scientific work in universities. Harvey Sapolsky shows that the ONR functioned as a "surrogate national science foundation" between 1946 and 1950 and argues that its activities emerged not from any particularly enlightened position but largely from a bureaucratic accident. Once involved with basic research, however, the ONR challenged a Navy skeptical of the value of independent scientific advice and established a national security rationale that gave American science its Golden Age. Eventually, the ONR's autonomy was worn away in bureaucratic struggles, but Sapolsky demonstrates that its experience holds lessons for those who are committed to the effective management of science and interested in the ability of scientists to choose the directions for their research. As military support for basic research fades, scientists are discovering that they are unprotected from the vagaries of distributive politics. Originally published in 1990. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

Foundational studies of the activities of spiking neurons in the awake and behaving human brain and the insights they yield into cognitive and clinical phenomena. In the last decade, the synergistic interaction of neurosurgeons, engineers, and neuroscientists, combined with new technologies, has enabled scientists to study the awake, behaving human brain directly. These developments allow cognitive processes to be characterized at unprecedented resolution: single neuron activity. Direct observation of the human brain has already led to major insights into such aspects of brain function as perception, language, sleep, learning, memory, action, imagery, volition, and consciousness. In this volume, experts document the successes, challenges, and opportunity in an emerging field. The book presents methodological tutorials, with chapters on such topics as the surgical implantation of electrodes and data analysis techniques; describes novel insights into cognitive functions including memory, decision making, and visual imagery; and discusses insights into diseases such as epilepsy and movement disorders gained from examining single neuron activity. Finally, contributors consider future challenges, questions that are ripe for investigation, and exciting avenues for translational efforts. Contributors Ralph Adolphs, William S. Anderson, Arjun K. Bansal, Eric J. Behnke, Moran Cerf, Jonathan O. Dostrovsky, Emad N. Eskandar, Tony A. Fields, Itzhak Fried, Hagar Gelbard-Sagiv, C. Rory Goodwin, Clement Hamani, Chris Heller, Mojgan Hodaie, Matthew Howard III, William D. Hutchison, Matias Ison, Hiroto Kawasaki, Christof Koch, Rüdiger Köhling, Gabriel Kreiman, Michel Le Van Quyen, Frederick A. Lenz, Andres M. Lozano, Adam N. Mamelak, Clarissa Martinez-Rubio, Florian Mormann, Yuval Nir, George Ojemann, Shaun R. Patel, Sanjay Patra, Linda Philpott, Rodrigo Quian Quiroga, Ian Ross, Ueli Rutishauser, Andreas Schulze-Bonhage, Erin M. Schuman, Demetrio Sierra-Mercado, Richard J. Staba, Nanthia Suthana, William Sutherling, Travis S. Tierney, Giulio Tononi, Oana Tudusciuc, Charles L. Wilson

This volume of Progress in Brain Research provides a synthetic source of information about state-of-the-art research that has important implications for the evolution of the brain and cognition in primates, including humans. This topic requires input from a variety of fields that are developing at an unprecedented pace: genetics, developmental neurobiology, comparative and functional neuroanatomy (at gross and microanatomical levels), quantitative neurobiology related to scaling factors that constrain brain organization and evolution, primate palaeontology (including paleoneurology), paleo-

anthropology, comparative psychology, and behavioural evolutionary biology. Written by internationally-renowned scientists, this timely volume will be of wide interest to students, scholars, science journalists, and a variety of experts who are interested in keeping track of the discoveries that are rapidly emerging about the evolution of the brain and cognition. Leading authors review the state-of-the-art in their field of investigation and provide their views and perspectives for future research Chapters are extensively referenced to provide readers with a comprehensive list of resources on the topics covered All chapters include comprehensive background information and are written in a clear form that is also accessible to the non-specialist

"For the instructor of Introduction to Neuroscience or Neurobiology courses with students who are intimidated by the study of the brain, our textbook From Neuron to Brain is designed to present difficult material on the nervous system through the process of experimentation. Lines of research are followed from the inception of an idea to new findings being made in laboratories and clinics today, allowing students to follow the path of experimentation toward an understanding of how the nervous system works. Nicholls et al. have built a readable and informative text that explains how nerve cells go about their business of transmitting signals, how the signals are put together, and how higher function emerges from this integration, all in an accessible and exciting way that will appeal to students. From Neuron to Brain, Sixth Edition and its exploration of the intricate workings of the nervous system will be of interest to instructors teaching undergraduate, graduate, and medical school courses in neuroscience"--

The authoritative reference on NEURON, the simulation environment for modeling biological neurons and neural networks that enjoys wide use in the experimental and computational neuroscience communities. This book shows how to use NEURON to construct and apply empirically based models. Written primarily for neuroscience investigators, teachers, and students, it assumes no previous knowledge of computer programming or numerical methods. Readers with a background in the physical sciences or mathematics, who have some knowledge about brain cells and circuits and are interested in computational modeling, will also find it helpful. The NEURON Book covers material that ranges from the inner workings of this program, to practical considerations involved in specifying the anatomical and biophysical properties that are to be represented in models. It uses a problem-solving approach, with many working examples that readers can try for themselves.

Choice Outstanding Academic Title, 1996. In hundreds of articles by experts from around the world, and in overviews and "road maps" prepared by the editor, The Handbook of Brain Theory and Neural Networks charts the immense progress made in recent years in many specific areas related to great questions: How does the brain work? How can we build intelligent machines? While many books discuss limited aspects of one subfield or another of brain theory and neural networks, the Handbook covers the entire sweep of topics—from detailed models of single neurons, analyses of a wide variety of biological neural networks, and connectionist studies of psychology and language, to mathematical analyses of a variety of abstract neural networks, and technological applications of adaptive, artificial neural networks. Expository material makes the book accessible to readers with varied backgrounds while still offering a clear view of the recent, specialized research on specific topics.

The authors of the most cited neuroscience publication, The Rat Brain in Stereotaxic Coordinates, have written this introductory textbook for neuroscience students. The text is clear and concise, and offers an excellent introduction to the essential concepts of neuroscience. Based on contemporary neuroscience research rather than old-style medical school neuroanatomy Thorough treatment of motor and sensory systems A detailed chapter on human cerebral cortex The neuroscience of consciousness, memory, emotion, brain injury, and mental illness A comprehensive chapter on brain development A summary of the techniques of brain research A detailed glossary of neuroscience terms Illustrated with over 130 color photographs and diagrams This book will inspire and inform students of neuroscience. It is designed for beginning students in the health sciences, including psychology, nursing, biology, and medicine. Clearly and concisely written for easy comprehension by beginning students Based on contemporary neuroscience research rather than the concepts of old-style medical school neuroanatomy Thorough treatment of motor and sensory systems A detailed chapter on human cerebral cortex Discussion of the neuroscience of conscience, memory, cognitive function, brain injury, and mental illness A comprehensive chapter on brain development A summary of the techniques of brain research A detailed glossary of neuroscience terms Illustrated with over 100 color photographs and diagrams

A comprehensive, integrated, and accessible textbook presenting core neuroscientific topics from a computational perspective, tracing a path from cells and circuits to behavior and cognition. This textbook presents a wide range of subjects in neuroscience from a computational perspective. It offers a comprehensive, integrated introduction to core topics, using computational tools to trace a path from neurons and circuits to behavior and cognition. Moreover, the chapters show how computational neuroscience—methods for modeling the causal interactions underlying neural systems—complements empirical research in advancing the understanding of brain and behavior. The chapters—all by leaders in the field, and carefully integrated by the editors—cover such subjects as action and motor control; neuroplasticity, neuromodulation, and reinforcement learning; vision; and language—the core of human cognition. The book can be used for advanced undergraduate or graduate level courses. It presents all necessary background in neuroscience beyond basic facts about neurons and synapses and general ideas about the structure and function of the human brain. Students should be familiar with differential equations and probability theory, and be able to pick up the basics of programming in MATLAB and/or Python. Slides, exercises, and other ancillary materials are freely available online, and many of the models described in the chapters are documented in the brain operation database, BODB (which is also described in a book chapter). Contributors Michael A. Arbib, Joseph Ayers, James Bednar, Andrej Bicanski, James J. Bonaiuto, Nicolas Brunel, Jean-Marie Cabelguen, Carmen Canavier, Angelo Cangelosi, Richard P. Cooper, Carlos R. Cortes, Nathaniel Daw, Paul Dean, Peter Ford Dominey, Pierre Enel, Jean-Marc Fellous, Stefano Fusi, Wulfram Gerstner, Frank Grasso, Jacqueline A. Griego, Ziad M. Hafed, Michael E. Hasselmo, Auke Ijspeert, Stephanie Jones, Daniel Kersten, Jeremie Knuesel, Owen Lewis, William W. Lytton, Tomaso Poggio, John Porrill, Tony J. Prescott, John Rinzel, Edmund Rolls, Jonathan Rubin, Nicolas Schweighofer, Mohamed A. Sherif, Malle A. Tagamets, Paul F. M. J. Verschure, Nathan Vierling-Claasen, Xiao-Jing Wang, Christopher Williams, Ransom Winder, Alan L. Yuille

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