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The Naked Neuron The NEURON Book Foundations of the Neuron Doctrine The NEURON Book The Cortical Neuron The Cooperative Neuron From Neuron to Brain From Neuron to Cognition via Computational Neuroscience Neuron Structure of the Brain Spiking Neuron Models Neuronal Dynamics The Neuron and the Mind From Neuron to Brain Synapse, Neuron, Brain Neural Cell Behavior and Fuzzy Logic Single Neuron Studies of the Human Brain Efferent Neurons: Advances in Research and Application: 2011 Edition Molecular Biology of the Neuron Neurons and Networks The Dynamic Neuron I of the Vortex Neuronal Recognition Single Neuron Computation Biophysics of Computation Biochemistry of Characterised Neurons Space-Time Computing with Temporal Neural Networks Brain Mechanisms Structure-Related Intrinsic Electrical States and Firing Patterns of Neurons With Active Dendrites Direct to Brain Windows The Visually Responsive Neuron From Neuron to Brain The NEURON Book The Neuron and the Glial Cell Neurons: Methods and Applications for the Cell Biologist Mirror Neurons and the Evolution of Brain and Language Correlated neuronal activity and its relationship to coding, dynamics and network architecture Neuronal Networks of the Hippocampus Governing Behavior Biology and Pathology of Astrocyte-Neuron Interactions The Neuron

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Synapse, Neuron, Brain, the third and last volume in the series Medical Physics, focuses on neurons and their interactions. Comprised of seven chapters regarding the brain's synapses and nerves, this volume concludes through the presentation of medical physics and its applications. An introductory chapter of this volume provides the necessary basic concepts and theories needed in the understanding of the book. This is followed by a discussion on the brain and its interconnections with the spinal cord. Chapter 3 focuses on the importance of evoked potentials as a diagnostic tool for the sensory organ and the neural processing of the stimuli. Chemical and electrical properties of synapses are also given emphasis. Other topics covered in this volume include the rall theory and neuronal integration; membrane noise at synaptic junctions; and new techniques on brain studies (autoradiography, positron annihilation, and nuclear magnetic resonance). As with the other volumes, this also caters to persons in various disciplines such as medicine, physiology, physics, and biology. Recent years have seen a remarkable expansion of knowledge about the basic cellular physiology and molecular biology of cortical neurons - their membrane properties, their synaptic characteristics, their functional connectivity, their development, and the mechanisms of their response to injury. This authoritative volume includes contributions by many of the renowned neurobiologists and neurologists directly responsible for these advances. It is divided into four main sections, each of which is prefaced with an overview by a leading expert in the field. The sections cover cortical neurons and synapses, the cortical network, the developing cortical neuron, and the vulnerable cortical neuron. This final section focuses on the cortical neuron in relation to the mechanisms of epilepsy. The emergence of language, social intelligence, and tool development are what made homo sapiens sapiens differentiate itself from all other biological species in the world. The use of language and the management of social and instrumental skills imply an awareness of intention and the consideration that one faces another individual with an attitude analogical to that of one's own. The metaphor of 'mirror' aptly comes to mind.Recent investigations have shown that the human ability to 'mirror' other's actions originates in the brain at a much deeper level than phenomenal awareness. A new class of neurons has been discovered in the premotor area of the monkey brain: 'mirror neurons'. Quite remarkably, they are tuned to fire to the enaction as well as observation of specific classes of behavior: fine manual actions and actions performed by mouth. They become activated independent of the agent, be it the self or a third person whose action is observed. The activation in mirror neurons is automatic and binds the observation and enaction of some behavior by the self or by the observed other. The peculiar first-to-third-person 'intersubjectivity' of the performance of mirror neurons and their surprising complementarity to the functioning of strategic communicative face-to-face (first-to-second person) interaction may shed new light on the functional architecture of conscious vs. unconscious mental processes and the relationship between behavioral and communicative action in monkeys, primates, and humans. The present volume discusses the nature of mirror neurons as presented by the research team of Prof. Giacomo Rizzolatti (University of Parma), who originally discovered them, and the implications to our understanding of the evolution of brain, mind and communicative interaction in non-human primates and man.(Series B) Cover -- Foundations of the Neuron Doctrine -- Copyright -- Dedication -- Contents -- Preface to the 25th Anniversary Edition -- Preface to the Original Publication -- Commentaries on the "Neuron Doctrine"--Cajal, Golgi, and Ariadne's Thread-Marina Bentivoglio -- Reflections on the Neuron Doctrine-Javier DeFelipe -- The Neuron Doctrine Revisited: A Personal Account-Sten Grillner -- Camillo Golgi, Foundations of the Neuron Doctrine, and the History of Neuroscience-Paolo Mazzarello -- Some Reflections on the Neuron Doctrine-Larry Swanson -- Back to Golgi? Neural Networks as a New Paradigm for Brain Circuits-Rafael Yuste -- 1. Introduction -- 2. From the Beginnings to the Cell Theory -- 3. Do Nerve Cells Belong in the Cell Theory? -- 4. Nerve Cells or Nerve Nets? -- 5. KÖlliker Gives In -- 6. Support Builds for Networks -- 7. The Nerve Cell Studies of Freud -- 8. The Revolutionary Method of Golgi -- 9. A Neuron Theory Begins to Take Form: His, Forel, Nansen -- 10. Ramón y Cajal: The Shock of Recognition -- 11. The Early Discoveries of Cajal -- 12. The Laws of Cajal -- 13. Joining the Mainstream -- 14. The Neuron Doctrine -- 15. The Law of Dynamic Polarization -- 16. Controversy -- 17. The Synapse and the Growth Cone -- 18. Forging a Consensus -- 19. Confrontation in Stockholm -- 20. Modern Revisions of the Neuron Doctrine -- References -- Index. Understanding and implementing the brain's computational paradigm is the one true grand challenge facing computer researchers. Not only are the brain's computational capabilities far beyond those of conventional computers, its energy efficiency is truly remarkable. This book, written from the perspective of a computer designer and targeted at computer researchers, is intended to give both background and lay out a course of action for studying the brain's computational paradigm. It contains a mix of concepts and ideas drawn from computational neuroscience, combined with those of the author. As background, relevant biological features are described in terms of their computational and communication properties. The brain's neocortex is constructed of massively interconnected neurons that compute and communicate via voltage spikes, and a strong argument can be made that precise spike timing is an essential element of the paradigm. Drawing from the biological features, a mathematics-based computational paradigm is constructed. The key feature is spiking neurons that perform communication and processing in space-time, with emphasis on time. In these paradigms, time is used as a freely available resource for both communication and computation. Neuron models are first discussed in general, and one is chosen for detailed development. Using the model, single-neuron computation is first explored. Neuron inputs are encoded as spike patterns, and the neuron is trained to identify input pattern similarities. Individual neurons are building blocks for constructing larger ensembles, referred to as "columns". These columns are trained in an unsupervised manner and operate collectively to perform the basic cognitive function of pattern clustering. Similar input patterns are mapped to a much smaller set of similar output patterns, thereby dividing the input patterns into identifiable clusters. Larger cognitive

systems are formed by combining columns into a hierarchical architecture. These higher level architectures are the subject of ongoing study, and progress to date is described in detail in later chapters. Simulation plays a major role in model development, and the simulation infrastructure developed by the author is described. Completely revised and enlarged with six new chapters, the second edition of Neurons and Networks is an introduction not just to neurobiology, but to all of behavioral neuroscience. It is an ideal text for first- or second-year college students with minimal college science exposure. Activity of the multi-functional networked neurons depends on their intrinsic states and bears both cell- and network-defined features. Firing patterns of a neuron are conventionally attributed to spatial-temporal organization of inputs received from the network-mates via synapses, in vast majority dendritic. This attribution reflects widespread views of the within-cell job sharing, such that the main function of the dendrites is to receive signals and deliver them to the axo-somatic trigger zone, which actually generates the output pattern. However, these views are now revisited due to finding of active, non-linear properties of the dendritic membrane practically in neurons of practically all explored types. Like soma and axon, the dendrites with active membrane are able to generate self-maintained, propagating depolarizations and thus share intrinsic pattern-forming role with the trigger zone. Unlike the trigger zone, the dendrites have complex geometry, which is subject to developmental, activity-dependent, or neurodegenerative changes. Structural features of the arborization inevitably impact on electrical states and cooperative behavior of its constituting parts at different levels of organization, from sub-trees and branches to voltage- and ligand-gated ion channels populating the dendritic membrane. More than two decades of experimental and computer simulation studies have brought numerous phenomenological demonstrations of influence of the dendritic structure on neuronal firing patterns. A necessary step forward is to comprehend these findings and build a firm theoretical basis, including quantitative relationships between geometrical and electrical characteristics determining intrinsic activity of neurons. The articles in this eBook represent progress achieved in a broad circle of laboratories studied various aspects of structure and function of the neuronal dendrites. The authors elucidate new details of dendritic mechanisms underlying intrinsic activity patterns in neurons and highlight important questions that remain open in this important domain of cellular and computational neuroscience. Brain Mechanisms: Linking Cognitive Phenomena to Neuron Activity shows how to understand higher cognition in terms of brain anatomy, physiology and chemistry. Natural selection pressures have resulted in all information processes in the brain being one of just two general types: condition definition/detections and behavioural recommendation definition/integrations. Using these information process types, hierarchies of description can be created that map from cognitive phenomena to the activity of the billions of neurons in the brain. These hierarchies make it possible to create an intuitively satisfying understanding of how neuron activity results in human memory, consciousness and self-awareness. These ideas were previously described at a technical level in Towards a Theoretical Neuroscience: from Cell Chemistry to Cognition. This book presents the ideas for a more general readership. The Cooperative Neuron is part of a revolution that is occurring in the sciences of brain and mind. It explores the new field of cellular psychology, a field built upon the recent discovery that many neurons in the brain cooperate to seek agreement in deciding what's relevant in the current context. This cooperative context-sensitivity provides the cellular foundations for knowledge, doubt, imagination, self-development, and the search for purpose in life. This emerging field has far-reaching and fundamental implications for psychology, neuroscience, psychiatry, neurology, and the philosophy of mind. In a clear and accessible style, the book explains the neuroscience to psychologists, the psychology to neuroscientists, and both to philosophers, students of the behavioral and brain sciences, and to anyone intrigued by the enduring mystery of how brains can be minds. This book is a valuable compendium of up-to-date reviews of neuronal molecular biology by leading researchers in the field. It covers all aspects of neuron structure and function, with the emphasis on genetic and molecular analysis. Efferent Neurons: Advances in Research and Application: 2011 Edition is a ScholarlyBrief™ that delivers timely, authoritative, comprehensive, and specialized information about Efferent Neurons in a concise format. The editors have built Efferent Neurons: Advances in Research and Application: 2011 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Efferent Neurons in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Efferent Neurons: Advances in Research and Application: 2011 Edition has been produced by the world’s leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/. This book covers at an advanced level the most fundamental ideas, concepts and methods in the field of applications of fuzzy logic to the study of neural cell behavior. Motivation and awareness are examined from a physiological and biochemical perspective illustrating fuzzy mechanisms of complex systems. Neurons in the brain communicate by short electrical pulses, the so-called action potentials or spikes. How can we understand the process of spike generation? How can we understand information transmission by neurons? What happens if thousands of neurons are coupled together in a seemingly random network? How does the network connectivity determine the activity patterns? And, vice versa, how does the spike activity influence the connectivity pattern? These questions are addressed in this 2002 introduction to spiking neurons aimed at those taking courses in computational neuroscience, theoretical biology, biophysics, or neural networks. The approach will suit students of physics, mathematics, or computer science; it will also be useful for biologists who are interested in mathematical modelling. The text is enhanced by many worked examples and illustrations. There are no mathematical prerequisites beyond what the audience would meet as undergraduates: more advanced techniques are introduced in an elementary, concrete fashion when needed. The questions of how a large population of neurons in the brain functions, how synchronized firing of neurons is achieved, and what factors regulate how many and which neurons fire

under different conditions form the central theme of this book. Important neurological techniques for the physiological reconstruction of a large biological neural network are presented. 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. Neural network research often builds on the fiction that neurons are simple linear threshold units, completely neglecting the highly dynamic and complex nature of synapses, dendrites, and voltage-dependent ionic currents. Biophysics of Computation: Information Processing in Single Neurons challenges this notion, using richly detailed experimental and theoretical findings from cellular biophysics to explain the repertoire of computational functions available to single neurons. The author shows how individual nerve cells can multiply, integrate, or delay synaptic inputs and how information can be encoded in the voltage across the membrane, in the intracellular calcium concentration, or in the timing of individual spikes.Key topics covered include the linear cable equation; cable theory as applied to passive dendritic trees and dendritic spines; chemical and electrical synapses and how to treat them from a computational point of view; nonlinear interactions of synaptic input in passive and active dendritic trees; the Hodgkin-Huxley model of action potential generation and propagation; phase space analysis; linking stochastic ionic channels to membrane-dependent currents; calcium and potassium currents and their role in information processing; the role of diffusion, buffering and binding of calcium, and other messenger systems in information processing and storage; short- and long-term models of synaptic plasticity; simplified models of single cells; stochastic aspects of neuronal firing; the nature of the neuronal code; and unconventional models of sub-cellular computation.Biophysics of Computation: Information Processing in Single Neurons serves as an ideal text for advanced undergraduate and graduate courses in cellular biophysics, computational neuroscience, and neural networks, and will appeal to students and professionals in neuroscience, electrical and computer engineering, and physics. 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 Biochemistry of Characterised Neurons provides a report on the progress made in the analysis of the biology of specific neurons in the central nervous system. This book emphasizes the biochemical, morphological, and functional aspects of characterized neurons, including ways and sophisticated techniques of isolating them. This publication is divided into 11 chapters. The first chapter evaluates the relevance of working with single neurons. Chapters 2 to 6 discuss specific, characterized, invertebrate neurons containing one of the putative neurotransmitter substances. Chapter 7 deals with the biochemistry of a unique vertebrate (Torpedo) cholinergic system that enables pure cholinergic neuronal cell bodies and endings to be analyzed separately. The sensitive radiochemical procedures used to analyze transmitter substances and transmitter enzymes, and how they can be adapted to map the distribution of transmitters in individual neurons of Aplysia, are discussed in Chapter 8. Chapter 9 describes methods for the analysis of specific cells in the retina, while Chapters 10 and 11 focus on the analysis of proteins within defined neurons. This text is beneficial

to biochemists and students interested in analyzing neurons. This book contains twenty-two original contributions that provide a comprehensive overview of computational approaches to understanding a single neuron structure. The focus on cellular-level processes is twofold. From a computational neuroscience perspective, a thorough understanding of the information processing performed by single neurons leads to an understanding of circuit- and systems-level activity. From the standpoint of artificial neural networks (ANNs), a single real neuron is as complex an operational unit as an entire ANN, and formalizing the complex computations performed by real neurons is essential to the design of enhanced processor elements for use in the next generation of ANNs. The book covers computation in dendrites and spines, computational aspects of ion channels, synapses, patterned discharge and multistate neurons, and stochastic models of neuron dynamics. It is the most up-to-date presentation of biophysical and computational methods. This timely new volume presents broad-based and wide-ranging contributions on all aspects of vision. The material is grouped for presentation in a logical fashion in five main themes: peripheral processing; sensory integration in superior colliculus; organization of visual projections; development and plasticity; and neuronal encoding and visually guided behavior. The material spans from molecules to cognition, including overt behavior, and synaptic and membrane levels of analysis. The species studied also range over diverse phyla, while contributors too form a diverse group representing Europe, North America, and Asia. The Visually Responsive Neuron is an exciting and informative addition to the well known Progress in Brain Research series. This solid introduction uses the principles of physics and the tools of mathematics to approach fundamental questions of neuroscience. In the beginning there was not only life but the ability to communicate and eventually to cooperate among the most basic, primeval creatures. In The Naked Neuron Dr. Joseph - an internationally respected neuroscientist and author of the highly praised The Right Brain and the Unconscious: Discovering the Stranger Within - takes us on an intriguing journey through time as he traces the evolution of communication and language from the most primitive single-celled animals to our earliest ancestors to humans today. As he so clearly demonstrates, we are linked to all levels of animals in a common bond of sensing, feeling, and communication. Be it singing wolves, dancing bees, or writhing rock and roll dancers, all communicate a treasure chest of meaning in the absence of the spoken word. Approximately 700 million years ago, a unique type of cell came into being - the neuron. This "naked" neuron, or nerve cell, lacked a protective fatty sheath. Still, it marked a monumental and world altering development, since it would become the building block of the brain. The naked neuron generated a revolutionary change resulting in a greater complexity and subtlety of thought. Dr. Joseph vividly depicts how neurons conferred on early humans advanced powers of mental and sensory acuity, including the gift of remembering one's past and contemplating the future. Although humans possess much of the same ancient brain tissue as our fellow primates, Dr. Joseph reveals to us the singular features of the human brain that have enabled humans uniquely to develop complex, spoken language. He holds us spellbound, revealing that although the new and old brain tissue are couched within the same brain, each often has difficulty understanding the impulses and language of the other. This ground-breaking book draws on Dr. Joseph's brilliant and original research and theories, fusing the latest discoveries made in neuroscience, sociobiology, and anthropology. He illuminates how the languages of the body and brain enhance intuitive understanding and spur a thirst for knowledge for its own sake. The human body and brain together are a veritable living museum which contains billions of cells with a long evolutionary history. As this unforgettable book shows, it is the communication of this panoply of cells - the residues of the past merged with the musings of the present - that gives rise to life, love, art, science, literature, and the ceaseless desire to search for and acquire knowledge Neurons: Methods and Applications for the Cell Biologist lays out numerous simple techniques for growing and carrying out experiments with many varieties of neurons. Subjects include peripheral and central neurons from vertebrate and invertebrate sources, as well as neuron-like cell lines. It also explains recent advances in our ability to introduce exogenous proteins and genes to neurons in culture. Procedures for successful protein infiltration, biolistic transfection, electroporation, and viral transgenic methods in neurons are also presented. Contains culture methodology for more than a dozen types of CNS and PNS neurons Includes most recent and reliable techniques from expert practitioners for specific experimental applications Addresses the latest strategies for transfecting neurons "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"-- From simple reflexes to complex movements, all animal behavior is governed by a nervous system. But what kind of government is it—a dictatorship or a democracy? Ari Berkowitz explains the variety of structures and strategies that control behavior, while providing an overview of thought-provoking debates and cutting-edge research. This book, a companion to William R. Uttal’s earlier work on macrotheories theories of mind-brain relationships, reviews another set of theories—those based on microneuronal measurements. Microneural theories maintain the integrity of individual neurons either in isolation or as participants in the great neuronal networks that make up the physical brain. Despite an almost universal acceptance by cognitive neuroscientists that the intangible mind must, in some way, be encoded by network states, Uttal shows that the problem of how the transformation occurs is not yet supported by empirical research findings at the micro as well as at the macro levels of analysis. Theories of the neuronal network survive more as metaphors than as robust explanations. This book also places special emphasis on the technological

developments that stimulate these metaphors. A major conclusion drawn in this book is that it is not at all certain that the mind-brain problem is solvable in the sense that many other grand scientific problems are. Correlated activity in populations of neurons has been observed in many brain regions and plays a central role in cortical coding, attention, and network dynamics. Accurately quantifying neuronal correlations presents several difficulties. For example, despite recent advances in multicellular recording techniques, the number of neurons from which spiking activity can be simultaneously recorded remains orders magnitude smaller than the size of local networks. In addition, there is a lack of consensus on the distribution of pairwise spike cross correlations obtained in extracellular multi-unit recordings. These challenges highlight the need for theoretical and computational approaches to understand how correlations emerge and to decipher their functional role in the brain. 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. This volume is made up of papers presented at the Second International Altschul Symposium: Biology and Pathology of Astrocyte-Neuron Interactions. The symposium was held in Saskatoon, Canada at the University of Saskatchewn in May, 1992 in memory of Rudolf Altschul, a graduate of the University of Prague and a pioneer in the fields of the biology of the vascular and nervous systems. Dr. Altschul was Professor and Head of the Department of Anatomy at the University of Saskatchewan from 1955 to 1963. The Altschul Symposia were made possible by an endowment left by Anni Altschul and by other contributions. The symposia are held biennially. One of the greatest challenges for present day scientists is to uncover the mechanisms of brain function. Although cellular anatomy of the nervous system has already been well outlined and indeed was delineated by the beginning of the century, experimental analysis of the function of the brain is relatively recent. The framework of the brain is made up of stellate cells, the astrocytes, which are interconnected by means of their processes, thus presenting a meshwork through which the neurons send their axons, accompanied by oligodendrocytes. Microglia are distributed throughout the brain. A comprehensive review of current research on synaptic plasticity. The traditional model of synapses as fixed structures has been replaced by a dynamic one in which synapses are constantly being deleted and replaced. This book, written by a leading researcher on the neurochemistry of schizophrenia, integrates material from neuroscience and cell biology to provide a comprehensive account of our current knowledge of the neurochemical basis of synaptic plasticity. The book presents the evidence for synaptic plasticity, an account of the dendritic spine and the glutamate synapse with a focus on redox mechanisms, and the biochemical basis of the Hebbian synapse. It discusses the role of endocytosis, special proteins, and local protein synthesis. Additional topics include volume transmission, arachidonic acid signaling, hormonal modulation, and psychological stress. Finally, the book considers pharmacological and clinical implications of current research, particularly with reference to schizophrenia and Alzheimer's disease. Assuming no previous knowledge of computer programming or numerical methods, The NEURON Book provides practical advice on how to get the most out of the NEURON software program. Although written primarily for neuroscientists, teachers and students, readers with a background in the physical sciences or mathematics and some knowledge about brain cells and circuits, will also find it helpful. Covering details of NEURON's inner workings, and practical considerations specifying anatomical and biophysical properties to be represented in models, this book uses a problem-solving approach that includes many examples to challenge readers. An outstanding characteristic of the nervous system is that neurons make selective functional contacts. Each neuron behaves as if it recog nizes the neurons with which it associates and rejects associations with others. The specific interneuronal relationships that result define the innate neuronal circuits that determine the functioning of this system. The purpose of this volume is to present some approaches to the problem of neuronal recognition. The volume has been somewhat arbitrarily divided into three sections. In the first section, the overrid ing theme is the degree of specificity of neuronal recognition. How specific is specific? Is the specificity so precise that the neurites of one neuron will only make synaptic contact with a unique target neuron? If less precise, within what range? Are the rules for specification that are operative in the embryo still operative at the same level of precision when connections regenerate in the mature organism? Are they still operative in dissociated tissue grown in culture? The second section of this volume contains reviews of morphologi cal studies of synaptogenesis and biochemical studies of synaptic com ponents. Can the morphology of developing cellular contacts provide clues about selectivity? Can the chemical components of synaptic junc tions be isolated and characterized? Do they include resolvable compo nents that mediate neuronal recognition? The third section contains studies seeking to identify the existence of specific molecules that might mediate cellular recognition. A major question here is whether molecules of this type even exist. 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 Assuming no previous knowledge of computer programming or numerical methods, The NEURON Book provides practical advice on how to get the most out of the NEURON software program. Although written primarily for neuroscientists, teachers and students, readers with a background in the physical sciences or mathematics and some knowledge about brain cells and circuits, will also find it helpful. Covering details of NEURON's inner workings, and practical considerations specifying anatomical and biophysical properties to be represented in models, this book uses a problem-solving approach that includes many examples to challenge readers.

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