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Toward Replacement Parts For The Brain: Implantable Biomimetic Electronics As Neural Prostheses (Bradford Books)



Synopsis

The continuing development of implantable neural prostheses signals a new era in bioengineering and neuroscience research. This collection of essays outlines current advances in research on the intracranial implantation of devices that can communicate with the brain in order to restore sensory, motor, or cognitive functions. The contributors explore the creation of biologically realistic mathematical models of brain function, the production of microchips that incorporate those models, and the integration of microchip and brain function through neuron-silicon interfaces. Recent developments in understanding the computational and cognitive properties of the brain and rapid advances in biomedical and computer engineering both contribute to this cutting-edge research. The book first examines the development of sensory system prostheses—cochlear, retinal, and visual implants—as the best foundation for considering the extension of neural prostheses to the central brain region. The book then turns to the complexity of neural representations, offering, among other approaches to the topic, one of the few existing theoretical frameworks for modeling the hierarchical organization of neural systems. Next, it examines the challenges of designing and controlling the interface between neurons and silicon, considering the necessity for bidirectional communication and for multiyear duration of the implant. Finally, the book looks at hardware implementations and explores possible ways to achieve the complexity of neural function in hardware, including the use of VLSI and photonic technologies.

Book Information

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Customer Reviews

An overview of vigorous ongoing efforts to lay the foundation for a future generation of neural science and medical devices. Although better sensory and motor prosthetics will be the early milestones in this endeavor, a splendid consequence of research into learning to interact with associational regions of the brain will be a deeper understanding of how parts of the brain think their thoughts. (Steven J. Schiff, Krasnow Professor of Neurobiology, George Mason University) *Toward Replacement Parts for the Brain* is an excellent compilation of outstanding research and development efforts that covers much of the promise of this area and the progress being made in this emerging field. Key contributions in neural coding and sensory prosthetics are presented, as are subjects that must be addressed before these technologies can be realized, such as biocompatibility and events at the interface of living and non-living systems. History will look back at this field and recognize this book as a key contribution to recognizing the tremendous goals and of the people pursuing them. (Alan S. Rudolph, former Chief of Biological Science and Technology at the Defense Advanced Research Projects Agency (DARPA)) --This text refers to an alternate Hardcover edition.

Theodore W. Berger is Professor of Biomedical Engineering in the School of Engineering at the University of Southern California. Dennis L. Glanzman is Program Chief for Theoretical and Computational Neuroscience at the National Institute of Mental Health (NIMH).

Emergent research topic of biomimetic electronics is presented in structured and easy to understand manner. Book is highly recommended to any interested person ranged from professional to beginner.

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