

The Cerebellum as a Neuronal Machine

John C. Eccles
Masao Ito
János Szentágothai

With 165 Figures



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The Cerebellum As A Neuronal Machine

Masao Itō



The Cerebellum As A Neuronal Machine:

The Cerebellum as a Neuronal Machine John C. Eccles, 2013-04-17 This book has had a three fold origin corresponding to the discoveries made by the three authors and their collaborators during the last few years mostly since 1962 A most fruitful symposium on the cerebellum was held in Tokyo at the time of the International Physiological Congress in September 1965 and there was then formulated the project of writing this book so as to organize all this new knowledge and make it readily available and to give opportunity for the conceptual developments that may be seen in Chapters XI XII and XV in particular The present account of the physiological properties of the cerebellar cortex is based to a large extent on systematic investigations that were concerned with discovering the mode of operation of the constituent neuronal elements of the cerebellar cortex This work was carried out in the Physiology Department of the Australian National University from 1963 to 1966 in collaboration with several visiting scientists initially Drs ANDERSEN Oscar and VORHOEF and later Drs LUNAS SAKI and STRATA to all of whom grateful thanks are extended for a great many of the figures and even more significantly for the original and critical contributions that they made to so many aspects of this exploration into the mode of operation of the neural machinery of the cerebellar cortex **The cerebellum as a neuronal machine** ,1967 **The Cerebellum and Neural Control** Masao Itō, 1984 Cerebellum and Neuronal Plasticity M. Glickstein, Christopher Yeo, John Stein, 2012-12-06 *The Neuronal Codes of the Cerebellum* Detlef Heck, 2015-10-07 The Neuronal Codes of the Cerebellum provides the most updated information on what is known on the topics of the cerebellum's anatomy and single cell physiology two areas where there has been a gap in knowledge regarding the specific codes it uses to process information internally and convey commands to other brain regions This has created difficulties for researchers and clinicians looking to develop an understanding of the mechanisms by which it contributes to behavior and how its dysfunction causes neurological symptoms Focused on findings related to the neuronal code used by cerebellar neurons for the representation of behavioral and sensory processes this edited volume will aid scientists in overcoming that knowledge gap also serving as the first resource to broadly address the different aspects of spike coding in the cerebellum that focuses on spike train analysis Compiles current knowledge about functioning of the cerebellum on a cellular basis and how information is encoded in the cerebellum Highlights findings related to the neuronal code used by cerebellar neurons for the representation of behavioral and sensory processes Contents include an introduction to the cerebellum and experimental theoretical techniques as well as the function of cerebral coding during disorder learning behavior generation motor behavior and more Bridges the gap for cerebellar researchers between single cell biophysics anatomic studies and behavioral studies Incorporates various in vivo approaches with different behavioral paradigms in primates and rodents modeling studies of coding and in vitro approaches The Cerebellum Masao Itō, 2012 Leading neuroscientist Dr Masao Ito advances a detailed and fascinating view of what the cerebellum contributes to brain function The cerebellum has been seen as

primarily involved in coordination of body movement control facilitating the learning of motor skills such as those involved in walking riding a bicycle or playing a piano The cerebellum is now viewed as an assembly of numerous neuronal machine modules each of which provides an implicit learning capability to various types of motor control The cerebellum enables us to unconsciously learn motor skills through practice by forming internal models simulating control system properties of the body parts Based on these remarkable advances in our understanding of motor control mechanisms of the cerebellum Ito presents a still larger view of the cerebellum as serving a higher level of brain functions beyond movements including the implicit part of the thought and cognitive processes that manipulate knowledge Ito extends his investigation of the cerebellum to discuss neural processes that may be involved implicitly in such complex mental actions as having an intuition imagination hallucination or delusion

Molecular mechanisms and pathways in cerebellar function

Catarina Osorio,Lilian Kisiswa,Alanna J. Watt,2023-08-21

Degeneration and Regeneration in Neurons of the Cerebellum

Reinhard Rohkamm,2012-12-06 The normal anatomy of the cerebellum has been thoroughly studied by numerous investigators over many years Anatomical aspects in terms of evolution Dow 1942 Larsell 1967 Llinas 1969 Gregory 1975 correlative anatomy Wallenberg 1931 and morphology Larsell 1952 LÖning and Jansen 1955 Ludwig Hauri 1955 Braitenberg and Atwood 1958 Jansen und Brodal 1958 Zeman and Innes 1963 have been presented Histological features have attracted many investigators Bergmann 1857 Denis senko 1877 Ramon y Cajal and Illera 1907 Addison 1911 Jakob 1928 Snider and Jacobs 1949 Braitenberg and Atwood 1958 Baud 1959 Altman 1962 1963 1966 1971 1972a b c 1973a b 1975 Birch Anderson et al 1962 Andres 1965 Eccles et al 1967 Fox and Snider 1967 Mugnaini and Forström 1967 Del Cerro and Snider 1968 1972a b O Leary et al 1968 1971 Chan Palay and Palay 1970 1971 1972 Rakic and Sidman 1970 Das and Altman 1971 Gobel 1971 Rakic 1971 1972a b Chan Palay 1972a b 1973c d Palay and Chan Palay 1972 1974 Sidman and Rakic 1973 Spacek et al 1973 Das et al 1974 Braak 1975 Crepel and Mariani 1975 Derrnietzel 1975a b Gregory 1975 Llinas 1975 Meller and Tetzlaff 1975 Cragg 1976 Rees et al 1976 Zelevic and Rakic 1976 Investigators of the cytological characteristics of the cerebellar cortex are numerous Sternberg and Krombholtz 1838 Smirnow 1897 Ramon y Fananas 1916 Larramendi et al

The Cerebellum and Its Disorders Mario Manto,Mario-Ubaldo Manto,Massimo Pandolfo,2002 The first comprehensive text on the cerebellum and its disorders for many years

The Cerebellum Masao Ito,2011-08-01

Leading neuroscientist Dr Masao Ito advances a detailed and fascinating view of what the cerebellum contributes to brain function The cerebellum has been seen as primarily involved in coordination of body movement control facilitating the learning of motor skills such as those involved in walking riding a bicycle or playing a piano The cerebellum is now viewed as an assembly of numerous neuronal machine modules each of which provides an implicit learning capability to various types of motor control The cerebellum enables us to unconsciously learn motor skills through practice by forming internal models simulating control system properties of the body parts Based on these remarkable advances in our understanding of motor control mechanisms of the

cerebellum Ito presents a still larger view of the cerebellum as serving a higher level of brain functions beyond movements including the implicit part of the thought and cognitive processes that manipulate knowledge Ito extends his investigation of the cerebellum to discuss neural processes that may be involved implicitly in such complex mental actions as having an intuition imagination hallucination or delusion

The Cerebellum: From Embryology to Diagnostic Investigations

,2018-06-08 The Cerebellum From Embryology to Diagnostic Investigations Volume 154 is designed to update the reader on the latest and clinically relevant advances in the study of cerebellar diseases in children and adults It is organized into sections detailing 1 Embryology Anatomy and Function and 2 Diagnostic investigations Neuroimaging and includes content on conventional sequences diffusion tensor imaging functional MRI and connectivity studies Its companion volume The Cerebellum Disorders and Treatment describes disorders starting from the fetal cerebellum to adult cerebellum encountered during daily practice and therapy including insights into innovative drug and rehabilitative approaches to treat children and adults with cerebellar disorders Provides an in depth understanding of the cerebellum and its involvement in a wide variety of diseases Explores the long term outcome data of pediatric cerebellar diseases and potential problems in adult life for patients with pediatric cerebellar diseases Features chapters co authored by two experts combining expertise in both pediatric and adult cerebellar diseases

Computational Theories and Their Implementation in the Brain

Lucia Vaina,Richard E. Passingham,2017 David Marr is known for his research on the brain in the late 60s and 70s becoming one of the main founders of Computational Neuroscience when neuroscience was in its infancy Written by distinguished contributors this book evaluates the extent to which his theories are still valid and identifies areas that need to be altered

Trials for Cerebellar Ataxias Bing-wen Soong,Mario Manto,Alexis Brice,Stefan M. Pulst,2023-05-29 Despite the critical importance of the cerebellum in brain function the scientific community still lacks effective treatments for most cerebellar ataxias This book provides a link between the pathogenesis and therapies of cerebellar ataxias while also providing a comprehensive assessment of the preclinical and clinical trials dedicated to cerebellar ataxias over the past 20 years of progress This is the first book fully dedicated to the trials and therapies of these disorders It is a truly authoritative and comprehensive reference and comes at a time of major advances in genetic tools and neuroimaging assessments The coverage begins by laying a foundation of the basic science of the cerebellum and ataxias proceeds to discuss biomarkers and the tools of trials offers guidelines on conducting trials and then explores the full range of therapeutics and their trials including gene therapy and cell transplantation The authors are top experts on cerebellar research and the contributing authors have all made seminal contributions in the field

Model Systems of Development and Aging of the Nervous

System Antonia Vernadakis,Alain M. Privat,Jean M. Lauder,Paola S. Timiras,2012-12-06 The last decade has generated a multitude of studies using in vitro model systems to explore growth and differentiation of the nervous system Although the findings have been exciting and have revealed unique properties of neural cells considerable concern continues to be

expressed regarding the significance of in vitro findings in terms of their applicability to in vivo biological events To examine this issue further a group of scientists presented and discussed their findings at a conference sponsored by the Institute of Developmental Neuroscience and Aging held in Crete Greece 26-29 May 1985 The conference was cosponsored by the University of Crete and was generously supported by the Ministry of Research and Technology of Greece Tourism Organization of Greece and also Sandoz and FIDIA The Directors of the Institute of Developmental Neuroscience and Aging are indebted to these Institutions for their support For the success of this conference the Directors owe much to Drs Eleni Fleischer Lambropoulos and Yiannis Tsouderos who spent countless hours in making arrangements so that the participants would have not only a scientific but also a unique cultural experience Several chapters of this book focus on the complex phenomena of neurogenesis and gliogenesis and the modulation of neuronal differentiation The concept that neuronal differentiation has both genetic and epigenetic components is documented by elegant studies using both in vitro cultured cells and neurons transplanted in vivo

Neurobiology Franco Conti, Vincent Torre, 2012-12-06 Understanding how the brain works is undoubtedly the greatest challenge for human intelligence and one of the most ambitious goals of contemporary science We are certainly far from this goal but significant advancements in several fields of Neuroscience and Neurobiology are being obtained at an increasing pace The NATO ASI School in Neurobiology held in Erice May 2-12 1995 as the 23rd Course of the International School of Biophysics provided an update on three basic topics Biophysics and Molecular Biology of Ion Channels Sensory Transduction and Higher Order Functions Current knowledge on these subjects was covered by formal lectures and critical discussions between lecturers and participants This book collects original contributions from those scientists who attended the School Many students presented their results in poster sessions steering lively informal discussions A selection of these contributions is also included A major portion of the program of the School was devoted to a general overview of current trends of thought and experimental approaches in neurobiology emphasising the importance of understanding molecular aspects of the elementary events underlying sensory transduction and processing in the nervous system without indulging however in a pure reductionistic view of such complex phenomena Recent studies of molecular biology and the electrophysiology of heterologously expressed ionic channels have shed new light on the molecular mechanisms underlying ionic permeation of excitable membranes and its regulation by physical and chemical parameters

Evolution of the Cerebellar Sense of Self John Montgomery, David Bodznick, 2016-11-17 The cerebellum is an intriguing component of the brain In humans it occupies only 10% of the brain volume yet has approximately 69 billion neurons that is 80% of the nerve cells in the brain The cerebellum first arose in jawed vertebrates such as sharks and early vertebrates also have an additional cerebellum like structure in the hindbrain Shark cerebellum like structures function as adaptive filters to discriminate self from other in sensory inputs It is likely that the true cerebellum evolved from these cerebellum like precursors and that their adaptive filter functionality was adopted for motor control paving the way for the

athleticism and movement finesse that we see in swimming running climbing and flying vertebrates This book uses an evolutionary perspective to open up the exciting body of work that is cerebellar research to a wide audience Understanding the brain is of interest to many people from many different backgrounds and for many different reasons Therefore understanding cerebellum is a significant step towards the wider challenge of understanding the brain This book will be of interest to neuroscientists neurologists and psychologists in addition to computer scientists and engineers concerned with machine human interactions and robotics

Cerebellar Dentate Nucleus V. Chan-Palay, 2013-12-20 Recent physiologic investigations have shown that the deep cerebellar nuclei may play an important role in the initiation and monitoring of skilled movements Much of this physiologic work has been carried out in the absence of a secure foundation in neuroanatomical information Although the main sources of the afferent fibers and the major terminations of the efferent fibers related to these nuclei have been known for many years remarkably little information about the organization of the nuclei themselves has been collected The kinds of nerve cells their arrangement within the nuclei the patterns of their dendritic arborizations the distribution of incoming fibers among the neurons the relationship between the outgoing nerve fibers and the nerve cells from which they originate these and many other morphologic features were either unknown or only superficially explored In fact so little was known about the deep cerebellar nuclei when I began to work on this subject that the investigations reported here are virtually without antecedents a refreshing change from the cerebellar cortex which has been repeatedly and exhaustively surveyed My studies on the cerebellar nuclei began in the spring of 1972 They were initiated with the intent of applying the principles of analysis that had been developed for the cerebellar cortex to a different but related part of the brain

The Cerebellum Dianne M. Broussard, 2013-10-28 The Cerebellum provides a concise accessible overview of modern data on physiology and function of the cerebellum as it relates to learning plasticity and neurodegenerative diseases Encompassing anatomy and physiology theoretical work cellular mechanisms clinical research and disorders the book covers learning and plasticity while introducing the anatomy of the cerebellum Known and proposed functions of the cerebellum are addressed on clinical physiological cellular and computational levels providing academics researchers medical students and graduate students with an invaluable reference

The Cerebellum: From Development to Learning Salvador Martinez, José A. Armengol, 2015-09-17 In this book laboratory leaders on cerebellar neuroscience have revised the present body of knowledge about cerebellum anatomy and function The trip throughout the cerebellar vineyard organization starts from the causal study of morphogenesis that is the molecular and cellular mechanisms underplaying form generation to the molecular mechanism regulation cellular differentiation Basson Dusart Hawkes Martinez and Rosi's groups contributions Then neurodevelopmental anomalies associated with structural disorganization are revised in Jissendi and Batkovich's group reviews describing and discussing pathogenic processes Finally functional mechanisms of cerebellar circuits involved in motor learning are revised by Delgado Garcia and Armengol's group contribution

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Brains ,1970-01-01 Computers and Brains

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