

Handbook Of Brain Microcircuits

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in order to focus on principles each chapter in this work is brief organized around 13 wiring diagrams of the key circuits with several pages of text that distil the functional significance of each microcircuit

microcircuits are the specific arrangements of cells and their connections that carry out the operations unique to each brain region this resource summarizes succinctly these circuits in over 40 regions enabling comparisons of principles across both vertebrates and invertebrates it provides a new foundation for understanding brain function that will be of interest to all neuroscientists oxford clinical neuroscience is a comprehensive cross searchable collection of resources offering quick and easy access to eleven of oxford university press s prestigious neuroscience texts joining oxford medicine online these resources offer students specialists and clinical researchers the best quality content in an easy to access format

leading neuroscientists discuss the function of microcircuits functional modules that act as elementary processing units bridging single cells to systems and behavior microcircuits functional modules that act as elementary processing units bridging single cells to

systems and behavior could provide the link between neurons and global brain function microcircuits are designed to serve particular functions examples of these functional modules include the cortical columns in sensory cortices glomeruli in the olfactory systems of insects and vertebrates and networks generating different aspects of motor behavior in this dahlem workshop volume leading neuroscientists discuss how microcircuits work to bridge the single cell and systems levels and compare the intrinsic function of microcircuits with their ion channel subtypes connectivity and receptors in order to understand the design principles and function of the microcircuits the chapters cover the four major areas of microcircuit research motor systems including locomotion respiration and the saccadic eye movements the striatum the largest input station of the basal ganglia olfactory systems and the neural organization of the glomeruli and the neocortex each chapter is followed by a group report a collaborative discussion among senior scientists contributors lidia alonso nanclares hagai bergman maria blatow j paul bolam ansgar büschges antonio caputi jean pierre changeux javier defelipe carsten duch paul feinstein stuart firestein yves frégnac rainer w friedrich c giovanni galizia ann m graybiel charles a greer sten grillner tadashi isa ole kiehn minoru kimura anders lanser gilles laurent pierre marie lledo wolfgang maass henry markram david a mccormick christoph m michel peter mombaerts hannah monyer hans joachim pflüger dietmar plenz diethelm w richter silke sachse h sebastian seung keith t sillar jeffrey c smith david l sparks d james surmeier eörs szathmáry james m tepper jeff r wickens rafael yuste

how does the motor cortex enable mammals to generate accurate complex and purposeful movements a cubic millimeter of motor cortex contains roughly 10^5 cells an amazing 4 km of axons and 0.4 km of dendrites somehow wired together with 10^9 synapses corticospinal neurons aka betz cells upper motor neurons are a key cell type monosynaptically conveying the output of the cortical circuit to the spinal cord circuits and lower motor neurons but corticospinal neurons are greatly outnumbered by all the other kinds of neurons in motor cortex which presumably also contribute crucially to the computational operations carried out for planning executing and guiding actions determining the wiring patterns the dynamics of signaling and how these relate to movement at the level of specific excitatory and inhibitory cell types is critically important for a mechanistic understanding of the input output organization of motor cortex while there is a predictive microcircuit hypothesis that relates motor learning to the operation of the cerebellar cortex we lack such a microcircuit understanding in motor cortex and we consider microcircuits as a central research topic in the field this research topic covers any issues relating to the microcircuit level analysis of motor cortex contributions are welcomed from neuroscientists at all levels of investigation from in vivo physiology and imaging in humans and monkeys to rodent models in vitro anatomy electrophysiology electroanatomy cellular imaging molecular biology disease models computational modeling and more

dr carl sagan takes us on a great reading adventure offering his vivid and startling insight into the brain of man and beast the origin of human intelligence the function of our most haunting legends and their amazing links to recent discoveries book jacket

this is the 2nd edition of a very well received and popular book that reflects the current state of the art of the ongoing research avenues concerning the hippocampus and processing units bridging the gap between single cell activity network activity and global

brain function it aims to provide a methodology to anyone interested in developing microcircuit level models of the hippocampus the book is divided into two thematic areas i experimental background and ii computational analysis in part i leading experimental neuroscientists discuss the morphological physiological and molecular characteristics as well as the connectivity and synaptic properties of the various cell types found in the hippocampus behaviour related ensemble activity patterns of morphologically identified neurons in anesthetized and freely moving animals provide insights on the function of the hippocampal areas in part ii computational neuroscientists present models of the hippocampal microcircuits at various levels of detail e g single cell level network level etc synaptomics and connectomics models of hippocampal structures are initially discussed then network models of memory rhythm generation and spatial navigation are presented followed by abstract and biophysical models of synaptic plasticity network models of hippocampal implicated disorders epilepsy and schizophrenia are then detailed and how their network topologies connectivities and activities change in these diseases finally two chapters are dedicated to describing simulator environments of single neurons and networks currently used by computational neuroscientists in developing their models and modelling tools to parametrically constrain them this engaging volume is invaluable to experimental and computational neuroscientists electrical engineers physicists mathematicians and others interested in developing microcircuit models of the hippocampus graduate level students and trainees in all of these fields can find this book a significant source of information

the neocortex is the most computationally advanced portion of the brain it is currently assumed to be composed of a large number of cortical columns intricate arrangements of cortical neurons approximately 300 500 μ m in diameter and 2 5 mm in height in humans that might serve as the elementary computational unit of the neocortex understanding the computation performed by this microcircuit is one of the keys to our comprehension of the brain the so called cortical column is not a static entity as it evolves throughout a lifetime and continually adapts to the information from its cortical environment despite the differences between cortical columns across the cortex a number of common features have been identified such as a laminar structure the dynamics of connections between identified neurons or the mechanisms for these connections to be modified this book presents the description of the differential connectivity and synaptic dynamics across two cell populations and the long term neuronal rewiring in a particular neuronal population within the cortical column these results were obtained during a phd work done at the swiss federal institute of technology in lausanne

researchers mostly in psychiatry and psychology but also other biomedical disciplines demonstrate how the understanding of fear and anxiety in humans can be better understood by combining results from basic neuroscience the neuroimaging of both animals and humans and careful clinical observation into common themes hypotheses and even concrete conclusions annotation 2004 book news inc portland or booknews com

an evolutionary perspective from lampreys to humans on how the forebrain coordinates movement while the networks in the brainstem and spinal cord handle the execution all living creatures interact with their environment even the most basic have a set of innate motor circuits they rely on to feed locomote fight and flee in the brain in motion sten grillner describes the evolution of the motor repertoire of vertebrates from

protovertebrates to primates with breadth and depth grillner explores how the brain uses the different microcircuits in the brainstem and spinal cord coordinating them through commands from the forebrain he also considers the normal function of the brain as a platform for understanding clinical conditions such as stroke parkinson s and huntington s diseases and spinal cord injury grillner also explains in the brain in motion how the remarkable finding that the lamprey forebrain has all the components of the mammalian one has radically changed scientists views on the evolutionary origin of the vertebrate forebrain we now know that the basic organization evolved 560 rather than 300 million years ago as was previously thought the forebrain says grillner is like an orchestra conductor while the microcircuits with their reaching grasping posture locomotion and numerous other patterns of behavior correspond to the members of the orchestra the conductor determines when each will be called into action providing an elegantly integrated perspective the brain in motion is essential reading for anybody that works professionally with movement control and function and dysfunction whether in basic research clinically or in the training of motor skills

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