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Lex Fridman Podcast #99 The Neuronal Environment Brain Homeostasis

Neurons make up half the brain. Neuroglial cells make up the other half. And one class of glial cells in particular seem to be as important for information processing in the brain and cognition as ...

The Little Known Cells That Are As Important As Neurons For Cognition

A previously unknown kind of human brain cell appears to help people center themselves in their personal maps of the world, according to a new study from neuroscientists at Columbia Engineering. This ...

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Newfound human brain cell type helps center people in mental maps

Researchers have discovered that astrocytes have a crucial role in closing the period of brain plasticity that follows birth, finding them to be key to the development of sensory and cognitive ...

How Astrocytes Shape the Developing Brain

Research in mice reveals how a subset of highly specialized immune cells modulate brain wiring by precision-targeting inhibitory synapses. The work deepens understanding of the versatile repertoire of ...

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The brain's wiring technicians

The detected increase in acidity and disruption of acid-base homeostasis in the brain ... A.L., 2009. Elevated brain lactate responses to neural activation in panic disorder: a dynamic 1H-MRS ...

Psychology Today

As part of a larger study exploring neural multiplexing and new modes of perception enabled by brain-computer interface, Johns Hopkins researchers have demonstrated the ability to “feel” virtual ...

Brain-Computer Interface Enables Johns Hopkins Study Participant to Touch and Feel Holographic

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Objects

For devastating disorders in which the brain or its nerve connections gradually disintegrate, maybe it's time to look south of the neck—towards the gut.

Treating the Brain Through the Stomach: Tweaking the Gut Microbiome Slowed ALS in Mice

When driving up to a busy intersection, you probably pay more attention to where you will be in the near future than where you are at that moment. After all, knowing when you will arrive at the ...

A peek inside a flying bat's brain uncovers clues to mammalian navigation

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and Assistant Professor ISHIHARA Toru from Kobe University's Graduate School of Human Development and Environment has illuminated the changes in the brain's neural network and cortex structure ...

Study sheds new light on the brain's neural network and cortex structure

Stress can be defined as any perturbation from homeostasis ... engage different neuronal and cell activities, that cause distinct pathways to be activated in the brain. Stimuli that overwhelm ...

Common Causes of Stress

(1) show that an unsuspected cellular

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player—astrocytes—control when experience-dependent wiring of brain circuits is permitted in the developing primary visual cortex (V1). This finding points to ...

Astrocytes control the critical period of circuit wiring

Christian Geis, Section of Neuroimmunology, from Jena University Hospital, investigated the impact of ATR loss on brain formation and neuron functionality. "If ATR was absent in the embryonic ...

An unknown role-ATR protein regulates neuronal activity

The chaotically moving objects dense clusters digital

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twins is being developed by students from NUST MISIS, ITMO and MIPT to navigate robots. It is going to be a web service using graph neural networks ...

Neural network to study crowd physics for training urban robots

the body responds and then returns to homeostasis when the event concludes. In a chronic crisis—a hostile work environment or a pandemic, for instance—our system constantly reacts, which takes ...

Stress can literally kill you. Here's how.

Theta waves, which wash over the hippocampus,

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trigger a state in the brain that's prone to a flow of ideas—à la “shower thoughts.” ...

How Virtual Reality Unveiled a Unique Brain Wave That Could Boost Learning

This level of conservation, together with the power of Drosophila genetics, makes the fly a very useful model system to study energy homeostasis ... cues to accommodate tissue-, age-, and ...

What fuels the fly: Energy metabolism in Drosophila and its application to the study of obesity and diabetes

Regular exercise, especially cardio, does change the

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Contrary to what some may think, the brain is a very plastic organ. Not only are new neuronal ... physical environment to the brain.

Leading neuroscience researchers offer a fresh perspective on neuronal function by examining all its many components-including their perturbation during major disease states-and relate each element to neuronal demands. Topics range from the dependency of neurons on metabolic supply, as well as on both ion and transmitter homeostasis, to their close interaction with the myelin sheath. Also

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addressed are the astrocytic signaling system that controls synaptic transmission, the extracellular matrix and space as communication systems, the role of blood flow regulation in neuronal demand and in blood-brain barrier function, and inflammation and the neuroimmune system. Insightful and integrative, *The Neuronal Environment: Brain Homeostasis in Health and Disease* demonstrates a clear new understanding that neurons do not work in isolation, that they need constant interactions with other brain components to process information, and that they are not the only information processing system in the brain.

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This e-book will review special features of the cerebral circulation and how they contribute to the physiology of the brain. It describes structural and functional properties of the cerebral circulation that are unique to the brain, an organ with high metabolic demands and the need for tight water and ion homeostasis. Autoregulation is pronounced in the brain, with myogenic, metabolic and neurogenic mechanisms contributing to maintain relatively constant blood flow during both increases and decreases in pressure. In addition, unlike peripheral organs where the majority of vascular resistance resides in small arteries and arterioles, large extracranial and intracranial arteries contribute significantly to vascular resistance in the

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brain. The prominent role of large arteries in cerebrovascular resistance helps maintain blood flow and protect downstream vessels during changes in perfusion pressure. The cerebral endothelium is also unique in that its barrier properties are in some way more like epithelium than endothelium in the periphery. The cerebral endothelium, known as the blood-brain barrier, has specialized tight junctions that do not allow ions to pass freely and has very low hydraulic conductivity and transcellular transport. This special configuration modifies Starling's forces in the brain microcirculation such that ions retained in the vascular lumen oppose water movement due to hydrostatic pressure. Tight water regulation is

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necessary in the brain because it has limited capacity for expansion within the skull. Increased intracranial pressure due to vasogenic edema can cause severe neurologic complications and death.

Virtually involved in all pathologies that present an inflammatory component, it is now evident that, in the central nervous system, chemokines and chemokine receptors possess pleiotropic properties beyond chemotaxis: constitutive brain expression of chemokines and their receptors on endothelial cells, but also on neurons and glia, suggests a role for such molecules in mediating homeostatic cross-talk between cells of the brain perenchyma. Cross-talk

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Between neurons and glia is determinant to the establishment and maintenance of a brain environment that ensure normal function, and in particular glial cells are active players that respond to environmental changes and act for the survival, growth, differentiation and repair of the nervous tissue: in this regard brain endogenous chemokines represent key molecules that play a role in brain development, neurogenesis, neurotransmission and neuroprotection. As important regulators of peripheral immune response, chemokines are molecules of the immune system that play a central role in coordinating communication between the nervous and the immune systems, in the context of infections

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and brain injury. Indeed, in pathological processes resulting from infections, brain trauma, ischemia and chronic neurodegenerative diseases, chemokines represent important neuroinflammatory mediators that drive leucocytes trafficking into the central nervous system, facilitating an immune response by targeting cells of the innate and adaptive immune system. The third edition of the international conference "Chemokines and Chemokine Receptors in the Nervous System", held in Rome in October 2013, represented an exciting platform to promote discussion among researchers in different disciplines to understand the role of chemokines in brain homeostasis. This Frontiers Research Topic arises

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from this conference, and wants to be an opportunity to further discuss and highlight the importance of brain chemokines as key molecules that, not only grant the interplay between the immune and the nervous systems, but in addition drive modulatory functions on brain homeostasis orchestrating neurons, microglia, and astrocytes communication.

Noradrenergic Signaling and Astroglia integrates what is known about the active role of astroglia in the locus coeruleus-noradrenergic system and outlines the most recent advances in the field. It discusses the molecular mechanisms underlying norepinephrine-induced receptor activation in astroglia, cellular

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metabolism and CNS energy provision, in vitro, ex vivo, and in vivo models, gliosignalling and neuronal activity, and astroglial networks, gap junctions, and morphological plasticity. The book also addresses the role of astroglial adrenergic receptor activation in memory formation, cognition, regulation of sleep homeostasis, and lastly in neurological disorders, including trauma (cellular edema), neurodegeneration (Alzheimer's disease), and neuroinflammation (multiple sclerosis). Noradrenergic Signaling and Astroglia is a valuable source of new knowledge for a wide audience, including graduate students, post-doctoral fellows, and researchers in neuroscience, life sciences, and the biological and biomedical sciences.

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Covers what is currently known about the role of astroglia in the noradrenergic system Provides biochemical and physiological mechanistic data to understand how noradrenergic signals acting on astroglia produce observed effects Includes figures and tables of structures, mechanisms and processes related to astroglia and noradrenergic signaling in CNS

This investigation has used invertebrate nervous systems to elucidate two basic aspects of central nervous ionic homeostasis: neuronal adaptations to ionic and osmotic stress and ionic homeostasis of the brain microenvironment. The research on the giant

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axons of polychaetes has established the important principle that some nerve cells can adapt to very large changes in the composition of their immediate fluid environment. These adaptations involve structural modification and changes in the cellular mechanisms which mediate excitation and conduction. The results of the investigation on the insect central nervous system has shed light on the permeability properties of the blood-brain interface, which shares some features with the functional organization of the mammalian central nervous system. The physiological information obtained has enabled a physiological model to be erected which explains all of the available experimental information

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and should be susceptible to further experimental tests. (Author).

Homeostatic Control of Brain Function offers a broad view of brain health and diverse perspectives for potential treatments, targeting key areas such as mitochondria, the immune system, epigenetic changes, and regulatory molecules such as ions, neuropeptides, and neuromodulators. Loss of homeostasis becomes expressed as a diverse array of neurological disorders. Each disorder has multiple comorbidities - with some crossing over several

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Conditions - and often disease-specific treatments remain elusive. When current pharmacological therapies result in ineffective and inadequate outcomes, therapies to restore and maintain homeostatic functions can help improve brain health, no matter the diagnosis. Employing homeostatic therapies may lead to future cures or treatments that address multiple comorbidities. In an age where brain diseases such as Alzheimer's or Parkinson's are ever present, the incorporation of homeostatic techniques could successfully promote better overall brain health. Key Features include - A focus on the homeostatic controls that significantly depend on the way one lives, eats, and drinks. - Highlights from

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Emerging research in non-pharmaceutical therapies including botanical medications, meditation, diet, and exercise. - Incorporation of homeostatic therapies into existing basic and clinical research paradigms. - Extensive scientific basic and clinical research ranging from molecules to disorders. - Emerging practical information for improving homeostasis. - Examples of homeostatic therapies in preventing and delaying dysfunction. Both editors, Detlev Boison and Susan Masino, bring their unique expertise in homeostatic research to the overall scope of this work. This book is accessible to all with an interest in brain health; scientist, clinician, student, and lay reader alike.

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Conn's Translational Neuroscience provides a comprehensive overview reflecting the depth and breadth of the field of translational neuroscience, with input from a distinguished panel of basic and clinical investigators. Progress has continued in understanding the brain at the molecular, anatomic, and physiological levels in the years following the 'Decade of the Brain,' with the results providing insight into the underlying basis of many neurological disease processes. This book alternates scientific and clinical chapters that explain the basic science underlying neurological processes and then relates that science to the understanding of neurological disorders and their treatment. Chapters cover

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disorders of the spinal cord, neuronal migration, the autonomic nervous system, the limbic system, ocular motility, and the basal ganglia, as well as demyelinating disorders, stroke, dementia and abnormalities of cognition, congenital chromosomal and genetic abnormalities, Parkinson's disease, nerve trauma, peripheral neuropathy, aphasia, sleep disorders, and myasthenia gravis. In addition to concise summaries of the most recent biochemical, physiological, anatomical, and behavioral advances, the chapters summarize current findings on neuronal gene expression and protein synthesis at the molecular level. Authoritative and comprehensive, Conn's Translational Neuroscience provides a fully up-

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to-date and readily accessible guide to brain functions at the cellular and molecular level, as well as a clear demonstration of their emerging diagnostic and therapeutic importance. Provides a fully up-to-date and readily accessible guide to brain functions at the cellular and molecular level, while also clearly demonstrating their emerging diagnostic and therapeutic importance Features contributions from leading global basic and clinical investigators in the field Provides a great resource for researchers and practitioners interested in the basic science underlying neurological processes Relates and translates the current science to the understanding of neurological disorders and their treatment

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Techniques in the neurosciences are evolving rapidly. There are currently very few volumes dedicated to the methodology - ployed by neuroscientists, and those that are available often seem either out of date or limited in scope. This series is about the methods most widely used by modern-day neuroscientists and is written by their colleagues who are practicing experts. Volume 1 will be useful to all neuroscientists since it concerns those procedures used routmely across the widest range of s- disciplines. Collecting these general techniques together in a single volume strikes us not only as a service, but will no doubt prove of exceptional utilitarian value as well. Volumes

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2 and 3 describe all current procedures for the analyses of amines and their metabolites and of amino acids, respectively. These collections will clearly be of value to all neuroscientists working in or contemplating research in these fields. Similar reasons exist for Volume 4 on receptor binding techniques, since experimental details are provided for all types of ligand-receptor binding, including chapters on general principles, drug discovery and development, and a most useful appendix on computer programs for Scatchard, nonlinear, and competitive displacement analyses. Volume 5 provides procedures for the assessment of enzymes involved in biogenic amine synthesis and catabolism.

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Volumes in the NEUROMETHODS series will be useful to neurochemists, -pharmacologists, -physiologists, -anatomists, psychopharmacologists, psychiatrists, neurologists, and chemists (organic, analytical, pharmaceutical, medicinal); in fact, everyone involved in the neurosciences, both basic and clinical.

Possible new breakthroughs in understanding the aging mind that can be used to benefit older people are now emerging from research. This volume identifies the key scientific advances and the opportunities they bring. For example, science has learned that among older adults who do not suffer from Alzheimer's disease or other dementias,

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Cognitive decline may depend less on loss of brain cells than on changes in the health of neurons and neural networks. Research on the processes that maintain neural health shows promise of revealing new ways to promote cognitive functioning in older people. Research is also showing how cognitive functioning depends on the conjunction of biology and culture. The ways older people adapt to changes in their nervous systems, and perhaps the changes themselves, are shaped by past life experiences, present living situations, changing motives, cultural expectations, and emerging technology, as well as by their physical health status and sensory-motor capabilities. Improved understanding of how physical

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and contextual factors interact can help explain why some cognitive functions are impaired in aging while others are spared and why cognitive capability is impaired in some older adults and spared in others. On the basis of these exciting findings, the report makes specific recommends that the U.S. government support three major new initiatives as the next steps for research.

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