Hindawi Publishing Corporation
Neural Plasticity
Volume 2007, Article ID 30585, 168 pages
doi:10.1155/2007/30585

Meeting Abstracts

Abstracts of the 16th Annual Meeting of The Israel Society for Neuroscience

Eilat, Israel, November 25–27, 2007

Received 9 October 2007; Accepted 9 October 2007

The Israel Society for Neuroscience—ISFN—was founded in 1993 by a group of Israeli leading scientists conducting research in the area of neurobiology. The primary goal of the society was to promote and disseminate the knowledge and understanding acquired by its members, and to strengthen interactions between them. Since then, the society holds its annual meeting every year in Eilat usually during December. At this annual meetings, the senior Israeli neurobiologists, their teams, and their graduate students, as well as foreign scientists and students, present their recent research findings in platform and poster presentations, and the program of the meeting is mainly based on the 338 received abstracts which are published in this volume. The meeting also offers the opportunity for the researchers to exchange information with each other, often leading to the initiation of collaborative studies. Both the number of members of the society and those participating in the annual meeting is constantly increasing, and it is anticipated that this year about 600 scientists will convene at the Princess Hotel in Eilat, Israel.

Further information concerning the Israel Society for Neuroscience can be found at http://www.isfn.org.il.

a phenomenon termed place field remapping. In a spatial memory task on a + maze hippocampal cell activity was also influenced by locations that were recently visited, or are forthcoming (i.e., expressing retrospective or prospective memory coding, Ferbinteanu and Shapiro, 2003). Thus, hippocampal neurons can jointly express contextual and mnemonic information that relates to the present, past, and future. This type of processing fits the view that the hippocampus supports episodic memory, and that memory demands can modulate hippocampal coding. The present experiment tested the effects of changing memory demands on retrospective and prospective coding, and examined if modulations of retrospective and prospective coding share the same dynamics as stimulus-induced place field remapping. We trained rats to perform a win-stay task with serial reversals on a + maze. Hippocampal unit activity was recorded as rats placed on either a North or a South start arm navigated to the correct East or West rewarded goal arm. In a novel condition, the start and goal arms were switched, so that the North and South arms served as the goal arms and the East and West arms served as the start arms. Preliminary data showed that all place fields remapped in the novel condition. Concurrently, performance decreased in the Novel condition from 91% to 74% correct, as did the percent of fields showing prospective or retrospective coding (30% to 15% and 50% to 8%, respectively). In contrast, the percent of fields coding location alone increased in the novel condition from 20% to 77%, though the fields were less stable. We are collecting additional data from CA1/CA3 fields in order to better understand the influence of changes to memory demand on hippocampal on-line processing.

Working memory: somatic spikes or synaptic calcium?

Barak O.,[1] Mongillo G.,[2] and Tsodyks M.[1]

[1]Department of Neurobiology, Weizmann Institute of Science, Israel
[2]Laboratory of Neurophysics and Physiology, UMR 8119, CNRS, Universitè Renè Descartes, France

The notion that synaptic plasticity supports long-term memory storage while persistent neuronal spiking activity maintains these memories in a short-term active form is widely held in theoretical neuroscience. We show that synapses can also effectively implement active memory function through their short-term plasticity. In this account, the short-term synaptic variables are used as a "buffer" which is loaded, read-out and refreshed by neural activity. The refresh rate is low, since it depends on the slow time constants associated with synaptic dynamics. The feasibility of this mechanism is demonstrated in a biologically plausible spiking network model. The resulting "working memory" system is robust, metabolically efficient, and can help explain recent electrophysiological results.

Topology Regulates Source Separation in Biologically Realistic Neural Networks

Barak E.,[1] Eytan D.,[2] Meir R.,[2] and Zeevi Y. Y.[2]

[1]Faculty of Medicine, Technion-Israel Institute of Technology, Haifa 32000, Israel
[2]Faculty of Electrical Engineering, Technion-Israel Institute of Technology, Haifa 32000, Israel

This study addresses the issue of relations that exist between topology and dynamics of large sparsely connected neural networks. In particular, it examines the hypothesis that topology governs the source separation ability of neural networks endowed with structural characteristics of cortical networks. For this purpose, extensive simulations of networks with different topologies and similar structural features (e.g., similar average in- and out-degrees) were carried out. Networks responses to various stimuli were analyzed in terms of neural recruitment order during a network burst. The latter measure is assumed to convey information relevant to source separation. The results showed that the responses of networks with Gaussian in-degree and Scale Free (SF) out-degree distributions to different stimuli varied significantly more than those of Erdös Rényi (ER) networks and networks with SF in-degree and Gaussian out-degree distributions. These results support the hypothesis that topology does indeed play a crucial role in source separation tasks executed by neural networks.

AxCaliber—in-vivo measurement of axon diameter distribution with MRI

Barazany D.,[1] Basser P.,[2] and Assaf Y.[1]

[1]Department of Neurobiochemistry, Faculty of Life Sciences, Tel Aviv University, Israel
[2]The National Institutes of Health, Bethesda, Md, USA

The axon diameter distribution (ADD) is an important anatomical feature of nerve fascicles both in normal and abnormal development. Axon diameter directly affects nerve function. It is well known that in myelinated axons, the conduction velocity is directly proportional to axon diameter. Thus, large-diameter axons generally arise in pathways that require short conduction times while smaller axons arise in pathways that can tolerate longer conduction times. In addition, it is hypothesized that in amyotrophic lateral sclerosis (ALS) large diameter axons are damaged selectively, while in autism, small-diameter axons are over-expressed. Despite its importance, the ADD within nerve fascicles has not been measurable in-vivo, and currently can only be assessed by invasive histological means. Here, we propose a new magnetic-resonance-imaging- (MRI-) based approach called AxCaliber that utilizes diffusion MRI to extract the ADD, in-vivo and noninvasively. Diffusion MRI measures the micron-scale displacements of water molecules; by altering the diffusion time and diffusion weighting morphological parameters of the tissue, such as the ADD and axonal density, can be measured experimentally. In this work, AxCaliber was used to extract the ADD within the corpus callosum (CC) of the rat. Using AxCaliber we were able to segment the CC to at least 3 distinct regions corresponding to the body, genu, and splenium of the CC. A narrow ADD with a mean of about 1 micron characterized the genu and splenium while the body

of the CC had a much broader distribution with a mean of about 4-5 microns. This segmentation resembles the known morphological arrangement of the CC as measured from histology. Applications of AxCaliber are expected in longitudinal studies designed to follow nerve growth in normal and abnormal development, as well as in diagnosing disorders and diseases affecting specific populations of axons in the CNS and PNS.

Akt is differently activated in the amygdala-prefrontal cortex-insular cortices circuit in acquisition and extinction of CTA

Bareni A., Maroun M., and Rosenblum K.

Department of Neurobiology and Ethology, Center of Brain and Behavior, University of Haifa, Israel

In conditioned taste aversion (CTA) a single gustatory experience (exposure to novel taste) is followed by visceral trauma. Consequently, the animal develops an aversion for the aversive taste. The memory of aversion is robust, however, repeated exposures to the taste without the association with the malaise leads to extinction of CTA. It is assumed that consolidation and extinction of CTA are each subserved by different neuronal mechanism and various parts of the brain are involved in these mechanisms. The neural circuit that underlies the acquisition and the extinction of CTA includes the amygdala and the insular cortex. Recently research from our laboratory has shown that the ventromedial prefrontal cortex (vmPFC) has a role in extinction of CTA. In the current study, we examined the differential activation of the phosphorylation levels of Akt, a serine/threonine kinase, which is a critical enzyme in signal transduction pathways, in the amygdala-prefrontal cortex-insular cortices circuit during acquisition and extinction of CTA. Our results show that following CTA acquistion there is an increased level of AKT phosphorylation in the amygdala, insular cortex and the prefrontal cortex. In contrast, following extinction training there was a decrease of Akt phosphorylation in the amygdala and PFC while no change was found in the IC. These results hint on the possibility that the amygdala-PFC-insular cortex circuit is differentially involved in acquisition and extinction of CTA.

Differences in early visual processing in synesthesia: an ERP study

Barnett K. J.,[1] Fox J. J.,[2] Molholm S.,[2] Kelly S. P.,[2] Shalgi S.,[1] Mitchell K. J.,[3] and Newell F. N.[1]

[1] Institute of Neuroscience (TCIN) and School of Psychology, Trinity College, Dublin 2, Ireland
[2] Cognitive Neurophysiology Lab, Nathan Kline Institute for Psychiatric Research, USA
[3] Department of Genetics, Trinity College, Dublin 2, Ireland

Stimuli that elicit synesthesia (e.g., letters of the alphabet) activate cortical color regions of the brain, including V4. While it has been demonstrated that synesthesia is a genuine perceptual phenomenon, its underlying neural substrates are not well understood. For example, the overall integrity of the visual system has never been assessed and it is not known whether differences in sensory-perceptual processing are associated with the condition. Here, we looked at visual evoked potentials (VEPs) to determine differences in sensory-perceptual processing using stimuli that differentially activate the magnocellular and parvocellular pathways of the visual system. High and low spatial frequency gratings (Gabors) and luminance-contrast squares were presented to 15 synesthetes and 15 controls. We report for the first time, early sensory-perceptual differences in synesthetes. The differences were associated with stimuli that do not elicit synesthetic color experiences and were manifest in early C1 and P1 components of the visual evoked potential (VEP). The findings were not confined exclusively to either magnocellular or parvocellular stimuli, but rather indicate widespread differences in the way that synesthetes process visual information during early time windows.

Modulation of dendritic calcium spike by extracellular calcium concentration

Bar-Yehuda D.,[2] Ben-Porat H.,[2] and Korngreen A.[1,2]

[1] The Mina and Everard Faculty of Life Sciences, Israel
[2] The Leslie and Susan Gonda Brain Research Center, Bar-Ilan University, Israel

It has been shown that in the apical dendrite of L5 pyramidal neurons, when a back-propagating action potential coincides with distal synaptic input, a dendritic calcium spike is generated, leading to the generation of a burst of action potentials at the soma. Many questions have been raised regarding the physiological role of this calcium spike. Lately, a different question has been raised whether the calcium concentration being used in the typical ACSF truly reflects the concentration in the CSF. Recent studies have shown that the calcium concentration in the ACSF is higher than in the CSF in vivo. We have performed in vitro recordings from acute brain slices, using the whole-cell configuration of the patch-clamp technique in the current-clamp mode from L5 pyramidal neurons. Regenerative calcium spikes were recorded and compared with calcium concentrations similar to the ACSF and CSF in the bath solution. Our results suggest that while the back-propagating action potential is robust under reduced extracellular calcium concentration, the dendritic calcium spike is suppressed by this modification.

Lentiviral delivery of LMX1a into human Mesenchymal Stem Cells directs towards dopaminergic differentiation

Barzilay R.,[1] Ben-Zur T.,[1] Bulvik S.,[2] Melamed E.,[1] and Offen D.[1]

[1] Neuroscience lab, Felsenstein Medical Research Center, Sackler Faculty of Medicine, Tel Aviv University, Israel
[2] Laniado Medical Center, Netanya, Israel