PROGRAM BOOK



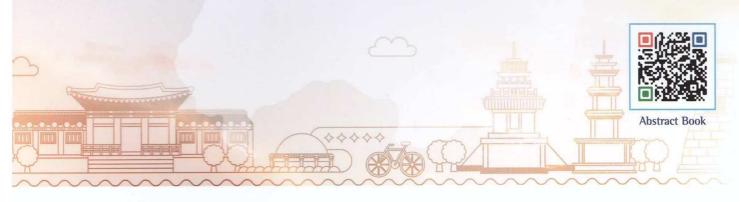
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P-116 ATP is neurotransmitter for type III cell sour transduction

<u>Mirriae Kim.</u> Myunghwan Choi

P-133

Hun Seok Choi, Taegon Kim

P-117 Mice communicate via ultrasound vocal interaction

Hamin Park, Hyuntae Jeong, Taeyeon Weon, Nakyung Lee, Yejin Kim, Somi Lee, Ela Li Maizel, Young-Gyun Park

Computational and Theoretical Neuroscience P-118 ~ P-134 Break-up and recovery of harmony between direct and indirect pathways in the basal ganglia; Huntington's disease and treatment Sang-Yoon Kim, Woochang Lim Frontal theta-gamma phase-amplitude coupling as a biomarker in on-medication parkinson's disease patients Min-Gyeong Seo, Dong-Joo Kim ≥ P-120 Spatiotemporal dynamics of pre-speech semantic and syntactic processing: an intracranial EEG study Ye Jin Park, Jii Kwon, Chun Kee Chung Distinct neural patterns in overt, mimed, and imagined speech: an electrocorticography study ≥ P-121 Jii Kwon, Ye Jin Park, Gyuwon Lee, Chun Kee Chung P-122 Associative memory improved by hippocampal theta-based alarm: human intracranial EEG study Seong Jin Lee, Chun Kee Chung ≥ P-123 Decoding the syllabic structure of imagined speech from human intracranial EEG Gyuwon Lee, Chun Kee Chung P-124 The relationship between the variables and the modulation efficiency ratio in normal and degenerated primate retina Yong Sook Goo, Yongseok Yoo, Seongkwang Cha Stimulus-specific neural variability in mouse primary visual cortex contributes to visual inference P-125 Jehyun Kim, Hyeyoung Shin Emergence of functional circuits from neuronal interference in auditory cortex P-126 Jeonghwan Cheon, Se-Bum Paik ≥ P-127 Stable receptive fields for flexible adaptation in the early visual pathway Minjun Kang, Seungdae Baek, Se-Bum Paik P-128 Inhibitory input modulation in a spiking neural network model explains how prediction modifies motion direction information in the visual cortex Jungryul Ahn, Seolmin Kim, Joonyeol Lee P-129 Transformations of neural geometry in the putamen: facilitating efficient value processing and reflecting value-guided Seong-Hwan Hwang, Ji-Woo Lee, Sung-Phil Kim, Hyoung F. Kim P-130 Relative phase of EEG infers directionality of phase dynamics and traveling waves Yukyung Kim, Youngjai Park, Joon-Young Moon Formation of probabilistic representation with prediction of upcoming sensory input during navigation Yeowon Kim, Yul Hr Kang Spiking neural network modeling of basal ganglia for Parkinson's disease prognosis and adaptive deep brain stimulation Jieun Kim, Taegon Kim

P-134 Dynamic causal modelling for functional near-infrared spectroscopy with source reconstruction and large-scale experimental data

Truc Chu, Kiyomitstu Niioka, Ippeita Dan, Sungho Tak

Investigation of the effect of neuromodulatory transmitters on information processing in the cerebellar granule cell layer by computational modeling Withdraw



Computational Neuroscience / Technology in Neuroscience

Sang-Yoon Kim, Woochang Lim

in The Basal Ganglia; Huntington's Disease and Treatment

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The basal ganglia (BG) in the brain exhibit diverse functions for motor, cognition, and emotion. Such BG functions could be made via competitive harmony between the two competing pathways, direct pathway (DP) (facilitating movement) and indirect pathway (IP) (suppressing movement). As a result of break-up of harmony between DP and IP, there appear pathological states with disorder for movement, cognition, and psychiatry. In this paper, we are concerned about the Huntington's disease (HD), which is a genetic neurodegenerative disorder causing involuntary movement and severe cognitive and psychiatric symptoms. For the HD, the number of D2 SPNs (N_{D2}) is decreased due to degenerative loss, and hence, by decreasing X_{D2} (fraction of N_{D2}), we investigate break-up of harmony between DP and IP in terms of their competition degree C_d , given by the ratio of strength of DP (S_{DP}) to strength of IP (S_{IP}) (i.e., $C_d = S_{DP} / S_{IP}$). In the case of HD, the IP is under-active, in contrast to the case of Parkinson's disease with over-active IP, which results in increase in C_d (from the normal value). Thus, hyperkinetic dyskinesia such as chorea (involuntary jerky movement) occurs. We also investigate treatment of HD, based on optogenetics and GP ablation, by increasing strength of IP, resulting in recovery of harmony between DP and IP. Finally, we study effect of loss of healthy synapses of all the BG cells on HD. Due to loss of healthy synapses, disharmony between DP and IP increases, leading to worsen symptoms of the HD.

Keywords: Basal ganglia, Huntington's disease, Direct pathway (DP), Indirect pathways(IP), Harmony between DP and IP, Competition degree, Optogenetics