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Virtual Conference

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The Korean Physical Society

G12.03 [11:34 - 11:46]

Pair Potential between Topological Defects of Spontaneously Twisted Liquid Crystals in a Cylindrical Cavity / ALMUKAMBETOVA Madina[1], JAVADI Arman[1], EUN Jonghee[1], JEONG Joonwoo[*1] ([1]Physics, UNIST)

G12.04 [11:46 - 11:58]

Diabetes prediction with KoGES data using Machine Learning / KIM Young Jin[1], SONG Harksoo[1], KANG Hyuk[*1], KIM Sang Soo[2,3], KIM Jeong Mi[2,3], JANG Min Hee[2,3], YI Wook[2,3], RYANG Soree[2,3], KIM Minsoo[2,3], KIM In Joo[2,3], KIM Jinmi[4] ([1]NIMS, [2]Division of Endocrinology and Metabolism, Department of Internal Medicine, Pusan National University Hospital, [3]Biomedical Research Institute, Pusan National University Hospital, [4]Department of Biostatistics, Clinical Trial Center, Biomedical Research Institute, Pusan National University Hospital)

G12.05 [11:58 - 12:10]

Effect of various recoding of granule cells on Pavlovian eyeblink conditioning in a cerebellar network / KIM Sang-Yoon[1], LIM Woochang[*1] ([1]Daegu National University Of Education)

G12.06 [12:10 - 12:22]

Human blood glucose modulation via insulin secretion adjustment / KANG Hyuk[*1], YOO Minha[1], KIM Jong-Ho[1], KIM Sang Soo[2,3], KIM Jeong Mi[2,3], JANG Min Hee[2,3], YI Wook[2,3], RYANG Soree[2,3], KIM Minsoo[2], KIM In Joo[2,3], KIM Jinmi[4] ([1]NIMS, [2]Division of Endocrinology and Metabolism, Department of Internal Medicine, Pusan National University Hospital, [3]Biomedical Research Institute, Pusan National University Hospital, [4]Department of Biostatistics, Clinical Trial Center, Biomedical Research Institute, Pusan National University Hospital)

G12.07 [12:22 - 12:34]

Two kinds of stochastic resonance in an ecological community / PARK Jong Il[*1], KIM Beom Jun[1], PARK Hye Jin[2] ([1]Department of Physics, Sungkyunkwan University, [2]Statistical physics of ecology and evolution group, APCTP)

G12.08 [12:34 - 12:46]

Competition between cells in a hierarchical tissue can suppress the accumulation of mutations / PARK Hye Jin[*1], ZHOU Da[2], TRAULSEN Arne[3] ([1]APCTP, [2]School of Mathematical Sciences, Xiamen University, [3]Department of Evolutionary Theory, Max Planck Institute for Evolutionary Biology)

Effect of various recoding of granule cells on Pavlovian eyeblink conditioning in a cerebellar network

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Abstract:

We consider the Pavlovian eyeblink conditioning (EBC) via repeated presentation of paired conditioned stimulus (tone) and unconditioned stimulus (airpuff). The effect of various temporal recoding of granule cells on the EBC is investigated in a cerebellar network where the connection probability P_c from Golgi to granule cells is changed. In an optimal case of P_c^* (=0.029), individual granule cells show various well- and ill-matched firing patterns relative to the unconditioned stimulus. Then, these variously-recoded signals are fed into the Purkinje cells (PCs) through parallel-fibers (PFs), and the instructor climbing-fiber (CF) signals from the inferior olive depress them effectively. In the case of well-matched PF-PC synapses, their synaptic weights are strongly depressed through strong long-term depression (LTD). On the other hand, practically no LTD occurs for the ill-matched PF-PC synapses. This type of "effective" depression at the PF-PC synapses coordinates firings of PCs effectively, which then make effective inhibitory coordination on cerebellar nucleus neuron [which elicits conditioned response (CR; eyeblink)]. When the learning trial passes a threshold, acquisition of CR begins. In this case, the timing degree $\mathcal{T}_d$ of CR becomes good due to presence of the ill-matched firing group which plays a role of protection barrier for the timing. With further increase in the trial, strength $\mathcal{S}$ of CR (corresponding to the amplitude of eyelid closure) increases due to strong LTD in the well-matched firing group, while its timing degree $\mathcal{T}_d$ decreases. In this way, the well- and the ill-matched firing groups play their own roles for the strength and the timing of CR, respectively. Thus, with increasing the learning trial, the (overall) learning efficiency degree $\mathcal{L}_e$ (taking into consideration both timing and strength of CR) for the CR is increased, and eventually it becomes saturated. By changing P_c from P_c^*, we also investigate the influence of various temporal recoding on the EBC. It is thus found that, the more various in temporal recoding, the more effective in learning for the Pavlovian EBC.

Keywords:

Eyeblink conditioning, Effective learning, Various temporal recoding, Synaptic plasticity