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P Poster

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7:00pm – 8:00pm

P **P114: Effect of Diverse Recoding of Granule Cells on Delay Eyeblink Conditioning in A Cerebellar Network**

Speakers: Woochang Lim

Slot 02

Sang-Yoon Kim, **Woochang Lim**

We consider a ring network for the delay eyeblink conditioning, and investigate the effect of diverse firing activities of granule (GR) cells on the eyeblink conditioning under conditioned stimulus (tone) by varying the connection probability _p c_ from Golgi to GR cells. For an optimal value of _p *c_, individual GR cells exhibit diverse spiking patterns which are well- or poor-matched with the unconditioned stimulus (airpuff). Then, these diversely-recoded signals via parallel-fibers (PFs) from GR cells are effectively depressed by the error teaching signals via climbing fibers (CFs) from the inferior olive. Synaptic weights at well-matched PF–Purkinje cell (PC) synapses of active GR cells are strongly depressed via strong long-term depression (LTD), while no LTD occurs at poor-matched PF–PC synapses. This kind of "effective" depression at PF-PC synapses coordinates firings of PCs effectively, which then exert effective inhibitory coordination on cerebellar nucleus (CN) [which evokes conditioned response (CR; eyeblink)]. When the learning trial passes a threshold, CR occurs. In this case, the timing degree _T d_ becomes good due to presence of poor-matched spiking group which plays a role of protection barrier for the timing. With further increase in trials, strength of CR _S CR_ increases due to strong LTD in the well-matched spiking group, while its timing degree decreases. Thus, the overall efficiency degree _L e_ (taking into consideration both timing and strength of CR) for the eyeblink increases with trials, and eventually saturates. By changing _p c_, we also investigate the delay eyeblink conditioning and find that a plot of _L e_ versus _p c_ forms a bell-shaped curve with a peak at _p *c_ (where the diversity degree _D_ in firing of GR cells is also maximum). The more diverse in spiking patterns of GR cells, the more effective in CR for the eyeblink.