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Denis Zakharov | HSE University

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Denis Zakharov (1), Daniil Radushev (1), Olesya Dogonasheva (2), and Boris Gutkin (3)

(1) Institute for cognitive Neuroscience, HSE University

(2) Institut de l'Audition, The Institut Pasteur, Université de Paris Cité

(3) Département d'études cognitives, ENS

The paper studies synchronization processes in a network consisting of populations of interneurons (IN) and pyramidal (PY) cells. In each of the populations, the interaction was carried out through connections with a non-local ring topology. In the absence of connections between populations, depending on the parameter values and initial conditions various coherent modes could be implemented in each subnet: full synchronization, cluster modes, traveling waves, static chimera states, traveling chimera states, etc. We have studied two cases of connections between populations:

1) The case of unidirectional nonlocal connections from interneurons to pyramidal cells;

2) The case of bidirectionally interacting populations.

Note that these cases can be considered as models of gamma rhythm generation: in the first case, InterNeuronal Gamma (ING), in the second, Pyramidal-InterNeuronal gamma (PING).

It was found that in the first case, the ring of PY cells qualitatively reproduces the dynamic state of the IN population. For example, if the initial state of the IN population is a traveling multimera state, then a similar traveling multimera state was observed in the PY population. It should be noted that the PY neurons, at the same time, showed not spike, but burst activity (typically 3-5 spike in bursts). In other words, in the ING model, the PY population acted as a passive signal amplifier from the IN subnetwork.



In the second case, with the bidirectional interaction of populations, the influence the PY neurons demonstrated the ability to exert a stabilizing effect on the dynamics of the IN population. It was shown that with sufficiently strong excitatory connections, the PY signal could significantly transform the state of the whole network. Here, there are some examples of transitions between IN-modes due to the action of PY cells: asynchronous state - synchronous state, traveling clusters of subthreshold oscillations – traveling wave, breathing chimera – stable multichimera, traveling multichimera – static multichimera, traveling multichimera – traveling wave, static multichimera with two synchronous clusters – two-cluster (antiphase) synchronization. Regardless of the presence or absence of PY-IN connections, after the establishment of a dynamic mode in the network, both populations demonstrate qualitatively similar dynamic regimes.

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