Modeling of spontaneous zero-lag and propagating synchronization in cat spinal cord

Kato H[1], Cuellar CA[2], Delgado-Lezama R[2], Rudomin P[2], Jiménez I[2], Manjarrez E[3] Mirasso CR[1]

(1) Instituto de Física interdisciplinar y sistemas complejos, Universidad de las Islas Baleares, E-07122 Palma de Mallorca, Spain
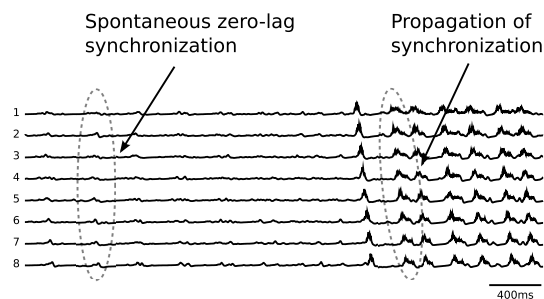(2) Departamento de Fisiología, Biofísica y Neurociencias CINVESTAV, México
(3) Instituto de Fisiología, Benemérita Universidad Autónoma de Puebla. 14 Sur 6301, Col. San Manuel, Apartado Postal 406, Puebla, Pue. CP 72570, México.
(hide@ifisc.uib-csic.es)

Two interesting phenomena were observed in the cat spinal cord [1]. The first one is the propagation of traveling sinusoidal electrical waves along the cat spinal cord. The second one is the spontaneous zero-lag synchronization. Although to explain the propagation nature, some theoretical studies proposed network models in which neuronal populations are rostrocaudally distributed along the cat spinal cord [2], there is no model for the spontaneous zero-lag synchronization.

In this study, we propose a simple but physiologically plausible network model that can reproduce not only the propagation of traveling electrical waves but also spontaneous zero-lag synchronization. As shown in Figure, our model qualitatively well reproduces the experimentally observed phenomena.

[1] Cuellar CA et al. J. Neurosci. **29**(3), 798 (2009). [2] T. Pérez et al. J. Neurosci. **29**(33), 10254 (2009).