Abstract for Dynamics Days Crete 2006
Topic: Neuro-Dynamics

Bursting of neurons induced by inhibitory mechanism

Pik-Yin Lai [1*], Y. S. Chou[1], C. K. Chan[2]

[1] Institute of Biophysics, and Center for Complex Systems, National Central University, Chungli, 320 Taiwan
[2] Institute of Physics, Academia Sinica, Nankang, Taipei, 115 Taiwan
[*] Electronic Address: pylai@phy.ncu.edu.tw

Synchronized bursting is observed in cortical neuronal cultures in vitro when the neuronal network is incubated for a sufficiently period of time[1, 2]. The synchronous bursting frequency is found to be much slower than the characteristic time scale of a neuron. We present a mean field model of the neural network that combines a Fitz-Hugh Nagumo (FHN) model with an additional dynamic variable. This new variable is slower than those in the FHN model. It enables the neuron firing to be inhibited and generates inter-spike intervals (ISI) with long time scales resulting in bursting. By comparison, the additional variable may be regarded as a glial field with inhibitory roles and some properties of our neuron model are discussed. In particular, bursting occurs when the mean coordination number of a neuron with glial field exceeds a threshold value. Furthermore, in the presence of noise, the ISI distribution displays complex and nontrivial patterns.

---

[1] L.C. Jia, M. Sano, Pik-Yin Lai, and C. K. Chan, *Phys. Rev. Lett.* **93**, 088101 (2004).

[2] Pik-Yin Lai, L. C. Jia, and C. K. Chan, *Phys. Rev. E* **73**, 051906 (2006).