ECE667-101 2009F
Project 2 Due: Dec 1, 2009

Phase resetting and locking in bio-systems.

Change in oscillation phase (resetting) can be induced by external stimuli in the form of single pulses. Except for oscillatory annihilation (see the black hole theory), the rhythm is reestablished with the same frequency/amplitude but a different phase. A single pulse stimulus can lead to either a longer or shorter cycle length, depending on the stimulus phase (at what part of the oscillation that the stimulus is delivered). Popular models for investigating this property include integrate-and-fire (reset integrator), limit cycle, FitzHugh-Nagumo, and Hodgkin-Huxley.

Such phenomenon is important to analyzing and modifying biological clocks and hence the mechanism of life.

Single pulse perturbation:

a. Provide an introduction to single pulse perturbation
b. Obtain a suitable differential equation model.
c. Generate a Simulink model and create the effects of single pulse perturbation.
d. Investigate existing pulse delivery devices such as pace maker and ICD. What are their sensing, decision, and pulse delivery mechanisms?

See reference papers on entrainment.

Additional References:

1. "Richard FitzHugh", Scholarpedia.Org, 2007

   <http://scholarpedia.org/article/User:FitzHugh> , 10 Dec 2007

2. Forger, D.B. and Paydarfar, D. *J. Theor. Biol.* **230**, 521-532 (2004).