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PDF文档

心肌单细胞兴奋模式转迁的非线性动力学机理

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利用Morris-Lecar模型研究实验观察到的培养心肌单细胞自发性兴奋模式转迁规律的动力学机理，确定性模型仿真，揭示了心肌单细胞随参数由“极化”静息经规则节律到“去极化”静息的节律变化规律。随机因素扰动下的模型仿真发现在分岔序列中的分岔点附近会出现含延迟后去极化电位、早后去极化电位的节律模式，其中，延迟后去极化节律产生于从“极化”静息到规则节律的分岔点附近，而早后去极化节律产生于从规则节律到“去极化”静息的分岔点附近。这表明含延迟后去极化电位的节律和含早后去极化电位的节律是系统在自动兴奋和静息之间的分岔点附近由于参数的随机扰动而产生的。

The nonlinear dynamics of rhythms transition in single cardiac cell

The Morris-Lecar (ML) model was used to investigate the mechanisms of the experimentally discovered rhythms transition in cultured single cardiac cells. Stimulated by the extern current (Iext), the deterministic ML model showed a transition process from the resting state of polarization to the resting state of over-depolarization through the uninterrupted regular rhythm. However, the delayed after-depolarization (DAD) rhythm and the early after-depolarization (EAD) rhythm similar to that found in experiment were appeared in the model containing stochastic fluctuation. The DAD rhythm located near Hopf bifurcation point between the resting state of polarization and the uninterrupted regular rhythm, and the EAD rhythm located near Hopf bifurcation point between the uninterrupted regular rhythm and the resting state of over-depolarization. Those results indicated that the DAD and EAD rhythm were generated by disturbing activation of small stochastic fluctuation.

关键词

Morris-Lecar模型(Morris-Lecar model); 分岔(Bifurcation); 延迟后去极化电位(Delayed after-depolarization); 早后去极化电位(Early after-depolarization); 随机因素(Stochastic fluctuation)