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混沌放电的可兴奋性细胞对外界刺激反应敏感的动力学机制

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在大鼠损伤背根节神经元受到去甲肾上腺（NE）、四乙基胺（TEA）和高浓度钙等刺激的实验中，观察到非周期放电的神经元明显地比周期放电的神经元对外界刺激的反应敏感程度高。现有的结果表明许多非周期放电的神经元实际上表现为确定性的混沌运动，比如混沌尖峰放电、混沌簇放电以及整数倍放电等。以修正的胰腺β细胞Chay模型为例，通过对其分岔结构的分析和对构成混沌吸引子的基本骨架的不稳定周期轨道的计算，揭示了分岔、激变和混沌运动对参数敏感依赖性是该现象产生的动力学机制。同时指出以往使用平均发放率来刻划可兴奋性细胞放电活动存在的缺陷，提出了一种新的利用周期轨道信息的刻划方法。

THE DYNAMICAL MECHANISMS FOR THE SENSITIVE RESPONSE OF EXCITABLE CELLS WITH CHAOTIC FIRING TO EXTERNAL STIMULATION

It has been observed that aperioidic firing neurons have higher sensitivity than periodic firing ones in the experiments about the injured dorsal root ganglion neurons in rats subjected to norepinephrine (NE), tetraethylammonium (TEA), high Ca2+ solutions, et al. Existing results show that a number of apeirodic firing neurons actually exhibit deterministic chaotic motions, for example, chaotic spiking, chaotic bursting, integer multiple spiking, and so on. Bifurcations, crises and sensitive dependence of chaotic motions on parameters are considered as the dynamic mechanisms for the phenomena of sensitive response through the analysis of the bifurcation structure and the calculation of unstable periodic orbits constituting the most fundamental building blocks of a chaotic attractor in terms of the modified pancreatic β-cells. At the same time, the deficiencies of mean firing rate in characterizing the firing activity of excitable cells is pointed out, and a novel describing method is presented using the information of periodic orbits.

关键词