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PDF文档

神经放电加周期分岔中由随机自共振引起一类新节律

杨明浩*、古华光、李莉、刘志强、任维
航天医学工程研究所

当改变实验性神经起步点细胞外[Ca2+]时，放电节律表现出从周期1节律转换为周期4节律的加周期分岔序列。其中，周期n节律转换为周期n+1节律的过程中（n=1,2,3）存在一种新的具有交替特征的节律，该新节律为周期n簇与周期n+1簇放电的交替，并且周期n+1簇的时间间隔序列呈现出整数倍特征。确定性神经放电理论模型（Chay模型）只能模拟周期n节律直接到周期n+1节律的加周期分岔序列；而随机Chay模型可以模拟实验中的加周期分岔过程和新节律。进一步，新节律被确认是经随机自共振机制产生的。这不仅解释了实验现象，也将随机自共振的产生区间从以前认识到的Hopf分岔点附近扩大到加周期分岔点附近，同时扩大了噪声在神经放电和神经编码中起重要作用的参数区间。

A TYPE OF NEW NEURAL FIRING PATTREN INDUCED BY AUTONOMOUS STOCHASTIC RESONANCE LYING IN A PERIOD ADDING BIFURCATION SCENARIO

A period adding bifurcation scenario from period 1 bursting to period 2 bursting was discovered in an experimental neural pacemaker when extra-cellular calcium concentration ([Ca2+]o) was decreased. A new firing pattern was observed in the procedure via which period n (n=1, 2, 3) bursting was changed into period n+1 bursting. The behavior of the new firing pattern was an alternation between period n burst and period n+1 burst. The series of interval between two continual period n+1 burst exhibited approximate integer multiple characteristics. The deterministic neuronal firing model (Chay model) could simulate only the period adding bifurcation scenario in which period n bursting was changed into period n+1 bursting directly. The period adding bifurcation scenario and the new firing pattern similar to the experiment could be simulated in the stochastic Chay model. Moreover, the new firing pattern was verified to be caused by noise through the effect of autonomous stochastic resonance (ASR). It not only interpreted the experimental discovery, but also extended the parameter regions where ASR could be generated from Hopf bifurcation point to period adding bifurcation point. Meanwhile, the parameter regions in which noise plays an important role in neural firing and neural coding were extended.

关键词