

Public Abstract

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Graduation Term:SS 2013

Department:Biological Sciences

Degree:PhD

Title:Motor neuron output in the crustacean cardiac ganglion is organized and maintained by homeostatic conductance relationships

Rhythmic behaviors important to animal survival such as movement, breathing and even heart contractions are often controlled by a networks of connected nerve cells called central pattern generators. The electrical activity generated by each nerve cell, or neuron, is what ultimately causes the important rhythmic behavior to occur. This electrical output is generated by pores in the cells membrane called ion channels; these ion channels pass charged ions resulting in an ionic current. The types of ion channels, as well as the amount of each type, will ultimately dictate the electrical output of a neuron. It is important to understand how the ion channels, and resulting ionic currents, are regulated in neurons to achieve and maintain an important electrical output. Here we show that neurons which control the heart beat of the crab *Cancer borealis* can generate identical electrical activity using very different sets of ion channels and ionic currents. This variability is in part the result of two types of ionic currents, which do very similar things, balancing one another. When one of these currents is high the other is low, and vice versa. This balance is actively maintained ; if one of the currents is decreased, the other will rapidly increase to compensate. This compensation helps maintain appropriate electrical activity in these neurons. These studies demonstrate that compensation between ionic currents in neurons allows two cells to have identical electrical activity, even when their underlying properties are very different.