Sieling *et al. BMC Neuroscience* 2010, **11**(Suppl 1):P1
http://www.biomedcentral.com/1471-2202/11/S1/P1

BMC Neuroscience

POSTER PRESENTATION | Open Access

Changes in electrical coupling via dynamic clamp produces correlates of operant conditioning in the feeding CPG networks of *Aplysia*

Fred H Sieling[1*], John Simmers[2], Astrid A Prinz[1,3], Romuald Nargeot[2]

From Nineteenth Annual Computational Neuroscience Meeting: CNS*2010
San Antonio, TX, USA. 24-30 July 2010

Appetitive operant conditioning, a form of associative learning, produces a long-lasting switch in the mollusk *Aplysia*'s food-seeking behavior from irregular, impulsive-like radula biting movements into stereotyped, compulsive-like recurrences of this cyclic act [1]. Three bilateral pairs of neurons (B63, B65, and B30) in the feeding central pattern generator (CPG) circuit, found in the buccal ganglia, are initiators of each radula bite motor pattern. Using isolated ganglia from naïve and operantly conditioned animals, it was previously found that learning increased both the frequency and regularity of spontaneous bursting activity in these three pairs of neurons. This plasticity was correlated with an increase in electrical coupling among these cells, together with an increased excitability and a change in their intrinsic oscillatory membrane properties [2]. In the present study, we explored the role that changes in electrical coupling between the 6 neurons might play in the operant learning-induced regularization and acceleration of biting motor pattern genesis.

In isolated buccal ganglia, we implemented a dynamic clamp procedure during fictive biting activity to artificially increase the electrical coupling among the identified motor pattern initiating neurons. In preparations which spontaneously generated irregular biting motor patterns, artificially increasing the coupling among groups of any 3-4 (out of the 6) neurons immediately switched the network from an irregular to a regular burst pattern. Conversely, in preparations in which the motor pattern-initiating cells spontaneously generated rhythmic motor output, a decrease in their electrical coupling switched the cell's bursting activity and radula motor pattern genesis from a rhythmic to an arrhythmic mode. These changes were not correlated to a change either in resting membrane potential of the recorded cells or in the frequency of their impulse bursts. These data therefore suggest a causal relationship between the strength of electrical coupling and the temporal regularity of motor pattern genesis underlying each radula cycle, while a separate mechanism is likely to account for the changes in motor pattern frequency. Plasticity induced by operant learning in electrical connectivity within a subset of CPG neurons, may thereby provide a cellular substrate for the behavioral switch between impulsive to compulsive motor actions in *Aplysia* as well as in more complex animals.

Author details
[1]Wallace H. Coulter Department of Biomedical Engineering, Georgia Institute of Technology and Emory University, Atlanta, GA 30332, USA . [2]Université de Bordeaux, CNRS UMR 5227, Laboratoire Mouvement Adaptation Cognition, Bordeaux F-33076, France . [3]Department of Biology, Emory University, Atlanta, GA, 30322, USA.

Published: 20 July 2010

References
1. Nargeot R, Petrissans C, Simmers J: **Behavioral and in vitro correlates of compulsive-like food seeking induced by operant conditioning in aplysia.** *Journal of Neuroscience* 2007, **27(30)**:8059-8070.
2. Nargeot R, Le Bon-Jego M, Simmers J: **Cellular and network mechanisms of operant learning-induced compulsive behavior in aplysia.** *Current Biology* 2009, **19**:975-984.

doi:10.1186/1471-2202-11-S1-P1
Cite this article as: Sieling *et al.*: Changes in electrical coupling via dynamic clamp produces correlates of operant conditioning in the feeding CPG networks of *Aplysia*. *BMC Neuroscience* 2010 **11**(Suppl 1):P1.

* Correspondence: fred.sieling@bme.gatech.edu
[1]Wallace H. Coulter Department of Biomedical Engineering, Georgia Institute of Technology and Emory University, Atlanta, GA 30332, USA