MOTOR NEURON OUTPUT IN THE CRUSTACEAN CARDIAC GANGLION IS ORGANIZED AND MAINTAINED BY HOMEOSTATIC CONDUCTANCE RELATIONSHIPS

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GENERATING APPROPRIATE AND FUNCTIONAL NEURONAL OUTPUT IS A MATTER OF FUNDAMENTAL IMPORTANCE TO NERVOUS SYSTEMS ACROSS SPECIES AND PHYLA. POTENTIAL PERTURBATIONS TO A NEURONS INTRINSIC EXCITABILITY ALONE INCLUDE HEBBIAN STYLE PLASTICITY, ION CHANNEL TURNOVER AND NEUROMODULATION. WITH THESE DYNAMIC PROCESSES IN PLACE, IT IS REMARKABLE THAT NEURONS ARE ABLE TO MAINTAIN STABLE AND FUNCTIONAL OUTPUT THROUGHOUT THE LIFE OF AN ORGANISM. YET LITTLE IS KNOWN ABOUT THE CELLULAR MECHANISMS IN NEURONS AND NETWORKS WHICH ACT TO STABILIZE FUNCTIONAL OUTPUT. HERE WE UTILIZE LARGE CELL MOTOR NEURONS OF THE CANCER BOREALIS CARDIAC GANGLION TO INVESTIGATE HOW THESE CELL’S IMPORTANT BURST OUTPUT IS GENERATED, MAINTAINED AND SYNCHRONIZED ACROSS CELLS IN A RHYTHMIC MOTOR NETWORK. WE FIND THAT LARGE CELL MOTOR NEURONS UTILIZE MULTIPLE INTRINSIC CURRENTS TO MEDIATE BURST POTENTIALS, AND THESE CURRENTS ARE IN PART LOCALIZED TO THE LC SOMATA, DISTAL FROM ACTION POTENTIAL GENERATING CURRENTS. NEXT WE EXAMINE THE FUNCTIONAL ORGANIZATION OF THESE INTRINSIC CURRENTS AND SHOW THAT LC MOTOR NEURONS, WHICH HAVE SYNCHRONOUS BURST ACTIVITY DURING NORMAL NETWORK BEHAVIOR, HAVE DIFFERENTIAL INTRINSIC TUNING EVEN ACROSS LCS IN A SINGLE NETWORK. THIS DIFFERENTIAL TUNING RESULTS IN CONSERVED VOLTAGE OUTPUT ACROSS LCS IN PART DUE TO COMPENSATORY CONDUCTANCE RELATIONSHIPS.