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Distinct rhythmic locomotor patterns can be generated by a simple adaptive neural circuit: biology, simulation, and VLSI implementation.

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Rhythmic motor patterns can be induced in leg motor neurons of isolated locust thoracic ganglia by bath application of pilocarpine. We observed that the relative phases of levators and depressors differed in the three thoracic ganglia. Assuming that the central pattern generating circuits underlying these three segmental rhythms are probably very similar, we developed a simple model circuit that can produce any one of the three activity patterns and characteristic phase relationships by modifying a single synaptic weight. We show results of a computer simulation of this circuit using the neuronal simulator NeuraLOG/Spike. We built and tested an analog VLSI circuit implementation of this model circuit that exhibits the same range of "behaviors" as the computer simulation. This multidisciplinary strategy will be useful to explore the dynamics of central pattern generating networks coupled to physical actuators, and ultimately should allow the design of biologically realistic walking robots.