COMPUTATIONAL MODELING OF COUGH AND BREATHING

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Noticeable progress in technology leads to increasing significance of computational modeling that has become an important tool in physiological and pathophysiological research.

Computational model presented here was developed at the University of South Florida. The model is based on MacGregor´s neural simulator published in his book *Neural and Brain modelling* (1). The model employs the neuronal connectivity data from extensive experimental studies on cat animal model. As such number of respiratory neuronal populations represented by 99 or 300 neurons are connected appropriately to other neuronal groups. The basic model utilizes neuronal excitation and inhibition and reciprocal inhibition between core neuronal populations and reproduces firing of neurons and respiratory motor output during breathing. Respiratory neural network (model) functions and reconfigures because of altered excitation and/or inhibition among neuronal populations and additional afferent inputs corresponding to modified physiological conditions. Appropriate afferent drive is capable to eliminate regular breathing pattern produced by simulator and turn it into cough motor pattern. Simulator is controlled by a graphical interface, allowing creation of model neuronal populations, the fiber populations providing connectivity among cells and editing parameters of the cells and their synaptic inputs. The display program produces waveform of integrated activities for selected cells and/or selected neuronal populations, as well as the motor drive in the simulated phrenic and iliohypogastric nerves (inspiratory and expiratory motor nerves) during the behaviors and simulated processes.

(1) **MacGregor, R. J.** *Neural and Brain Modeling.* New York: Academic, 1987.