Resource Summary Report

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PNEUMA

RRID:SCR_001391
Type: Tool

Proper Citation

PNEUMA (RRID:SCR_001391)

Resource Information

URL: http://bmsr.usc.edu/software/pneuma/

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Description: A set of modules that are used to simulate the autoregulation of the cardiovascular and respiratory systems under conditions of changing sleep-wake state and a variety of physiological and pharmacological interventions. It models the dynamic interactions that take place among the various component mechanisms, including those involved in the chemical control of breathing, heart rate, and blood pressure, as well as the effects of changes in the sleep-wake state and arousal from sleep. PNEUMA includes the autonomic control of the cardiovascular system, chemoreflex and state-related control of breath-to-breath ventilation, state-related and chemoreflex control of upper airway potency, as well as respiratory and circulatory mechanics. The model is capable of simulating the cardiorespiratory responses to sleep onset, arousal, continuous positive airway pressure, the administration of inhaled carbon dioxide and oxygen, Valsalva and Mueller maneuvers, and Cheyne-Stokes respiration during sleep. In PNEUMA 3.0, we have extended the existing integrative model of respiratory, cardiovascular, and sleepwake state control, to incorporate a sub-model of glucoseinsulinfatty acid regulation. The extended model is capable of simulating the metabolic control of glucoseinsulin dynamics and its interactions with the autonomic nervous system. The interactions between autonomic and metabolic control include the circadian regulation of epinephrine secretion, epinephrine regulation on dynamic fluctuations in glucose and free fatty acids in plasma, metabolic coupling among tissues and organs mediated by insulin and epinephrine, as well as the effect of insulin on peripheral vascular sympathetic activity. This extended model represents a starting point from which further in silico investigations into the interaction between the autonomic nervous system and the metabolic control system can proceed. Features in PNEUMA 3.0 * Incorporates metabolic component based on prior models of glucose-insulin regulation and free fatty acid (FFA) regulation. * Changes in sympathetic activity from the autonomic portion of PNEUMA produce changes in epinephrine output, which in turn affects the metabolic sub-model. *

Inputs from the dietary intake of glucose and external interventions, such as insulin injections, have also been incorporated. * Also incorporated is autonomic feedback from the metabolic component to the rest of PNEUMA: changes in insulin level lead to changes in sympathetic tone. System Requirements: PNEUMA requires Matlab R2007b or higher with the accompanying version of Simulink to be installed on your computer.

Abbreviations: PNEUMA

Resource Type: software resource, simulation software, software toolkit, software application

Defining Citation: PMID:17271149

Keywords: matlab, simulate, autoregulation, cardiovascular system, respiratory system, sleep-wake state, physiological intervention, pharmacological intervention, drug, breathing, heart rate, blood pressure, respiration, glucose, insulin, fatty acid, regulation, autonomic nervous system, chemoreflex, ventilation, circulation, cardiorespiratory, metabolic control system, circadian, regulation, epinephrine

Funding: NIBIB P41-EB001978;
NCRR P41-RR01861

Availability: Free, Under the terms of a Release Agreement.

Resource Name: PNEUMA

Resource ID: SCR_001391

Alternate IDs: nlx_152572

Record Creation Time: 20220129T080207+0000

Record Last Update: 20250524T055809+0000

Ratings and Alerts

No rating or validation information has been found for PNEUMA.

No alerts have been found for PNEUMA.

Data and Source Information

Source: SciCrunch Registry

Usage and Citation Metrics

We found 3 mentions in open access literature.

Listed below are recent publications. The full list is available at NIF.

Diem G, et al. (2023) Salivary antibodies induced by BA.4/BA.5-convalescence or bivalent booster Immunoglobulin vaccination protect against novel SARS-COV-2 variants of concern. Microbiology spectrum, 11(5), e0179323.

Daneman N, et al. (2020) Bacteremia Antibiotic Length Actually Needed for Clinical Effectiveness (BALANCE) randomised clinical trial: study protocol. BMJ open, 10(5), e038300.

Serna LY, et al. (2018) An Improved Dynamic Model for the Respiratory Response to Exercise. Frontiers in physiology, 9, 69.