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Control of the cardiorespiratory system: challenges and opportunities

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Maintaining physiological levels of oxygen (O_2) and carbon dioxide (CO_2) in the blood is crucial for survival and is achieved by sophisticated neural control mechanisms affecting both the breathing pattern and heart rate. Neural activity, originated in the brainstem, drives the respiratory muscles, providing air flow into and out of the lungs where gas exchange takes place and also affects heart rate and blood flow. Chemoreceptors that sense the levels of O_2 and CO_2 in the blood, mechanical stretch receptors within the lungs and blood pressure sensors provide feedback signals to the brainstem networks which then regulate the breathing pattern and heart rate appropriately. Understanding how the neural system responds to all the feedback signals it receives is still lacking. I will outline the challenges we face from a modelling perspective and the different approaches we take in our attempt to resolve them.

Primary author: Dr BEN-TAL, Alona (Massey University)

Presenter: Dr BEN-TAL, Alona (Massey University)

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