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I am originally from Milan, Italy, where I obtained an undergraduate degree with distinction in Pharmaceutical Chemistry from one of the most prestigious Pharmacy Schools in Italy (University of Milan). While training at the “Carlo Besta” National Neurological Institute (Milan, Italy) I also obtained a specialization degree with distinction (Master’s equivalent) in Pharmacology at the University of Milan. For my Master’s degree, I studied neurodevelopmental defects and pharmacological properties of excitatory receptors in human samples and animal models of epilepsy.

After my Master’s I moved to the University of Alberta, where I obtained a PhD in Physiology under the supervision of Dr. John Greer (Physiology). My research focus was on respiratory neurobiology; specifically the anatomical and physiological properties of neuronal networks involved in the neural control of breathing in both control and mutant rodents. In these studies we were able to identify the time of genesis and migration of respiratory rhythmogenic neurons, the time of inception of respiratory rhythmogenesis in the embryonic period, and transcription factors involved in the specification of different neuronal populations of the respiratory networks. We also identified aberrant development in network and cellular properties of transgenic mice with associated respiratory disorders (e.g., Prader Willi Syndrome).

At the end of my PhD, I pursued postdoctoral studies at the University of California at Los Angeles (UCLA) under the supervision of Dr Jack Feldman. I used an in vivo animal model and a combination of neuropharmacological and optogenetic manipulations to study interactions between brainstem structures involved in respiratory rhythm generation. We identified and characterized some of the pharmacological and physiological properties of a putative expiratory rhythm generating centre, the paraFacial Respiratory Group (pFRG), in adult anesthetized rats. We demonstrated that pFRG is a conditional expiratory oscillator that is silent at rest and becomes rhythmically active upon release of inhibition. We also used optogenetics to directly stimulate pFRG neurons, record from these neurons and test respiratory reset phenomenon upon photostimulation.

At the end of my training at UCLA I was recruited back to the University of Alberta as a Parker B. Francis Fellow co-supervised by Drs. Greer, Funk (Physiology) and Dickson (Psychology & Physiology). Here, I had the opportunity of working on a research project concerning state dependent modulation of respiration in *in vivo* animal models. In this project, we analyzed state dependent modulation of different breathing parameters under urethane anesthesia (Pagliardini et al., 2012, J. Neuroscience). Recent studies published by Dr Dickson have shown that rats anesthetized with urethane show spontaneous brain alternations that closely mimic natural sleep (with REM-like and nREM-like epochs), therefore providing a potential model of sleep in which rats do not wake up but show predictable and spontaneous brain state transitions. In this study we demonstrated that this is also a good model for studying state-dependent modulation of breathing in both rats and mice (manuscript in preparation), since rodents under urethane

anaesthesia show changes in respiratory flow and respiratory muscle activity across states that are similar to natural sleep.

For example, we focused our attention on one of most studied tongue muscles, the genioglossus, which is critical for maintenance of upper airway patency. The loss of tone in this muscle during sleep has important implication in the development of obstructive sleep apnea in humans, a common disease characterized by occurrence of repetitive apneas during sleep that eventually alter sleep pattern and in the long term are responsible for the development of cardiovascular and cognitive disorders. In this model of sleep, we were able to demonstrate that genioglossus activity is modulated by state in a similar fashion to what occurs in natural sleep in both rodents and humans, therefore providing the foundation for further studies focused on determining mechanisms controlling this loss of muscle activity across states and testing potential treatments for obstructive sleep apnea.

In this study we were also able to demonstrate that in both REM-like epochs (under urethane anaesthesia) and in REM epochs of natural sleep, abdominal muscle activity (likely generated by endogenous activation of pFRG) is often recruited and it is clearly expiratory. This observation is novel and even though neither the central origin nor the function of this expiratory abdominal muscle recruitment is known, it is intriguing to speculate that abdominal activity helps preserve ventilation when inspiration is more fragile and upper airways are more prone to collapse. These results provide the foundation for further investigations on the functional role of expiratory activity across sleep states in both rodents and humans in both regular ventilation and in presence of respiratory disturbances (sleep-disordered breathing in premature infants, neurodegenerative disease and in presence of genetic disorders associated with sleep disordered breathing).

This project constitutes the building foundation for my own research laboratory and my academic career as Assistant Professor in the Department of Physiology at the University of Alberta.