

日時: 令和元年9月30日(月) 17:00~18:30

場所: 共同会議室(研究棟B・2階)

Molecular mechanisms of central respiratory chemoreception

Dr Natasha Kumar

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Since establishing an independent research group in 2016,
she has attracted federal funding, as CIA.

Notably, she is convenor of the UNSW Neuroscience Honours program,
and is the SoMS Outreach and Public Engagement coordinator.

Prior to 2016, Dr Kumar held post-doctoral positions at the University of Virginia (USA) and Macquarie University. She holds a Bachelor of Medical Science (Hons1, USYD) and a PhD (Medicine USYD).



Chemoreceptor neurons in the Phox2b-expressing retrotrapezoid nucleus (RTN) are CO₂-responsive and critical in mediating the central respiratory chemoreflex. They directly sense CO₂/H⁺ and adjust ventilation to rapidly regulate CO₂ excretion and acid-base balance. RTN neurons extensively project to the ventral respiratory column (VRC) which generates the rhythmic breathing pattern.

Study 1: Using a combination of genetic loss-of-function, cellular pharmacology and molecular biology, in vitro and in vivo physiology, and RTN neuron-specific re-expression and rescue, we identified GPR4, a proton-activated G protein-coupled receptor, and TASK2, an alkaline activated potassium leak channel, as molecular substrates for CO₂/H⁺-dependent RTN neuronal excitability and breathing. (Kumar NN et al 2015, Science)

Study 2: RTN neurons co-express glutamate and specific subsets of neuropeptides (including Neuromedin B [NMB], galanin, PACAP, gastrin-releasing peptide [GRP]). We are assessing the contribution of RTN neuropeptide co-release to adaptation of the respiratory chemoreflex in response to long-term hypercapnia (such as occurs in respiratory disorders). In the mouse, 50% of RTN neurons express inducible inhibitory neuropeptide galanin; galanin mRNA expression in the RTN increases by 70% after long term hypercapnia (LH 10 days, 8% CO₂). We have also characterised the galanergic neurons projecting to the VRC using retrograde tracing, the expression of galanin receptors in the VRC and determined alterations in RTN activation in response (cFos) to hypercapnic chemoreflex, after LH. Finally, we have assessed alterations to Phox2b-expressing RTN neurons in a piglet model of SIDS (intermittent hypoxia hypercapnia). (Manuscript in preparation).

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