Speaker	Hari Subramanian
Talk Title	Neuromodulation of the midbrain periaqueductal gray: Opportunities and Challenges
Institution	The University of Queensland
Department	UQ Centre for Clinical Research
E-mail	h.subramanian@uq.edu.au
Webpage	http://www.uqccr.uq.edu.au/apcn.aspx

1. Tentative Abstract

DBS has become an established neurosurgical treatment for Parkinson's disease, dystonia, and tremors. This is because neuroscientific research in mamalian animal models has contributed to improved understanding of brain circuitries underlying locomotor control. DBS is seen as an emerging technology for treatment of intractable autonomic disease. Autonomic diseases include breathing problems, vocalization disorders, hypertension and urinary incontinence and manifest either due to neurogenic dysfunction of brainstem autonomic control circuits and/or accompany psychiatric and emotional disorders. The midbrain periaqueductal gray (PAG) could be a one 'stop shop' for treatment of autonomic disease via DBS induced neuromodulation because, we have shown[1] that 1) the PAG functions as the critical relay center of the limbic brain, 2) it possibly represents the only nucleus that projects to various autonomic control circuits located in the caudal brainstem and spinal cord and, 3) various types of autonomic deficits such as dyspnea, apnea, ataxic, asthmatic and sleep disordered breathing, hyper & hypotension and micturition disruption can be evoked by stimulating the PAG. This lecture would examine whether an autonomic topography exists within the PAG. Secondly, whether there exists segregation of neural circuits specific to single autonomic function. Thirdly, how selective manipulation of of neural circuits for therapeutic targets can be achieved. Further the seminar would examine the design and implantation aspects of

neural prosthesis in the brainstem for neuromodulation. Answering these will facilitate application of selective DBS neuromodulation for specific autonomic disease state.

1. **Subramanian HH** and Holstege G (2014). The midbrain periaqueductal gray changes the eupneic respiratory rhythm into a breathing pattern necessary for survival of the individual and of the species. ***Progress in Brain Res***. 212:352-384.

2. Brief Biography

Dr. Subramanian completed his PhD in Systems Neuroscience from The University of Sydney on a National Health & Medical Research Council (NHMRC) scholarship. He has since held a postdoctoral fellowship at the Nobel Institute for Neurophysiology, Karolinska Institutet, Stockholm and an Assistant Professorship at The University of Groningen, The Netherlands. Dr. Subramanian currently holds a Senior Research Fellowship at the University of Queensland, Centre for Clinical Research (UQCCR), Asia-Pacific Centre for Neuromodulation (APCN). In this position he heads the Neuromodulation Neuroscience laboratory with a focus on systems neurophysiology of autonomic control and treatment of neurogenic autonomic disorders (respiratory, cardiovascular and urinary) via neuromodulation of brainstem circuits. Dr. Subramanian is also an affiliate at the Queensland Brain Institute (QBI), a Teaching Intern at the School of Biomedical Sciences (SBMS, UQ) and a Honorary Senior Research Associate at The University of Sydney. Dr. Subramanian is a pioneer on the systems neuroscience of the midbrain neural circuits. He has published > 20 peer-reviewed scientific papers in top neuroscience journals, > 35 peer-reviewed conference papers and edited two thematic books on homeostatic control mechanisms for the prestigious journal Progress in Brain Research. He has several invited national and international lectures, editorials, awards, prizes and recognitions to his credit. He is also a recipient of research grant funding >$2.4 million (project & infrastructure grants and fellowships) from various national and international agencies. Dr. Subramanian was recently selected as a discussant for Minister for Health's 2013 Theo Murphy High Flyers Think-Tank Melbourne themed "inspiring smarter brain research in Australia".

3. List of Representative Publications

1. **Subramanian HH** and Holstege G (2014). The midbrain periaqueductal gray changes the eupneic respiratory rhythm into a breathing pattern necessary for survival of the individual and of the species. ***Progress in Brain Res***. 212:352-384.

2. **Subramanian HH** and Holstege G (2013). Stimulation of the midbrain periaqueductal gray modulates pre-inspiratory neurons in the ventrolateral medulla in the in vivo rat. ***Journal of Comparative Neurology:*** 521(13):3083-98.

3. **Subramanian HH** (2013). Descending control of the respiratory neuronal network by the midbrain periaqueductal grey in the rat in vivo. ***Journal of Physiology***, 591:109-22. ***(cited by Faculty of 1000 Biology:*** http://f1000.com/prime/717967820#eval793467507***).***

4. **Subramanian HH** and Holstege G (2011). The midbrain and medullary control of post-inspiratory activity of the crural and costal diaphragm in vivo. ***Journal of Neurophysiology***. 105(6): 2852-62.

5. **Subramanian HH** and Holstege G (2009). The nucleus retroambiguus control of respiration. ***Journal of Neuroscience***, 29(12): 3824-32..

6. **Subramanian HH**, Balnave RJ and Holstege G (2008). The midbrain periaqueductal gray control of respiration. ***Journal of Neuroscience***, 28(47):12274-12283. ***(cited by Faculty of 1000 Biology: http://www.f1000biology.com/article/id/1141935/evaluation).***