

Supervisors



Prof Doug McEvoy
Tel: 8275 1187
Fax: 8277 6890
Email: doug.mcevoy@rgh.sa.gov.au
Web: www.adelaidesleephealth.org.au



A/Prof Peter Catcheside
Tel: 8275 1309
Fax: 8277 6890
Email: peter.catcheside@rgh.sa.gov.au
Web: www.adelaidesleephealth.org.au



Dr Stuart Baulk
Tel: 8275 1098
Fax: 8275 1114
Email: stuart.baulk@rgh.sa.gov.au
Web: www.unisanet.unisa.edu.au/staff/Homepage.asp?Name=stuart.baulk

Broad Research Area: *Mechanisms and Consequences of Sleep Disordered Breathing*

The Adelaide Institute for Sleep Health provides a clinical service for adult patients with sleep related problems, such as obstructive sleep apnoea (repeated obstructive breathing events in sleep in otherwise healthy subjects), insomnia and sleep hypoventilation in patients with known respiratory muscle weakness or lung disease. Breathing disturbance and sleep fragmentation have important daytime consequences including pathological daytime sleepiness, neurocognitive impairments and a substantially increased risk of traffic and other accidents. Sleep apnoea is also associated with cardiovascular disease (eg hypertension and heart disease).

Our group is one of the leading clinical research laboratories in Australia investigating cardiorespiratory and sleep physiology, with a particular focus on mechanisms and consequences of sleep breathing disorders. There are several opportunities for Honours projects in a number of broad research areas including.

Potential Honours Projects

Arousal and respiratory control factors in the pathogenesis of obstructive sleep apnoea

Breathing responses to arousal and other respiratory control factors, such as an inherently unstable respiratory control system, may play key roles in the pathophysiology of OSA. Our group is investigating potential pathogenic mechanisms that may help explain why breathing disturbances markedly improve in deep versus light sleep and why some patients are more at risk of breathing disturbances than others despite apparently similar upper airway collapsibility. Understanding these mechanisms is ultimately important for improving diagnostic and treatment options in patients. Potential Honours projects within this broad research area include;



- A comparison of respiratory control stability in OSA patients versus healthy individuals during wakefulness and sleep.
- The propensity for upper airway collapse during periods of low ventilatory drive.
- Measures of upper airway collapsibility during sleep.

Relevant Publications

1. Jordan AS, Eckert DJ, Catcheside PG, McEvoy RD. Ventilatory response to brief arousal from non-rapid eye movement sleep is greater in men than in women. *Am J Respir Crit Care Med* 2003; 168: 1512-1519.
2. Jordan AS, McEvoy RD, Edwards JK, Schory K, Yang CK, Catcheside PG, Fogel RB, Malhotra A, White DP. The influence of gender and upper airway resistance on the ventilatory response to arousal in obstructive sleep apnoea in humans. *J Physiol* 2004; 558: 993-1004.
3. Hudge DW, Gordon EA, Thanakitcharu S, Bruce EN. Instability of ventilatory control in patients with obstructive sleep apnea. *Am J Respir Crit Care Med*. 1998;158:1142-9.

Vulnerability to driving and neurocognitive impairment in obstructive sleep apnoea

Increased public and medical awareness is leading to the identification of large numbers of OSA patients but the ability of road safety and health care professionals to assess motor-vehicle accident risk and advise on risk reduction is lagging seriously behind. For example, while data suggest that patients with severe OSA are at increased risk, little is known about MVA risk and driving performance in patients with mild-moderate disease. We know that healthy, young adult drivers are prone to fall-asleep accidents after partial sleep deprivation, and that low-dose alcohol acts synergistically with sleep loss to markedly impair driving. The vulnerability of OSA patients to these additional insults is unknown - yet they are common and likely to be important. Treatment of severe OSA improves driving performance and accident risk, but treatment response in certain functional domains (eg sleepiness, response time) is often incomplete, raising the spectre of ongoing driving impairment. We are currently comparing driving simulator performance in a large sample of OSA patients with that in healthy, matched controls. We are also comparing the vulnerability of patients and controls to separate conditions of sleep deprivation and low dose alcohol, and will determine the effects of CPAP treatment in a sub-sample of severely affected patients. The findings of these studies will significantly improve the clinical management of OSA, and will help inform government education and awareness campaigns, and fitness to drive regulations.



Within this larger project there is scope for a physiology honours project, focussing on one of several different aspects of vulnerability in obstructive sleep apnoea (OSA).

Relevant Publications

1. Vakulin, A., Baulk, S.D., Catcheside, P.G., Anderson, R., van den Heuvel, C.J., Banks, S. & McEvoy, R.D. Effects of moderate Sleep Deprivation and Low dose alcohol on driving simulator performance and perception measures in young men. *Sleep*, 2007; 30(10): 1327-33.
2. Horne, J.A. & Baulk, S.D. (2004) Awareness of Sleepiness when Driving. *Psychophysiology*, 41(1): 161-5.
3. Banks, S., Catcheside, P., Lack, L., Grunstein, R.R., & McEvoy, R.D. (2004) Low Levels of Alcohol Impair Driving Simulator Performance and Reduce Perception of Crash Risk in Partially Sleep Deprived Subjects. *Sleep*, 27(6): 1063-7.
4. Barrett, P.R., Horne, J.A., & Reyner, L.A. (2004) Alcohol continues to affect sleepiness related driving impairment, when breath alcohol levels have fallen to near-zero. *Hum Psychopharmacol Clin Exp*, 19: 421-3.

Respiratory load sensations

Humans can detect the presence of impediments to breathing with considerable acuity, and sensations arising from the airways, lungs and/or chest wall are an important component of several key protective reflex and behavioural responses while awake and asleep (e.g. cough, seeking asthma treatment, ventilatory compensation to increased breathing load and arousal from sleep). Our group has shown that hypoxia, which frequently accompanies compromised breathing awake and asleep (e.g. acute asthma, chronic lung disease, sleep hypoventilation and sleep apnoea) appears to suppress awake load sensations and the cough reflex and delay arousal in sleep. Several key questions remain in this area. Potential Honours projects include;

- Does intermittent hypoxia, similar to that experienced in obstructive sleep apnoea, impair respiratory load sensations and reflexes as with sustained hypoxia?
- What are the key afferent/efferent signal qualities contributing to the magnitude of awake load sensations and arousal responses to respiratory load during sleep?

Relevant Publications

1. Hlavac MC, Catcheside PG, McDonald R, Eckert DJ, Windler S, McEvoy RD. Hypoxia impairs the arousal response to external resistive loading and airway occlusion during sleep. *Sleep* 29(5): 624-631, 2006.
2. Eckert DJ, Catcheside PG, McDonald R, Adams AM, Webster KE, Hlavac MC, McEvoy RD. Sustained hypoxia depresses sensory processing of respiratory resistive loads. *Am J Respir Crit Care Med*. 172(8):1047-54, 2005.
3. Eckert DJ, Catcheside PG, Smith JH, Frith PA, McEvoy RD. Hypoxia suppresses symptom perception in asthma. *Am. J. Resp. Crit. Care Med*. 169(11): 1224-1230, 2004.
4. Eckert D.J., Catcheside P.G., Stadler D.L., McDonald R., Hlavac M.C., McEvoy R.D. Acute sustained hypoxia suppresses the cough reflex in healthy subjects. *Am J Respir Crit Care Med* 2006; 173(5):506-11.
5. Orr RS, Jordan AS, Catcheside P, Saunders NA, McEvoy RD. Sustained isocapnic hypoxia suppresses the perception of the magnitude of inspiratory resistive loads. *J Appl Physiol* 2000; 89: 47-55.