

**WEST AUSTRALIAN SLEEP DISORDERS
RESEARCH INSTITUTE (INC.)**

SUMMARY OF RESEARCH ACTIVITY

**DRS BHAJAN SINGH AND BILL FINUCANE
DIAPHRAGM/CONTROL OF BREATHING**

Fields of Work

1. Neuro-mechanical efficiency of the diaphragm;
2. Respiratory failure and the chemical control of breathing in chronic obstructive lung disease.

Research Personnel

Ms Karen Wills Research Assistant

Collaborations

Australian Research Centre for Medical Engineering (ARCME), Murdoch University

Techniques

1. Measurement of diaphragm displacement by radiography, fluoroscopy and ultrasound;
2. Measurement of diaphragm electromyography.

Presentations and Invited Lectures

Local

1. Singh B. Measuring neural drive to the diaphragm. Lung Research Group, Perth.

National

1. Singh B. "Computerised measurement of the volume displaced by diaphragm motion (ΔV_{di}) is accurate and efficient". Thoracic Society of Australia and New Zealand, Annual Scientific Meeting, Adelaide, April 2003.
2. Singh B. " Diaphragm volume displacement, power and neuromechanical efficiency are reduced in a model of emphysema". Thoracic Society of Australia and New Zealand, Annual Scientific Meeting, Adelaide, April 2003.

International

1. Singh B. "Computerised measurement of the volume displaced by diaphragm motion (ΔV_{di}) is accurate and efficient". American Thoracic Society, International Conference. Seattle, May 2003. Presented by P R. Eastwood and D R Hillman.
2. Singh B. " Diaphragm volume displacement, power and neuromechanical efficiency are reduced in a model of emphysema". American Thoracic Society, International Conference. Seattle, May 2003. Presented by P R. Eastwood and D R Hillman.

Publications

1. Singh B, Panizza JA, Finucane KE. Breath-by-breath measurement of the volume displaced by diaphragm motion. *J Appl Physiol* 2003; 94: 1084-1091.
2. Lee YC, Singh B, Pang SC, de Klerk NH, Hillman DR, Musk AW. Radiographic (ILO) readings predict arterial oxygen desaturation during exercise in subjects with asbestosis. *Occup Environ Med* 2003 Mar; 60(3): 201-6.

Patent

- 2003 KE Finucane, B Singh. Breath by breath measurement of the volume displaced by the diaphragm. *Patent pending.*

DRS DAVID HILLMAN AND PETER EASTWOOD UPPER AIRWAY, UPPER AIRWAY, RESPIRATORY MUSCLES

Research Personnel

Dr David Hillman	Head of Department
Dr Peter Eastwood	Senior Research Fellow, Adjunct Associate Professor
Ms Kelly Shepherd	Research Assistant
Mrs Cathryn Jensen	Research Assistant
Ms Danielle Philippe	Research Assistant
Ms Kylie Hill	PhD candidate
Ms Cara Weisbrod	PhD candidate
Ms Kathleen Maddison	Honours candidate

Fields of Work

1. Assessment of upper airway dimensions using optical interferometry;
2. Effect of lung volume on upper airway collapsibility;
3. Respiratory muscle training in patients with chronic lung disease;
4. Aerophagia and gastro-oesophageal reflux in non-invasive positive pressure ventilation.

Grants 2001-2003

2000-02	PR Eastwood DR Hillman	NHMRC (109903)	\$317,324
2002	PR Eastwood DR Hillman	Sir Charles Gairdner Hospital Research Foundation	\$10,000
2002	PR Eastwood	Medical and Health Research Infrastructure Council (WA)	\$15,000
2003	SJ Jenkins C Camarri J Francis N Cecins PR Eastwood	Sir Charles Gairdner Hospital Research Fund (Ref. F03/03)	\$10,000

2003	PR Eastwood	Medical and Health Research Infrastructure Fund, Department of Health, Government of Western Australia	\$16,958
2002-04	PR Eastwood DR Hillman SC Jenkins N Cecins D Green M Phillips	NHMRC (212016)	\$340,000

Collaborations

Local

A/Prof S Jenkins, Department of Physiotherapy, SCGH; School of Physiotherapy, Curtin University;

Dr P Platt, Department of Anaesthetics, SCGH;

Professor D Sampson, Department of Electronic and Electrical Engineering, UWA;

Professor P Thompson, Asthma and Allergy Research Institute, Sir Charles Gairdner Hospital;

A/Prof J Pan, Department of Mechanical Engineering, UWA;

A/Prof G Allison, Centre for Musculoskeletal Studies, UWA;

Dr Randy Hill, Western Australian Institute for Sport.

National

Dr D McEvoy, Department of Respiratory Medicine, Repatriation Hospital, SA;

Dr R Grunstein, Sleep Disorders Centre, Royal Prince Alfred Hospital, NSW;

Dr E Ellis,

A/Prof J Wheatley, Department of Respiratory Medicine, Westmead Hospital , Sydney, NSW;

Dr T Amis, Department of Respiratory Medicine, Westmead Hospital , Sydney, NSW;

Mr J Kirkness, Department of Respiratory Medicine, Westmead Hospital , Sydney, NSW.

International

A/Prof A Schwartz, Johns Hopkins Medical School, Asthma and Allergy Centre, Baltimore, Maryland, USA;

Mr R Brandmeier, MAP Medizin-Technologie GmbH, Martinsreid, Germany.

Techniques

1. Oesophageal impedance
2. Oesophageal manometry
3. Administration of non-invasive ventilation
4. Polysomnography
5. Respiratory muscle training
6. Oesophageal pH monitoring
7. Cycle ergometry

Presentations and Invited Lectures

Local

1. Eastwood PR. "Publications: choosing the right journal." Thoracic Society of Australia and New Zealand Winter Scientific Meeting (Western Australian Branch). York, WA, July 2002.
2. Eastwood PR. Chair – Research Updates. Thoracic Society of Australia and New Zealand Winter Scientific Meeting (Western Australian Branch). York, WA July 2002
3. Eastwood PR. "Behaviour of the upper and lower oesophageal sphincters during sleep." Lung Research Group Sir Charles Gairdner Hospital, Nedlands, WA, August 2002.
4. Eastwood PR. Invited Lecture "Gastro-oesophageal reflux and sleep apnoea." Sleep-disordered breathing support group of Western Australia, October 2002.
5. Eastwood PR. "Exercise-induced asthma – pathophysiology, investigation and management". Asthma and COPD Interested Respiratory Group Meeting. Dunsborough, WA, February 2003.
6. Eastwood PR. "Upper airway imaging using catheter based optical coherence tomography". Lung Research Group, Sir Charles Gairdner Hospital, Nedlands, WA, June, 2003.

National

1. Eastwood PR. Session chair. "Oral Presentations Respiratory II." Australasian Sleep Association Annual Scientific Meeting, Hobart, October 2002.
2. Eastwood PR. "The effect of nasal positive airway pressure on the upper and lower oesophageal sphincters- implications for aerophagia and gastroesophageal reflux." Symposium on sleep and breathing, Melbourne, March 2003.
3. Hillman DR. "Respiratory High Dependency Unit- Logistical Issues: Who should receive CPAP for Obstructive Sleep Apnoea." Workshop: Pathophysiology of Respiratory Failure and Physiological Principles of Treatment. Princess Alexandra Hospital/ Prince Charles Hospital, Brisbane 2002.
4. Hillman DR. "Upper airway in anaesthesia and sleep: Pre-operative respiratory assessment." Jobson Anaesthesia Symposium, University of Sydney, 2003.
5. Hillman DR. Invited Speaker. "Non-Invasive Ventilation: Theory and Practice." Respiratory Mechanics. Thoracic Society of Australia and New Zealand Annual Scientific Meeting, Course for Advanced Trainees in Respiratory Medicine, Adelaide, 2003.
6. Van der Touw T. Poster presentation "Lactate production during inspiratory threshold loading in COPD." Thoracic Society of Australia and New Zealand Annual Scientific Meeting, Adelaide, 2003.

Publications

1. Rogers IR, Speedy D, Hillman D, Noffsinger W, Inglis S. Respiratory function changes in a wilderness multisport endurance competition: a prospective case study. *Wild Environ Med* 2002; 13: 135-9.
2. Eastwood PR, Szollosi I, Platt PR, Hillman DR. Collapsibility of the upper airway during anaesthesia with Isoflurane. *Anesthesiology* 2002; 97: 786-93.

3. Eastwood PR, Szollosi I, Platt PR, Hillman DR. Upper airway collapse during general anaesthesia and sleep. *Lancet* 2002; 359: 1207-1209.
4. Dempsey, JA, Smith CA, Wilson CR, Eastwood PR and Khoo MCK. Sleep-Induced Respiratory Instabilities. In: Sleep Apnoea (editor, A.J. Pack), Marcel Dekker, New York, 2002, p 57-98.
5. Sturdy GS, Hillman DR, Green D, Jenkins S, Cecins N, Eastwood PR. Feasibility of high-intensity interval-based respiratory muscle training in COPD. *Chest* 2003; 123: 142-150.
6. Lee YCG, Singh B, Pang SC, De Klerk NH, Hillman DR, Musk AW. Radiographic (ILO) readings predict arterial oxygen desaturation during exercise in subjects with asbestosis. *Occup Environ Med* 2003; 60(3): 201-206.
7. Kirkness JP, Eastwood PR, Szollosi I, Platt PR, Wheatley JR, Amis TC, Hillman DR. Effect of surface tension of mucosal lining liquid on upper airway mechanics in anesthetized humans. *J Appl Physiol* 2003; 95: 357-363.
8. Eastwood PR, Allison GT, Szollosi I, Shepherd KL, Hillman DR. Heterogeneous activity of the human genioglossus muscle assessed by multiple bipolar fine-wire electrodes. *J Appl Physiol* 2003; 94: 1849-1858.
9. Hillman DR, Platt PR, Eastwood PR. The upper airway during anaesthesia. *Br J Anaesthesia* 2003; 91(1): 31-39.
10. Lee YCG, Singh B, Pang SC, de Klerk NH, Hillman DR, Musk AW. Radiographic (ILO) readings predict arterial oxygen desaturation during exercise in subjects with asbestosis. *Occup Environ Med* 2003; 60: 201-206.
11. Armstrong JJ, Leigh MS, Walton ID, Zvyagin AV, Alexandrov SA, Schwer S, Sampson DD, Hillman DR, Eastwood PR. Long-range optical coherence tomography for *in vivo* profiling of large hollow organs. *Optics letters* 2003; 11: 1817-1826.
12. Sturdy GA, Hillman DR, Green DG, Jenkins SC, Cecins NM, Eastwood PR. Mechanisms underlying responses to repeated tests of inspiratory muscle function in patients with chronic obstructive disease. *Resp Med* (accepted 3-Jun-2003).

**ASSOC PROF ALAN JAMES AND DR NEIL CARROLL
AIRWAY REMODELING AND INFLAMMATION**

AIRWAY DISEASES - REMODELING AND INFLAMMATION

Research Personnel

A/Prof Alan James	Principal Investigator, NHMRC Practitioner Research Fellow
Dr Neil Carroll	Senior Research Officer (Edith Cowan University, Bunbury)
Ms Jasmine Lamb	Research Officer
Ms P Maxwell	Research Officer
Mr John Elliot	Research Officer
Mr Mark Carroll	Research Assistant
Ms Charlotte Chapman	Research Assistant (Edith Cowan University, Bunbury)
Mrs Cathryn Jensen	Research Assistant
Mr Slavko Mutavdzic	Research Assistant

Fields of Work

1. Mechanisms of persistent airway inflammation in Asthma and COPD
 - Lymphoid aggregates – their role in activating T-cells in situ
 - Proliferation, apoptosis – roles in accumulation of airway smooth muscle and inflammatory cells
 - Dendritic cells – density in the airway wall and in lymphoid aggregates
 - Inflammatory cells – interactions with airway structure
 - HLA-DR – expression in the airway wall
2. Airway remodeling and airway mechanics
 - Airway dimensions in asthma and COPD, relation to severity, treatment and inflammation
 - Fibroblasts – enumeration and relation to airway remodeling
 - Growth factors – relation to remodeling
3. Assessment of airway inflammation
 - Induced sputum, methacholine vs. hypertonic saline
4. Epidemiology of respiratory disease
 - Aboriginal population studies
 - Busselton population studies
 - Our group is also involved in the collection (in the field) and analysis of respiratory data from the above populations studies.
5. Sudden Infant Death Syndrome (SIDS)
 - Influence of parental smoking on airway structure and inflammation

Grants 2002-2003

2000-02	AL James NH de Klerk ML Croft J Hansen	NHMRC (110320)	\$387,349
2001-03	AL James NG Carroll	NHMRC (169901)	\$100,000
2002-03	M Knuiman AL James AW Musk	NHMRC (211988)	\$113,800
2002	AL James P Maxwell	Hollywood Private Hospital Research Foundation	\$5,000
2002	NG Carroll AL James	Sir Charles Gairdner Hospital Research Foundation	\$10,000
2003-05	AL James NG Carroll	Western Australian Institute for Medical Research	\$63,000

2003-05	AW Musk AL James PN le Souëf WOC Cookson G Waterer M Knuiman NG de Klerk J Beilby	Western Australian Institute for Medical Research	\$73,000 p.a.
2003	Elliot, J James, A	Asthma WA	\$21,461
2003	James, AL Elliot, J	Sir Charles Gairdner Hospital Research Foundation	\$10,000
2003	James, AL	MHIRF	\$17,000

Collaborations

Local

Clin Prof AW Musk, Department of Respiratory Medicine, SCGH;
 Prof N de Klerk, Department of Biostatistics, Institute for Child Health Research;
 Dr K Finucane, Department of Pulmonary Physiology, SCGH;
 Dr D Hillman, Department of Pulmonary Physiology, SCGH;
 Dr J Hansen, Department of Respiratory Medicine, Institute for Child Health Research;
 Dr D Knight, University Department of Medicine, UWA;
 Prof P le Souëf, Department of Paediatrics, Princess Margaret Hospital;
 A/Prof H Mitchell, Department of Physiology, UWA;
 Clinical Prof AW Musk, Department of Respiratory Medicine, SCGH;
 Prof P Sly, Institute for Child Health Research;
 Assoc Prof Steve Stick, Institute for Child Health Research;
 Dr D Turner, Institute for Child Health Research;
 Prof P Thompson, University Department of Medicine, UWA.

National

A/Prof R Kumar, School of Pathology, University of New South Wales;
 Dr K MacKay, Department of Respiratory Medicine, Children's Chest Research Centre, Children's Hospital at Westmead, NSW;
 A/Prof M Abramson, Department of Epidemiology and Preventive Medicine, Monash Medical School, Alfred Hospital, Victoria;
 Prof H Walters, Department of Epidemiology and Preventive Medicine, Monash Medical School, Alfred Hospital, Victoria;
 A/Prof P Robinson, Department of Thoracic Medicine, Royal Children's Hospital, Victoria;
 A/Prof J Wilson, Department of Respiratory Medicine, Alfred Hospital, Victoria.

International

Dr F Green, Faculty of Medicine, University of Calgary, Canada;

Prof J Hogg, MacDonald Research Laboratory, St Paul's Hospital, Vancouver, Canada;

Prof P Pare, MacDonald Research Laboratory, St Paul's Hospital, Vancouver, Canada;

Prof WOCM Cookson, Henry Wellcome Building for Human Genetics, Oxford University, England;

Prof P Jeffrey, Royal Brompton National Heart and Lung Institute, London, England;

Prof M Vignola, Istituto di Fisopatologia, Palermo, Italy;

Prof E Spindel, Oregon Regional Primate Research Centre, Oregon, USA.

Techniques

1. Morphometry and stereology
2. Immunohistochemistry
3. Airway responsiveness
4. Lung function
5. Atopy testing
6. Induced sputum.

Presentations and Invited Lectures

National

1. Carroll M, Lamb J, James A, Upham J, Carroll N. Airway nuclear transcription factor RelB expression in cases of fatal and nonfatal asthma. *Respirology* 2003; 8(Suppl): A18.
2. Lamb J, James A, Carroll N, Siena A, Carroll M, Elliot J, Vignola M. Reduced apoptosis of memory T-cells in the inner wall of mild and severe cases of asthma. *Respirology* 2003; 8(Suppl): A18.
3. Jensen CM, Turner DJ, Elliot JG, Carroll NG, Kumar RK, James AL. Airway lymphoid aggregate formation following aerosolised ovalbumin sensitisation in a murine model of inflammation. *Respirology* 2003; 8(Suppl): A20.
4. James A, Hansen J, Ewart H, Croft M, Coleman K. Familial aggregation of exhaled nitric oxide – A twins study. *Respirology* 2003; 8(Suppl): A26.
5. Elliot J, Carroll N, Mutavdzic S, Spindel E, Robinson P, James A. Maternal cigarette smoking and expression of $\alpha 7$ nicotinic receptors in the airways of infants. *Respirology* 2003; 8(Suppl): A55.
6. Candelaria PV, Khoo SK, Laing IA, Judge PK, Backer V, Lynch N, Hagel I, Musk AW, James AL, Goldblatt J, Le Souef PN. Prevalence of proinflammatory alleles in populations adapted to different climates. *Respirology* 2003; 8(Suppl): A27.

International

1. Moffatt MF, Hill AL, Musk AW, James AL, Cookson WOCM. Innate immunity genes, asthma and immunoglobulin E in Australian Aborigines. *Am J Respir Crit Care Med* 2003; 167(7): A439.
2. Candelaria PV, Khoo SK, Laing IA, Judge PK, Hayden CM, Backer V, Lynch N, Hagel I, Palenque ME, Musk AW, James AL, Hall IP, Scrivener S, Britton J,

- Yemaneberhan H, Goldblatt J, Le Souef PN. Prevalence of atopy/asthma associated alleles in 7 different populations. *Am J Respir Crit Care Med* 2003; 167(7): A630.
3. Khoo SK, Candelaria PV, Brooks AS, Backer V, Lynch NR, Hagel I, Palenque M, Musk AW, James AL, Goldblatt J, Le Souef PN. Prevalence of IL12B A1188C polymorphism in populations adapted to different climates. *Am J Respir Crit Care Med* 2003; 167(7): A750.
 4. James A, Hansen J, Ewart H, Croft M, Coleman K, Frankland P, de Klerk N. Heritability of exhaled nitric oxide – A twins study. *Am J Respir Crit Care Med* 2003; 167(7): A153.
 5. James A, Lamb J, Carroll M, Upham J, Carroll N. Airway nuclear transcription factor RelB expression in cases of fatal and non-fatal asthma. *Am J Respir Crit Care Med* 2003; 167(7): A733.
 6. James A, Elliot J, Carroll N, Mutavdzic S, Spindel E, Robinson P. Maternal cigarette smoking and expression of $\alpha 7$ nicotinic receptors in the airways of infants. *Am J Respir Crit Care Med* 2003; 167(7): A65.
 7. James A, Lamb J, Carroll N, Siena A, Carroll M, Elliot J, Vignola M. Reduced apoptosis of memory T-cells in the inner airway wall of mild and severe cases of asthma. *Am J Respir Crit Care Med* 2003; 167(7): A490.

Publications

1. James AL. Peripheral airways in asthma. Current Allergy and Asthma Reports. Ed Kaliner MA. Current Science Inc. Philadelphia PA. *Current Allergy and Asthma Reports* 2002; 2(2): 166-174.
2. Carroll NG, Mutavdzic S, James AL. Distribution and degranulation of airway mast cells in normal and asthmatic subjects. *Eur Respir Dis* 2002; 19: 879-885.
3. Carroll NG, Mutavdzic S, James AL. Increased mast cells and neutrophils in submucosal mucous glands and mucous plugging in patients with asthma. *Thorax* 2002; 57(8): 677-682.
4. James AL, Carroll NG. Transbronchial biopsy as a tool to evaluate small airways disease in asthma. Cons. Editorial. *Eur Respir J* 2002; 20:1-3.
5. Verheijden MW, Ton A, James AL, Wood M, Musk AW. Respiratory morbidity and lung function in two aboriginal communities in Western Australia. *Respirology* 2002; 7: 247-253.
6. James AL, Maxwell P, Pearce-Pinto G, Elliot JG, Carroll NG. The relationship of reticular basement membrane thickness to airway wall remodeling in asthma. *Am J Crit Care Med* 2002; 166(12): 1590-1595.
7. Elliot J, Carroll N, James A, Robinson P. Airway alveolar attachment points and exposure to cigarette smoke in utero. *Am J Respir Crit Care Med* 2003; 167: 45-49.
8. Moffatt MF, Faux JA, Lester S, Paré P, McCuskey JC, Spargo S, James A, Musk AW, Cookson WOCM. Atopy, respiratory function and HLA-DR genes in Aboriginal Australians. *Hum Mol Gen* 2003; 12: 625-630.