WEST AUSTRALIAN SLEEP DISORDERS RESEARCH INSTITUTE (INC.)

SUMMARY OF RESEARCH ACTIVITY

July 1 2006 – June 30 2007

Level 5, G Block
Queen Elizabeth II Medical Centre
Hospital Avenue
Nedlands
Western Australia  6009
Australia
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<td>UPPER AIRWAY RESPIRATORY MUSCLES</td>
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<td>SUMMARY OF RESEARCH ACTIVITIES</td>
<td>18</td>
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</tbody>
</table>

DR DAVID HILLMAN  
UPPER AIRWAY RESPIRATORY MUSCLES  
DR PETER EASTWOOD

Fields of Work

1. Sleep-Disordered Breathing
   • Upper airway function during anaesthesia and sleep
   • Computational dynamics of the human upper airway
   • Upper airway imaging using endoscopic optical coherence tomography
   • Upper and lower oesophageal sphincter function during wakefulness and sleep
   • Non-invasive detection of gastric insufflation
   • Intramuscular recording of genioglossus myoelectric activity
   • The relationship between sleep apnoea, vascular function and erectile dysfunction
   • The relationship between travel, sleep quality and elite athletic performance

2. Chronic Lung Disease
   • The role of respiratory muscle training in chronic lung disease
   • Measuring functional capacity in chronic lung disease
   • Defining the burden of disease and benefits of exercise in moderate to severe asthma

Grants

<table>
<thead>
<tr>
<th>Year</th>
<th>Principle Invest.</th>
<th>Funding Body; Project Title</th>
<th>$ Awarded</th>
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<tbody>
<tr>
<td>2004-2006</td>
<td>PR Eastwood, DR Hillman</td>
<td>NHMRC (303218) Factors determining collapsibility of the human upper airway during sleep and general anaesthesia</td>
<td>$259 625</td>
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<tr>
<td>2004-2008</td>
<td>PR Eastwood</td>
<td>NHMRC (294404) R Douglas Wright Biomedical Career Development Award</td>
<td>$417 500</td>
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<tr>
<td>2005-2007</td>
<td>AD Lucey, PR Eastwood, DR Hillman, DD Sampson, T Balint</td>
<td>Australian Research Council (DP0559408) Modeling and methods of flow-obstruction dynamics in the human upper airway</td>
<td>$425 000</td>
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<td>2005-2008</td>
<td>JP Kirkness</td>
<td>NHMRC (513716) CJ Martin Fellowship Neurohumoral and neuromuscular control of upper airway patency in obesity and sleep apnoea</td>
<td>$301 462</td>
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<td>2006</td>
<td>KF Smith, SC Jenkins, PR Eastwood, DR Hillman</td>
<td>Physiotherapy Research Foundation. National Cardiothoracic Group Research Grant The effect of arm support during exercise in subjects with chronic obstructive pulmonary disease (COPD)</td>
<td>$5 000</td>
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<td>2006</td>
<td>KF Smith, SC Jenkins, PR Eastwood, DR Hillman</td>
<td>Curtin University of Technology, School of Physiotherapy: Early Career Research Grant The effect of arm support during exercise in subjects with chronic obstructive pulmonary disease (COPD)</td>
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<td>2006-2008</td>
<td>PR Eastwood, DD Sampson, DR Hillman</td>
<td>NHMRC (403953) Mechanisms of pharyngeal collapse in obstructive sleep apnoea defined by optical coherence tomography</td>
<td>$467 750</td>
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<td>2007</td>
<td>PR Eastwood</td>
<td>Medical and Health Research Infrastructure Fund (WA) Department of Health, Government of Western Australia Infrastructure Grant - Round 10</td>
<td>$31 147</td>
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<td>2007</td>
<td>JH Walsh, P Platt</td>
<td>Sir Charles Gairdner Hospital Research Foundation The efficacy of head posture modifications in the treatment of obstructive sleep apnoea</td>
<td>$10 000</td>
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Mechanisms underlying gastroesophageal reflux in obstructive sleep apnoea

$10,000

The effect of arm support during exercise in subjects with chronic obstructive pulmonary disease (COPD)

$10,000

Research Personnel
Dr Jason Kirkness: Postdoctoral Research Fellow
Dr Jennifer Walsh: Postdoctoral Research Fellow
Ms Kathleen Maddison: Research Assistant
Ms Danielle Philippe: Research Assistant
Mr Liam Coffey: Research Assistant (part-time)
Ms Kate Godde: Research Assistant (part-time)
Ms Patricia Ziegler: Administration Clerk (part-time)
Ms Laila Robertson: PhD Candidate
Ms Kelly Shepherd: PhD Candidate
Ms Kate Smith: PhD Candidate
Ms Sian Turner: PhD Candidate
Dr Jonathan Williamson: PhD Candidate
Ms Bethany Indrawan: Honours Candidate
Ms Jane Potter: Honours Candidate

Collaborations
Local
A/Prof G Allison: Centre for Musculoskeletal Studies, University of Western Australia
A/Prof S Jenkins: Department of Physiotherapy, Sir Charles Gairdner Hospital; School of Physiotherapy, Curtin University
A/Prof J Pan: Department of Mechanical Engineering, University of Western Australia
Dr P Platt: Department of Anaesthetics, SCGH
Prof D Sampson: Department of Electronic and Electrical Engineering, University of Western Australia
Mr G Sturdy: Keogh Institute for Medical Research, Queen Elizabeth II Medical Centre
Prof PJ Thompson: Asthma and Allergy Research Institute, Queen Elizabeth II Medical Centre

National
Dr T Amis: Department of Respiratory Medicine, Westmead Hospital, NSW
Dr R Grunstein: Sleep Disorders Centre, Royal Prince Alfred Hospital, NSW
Prof R Holloway: Department of Gastroenterology Hepatology, Royal Adelaide Hospital, SA
Dr D McEvoy: Department of Respiratory Medicine, Repatriation Hospital, SA
A/Prof J Wheatley: Department of Respiratory Medicine, Westmead Hospital, NSW

International
Mr R Brandmeier: MAP Medizin-Technologie GmbH, Martinsreid, Germany
A/Prof A Schwartz: Johns Hopkins Medical School, Asthma and Allergy Centre, Baltimore, Maryland, USA
Techniques
1. Oesophageal impedance
2. Oesophageal manometry
3. Oesophageal pH monitoring
4. Administration of non-invasive ventilation
5. Polysomnography
6. Optical coherence tomography
7. Intramuscular electrodes
8. Respiratory muscle training
9. Portable metabolic gas analyser
10. Cycle ergometry
11. Treadmill ergometry
12. Dual energy X-ray absorptiometry (DEXA)

Presentations and Invited Lectures

Local
1. Walsh J. “Exposing the Upper Airway & Sleep Apnoea - Is It All Just In The Head (Position)?” Department of Anatomical Pathology, Royal Perth Hospital, Perth. July 2006.
5. Eastwood PR. Invited speaker: “Quantitative determination of tracheobronchial airway calibre using anatomical optical coherence tomography (aOCT) – what can it tell us about lung disease?” Asthma and Allergy Research Institute Annual Scientific Meeting, Margaret River. November 2006.


National

1. Eastwood PR. Invited speaker: “What you don’t know might kill you - Probing for the causes of snoring and upper airway collapse during sleep.” University of South Australia, Division of Health Sciences, Adelaide, SA. July 2006.


**International**


**Publications**


2. Eastwood PR, Katagiri S, Sheperd K, Hillman DR. Modulation of upper and lower esophageal sphincter tone during sleep. *Sleep Me* 2007; March 8(2); 135-143.


**DR STEWART CULLEN SLEEP APNOEA**

**Fields of Work**

1. Predictors of sleep apnoea using questionnaires and laser measurements of oral dimensions

2. Treatment of sleep apnoea:
   - Mandibular advancement splints: new models
   - Tongue retaining devices
   - Positional therapy: new appliances

3. Validation of the radical pulse oximeter in the detection of sleep apnoea

4. Sleep studies in the Busselton Health Survey

Collaborations

Local
A/Prof A James  Department of Pulmonary Physiology, West Australian Sleep Disorders Research Institute
Dr N McArdle  Department of Pulmonary Physiology, West Australian Sleep Disorders Research Institute
Mr W Noffsinger  Department of Pulmonary Physiology, West Australian Sleep Disorders Research Institute
Dr S Phung  Department of Respiratory Medicine, Royal Perth Hospital

Techniques
1. Lasers
2. Radical oximeters
3. Mandibular advancement splints and tongue retaining devices

Presentations and Invited Lectures

Local

A/PR ALAN JAMES  AIRWAY REMODELING AND INFLAMMATION

Fields of Work
1. Airway Remodeling
   • Hypertrophy and hyperplasia of airway smooth muscle in asthma
     - Stereological measurement of airway smooth muscle and extracellular matrix in asthma
     - Validation of methods – section orientation and image analysis
     - Relation of changes in airway smooth muscle and extracellular matrix to age and duration and severity of asthma, an international collaborative study
   • Comparison of airway remodeling (smooth muscle, extracellular matrix, reticular basement membrane) in biopsies and transverse sections of airways in control nonfatal and fatal asthma cases.
2. Airway Inflammation
   • Validation study of biopsy to assess airway and lung inflammation
   • Identification of dendritic cells with immunohistochemical labeling (DC-SIGN)
   • Inflammation in allergen-sensitised and exposed mice
3. Population Studies
   • Burden of obstructive lung disease (BOLD)
     - Multi-centre national study
     - Random sample of current Busselton adult population: questionnaires, forced oscillatory technique, exhaled nitric oxide, spirometry, allergy skin tests
   • Busselton Health Survey 2005-2007
     - Random sample of current Busselton population (adults and children)
- Questionnaires; morphometry; blood pressure; spirometry; exhaled nitric oxide; forced oscillation technique; airway responsiveness to methacholine; allergy prick skin tests; collection of blood for full blood counts, stored serum and DNA analysis

- Collaborative (The Netherlands; Italy; Hungary) study of bronchodilator response of forced oscillatory technique
  - Age and gender stratified
  - Sample of Busselton Survey (1994) attendees

- Indigenous Health
  - Working Party on Aboriginal Respiratory Health

- Epidemiology of obstructive sleep apnoea
  - WASDRI Sleep database and genetics study
  - Busselton Health Survey: re-survey of current population

4. Genetic influences on airway disease and allergy

- Single nucleotide polymorphisms
  - Collaborative studies with Canadian and European Consortia to achieve large genome wide associations.

- Genome screen
- HLA-DR

5. SIDS

- Influence of parental smoking on airway structure and inflammation.
- Ethical issues in seeking parental consent.

6. Clinical Trials

Grants

<table>
<thead>
<tr>
<th>Year</th>
<th>Principle Invest.</th>
<th>Funding Body; Project Title</th>
<th>$ Awarded</th>
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<tbody>
<tr>
<td>2003-2007</td>
<td>James, AL</td>
<td>NHMRC (26100) Practitioner Fellowship</td>
<td>$325 000</td>
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<td>2004-2006</td>
<td>Upham, J</td>
<td>NHMRC (303161) Effects of allergens on dendritic cell function in allergic asthma</td>
<td>$83 500 p.a.</td>
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<td>James, AL</td>
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<td>2005-2007</td>
<td>James, AL</td>
<td>NHMRC (343601) Hyperplasia and hypertrophy of airway smooth muscle in asthma</td>
<td>$281 000</td>
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<td>Carroll, NC</td>
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<td>2005-2007</td>
<td>Musk, AW</td>
<td>NHMRC (353532) The changing prevalence of asthma and chronic obstructive disease in Australia</td>
<td>$729 380</td>
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<td>James, AL</td>
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<td>Beilby, JP</td>
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<td>Palmer, LJ</td>
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<td>Knuiman, MW</td>
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<td>2006</td>
<td>Lamb, J</td>
<td>Sir Charles Gairdner Hospital Research Foundation Distribution of the novel smooth muscle relaxation factor, calponin homology-associated smooth muscle protein (CHASM), in airways from asthma cases</td>
<td>$10 000</td>
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<tr>
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<td>James, AL</td>
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<td>2006</td>
<td>Musk, AW</td>
<td>Asthma Foundation of WA Measurement of respiratory resistance by the forced oscillation technique and asthma in the general population</td>
<td>$17 743</td>
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<td>James, AL</td>
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<td>2006</td>
<td>Elliot, J</td>
<td>Asthma Foundation of WA Mast cell degranulation and time to death in fatal asthma</td>
<td>$45 100</td>
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<td></td>
<td>Carroll, NG</td>
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2006
James, AL
Rebecca Cooper Foundation
Hyperplasia and hypertrophy of airway smooth muscle in asthma

2007-2009
James, AL
Carroll, NG
NHMRC (446800)
Assessment of airway smooth muscle hypertrophy in asthma and chronic obstructive pulmonary disease (COPD)

2007-2009
Marks, G
Abramson, M
James, AL
Maguire, G
Toelle, B
Wood-Baker, R
NHMRC (457385)
Burden of obstructive lung disease in Australia

2007
Carroll, N
James, AL
Asthma Foundation of WA
Can endobronchial biopsy be used as a tool to evaluate airway smooth muscle (ASM) remodeling in patients with asthma?

2007
James, AL
Sir Charles Gairdner Hospital Research Foundation (0707)
Assessment of extracellular matrix deposition and smooth muscle hypertrophy in asthma and COPD

2007
James, AL
Medical and Health Research Infrastructure Fund (WA)
Department of Health, Government of Western Australia Infrastructure Grant - Round 10

Research Personnel
Mr John Elliot Research Officer
Ms Jasmine Lamb Research Officer (part-time)
Ms P Maxwell Research Officer (part-time)
Ms Robyn Jones Research Assistant
Mr Mark Carroll PhD candidate
Dr Andreas Fiene Respiratory Trainee

Collaborations

Local
Prof Adrian Baddeley School of Mathematics, University of Western Australia
Dr K Bill Finucane Department of Pulmonary Physiology, Sir Charles Gairdner Hospital
Dr Graham Hall Institute for Child Health Research
Dr David Hillman Department of Pulmonary Physiology, Sir Charles Gairdner Hospital
Dr Anthony Kicic Institute for Child Health Research
Dr Peter McFawn Department of Physiology, University of Western Australia
Dr Graeme Maguire WA Country Health Service
Prof Howard Mitchell Department of Physiology, University of Western Australia
Prof AW Bill Musk Department of Respiratory Medicine, Sir Charles Gairdner Hospital
Dr Peter Noble Department of Physiology, University of Western Australia
Mr W Bill Noffsinger Department of Pulmonary Physiology, Sir Charles Gairdner Hospital
Prof P Sly Institute for Child Health Research
A/Prof Stephen Stick Institute for Child Health Research
Dr Debra Turner Institute for Child Health Research
Dr Sally Young Department of Pulmonary Physiology, Sir Charles Gairdner Hospital
National
A/Prof Michael Abramson Department of Epidemiology and Preventive Medicine, Monash Medical School, Alfred Hospital, Victoria
Dr Greg King Woolcock Institute of Medical Research, University of Sydney, New South Wales
A/Prof Rakesh Kumar School of Pathology, University of New South Wales
Dr Karen MacKay Department of Respiratory Medicine, Children’s Chest Research Centre, Children’s Hospital at Westmead, NSW
A/Prof Guy Marks Woolcock Institute of Medical Research, New South Wales
A/Prof Phil Robinson Department of Thoracic Medicine, Royal Children’s Hospital, Victoria
Dr Brett Toelle Woolcock Institute of Medical Research, New South Wales
Prof John Upham Princess Alexandra Hospital, Queensland
Prof Haydn Walters School of Medicine, University of Tasmania
Dr Richard Wood-Baker Respiratory Medicine, University of Tasmania

International
Prof Tony Bai MacDonald Research Laboratory, St Paul’s Hospital, Vancouver, Canada
Prof Marisa Bonsignore Instituto di Fisopatologia, Palermo, Italy
Prof W Bill Cookson Imperial College London, England
Dr Marisa Dohlnikof Department of Pathology, Sao Paulo University Medical School, Brazil
Dr Francis Green Faculty of Medicine, University of Calgary, Canada
Prof Jim Hogg James Hogg iCAPTURE Centre, University of British Columbia, Vancouver, Canada
Dr Darryl Knight James Hogg iCAPTURE Centre, University of British Columbia, Vancouver, Canada
Dr Thais Mauad Department of Pathology, Sao Paulo University Medical School, Brazil
Prof Peter Pare MacDonald Research Laboratory, St Paul’s Hospital, Vancouver, Canada
Prof Eliot Spindel Oregon Regional Primate Research Centre, Oregon, USA
Ellie Oostve’en University Hospital, Antwerp, Belgium
Zoltan Hantos University of Szeged, Szeged, Hungary

Techniques
1. Morphometry and stereology
2. Immunohistochemistry
3. Physiology - airway responsiveness; forced oscillation technique
4. Exhaled nitric oxide
5. Atopy
6. Induced sputum
7. Population surveys

Presentations and Invited Lectures

Local

National

International
2. James AL. Invited Speaker: “Hyperplasia and hypertrophy of airway smooth muscle in asthma”. Structure and function weekly presentation, Pulmonary Research Laboratory, St Paul’s Hospital, Vancouver, Canada. October 2006.

Publications
5. James AL, Wenzel S. Clinical relevance of airway remodelling in airway diseases.


**DR NIGEL MCARDLE**

**SLEEP APNOEA**

**Fields of Work**

1. Sleep Apnoea and vascular disease
2. Treatment of Sleep apnoea
3. Diagnostic strategies for Sleep apnoea

**Grants**

<table>
<thead>
<tr>
<th>Year</th>
<th>Principle Invest.</th>
<th>Funding Body; Project Title</th>
<th>$ Awarded</th>
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<tbody>
<tr>
<td>2005-06</td>
<td>N McArdle</td>
<td>ResMed Pty Ltd</td>
<td>Automatic compared to manual CPAP titration for obstructive sleep apnoea</td>
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<tr>
<td></td>
<td>B Singh</td>
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<tr>
<td></td>
<td>K Gain</td>
<td></td>
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<td></td>
<td>M Murphy</td>
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<tr>
<td></td>
<td>D Hillman</td>
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</table>

**Collaborations**

**Local**

Prof L Beilin  Royal Perth Hospital
Dr K Gain  Royal Perth Hospital
Dr S Mukherjee  West Australian Sleep Disorders Research Institute
Prof L Palmer  Western Australian Institute for Medical Research
Prof G Watts  Royal Perth Hospital

**Presentations and Invited Lectures**

**Local**


5. McArdle N, Singh B, Gain K, Murphy M, Hillman D. Cost comparisons of automatic (home and laboratory) and manual continuous positive airway pressure (CPAP) titration for obstructive sleep apnoea (OSA). 2006 Sleep and Biological Rhythms: 4; P89.

**Publications**


**DR SUTAPA MUKHERJEE**  
**EPIDEMIOLOGY**

**Fields of Work**

1. Establishment of the WA Sleep Disorders Cohort, a population-based resource, to investigate the epidemiology of obstructive sleep apnoea in WA;

2. Occupational exposures and health effects- with particular interest in asbestos and diesel exposure;

3. Malignant mesothelioma.

**Grants**

<table>
<thead>
<tr>
<th>Year</th>
<th>Principle Invest.</th>
<th>Funding Body; Project Title</th>
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<tr>
<td>2007</td>
<td>S Mukherjee</td>
<td><em>Hollywood Private Hospital Research Foundation</em> Establishment of a population-based database for sleep apnoea</td>
<td>$10 000</td>
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<tr>
<td>2007</td>
<td>S Mukherjee</td>
<td><em>Sir Charles Gairdner Hospital Research Foundation</em> Establishment of a population-based database for sleep apnoea</td>
<td>$10 000</td>
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**Research Personnel**

Ms J Lee  
Research Assistant (part-time)

Mr Greg Love  
Research Assistant (part-time)

Ms Annette Fedson  
PhD Candidate

Ms Laila Robertson  
PhD Candidate

**Collaborations**

**Local**

Dr P Eastwood  
West Australian Sleep Disorders Research Institute

Dr J Kirkness  
West Australian Sleep Disorders Research Institute

Prof N de Klerk  
Department of Biostatistics, Telethon Institute for Child Health Research
**Clin Prof AW Musk**  Department of Respiratory Medicine, Sir Charles Gairdner Hospital  
**Prof L Palmer**  West Australian Institute for Medical Research; University of Western Australia  

**International**  
**Prof D Christiani**  Harvard School of Public Health, USA  

**Presentations and Invited Lectures**  

**Local**  
2. “Management of asthma and COPD”. Lecture series to General Practitioners of Perth and Geraldton.

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**DR BHAJAN SINGH**  
**DIAPHRAGM CONTROL OF BREATHING**  
**DR BILL FINUCANE**

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

**Grants**

<table>
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<tr>
<th>Year</th>
<th>Principle Invest.</th>
<th>Funding Body; Project Title</th>
<th>$ Awarded</th>
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</table>
| 2005-2007  | B Singh           | *Boehringer Ingelheim Pty Ltd*  
                 | *Pfizer Pharmaceuticals*  
                 | Lung volume reduction with tiotropium in chronic obstructive pulmonary disease (COPD): Improved dyspnoea: Mechanisms and clinical implications | $214 000 |

**Research Personnel**  
**Ms Karen Wills**  Research Assistant (-Feb 2007)  
**Ms Gillian Vinton**  Research Assistant (-Jan 2007)

**Collaborations**  

**Local**  
**Mr S Dhaliwal**  Department of Public Health, Curtin University

**Techniques**  
1. Measurement of diaphragm displacement by radiography, fluoroscopy and ultrasound;  

**Presentations and Invited Lectures**  

**Local**  


6. Singh B. Respiratory Physiology. FRACP Tutorial, Department of Medicine, Sir Charles Gairdner Hospital, July 2006.

7. Singh B. Obesity & health. Clinical meeting, West Australian Sleep Disorders Research Institute, Sir Charles Gairdner Hospital, September 2006.

8. Singh B Lactate stress test. Clinical Meeting Department of Pulmonary Physiology, Sir Charles Gairdner Hospital, October 2006.

9. Singh B. Case presentation. Clinical Meeting Department of Pulmonary Physiology, Sir Charles Gairdner Hospital, November 2006.


11. Singh B. Arterial blood gases and case studies. Educational Meeting, Department of Speech Pathology, Sir Charles Gairdner Hospital, November 2006.


14. Singh B. Literature review. Clinical meeting, West Australian Sleep Disorders Research Institute, Sir Charles Gairdner Hospital, April 2007.

15. Singh B. Selecting patients for lung resection. Clinical meeting, Department of Respiratory Medicine, Sir Charles Gairdner Hospital, April 2007.

16. Singh B. The role of lung function testing during bleomycin therapy. Clinical Meeting, Department of Pulmonary Physiology, Sir Charles Gairdner Hospital, June 2007.
## SUMMARY OF RESEARCH ACTIVITIES

<table>
<thead>
<tr>
<th>Activity</th>
<th>Count</th>
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<td>Number of research staff</td>
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<td>Full-time</td>
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<td>Number of publications 2006/07</td>
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<td>Grants awarded to WASDRI Researchers:</td>
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