ALERTNESS SAFETY AND PRODUCTIVITY

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

2018 Annual Report

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World Sleep Day 2018 asked us if we're in tune with our body's rhythms; our body clock. The Alertness CRC in partnership with The Sleep Health Foundation and Australasian Sleep Association ran a collaborative campaign to promote good sleep health, and to provide advice around how to preserve your circadian rhythms.

Are you in tune with your body's rhythms?

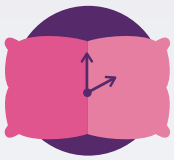
Sleep is one of the three pillars of health, along with diet and exercise.

Adults should have between 7–9 hours of sleep each night, however 40% of Australian adults still get inadequate sleep.

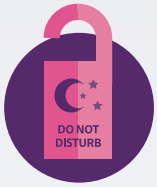
World Sleep Day
JOIN THE SLEEP WORLD, PRESERVE YOUR RHYTHMS TO ENJOY LIFE

16 March 2018

We have an internal body clock, known as a circadian rhythm, which influences sleep and other bodily functions like body temperature, hormone levels and metabolism.



Time invested in getting enough sleep can have long term health benefits. If work affects the time you can sleep, try to ensure a dark, cool and quiet sleep environment.



Giving our bodies time to wind down in the evening—away from phone and TV screens—can help us get to sleep at a time that suits our rhythm.

CRC ALERTNESS SAFETY AND PRODUCTIVITY

Australian Government Department of Industry, Innovation and Science | Business Cooperative Research Centres Programme

Sleep Health Foundation

sleep Australasian Sleep Association

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Message from the CEO

Through its fifth year, the Alertness CRC has continued to work with its highly engaged and effective industry, government and university sector partners to develop a series of novel alertness prediction and sleep health management technologies.

These AlertSafe™ technologies include:

- Sleep health management decision support tools;
- Insomnia treatments;
- Individualised sleep management software;
- Enterprise work scheduling software;
- Alertness testing and road safety monitoring;
- Advances in clinical sleep disorder screening; and
- Best practices in lighting design.

The Alertness CRC is preparing these exciting technologies for translation into viable real-world workplace and community solutions.

The transport, mining, and health sectors remain the key translation pathways, with SME partners presenting valuable field test opportunities and networks to broader markets.

The Alertness CRC remains committed to a strong education program and delivering genuine value to the Australian and international community through high impact commercialisable solutions in alertness and sleep health management.

Anthony Williams, CEO, Alertness CRC Ltd

Alertness CRC Participants as at June 2018

Technology and Development End-Users

SOLEMMA
COGSTATE
OPTALERT
SMART CAP
BIOPLATFORMS AUSTRALIA
PHILIPS
LightingScience
seeingmachines
GREY INNOVATION TECHNOLOGY COMMERCIALISATION
ELECTRO LIGHT
fmi
OPTURION
goAct
Versalux

Industry and Employment End-Users

Austin Health
ICMM International Council on Mining & Metals
asmof nsw
Government of South Australia SA Health
Australian Government Department of Defence Science and Technology

Policy, Regulatory and Insurance End-Users

TAC Transport Accident Commission
WorkSafe Victoria
Bupa
NTC Australia National Transport Commission
vicroads

Research, Education and Training

Australasian SleepTrials Network
Sleep Health Foundation
IBAS Institute for Breathing & Sleep
Woolcock Institute of Medical Research
Flinders University
The University of Sydney
CSIRO
Monash University
NeuRA Discover. Conquer. Cure.

1 Research

Image courtesy of Monash Biomedical Imaging

The Alertness CRC is adapting its key research outputs into viable workplace, government and community solutions. The research program structure continues to provide the framework for:

- Improved workplace and community safety and alertness through the development of effective, low-cost, validated tools for alertness assessment, including real-time fitness-for-duty and portable roadside alertness tests;
- Improved group-level scheduling solutions where healthcare and mining partners provide key high-risk target sectors for early adoption;
- Tailored and improved lighting in workplaces to increase worker alertness levels, reducing accidents and errors;
- A better understanding of sleep disorders and individual differences to enable more personalised use of treatments; and
- The development of new clinical and consumer devices and systems to improve utilisation and access to effective treatments of major sleep disorders such as sleep apnoea and insomnia.

Program One: Alertness Measurement, Testing and Prediction

Professor Shantha Rajaratnam, Monash University

Research Program One is focused on the development and verification of tools to measure current alertness levels accurately, to predict the risk of future critical lapses and to intervene before poor alertness impairs productivity and safety.

The program is on target to deliver the following four key research outputs:

1) Ocular- and metabolite-based test of alertness

Ocular measures of alertness can be used in developing a test for predicting alertness failure. We have developed a fitness-to-drive algorithm that can predict subsequent driving impairment and retrospectively detect prior driving impairment. We've also commenced validating and identifying candidate biomarkers of 'time awake'. Validation has included benchmarking against performance impairment with final biomarkers to be incorporated into devices for on-road and workplace evaluation.

"Shift work is associated with impaired alertness and neurobehavioral functioning due to sleep loss and circadian misalignment. We investigated, in intensive care doctors and nurses, the amount of sleep obtained between different shift types, and alertness and performance during day and successive night shifts. We found that evening-to-day transitions should be minimised as they provide limited opportunity for recovery sleep between shifts due to the early morning shift start. Despite short sleep between day shifts, alertness and performance remain most impaired during night shifts, particularly at the end of shift. While healthcare workers report more sleepiness on the first night shift compared to subsequent nights, objective performance is equally impaired across night shifts."

Saranea Ganesan, Alertness CRC PhD Student

Shift Work and its Impact on Sleep, Alertness and Performance in an Intensive Care Unit; Presented at the 32nd Annual Meeting of the Associated Professional Sleep Societies, Baltimore, June 2018

1 Research

2) Prototypes of low-cost, non-invasive, real-time, biomarker-based tests for alertness

In conjunction with Output (1), we are developing an algorithm based on multiple metabolomic signatures with different rhythmic expressions to accurately predict circadian phase. This algorithm will support a device that can measure metabolites with just two samples, to provide an accurate estimate of circadian phase, allowing a personalised approach to circadian medicine.

3) Development of prototypes of a range of non-invasive, individual alertness monitoring, prediction and feedback devices

We have undertaken in-depth customer interviews with shift working nurses to understand their needs and motivations. These data are being used to develop a personalised app-based solution to assist individuals with managing shift work. The app will include planning and recovery information in relation to sleep-wake recommendations, and will take into account work schedule, social constraints and user experience/feedback.

4) New fitness-for-duty and road safety guidelines sufficient to propose changes to regulations and/or new guidelines. These will be suitable for deployment as evidence-based information to inform new heavy vehicle fatigue regulations

We continue to work with the National Transport Commission to identify the barriers and opportunities informing future policy development and legislation regarding heavy vehicle fatigue regulations.

Program Two: Safety and Productivity Improvements

Professor Steven W Lockley, Monash University

Research Program Two is focused on three key outputs under the two main research themes of scheduling and smart lighting.

1) Development of prototype of work/duty scheduling software system and scheduling guidelines for groups of employees

In partnership with Opturion Pty Ltd, we are on track to deliver a scheduling software system and associated guidelines for group work scheduling, to help promote safer and more productive work schedules. The product is the first of its kind, combining logistics modelling software, 'alert-safe' scheduling principles, and-state-of-the-art biomathematical modelling-into a-single user-friendly tool.

The rostering system is unique in its ability to create rosters that are compliant with clinical and financial requirements while, at the same time, minimising costs. The incorporation of the novel 'alert-safe' algorithms and state-of-the-art Alertness CRC models that predict alertness, provide a further level of differentiation, innovation and benefit.

"Some claims on the concept of Human Centric Lighting are dubious, in that they are not consistent with the scientific evidence. Together with the Alertness CRC and Monash University, we are helping to lead the introduction of a line of science-backed "alertness lighting" products and solutions, which will be compliant with the "AlertSafe" brand, and which will enable improved alertness, safety and productivity in the workplace and at home."

Bruno Campisi, Joint Managing Director, Versalux

2) Development of lighting design systems to maximise alertness, safety and productivity

We partnered with one of the world's leading lighting design software products, DIVA-for-Rhino by Solemma, to develop a software module that allows designers to model the non-visual effects of light and ultimately predict the alertness, safety and productivity benefits of their design.

The software is called 'Adaptive Lighting for Alertness' (ALFA; https://www.solemma.com/Alfa.html), and the global launch of the beta-version occurred in Melbourne in March 2018. The full commercial product was then launched in June 2018.

This state-of-the-art tool promises to revolutionise the ability of designers to incorporate the non-visual effects of light at the same time as all other design considerations, in a single comprehensive and unique package.

3) Development of customised lighting products for use in occupational and other settings (e.g. vehicles) to maximise alertness, safety and productivity

Working with Melbourne-based light manufacturer and distributor, Versalux Pty Ltd, the Alertness CRC has successfully completed a review of the technological requirements, technology sources, lighting market, and neuroscience underpinning the health effects of light. The project team is now developing a series of 'AlertSafe™' lighting guidelines and product concepts that will be the focus of a national research translation initiative.

Program Three: Sleep Health

Professor Ron Grunstein, Woolcock Institute of Medical Research

Research Program Three continues to develop new systems for phenotyping and managing patients with insomnia and obstructive sleep apnoea (OSA).

The program is on target to deliver the following three key research outputs:

1) OSA Respiratory Phenotyping

We have demonstrated the clinical utility of respiratory phenotyping to effectively treat a sub-group of patients with an unstable respiratory control phenotype (in OSA) using oxygen.

2) OSA Vulnerability to Alertness Failure (VAF) Phenotyping

Activities have focused on validating the laboratory VAF phototyping approach against retrospective real-world outcomes of driving performance, safety, productivity, and healthcare costs. We aim to develop a sleep laboratory alertness failure phenotyping toolkit that is readily deployable in clinical practice. It will be able to identify patients who are at high or low risk of alertness failure with a high level of clinical significance.

Through a PhD project, we have also assessed driving simulator-based crash risk in people with OSA. The results demonstrated an excellent prediction of crash from limited brain activity data six minutes before a crash. This output has great potential for end-user engagement, with the team now seeking suitable partners for commercialisation.

"We set out to quantify the differences in upper airway collapsibility and pharyngeal muscle activity during different phases of the respiratory cycle. We found that, as with the pharyngeal muscle activity, upper airway collapsibility varies throughout the cycle. In fact, the upper airway is more than three times more collapsible during mid-expiration compared to mid inspiration. These findings have provided insight into the physiological mechanisms of pharyngeal collapse in obstructive sleep apnoea."

Amal Osman, Alertness CRC PhD student

1 Research

3) The Insomnia Research Program

We took our findings in how insomnia phenotypes respond to digital cognitive behavioural therapy, together with an evaluation of objective biomarkers (sleep, movement, brain activity), to try and predict subjective sleep quality and daytime performance. We've also worked with data scientists to develop algorithms to enhance phenotyping accuracy and improve monitoring of treatment.

In addition, we've commenced the development of a mobile insomnia treatment application. The smartphone app will be used in conjunction with a wearable device for integration of sleep metrics, and uses an evidence-based behavioural treatment approach that provides a faster therapy option with broader accessibility than current therapies.

Education and Training

The Alertness CRC Education Committee oversees the selection, training and interaction of students and postdoctoral awardees of the Alertness CRC. The education program is designed to include students and early career researchers in all aspects of the collaborative process, including direct contact with industry partners. Through the Education Committee, students and postdoctoral fellows have also been given the opportunity to present their approved research findings at both domestic and international conferences, helping them to gain valuable exposure to further enhance the capacity of these future research leaders.

Postdoctoral Training

A total of 27 postdoctoral fellows are currently involved in 21 research projects across the three research programs. This includes 12 Project Leaders, who are continuously engaging with project parties across several research institutions and end-user participants, with the guidance and mentoring from the respective Program Leaders, Theme Leaders and Chief Investigators.

PhD, Masters and Industry Based Learning Program

PhD student recruitment has increased, with a new total of 21 PhD students to date.

Three of those PhD students were recruited and integrated into the research project this year. To date, the Alertness CRC has recruited four Masters students, two of whom were successfully transitioned to the PhD Program.

The Alertness CRC remains a strong supporter of the Industry Based Learning (IBL) Program at Swinburne University. We have had 16 IBL students participating in Alertness CRC activities, enabling them to work closely with the Project Leaders, postdoctoral fellows and PhD students in an end user-driven project environment.

Industry Placement

Industry placement opportunities and experiences for our students and postdoctoral fellows have been provided by Austin Health, Bioplatforms Australia, Cogstate Pty. Ltd., Philips Respironics, Opturion Pty. Ltd., and Seeing Machines Ltd. Students have also had the opportunity to work closely with the Alertness CRC's third party participants including Curve Tomorrow Pty. Ltd. and Planet Innovation Pty. Ltd., giving them valuable experience and knowledge in areas that are typically outside their fields of expertise.

PhD placement takes to the skies

Thanks to an opportunity that arose through the Alertness CRC and Monash University, PhD student Julia Stone spent three invaluable weeks at Philips Eindhoven in The Netherlands.

The placement encouraged Julia to consider how she can better channel her research knowledge into something that can be applied in the real world.

"My research in circadian phase prediction enabled me to work closely with Philips, and learn how to best approach research translation. I was introduced to the process of translating data to technology – specifically software for monitoring biological rhythms, in healthcare and for normal living conditions. In return, I was encouraged to apply my knowledge across many different areas – effectively learning how to translate my own skills. This two-way knowledge-sharing collaboration has really enhanced my learning experience. It was a real eye-opener."

Julia Stone, PhD Student

Hear more on this placement in this video: https://www.youtube.com/watch?v=DKWPQ2-vY9c.

1 Research

CASE STUDY 1:

ALFA Launch

In partnership with participants Solemma LLC and Monash University, the Alertness CRC has developed a world-first software program that optimises lighting for alertness, safety and productivity.

The new lighting design software program, ALFA (Adaptive Lighting for Alertness), will help architects and lighting professionals manipulate the way light works on human senses, and configure light combinations to have predictable impacts on alertness, safety and productivity.

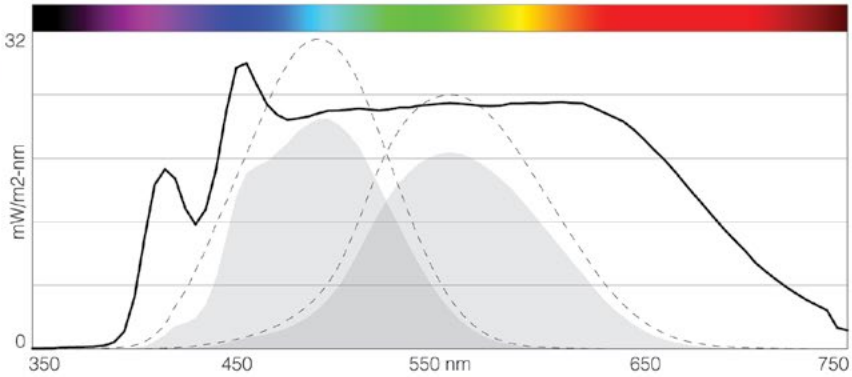
It is the first lighting design software that incorporates the impact of what is termed 'non-visual' effects of light.

The worldwide launch of this innovative tool took place in Melbourne in March 2018.

More information can be found at https://www.solemma.com/Alfa.html.

ALFA ADAPTIVE LIGHTING FOR ALERTNESS

M/P Ratio
0.973
Melanopic Lux
1814
Photopic Lux
1863



2 Results


What impact does shift work disorder have on the severity of depression and anxiety amongst healthcare shift workers?
Introduction
Results
Aim
Method
Discussion
Conclusion
Shift work and Intensive Care
Austin Health
MONASH University
ALERTNESS SAFETY AND PRODUCTIVITY

Commercialisation

Sleep health and alertness are widely recognised as major public health, safety and productivity issues. The sleep health industry is collectively worth an estimated $30 billion to $40 billion, and is growing more than eight percent per annum (ref: *Maureen Mackey, "Sleepless in America: A $32.4 billion business", Fiscal Times, July 23, 2012. http://www.thefiscaltimes.com/Articles/2012/07/23/Sleepless-in-America-A-32-4-Billion-Business*).

The Alertness CRC is developing a portfolio of novel algorithms, technologies and product concepts in sleep health, including:

- Sleep Health Management Decision Support Tools
- Personalised Sleep Health Management support
- Group Work Scheduling solutions
- Fatigue Risk Management tools
- Alertness and Circadian Biomarkers.

Our portfolio is underpinned by extensive and unique datasets and state-of-the-art data science capabilities that can drive further innovation.

Communications

During the year, we co-hosted several events and activities including the launch with the Sleep Health Foundation of "*Asleep on the Job*", a report by Deloitte Access Economics on the national cost of sleep disorders, as well as the worldwide launch of the ALFA software at DIVA Day 2018.

A new website initiative, WorkAlert™ (http://www.workalert.org.au/), was also established in partnership with the Sleep Health Foundation. WorkAlert™ provides science-driven tips and knowledge to help conquer the challenges of staying alert in a busy world, providing advice on how employers and employees can keep themselves and their workplaces safe.

Furthermore, the following major stories appeared on our and other websites, and within industry magazines.

Media Release: Sleep-Smart Rosters Help Keep Doctors Sharper and Safer. An Australian-first rostering system trial underway at two leading Victorian hospitals aims to improve doctors' performance and wellbeing and enhance patient safety.

Stories of Australian Science article: Towards a portable test for tiredness. Saliva or blood tests may one day be used to detect when we're too tired to drive or think clearly. A team of scientists has found specific biological markers (biomarkers) linked to reduced alertness, including eye movement patterns, blood-based metabolites, chemiresistor signal responses and various speech parameters.

*Media Release: Sleep Starved Aussies Run Up $66b Bill: Repor*t. Millions of Australians are failing to get the sleep they need to live healthy, happy lives, a national scourge that costs the country $66 billion a year in health bills, lost productivity and wellbeing, a new report says.

Media Release: Exciting new product to enhance sleep. Developed with doctors and researchers from the Alertness CRC, SmartSleep™ is a wearable sleep technology clinically proven to help improve the quality.

Media Release: New circadian lighting design software launched in Australia. The Alertness CRC recently hosted a workshop on Lighting for Health and Wellbeing in the 21st Century, featuring the worldwide launch of ALFA – Adaptive Lighting for Alertness – a new circadian lighting design software for architects, researchers, and lighting professionals.

Media release: Why and how should we 'preserve our rhythms'? Circadian rhythm and sleep experts from the Alertness CRC, Sleep Health Foundation and Australasian Sleep Association provide advice for World Sleep Day 2018.

2 Results

CASE STUDY 2:

The WorkAlert Website

The Alertness CRC continues to establish strong research translation networks through the Sleep Health Foundation, with joint initiatives continuing to focus on workplace safety and productivity, and establishing sleep health as a national policy priority.

One of this year's initiatives was the launch of the WorkAlert™ website.

WorkAlert™ shares science-driven tips and knowledge with industry and the community to help conquer the challenges of staying alert in a busy world. It provides advice on how employers and employees can keep themselves and their workplaces safe.

- What can you do as an employer to ensure safe and productive schedules?
- What can you do as an employee to improve your sleep health?
- How can you an employer screen your staff for sleeping disorders?
- What are the best lighting solutions for maximum alertness – at work and at home?

Advice on all of these topics and more is provided at http://www.workalert.org.au/.

Science Meets Parliament

Science Meets Parliament has become a keenly anticipated annual highlight of the Federal Parliamentary calendar, and has continued to provide outstanding opportunities to elevate visibility, awareness and understanding of science, technology, engineering and mathematics (STEM) in Federal Parliament and Federal Government departments.

More than 200 scientists, technologists and other STEM professionals took part in the February 2018 event over two very full days. This included Alertness CRC Communications Manager, Ms Susan Waterer.

Event hosts Science & Technology Australia (STA) worked with delegates to build understanding and connections between federal parliamentarians and those working in science and technology, to ensure science stays on the agenda at this critical time.

Key highlights included:

- An inspirational Opening Address from Australia's Chief Scientist, Dr Alan Finkel, reminding everyone about the importance of science and collaboration – and the importance of communicating science.
- Fifth appearance at the Gala Dinner by Opposition Leader, Mr Bill Shorten, who delivered an energising speech on the importance of science, and the need for science to be better represented in Parliament through a dedicated Member.
- Senator the Hon Zed Seselja, Assistant Minister for Science, Jobs and Innovation, declared the importance of science, the importance of women in STEM, and the need for scientists to keep engaging with Parliament, and vice-versa.
- Senator the Hon Kim Carr, Shadow Minister for Innovation, Industry, Science and Research, claimed that "without innovation programs, we cannot build an economy", and pointed out the need for science to approach and assist Parliament by bringing their innovations to them.

3 Resources

Our research and development collaboration remains focused on innovation and commercialisation with strong governance and access to an extensive array of industry and academic expertise.

Governance – Board, Committees and Key Staff

The Board

The Governance structure of the Alertness CRC is represented in Figure 1.

The Board of the Alertness CRC Ltd comprises four independent Directors led by Chair, Deena Shiff. Details of our board members can be found in Table 1, and the dates of board meetings and attendance by board members are shown in Table 2.

Committees

The Finance, Audit and Risk Committee (FAR) and the Commercialisation Committee continue to oversee activities of the Board.

The FAR Committee meets biannually and is chaired by Ian Farrar. Its primary functions remain to review the appropriateness of the Alertness CRC's:

- Financial planning;
- Performance reporting;
- System of risk oversight and management;
- System of internal control;
- Risk management framework (monitoring), and making recommendations to the Board on changes to the framework;
- Recommendations to the Board on the appointment, assessment and removal of external auditors, and oversee their independence;
- Recommendations to the Board on the approval of annual audited financial reports;
- Annual review and approval of the external audit fees, plans and their audit scope;
- Monitoring of the internal control environment and procedures designed to achieve compliance with laws, regulations, internal standards and policies; and
- Overseeing of compliance with statutory and other legal requirements.

The Commercialisation Committee is chaired by Jan Bingley. It continues to ensure that the Alertness CRC demonstrates impact in the field through the commercialisation of the Alertness CRC's outputs and measurable economic benefit to Australia. Terms of reference include:

- Assessing the commercial value of project proposals;
- Setting performance milestones;
- Identifying industry partners to attach to a project;
- Offering mentoring or business support by arrangement with specialists within participating universities and relevant partners;
- Reviewing proposed commercialisation structures and returns for Alertness CRC project parties; and
- Making recommendations to the Alertness CRC Board regarding resource allocation to project activities.

3 Resources

Figure 1: Alertness CRC Governance Structure

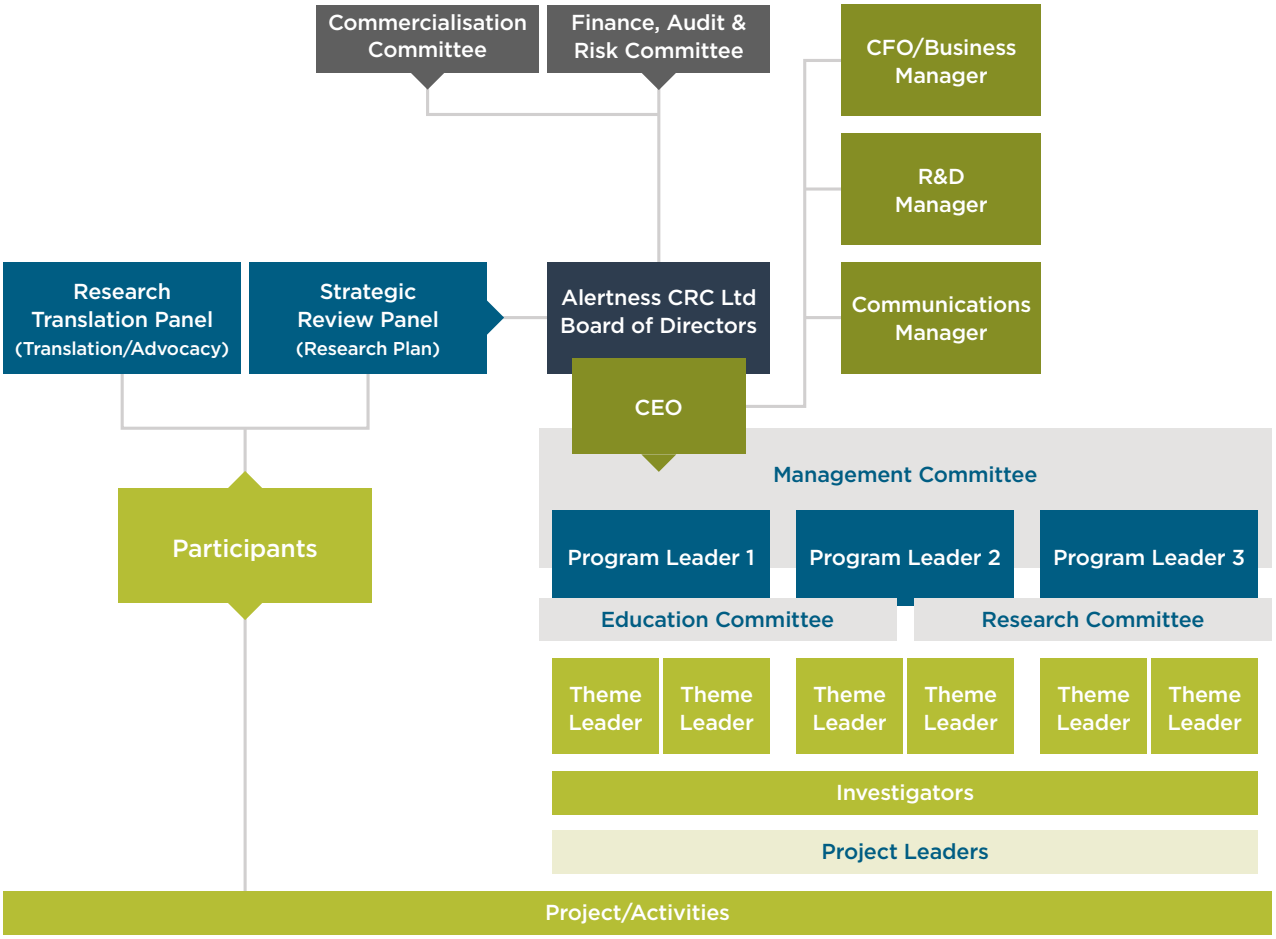


Table 1: Board Members

Name	Role	Key skills	Independent/ Organisation
Deena Shiff	Chair	Deena Shiff, B. Sc (Econ) Hons; B.A. (Law) Hons, has had a senior executive and a legal career and has held senior roles in the public sector. Deena served as a Group Managing Director at Telstra Corporation between 2005 and 2013, during which time she led the Wholesale Division, established Telstra's Business Division and was the founding CEO of Telstra's corporate venture capital arm, Telstra Ventures. Prior to that, Deena was a Partner at Mallesons, in house corporate and regulatory counsel at Telstra, and a senior executive and adviser on legal and social policy reforms for the Australian Government. Deena chairs the global board of BAI Communications Ltd; is the Chairman of the Supervisory Board of Marley Spoon AG, and is a director on a number of boards including ASX listed Appen, Infrastructure Australia and Opera Australia.	Independent
Anthony Williams	CEO	Anthony Williams, B. App. Sci., MPH, is a research and development professional with extensive experience and a proven track record in clinical research and business development. Anthony has expertise in research management, financial modelling, corporate governance, intellectual property management and contract development. He has worked in the area of sleep and alertness for 20 years and has developed extensive networks and relationship across industry and academia, both in Australia and internationally.	Independent
Ian Farrar	Board Member	Ian Farrar, B. Comm, ANU; FCPA; FAICD; FCIS, has extensive experience in research management. For over 20 years he held a number of senior executive positions in CSIRO, Australia's premier research organisation. These included Senior Principal Advisor (Special Projects) and General Manager (Corporate Resources). In 1992 he was appointed Chairman/CEO of the Joint Coal Board which had responsibility for monitoring the health and welfare of NSW coal miners. He chaired the JCB Health and Safety Trust which funded research in the health and safety area. He is also a member of the Advisory Board of the Climate Change Institute at the ANU.	Independent
Jan Bingley	Board Member	Jan Bingley, Bbus (Accounting); RTTP; ACSA; CPA; FAICD, has more than 17 years of experience in the financial sector, including 11 years at the Sydney Futures Exchange, where she managed research and business analysis for market and product design projects. In 2000 Jan formed Universal Carbon Exchange Ltd, which was active in facilitating funding in Australia for technologies promoting green energy and coupling those projects with secured carbon credits. Jan joined CSIRO in 2004 and headed up Business Development and Commercialisation team. Leaving CSIRO in 2015 Jan has undertaken a number of consulting roles and a full time executive role with the Global CCS Institute where she was responsible for business development and strategy. Jan has been a board member of several spin-out companies, was a board member of Commercialisation Australia and was on the Executive Committee of Knowledge Commercialisation Australasia. She is currently on the federal governments Innovation Investment Committee and the Investment Committee for Tank Stream Ventures.	Independent

3 Resources

Table 2: Board of Director Meetings, 2018

Name	Board Meeting Dates	Eligible to attend	Attended
Deena Shiff	12 September 2017	YES	YES
Anthony Williams	29 November 2017	YES	YES
Ian Farrar	20 March 2018	YES	YES
Jan Bingley	7 June 2018	YES	YES

Key Staff

Alertness CRC key staff are listed in Table 3.

Alertness CRC operations continue to be managed by the CEO with the assistance of the Business Manager, Research & Development Manager, newly appointed Finance Manager, and the Communications Manager. The CEO chairs a Management Committee with the Research Program Leaders, who meet monthly to ensure direct communication between the executive and research teams. This Management Committee is supported by the Education Committee and Research Committee.

The Research Committee is chaired rotationally by the Program Leaders, and all Theme Leaders participate to discuss and resolve issues in relation to the research plan and associated activities.

The Education Committee is comprised of representatives from the three University participants, and meets quarterly to address matters pertaining to the Alertness CRC education program, such as the award of scholarships or top-up stipends to the students, and to ensured that the students' research projects are relevant to the objectives of the research programs of the Alertness CRC.

Table 3: Alertness CRC Key Staff as at 30 June 2018

Name	Organisation	Position/Role
Anthony Williams	Alertness CRC Ltd	CEO
Wee Mong Wong	Alertness CRC Ltd	CFO/Business Manager
Andrew Tucker	Alertness CRC Ltd	General Manager Research & Development
Susan Waterer	Alertness CRC Ltd	Communications Manager
Jenna Teh	Alertness CRC Ltd	Finance Manager
Ron Grunstein	Woolcock Institute of Medical Research	Program Leader
Shantha Rajaratnam	Monash University	Program Leader
Steven Lockley	Monash University	Program Leader
Clare Anderson	Monash University	Theme Leader
Doug McEvoy	Flinders University	Theme Leader
Karen Reynolds	Flinders University	Theme Leader

Name	Organisation	Position/Role
Mark Howard	Institute for Breathing and Sleep/Austin Health	Theme Leader
Mark Wallace	Monash University	Theme Leader
Svetlana Postnova	The University of Sydney	Theme Leader
Andrew Vakulin	Flinders University	Project Leader
Anna Clark	Monash University	Project Leader
Christopher Gordon	The University of Sydney/ Woolcock Institute of Medical Research	Project Leader
Jennifer Cori	Institute for Breathing and Sleep	Project Leader
Kathryn Jeppe	Monash University	Project Leader
Michelle Magee	Monash University	Project Leader
Tracey Sletten	Monash University	Project Leader

Participants

This year, we welcomed four new other participants:

- goACT Pty Ltd (other participant)
- Roads Corporation (Vicroads) (other participant)
- The Defence Science and Technology Group of The Department of Defence (other participant)
- Versalux Pty Ltd (other participant).

All Alertness CRC Participants for this year are listed in Table 4.

Table 4: Alertness CRC Participants

No	Participant Name	Participant Type	ABN/ACN	Organisation Type
1	Austin Health	Essential	96 237 388 063	State Government
2	Australian Sleep Trials Network	Other	88 002 198 905	Other
3	Australian Salaried Medical Officers Federation	Essential	56 536 563 722	Other
4	Bioplatforms Australia Limited	Essential	40 125 905 599	Other
5	Brain Resource Limited	Essential	24 094 069 682	Industry/Private Sector

3 Resources

No	Participant Name	Participant Type	ABN/ACN	Organisation Type
6	BUPA Foundation (Australia) Pty Ltd	Essential	67 113 817 637	Industry/Private Sector
7	Cogstate Pty Ltd	Other	80 090 975 723	Industry/ Private Sector
8	Constraint Technologies International Pty Ltd	Essential	13 054 631 462	Industry/Private Sector
9	Commonwealth Scientific and Industrial Research Organisation	Other	41 687 119 230	Australian Government
10	Curve Tomorrow Pty Ltd (New)	Third Party	75 163 458 982	Industry/Private Sector
11	Electrolight Pty Ltd	Other	93 288 579 088	Industry/Private Sector
12	Fatigue Management International	Other	UK company registration 06431894	Industry/Private Sector
13	Grey Innovation Pty Ltd	Other	14 083 304 214	Industry/Private Sector
14	goACT Pty Ltd (New)	Other	28 142 877 049	Industry/Private Sector
15	Institute for Breathing and Sleep	Essential	39 093 685 879	Other
16	International Council of Mining and Metals	Essential	UK based	Industry/Private Sector
17	Lighting Science Group Corporation (Resigned)	Essential	US based	Industry/Private Sector
18	Monash University	Essential	12 337 614 012	University
19	National Transport Commission	Essential	67 890 861 578	Australian Government
20	Neuroscience Research Australia	Other	94 050 110 346	Other
21	Optalert Australia Pty Ltd	Other	79 121 747 591	Industry/Private Sector
22	Opturion Pty Ltd	Other	13 146 662 053	Industry/Private Sector
23	Planet Innovation Pty Ltd (New)	Third Party	35 137 428 141	Industry/Private Sector
24	Respironics Inc – A Phillips Healthcare Company	Essential	24 008 445 743	Industry/Private Sector
25	Roads Corporation (Vicroads) (New)	Other	61 790 960 480	State Government
26	Seeing Machines Limited	Other	34 093 877 331	Industry/Private Sector

No	Participant Name	Participant Type	ABN/ACN	Organisation Type
27	SmartCap Technologies Pty Ltd (f.k.a EdanSafe Pty Ltd)	Other	61 094 352 959	Industry/Private Sector
28	Solemma LLC	Other	US based	Industry/Private Sector
29	Southern Adelaide Local Health Network	Essential	14 227 133 467	State Government
30	The Defence Science and Technology Group of The Department of Defence (New)	Other	68 706 814 312	Australian Government
31	The Flinders University of South Australia	Essential	65 542 596 200	University
32	The Sleep Health Foundation	Essential	91 138 737 854	Other
33	The University of Sydney	Essential	15 211 513 464	University
34	Transport Accident Commission	Essential	22 033 947 623	State Government
35	Transport for New South Wales	Third Party	18 804 239 602	State Government
36	Versalux Pty Ltd (New)	Other	68 005 911 802	Industry/Private Sector
37	Woolcock Institute of Medical Research	Essential	88 002 198 905	Other
38	Worksafe Victoria	Essential	90 296 467 627	State Government

3 Resources

CASE STUDY 3:

Launch of "Asleep on the Job"

The Alertness CRC, Sleep Health Foundation (SHF) and Australasian Sleep Association (ASA) worked together to update the Deloitte Access Economics Report, which focuses on the economic burden of sleep disorders and sleep disruption.

The revised report, "*Asleep on the Job*", was launched on the evening of Tuesday 8 August 2017 at Parliament House in Canberra.

Organised by the SHF, the event was attended by several politicians and other key figures, including the Federal Minister for Health, the Hon. Greg Hunt, who delivered a speech in which his support for the report – and sleep health in general – was expressed.

The Alertness CRC was invited to set up a small demonstration project in the room on the day, providing sleep health information to the attending Politicians, their staffers, and the other event attendees.

Four Alertness CRC PhD students were given the opportunity to present their knowledge to the event attendees, and provide general advice on sleep health where feasible. It was also an opportunity for the students to network with those in Government and industry, seeing their science put into motion.

The Alertness CRC set-up was very well received, and the key message – to promote the fact that sleep and alertness are linked to health and performance – was a key take-out for all.

Attendees were each provided with an Alertness CRC-branded USB containing all information from the event, together with related sleep health fact sheets from the SHF.


CRC
ALERTNESS


CRC
ALERTNESS
PRODUCTIVITY

4 Financial Management

During the 2017/18 financial year, the Alertness CRC received total cash contributions of $3.696 million. Of the total cash received, 32% was provided by the Commonwealth through the CRC funding agreement, 48% was received from participant organisations and the remaining 20% was made up of interest income (1%) and other revenue from third party participants (19%), as shown in Figure 2.

Figure 2: Composition of Cash Received during FY18 vs Agreement

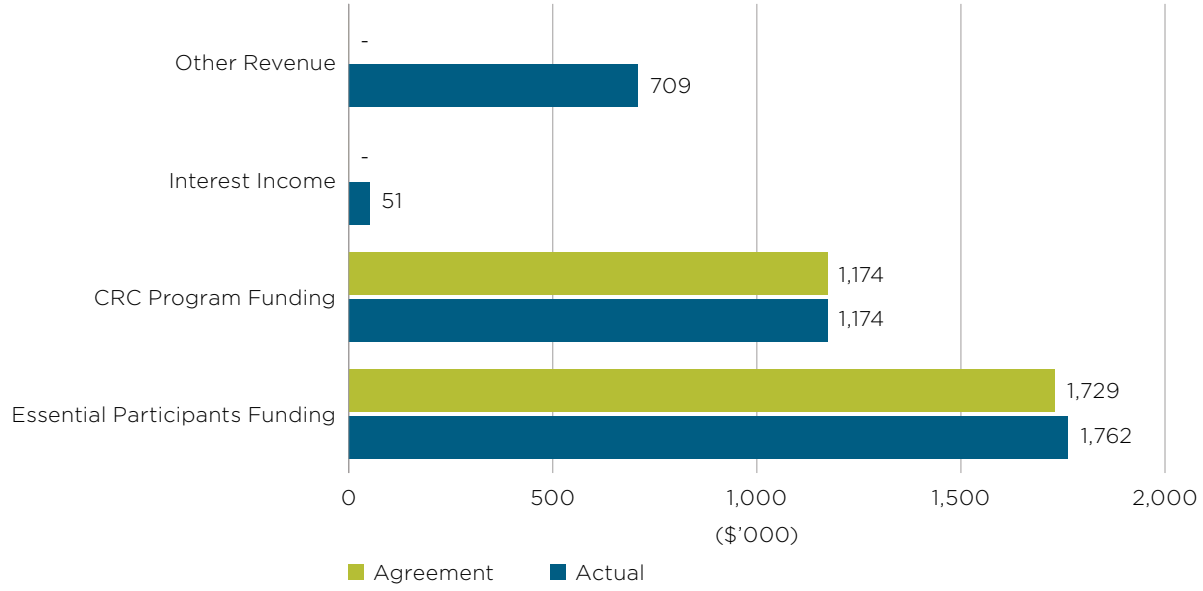
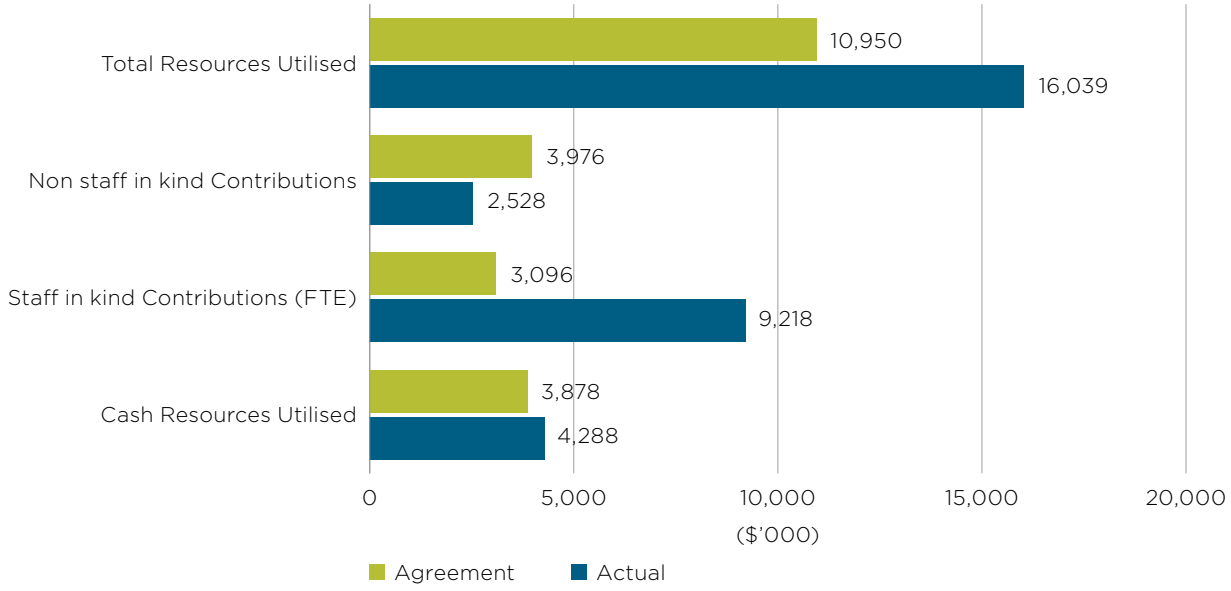


Figure 3 highlights the breakdown of Year Five resources utilised by category relative to original participant commitments for 2017/18.

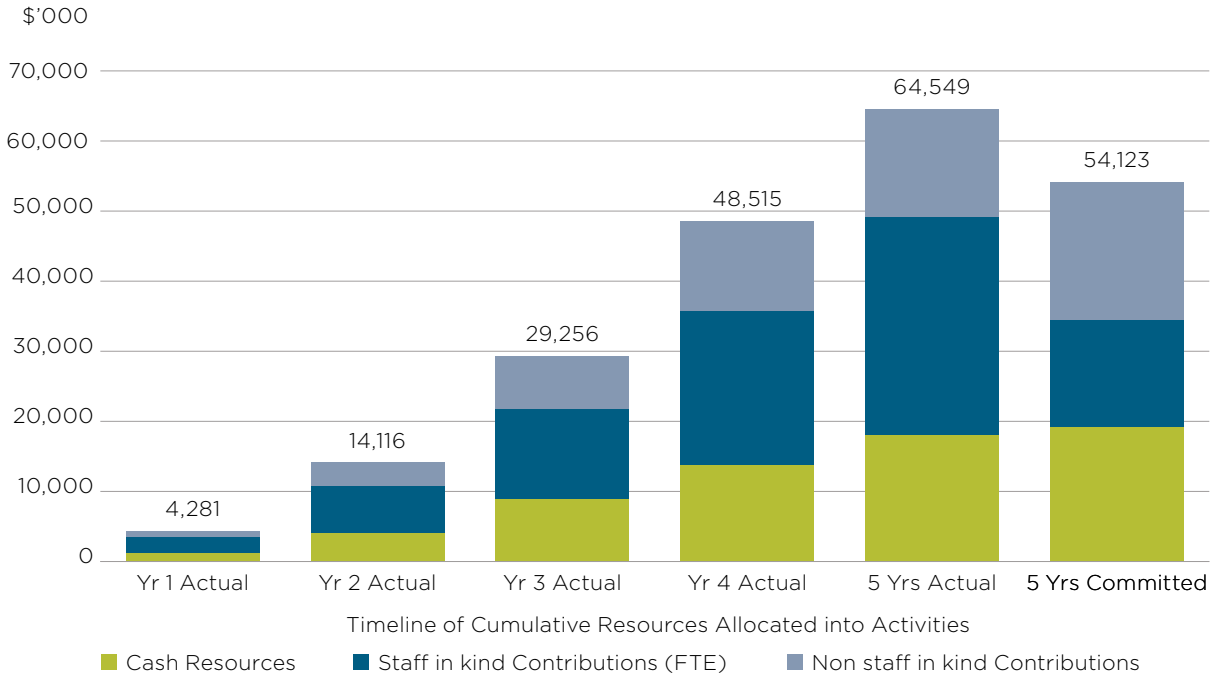
Figure 3: FY18 Allocation of Utilised Resource Category – Actual vs Agreement



4 Financial Management

As at 30 June 2018, Alertness CRC recorded an additional $10.426 million in total resources utilised over the cumulative five year period as compared to original commitments over the same period, as shown in Figure 4.

Figure 4: Five Years Cumulative Resources Allocated into Activities– Actual vs Agreement



The independent auditor's report for the financial year 2017/18 confirms that the financial records have been prepared in accordance with Division 60 of the Australian Charities and Not-for-profits Commission Act 2012, and comply with the Australian Accounting Standards – Reduced Disclosure Requirements and Division 60 of the Australian Charities and Not-for-profits Commission Regulation 2013.

Their opinion further states that:

- The financial statements as at 30 June 2018 give a true and fair view of the Company's financial position as at that date and of its financial performance for the year ended on that date;
- Contributions of both cash and in-kind have been made and recorded in accordance with the budget as specified and in accordance with the terms of the Commonwealth Agreement;
- The Commonwealth funding and the contributions have been expended solely for the activities and in accordance with the Commonwealth Agreement and Australian accounting concepts and applicable Australian standards; and
- All transactions for the activities as specified in the Commonwealth Agreement have been conducted through the Alertness CRC Account.

5 Appendices

5 Appendices

Appendix 1: Publications

Accepted articles in peer reviewed journals 2017–18 FY

Lack, L., Scott, H., Micic, G. & Lovato, N. (2017). *Intensive Sleep Re-training: From bench to bedside. Brain Sciences,* 7(4), 33 doi:10.3390/brainsci7040033 https://www.mdpi.com/2076-3425/7/4/33

Flynn-Evans EE, Shekleton JA, Miller B, Epstein LJ, Kirsch D, Brogna LA, Burke LM, Bremer E, Murray JM, Gehrman P, Rajaratnam SMW, Lockley SW. *Circadian phase and phase angle disorders in primary insomnia*. Sleep. 2017 Oct 3. doi: 10.1093/sleep/zsx163. PMID: 29029340 [Epub ahead of print]. https://www.ncbi.nlm.nih.gov/pubmed/29029340

Sletten TL, Ftouni S, Nicholas CL, Magee M, Grunstein RR, Ferguson S, Kennaway DJ, O'Brien D, Lockley SW, Rajaratnam SMW. *Randomised controlled trial of the efficacy of a blue-enriched light intervention to improve alertness and performance in night shift workers*. Occup Environ Med. 2017 Nov;74(11):792-801. doi: 10.1136/oemed-2016-103818. Epub 2017 Jun 19. https://www.ncbi.nlm.nih.gov/pubmed/28630378

Miller, C.B., Rae, C. D., Green, M., Yee, B. J., Kyle, S.D., Gordon, C.J, Marshall, N.S., Espie, C.A., Grunstein, R.R. & Bartlett D.J. *An objective short sleep insomnia disorder subtype is associated with reduced brain metabolite concentrations in vivo: a preliminary magnetic resonance spectroscopy assessment.* Sleep. 2017 Nov 1;40(11). doi: 10.1093/sleep/zsx148. https://www.ncbi.nlm.nih.gov/pubmed/28958033

Sprajcer M, Jay SM, Vincent GE, Vakulin A, Lack L, Ferguson LA. *Uncertain call likelihood negatively affects sleep and next day cognitive performance while on-call in a laboratory environment*. Chronobiology International, accepted Dec 21, 2017. https://www.ncbi.nlm.nih.gov/pubmed/29750547

Anderson C, Ftouni S, Ronda JM, Rajaratnam SMW, Czeisler CA, Lockley SW. *Self-reported drowsiness and safety outcomes while driving after an extended duration work shift in trainee physicians*. Sleep. 2017 Dec 22. doi: 10.1093/sleep/zsx195. [Epub ahead of print]. https://www.ncbi.nlm.nih.gov/pubmed/29281091

Lau, T., Lovato, N., & Lack, L. (2018). *Evaluation of a portable light device for phase advancing the circadian rhythm in the home environment*. Sleep and Biological Rhythms, https://doi.org/10.1007/s41105-018-0167

Sprajcer M, Jay SM, Vincent GE, Vakulin A, Lack L, Ferguson LA. *The effects of anticipating a high stress task on sleep and performance during simulated on-call work*. Journal of Sleep Research, accepted 27/02/18. https://www.ncbi.nlm.nih.gov/pubmed/29682871

Postnova S, Lockley SW, Robinson PA. *Prediction of Cognitive Performance and Subjective Sleepiness Using a Model of Arousal Dynamics*. J Biol Rhythms. 2018 Apr;33(2):203-218. doi: 10.1177/0748730418758454. https://www.ncbi.nlm.nih.gov/pubmed/29671707

LK Grant, S Ftouni, B Nijagal, D De Souza, SW Rajaratnam, SW Lockley, C Anderson. *Circadian and wake-dependent changes in the human plasma metabolome*. Sleep, Volume 40, Issue suppl_1, 28 April 2017, Pages A3. https://doi.org/10.1093/sleepj/zsx050.006

Miller CB, Espie CA, Bartlett DJ, Marshall NS, Gordon CJ, Grunstein RR. *Acceptability, tolerability, and potential efficacy of cognitive behavioural therapy for Insomnia Disorder subtypes defined by polysomnography: A retrospective cohort study*. Sci Rep. 2018 Apr 27;8(1):6664. doi: 10.1038/s41598-018-25033-3. https://www.nature.com/articles/s41598-018-25033-3

Sletten TL, Magee M, Murray JM, Gordon CJ, Lovato N, Kennaway DJ, Gwini SM, Bartlett DJ, Lockley SW, Lack LC, Grunstein RR, Rajaratnam SMW; *Efficacy of melatonin with behavioural sleep-wake scheduling for delayed sleep-wake phase disorder: A double-blind, randomised clinical trial*. Delayed Sleep on Melatonin (DelSoM) Study Group. PLoS Med. 2018 Jun 18;15(6):e1002587. doi: 10.1371/journal.pmed.1002587. eCollection 2018 Jun. https://www.ncbi.nlm.nih.gov/pubmed/29912983

Stone JE, Sletten TL, Magee M, Ganesan S, Mulhall MD, Collins A, Howard M, Lockley SW, Rajaratnam SMW. *Temporal dynamics of circadian phase shifting response to consecutive night shifts in healthcare workers: role of light-dark exposure*. J Physiol. 2018 Jun;596(12):2381-2395. doi: 10.1113/JP275589. Epub 2018 Apr 6. https://www.ncbi.nlm.nih.gov/pubmed/29589871.

Dickinson DL, Wolkow AP, Rajaratnam SMW, Drummond SPA. *Personal sleep debt and daytime sleepiness mediate the relationship between sleep and mental health outcomes in young adults*. Depress Anxiety. 2018 May 22. doi: 10.1002/da.22769. [Epub ahead of print]. https://www.ncbi.nlm.nih.gov/pubmed/29790238

Abeysuriya RG, Lockley SW, Robinson PA, Postnova S. *A unified model of melatonin, 6-sulfatoxymelatonin, and sleep dynamics*. J Pineal Res. 2018 May;64(4):e12474. doi: 10.1111/jpi.12474. Epub 2018 Mar 8. https://www.ncbi.nlm.nih.gov/pubmed/29437238

Papers in refereed conference proceedings

Lovato, N. *Insomnia in older adults: Phenotypic responses to treatment*. Symposia presentation at the 29th Annual Scientific Meeting of the Australasian Sleep Association, Auckland, NZ, 2017.

Philip, R., Catcheside, D., Stevens, D., Lovato, N., McEvoy, D., Vakulin, A. (2017). *Comorbid insomnia and sleep apnoea is associated with greater neurocognitive impairment compared with OSA alone*. 29th Annual Scientific Meeting of the Australasian Sleep Association, Auckland, NZ, 2017.

Papers presented at conferences

Grant, Leilah. *Inter-individual differences in the circadian modulation of the human plasma polar metabolome*. ACS Meeting October 2017.

McMahon, William. *Sleep deprived cognitive performance during the wake maintenance zone depends on cognitive domain*. Australasian Sleep Association Meeting, ACS Meeting October 2017.

Anderson, Clare. *Developing biomarkers of sleep and circadian timing – the utility of the human polar metabolome*. Australasian Sleep Association Meeting, October 2017

Grant, Leilah. *Sleep, circadian rhythms and the metabolome*. Australasian Sleep Association Meeting, October 2017

McMahon, William. *Higher order cognition is preserved in the wake maintenance zone during 40h sleep deprivation*. Australasian Sleep Association Meeting, October 2017.

Osman A. *Awake upper airway collapsibility is related to airway collapsibility during sleep (Pcrit) in obstructive sleep apnea*. Australasian Sleep Association Meeting, October 2017.

Anderson, Clare. *Acoustical stimulation of slow wave sleep*. World Sleep 2017.

Booker, Lauren. *Shift work and Individual Management (S.W.I.M): Shift Work Disorder and its impact of Sleep and Mood*. Transplant Nurses Association Conference, November 2017.

Vakulin, Andrew. *New Technologies for Sleep Disorder Screening and Management*. Sleep Health Services Symposium, November 2017.

Booker, Lauren. *Shift work and Individual Management (S.W.I.M): Shift Work Disorder and its impact of Sleep and Mood*. Australian Nursing and Midwifery Federation, March 2018.

Osman, A. *A simple wakefulness upper airway collapsibility test closely relates to the pharyngeal critical closing pressure (Pcrit) during sleep in obstructive sleep apnea*. ATS conference May 2018.

Osman, A. *The pharyngeal airway is most collapsible during mid-expiration in obstructive sleep apnea*. ATS conference 2018.

Ganesan, Saranea. *Shift work and its impact on sleep, alertness and performance in Intensive Care health workers*. Sleep 2018, Baltimore, June 2018.

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Invited presentations

Vakulin, A. *Clinical biomarkers for the assessment of alertness failure and driving performance in patients with OSA*. ASA member association symposium, 2017.

Vakulin, A. *Biomarkers of Alertness Failure and Driving Impairment in OSA*. ASA Breakfast Symposium, SDU Auckland, New Zealand, 2017.

Vakulin, A. *Industry Partner Grants – Insights from the CRC model. ASA Early Career Session*, SDU Auckland, New Zealand, 2017.

Stone, Julia. *Circadian response to shift work*. University of Melbourne lecture, 16 August 2017.

Sletten, Tracey. *Heavy Vehicle Driver Fatigue under current Heavy Vehicle National Law*. Monash Sleep Network meeting, August 2017.

Grunstein, R. *Dental Sleep Medicine Council (ASA) Course*, Sydney, "*Pathophysiology, clinical manifestations and complications of obstructive sleep apnoea*", 15 September 2017.

Postnova, S. "*Physiologically-based modelling of Alertness*", WIMSIG: Celebration of Women in Australian Mathematical Sciences, Adelaide, Australia, 24-26 September 2017.

Wotherspoon, Elizabeth (Austin Health). *Applying science to shift work to help staff and patients*. Austin Health meeting with ANMF and hospital representatives, September 2017.

Lockley, S. '*The eye is not just for seeing: How light affects alertness, sleep and circadian rhythms*', DIVA Day 2017, University of California Berkeley, USA, October 27, 2017.

Grunstein, R. *Sleep Theme Symposium: Precision Sleep Medicine*, Charles Perkins Centre, University of Sydney, "Precision Approaches to Insomnia Diagnosis and Management", Wednesday 8 November 2017.

Lockley, S. '*The right light at the right time: Redesigning light for alertness, sleep and health*', Greenbuild International Conference and Expo, Boston, USA, November 8, 2017.

Lockley, S. '*Human Needs in the Built Environment',* International Dark-Sky Association 2017 Annual General Meeting & Conference: Reclaiming the Night, Boston, USA, November 11, 2017.

Dormer, Alan (Opturion). *Alert Safe Rostering for Medical Staff*. Safe & Secure Hospitals Conference, Sydney, November 2017.

Vakulin, A. *Wearables for Assessment of Sleep and Circadian Rhythms*. International Biomarkers Workshop 2018, SLEEP 2018, Baltimore, US, 2018.

Lockley, S. '*How biology and new lighting technology can work together to improve alertness, sleep and health*', Department of Design, Architecture and Building, University of Technology Sydney, Sydney, 19 March, 2018.

Lockley, S. '*The eye is not just for seeing – the science of non-visual photoreception*',, Lighting for Health and Wellbeing in the 21st Century: A workshop on the science, application, measurement, modelling and financing the non-visual benefits of light, CRC for Alertness, Safety and Productivity, Monash, Melbourne, 27 March 2018.

Lockley, S. '*Developing metrics for light and health applications',* IES Research Symposium: Light + human health, Atlanta, USA, 10 April 2018.

Lockley, S. '*The eye is not just for seeing: How light affects alertness, sleep and circadian rhythms'*, Chartered Institution of Building Services Engineers, London, UK, 3 May 2018.

Wolkow, Alex. Managing alertness and performance in operational settings. NTC meeting May 2018.

Grunstein, R. *Sydney Local Health District Sydney Innovation Symposium*, Australian Technology Park Sydney, "*Sleep – Who Needs it Anyway?*", 22 June 2018.

Posters

Stone, J. *Circadian phase shifting response to consecutive night shifts in healthcare workers: Role of light-dark exposure*. World Sleep Congress 2017.

Booker, L. *What impact does shift work disorder have on the severity of depression and anxiety amongst healthcare shift workers?* Research FEST 2017 and ASA Conference, October 2017.

Ganeson, S. *Shift work and its impact on sleep, alertness and performance in Intensive Care health workers*. APSS 2018, Baltimore, June 2018.

Booker, L. *What impact does shift work disorder have on depression and anxiety severity amongst healthcare shift workers?* ESRS 2018, Basel, Switzerland, September 2018.

Booker, L. *Poor sleep hygiene is the biggest contributor to sleep impairment in healthcare shift workers*. ASA Conference 2018.

Presentations

Sletten, T. Heavy Vehicle Driver Fatigue under current Heavy Vehicle National Law. Presented at the Monash Sleep Network meeting, Monash University, 2017.

Wotherspoon, E. *Applying Science to Shiftwork to help staff and patients*. Presented in a meeting with the ANMF and hospital representatives, Melbourne, 2017.

Grant, L. *Inter-individual differences in the circadian modulation of the human plasma polar metabolome*. Presented at the ACS Meeting, October 2017.

Grant, L. *Sleep, circadian rhythms and the metabolome*. Presented at the ASA Meeting, October 2017.

McMahon, W. *Sleep deprived cognitive performance during the wake maintenance zone depends on cognitive domain*. Presented at the ACS Meeting, October 2017.

McMahon, W. *Higher order cognition is preserved in the wake maintenance zone during 40h sleep deprivation*. Presented at the ASA Meeting, October 2017.

Anderson, C. *Acoustical stimulation of slow wave sleep*. Presented at World Sleep 2017.

Booker, L. *Shift work and Individual Management (S.W.I.M): Shift Work Disorder and its impact of Sleep and Mood*. Presented at the Transplant Nurses Association Conference, November 2017.

Vakulin, A. *New Technologies for Sleep Disorder Screening and Management*. Presented at the Sleep Health Services Symposium, November 2017.

Dormer, A. *Alert Safe Rostering for Medical Staff*. Presented at the Safe & Secure Hospitals Conference, November 2017, Sydney.

Booker, L. *Shift work and Individual Management (S.W.I.M): Shift Work Disorder and its impact of Sleep and Mood*. Presented at the Australian Nursing and Midwifery Federation Meeting, 2018.

Ganeson, S. *Shift work and its impact on sleep, alertness and performance in Intensive Care health workers*. Presented at APSS 2018, Baltimore, June 2018.

Wolkow, A. *Managing alertness and performance in operational settings*. Presented at an NTC Meeting, May 2018.

Anderson, C. *Developing biomarkers of sleep and circadian timing –the utility of the human polar metabolome*. Presented at ASA Meeting 2018.

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Submitted Abstracts

Grant, L. *Inter-individual differences in the circadian modulation of the human plasma polar metabolome*. Submitted for Australasian Chronobiology Society Meeting, October 2017.

Vakulin, A. *The effect of extended wakefulness on postural control in obstructive sleep apnoea and healthy controls*. Submitted for World Sleep Congress 2017.

Vakulin, A. *Comorbid insomnia and sleep apnoea is associated with greater neurocognitive impairment compared with OSA alone*. Submitted for World Sleep Congress 2017.

Diep, C. *Slow wave enhancement via automated phase locked acoustic stimulation*. Submitted for 2017 ASA Sleep Down Under conference.

McMahon, W. *Sleep deprived cognitive performance during the wake maintenance zone depends on cognitive domain*. Submitted for Annual Meeting of the Australasian Chronobiology Society (ACS meeting) 2017.

Osman, A. *Awake upper airway collapsibility is related to airway collapsibility during sleep (Pcrit) in obstructive sleep apnoea*. Submitted for TSANZ Meeting, October 2017.

Osman, A. *A simple wakefulness upper airway collapsibility test closely relates to the pharyngeal critical closing pressure (Pcrit) during sleep in obstructive sleep apnoea*. Submitted for the ATS Conference 2018.

Osman, A. *The pharyngeal airway is most collapsible during mid-expiration in obstructive sleep apnoea*. Submitted for the ATS Conference 2018.

Bickley, K. *Re-evaluating the measurement of daytime functioning in insomnia – a new tool for assessment*. Submitted for the Sleep DownUnder Conference 2017, Adelaide.

Ganesan, S. *Shift Work and its Impact on Sleep, Alertness and Performance in Intensive Care Workers*. Submitted for the APSS Conference 2018.

Osman, A. *The pharyngeal airway is most collapsible during mid-expiration in obstructive sleep apnoea*. Submitted for the National Upper Airway Meeting, February 2018.

Kuo, J. *Using real time driver monitoring to examine visual time-sharing in naturalistic driving*. Submitted for the Australasian Road Safety Conference, October 18.

Stone, J. *Circadian phase estimation using ambulatory light and skin temperature monitoring: a neural network approach*. Submitted for the Society for Research on Biological Rhythms (SRBR) Biannual Meeting, May 2018.

Andrerson, C. *Fatigue and road safety – addressing the gaps for improved road safety*. Submitted for the Australasian Road Safety Conference, October 2018.

Mulhall, M. *Predicting driving impairment and ocular measures during naturalistic driving in shift workers*. Submitted for ESRS 2018, Basel, Switzerland, September 2018.

Tekieh, T. *Quantitative modelling of the direct alerting effects of light*. Submitted for ESRS 2018, Basel, Switzerland, September 2018.

Collett, J. *Circadian and sleep/wake modulation of attention processes: A characterisation using ocular motor tasks*. Submitted for ESRS 2018, Basel, Switzerland, September 2018.

Booker, L. *To investigate the impact depression and anxiety has on shift work disorder risk amongst healthcare shift workers*. Submitted for ESRS 2018, Basel, Switzerland, September 2018.

Gordon, C. *Treatment response of Insomnia Disorder phenotypes and subtypes to standardised digital cognitive behavioural therapy*. Submitted for ESRS 2018, Basel, Switzerland, September 2018.

Mulhall, M. *Pre-drive ocular assessment predicts driving performance in shift workers: a naturalistic driving study*. Submitted for the ASA Meeting, October 2018.

Osman, A. *The upper airway is most collapsible during expiration in obstructive sleep apnoea*. Submitted for the ASA Meeting, October 2018.

Diep, C. *Interindividual Variability In Response To Acoustic Stimulation*. Submitted for the ASA Meeting, October 2018.

Collet, J. *Sleep/wake and circadian modulation of inhibitory attentional control: A characterisation using the antisaccade task*. Submitted for the ASA Meeting, October 2018.

Collet, J. *Diurnal rhythms in the inhibitory control of attention: Characterisation using the antisaccade task*. Submitted for the ASA Meeting, October 2018.

McMahon, W. *Fixed sleep schedules prior to an in-lab study – individual differences in sleep, circadian timing and subsequent vulnerability to sleep deprivation*. Submitted for the ASA Meeting, October 2018.

Booker, L. *What unique demographic and lifestyle factors contribute to the risk of SWD in healthcare shift workers?* Submitted for the ASA Meeting, October 2018.

Diep, C. *Executive function improves following acoustic slow wave sleep enhancement with a novel, automated device. Executive function improves following acoustic slow wave sleep enhancement with a novel, automated device*. Submitted for the ASA Meeting, October 2018.

Osman, A. *The upper airway is most collapsible during expiration in obstructive sleep apnoea*. Submitted for Motor Impairment Meeting, November 2018.

Videos

Wasnik, S. *Computational models to predict alertness failure*. Submitted for the CRCA ECR Showcase competition 2018.

Osman, A. *A new approach to direct targeted therapies for OSA*. Submitted for the CRCA ECR Showcase competition 2018.

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Appendix 2: Education

Post-Doctoral Fellows 2017–18

No	Name	Research Project (Program Number#)	Research Organisation
1	Alexander Wolkow	Heavy Vehicle Driver Fatigue Research Project (RP1 & RP2)	Monash University, Australia
2	Andrew Vakulin	Sleep Disorder Phenotyping & Sleep Companion Decision Support Tool (RP3)	Flinders University, Australia
3	Angela D'Rozario	Sleep Disorder Phenotyping & Insomnia Decision Support Development (RP3)	Woolcock Institute of Medical Research, Australia
4	Angus Wallace	Device Development & Sleep Companion Decision Support Tool (RP1, RP2 & RP3)	Flinders University, Australia
5	Ben Fulcher	Laboratory (RP1)	Monash University, Australia
6	Bradley Edwards	Sleep Disorder Phenotyping (RP3)	Monash University, Australia
7	Bryn Jeffries	Database Development & Sleep Companion Decision Support Tool (RP3)	The University of Sydney, Australia
8	Christopher Gordon	Sleep Disorder Phenotyping, Insomnia Decision Support Development & SleepFix (RP3)	The University of Sydney/ Woolcock Institute of Medical Research, Australia
9	Christopher Miller	Sleep Disorder Phenotyping (RP3)	Woolcock Institute of Medical Research, Australia
10	David Stevens	Sleep Disorder Phenotyping (RP3)	Flinders University, Australia
11	Emily Anderson	Device Development (RP1, RP2 & RP3)	Flinders University, Australia
12	Gleb Belov	Group Work Scheduling (RP2)	Monash University, Australia
13	Jennifer Cori	Healthcare (RP2), Sleep Disorder Phenotyping (RP3), Ocular Measure Fitness to Drive (RP1) & Heavy Vehicle Driver Fatigue Research Project (RP1 & RP2)	Institute for Breathing and Sleep, Australia
14	Jong Won Kim	Modelling and Data Fusion (RP1)	The University of Sydney/ Woolcock Institute of Medical Research, Australia

No	Name	Research Project (Program Number#)	Research Organisation
15	Maria Comas	Sleep Disorder Phenotyping (RP3)	Woolcock Institute of Medical Research, Australia
16	Michelle Magee	Healthcare (RP2) & Shift Work Management (RP1)	Monash University, Australia
17	Nicole Lovato	Sleep Disorder Phenotyping & Sleep Companion Decision Support Tool (RP3)	Flinders University, Australia
18	Pasquale Alvaro	Healthcare (RP2)	Institute for Breathing and Sleep, Australia
19	Peter Catcheside	Sleep Disorder Phenotyping & Sleep Companion Decision Support Tool (RP3)	Flinders University, Australia
20	Romesh Abeysuriya	Modelling (RP1)	The University of Sydney, Australia
21	Shane Landry	Sleep Disorder Phenotyping (RP3)	Monash University, Australia
22	Simon Joosten	Laboratory (RP1) & Sleep Disorder Phenotyping (RP3)	Monash University, Australia
23	Suzanne Ftouni	Laboratory (RP1)	Monash University, Australia
24	Svetlana Postnova	Modelling & Group Work Scheduling (RP2)	The University of Sydney, Australia
25	Tracey Sletten	Healthcare (RP2) & Heavy Vehicle Driver Fatigue Research Project (RP1 & RP2)	Monash University, Australia
26	Stuart Knock	Modelling & Group Work Scheduling (RP2)	The University of Sydney, Australia
27	Kathryn Jeppe	Biomarker for Alertness (RP1)	Monash University, Australia

denotes:
Research Program 1 (RP1) – Alertness Measurement, Prediction and Testing
Research Program 2 (RP2) – Safety and Productivity Improvements
Research Program 3 (RP3) – Sleep Health

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PhD Degree Scholarships 2017–18

No	Name	Date Commenced	Research Project (Program Number#)	Research Title	Research Organisation	Expected Completion Date
1	Amal Osman	14-Jul-15	Sleep Disorder Phenotyping (RP3)	Development of A Simple Clinical Technique to Quantify Upper Airway Collapsibility.	Neuroscience Research Australia (NeuRA)/ UNSW	13-Jul-18
2	Anna Mullins	22-Jan-15	Sleep Disorder Phenotyping (RP3)	Quantitative EEG Biomarkers for Sleep Disorder Phenotyping and Personalised Sleep Health Quantitative Analysis of Polysomnography: From Sleep Macrostructure to Microstructure.	The University of Sydney, Australia	31-May-18
3	Charmaine Diep	22-Feb-16	Laboratory (RP1)	Laboratory-based development of systems and biomarkers to assess circadian, sleep and alertness State.	Monash University, Australia	22-Feb-19
4	Devaang Kevat	22-Jan-15	Healthcare (RP2)	Examining Worker Safety and Productivity In The Healthcare Setting.	Monash University, Australia	21-Jan-16
5	Haidar Naqvi	01-Sep-14	Sleep Disorder Phenotyping (RP3)	Neurobehavioural effects of sleep loss in patients with obstructive sleep apnoea.	Woolcock Institute of Medical Research, Australia	31-Aug-17
6	Jade Murray	01-Feb-14	Healthcare (RP2)	Investigating Circadian Misalignment in a Population of Patients with Symptoms of Delayed Sleep Phase Disorder (DSPD).	Monash University, Australia	31-Jan-17
7	Julia Stone	02-Mar-15	Healthcare (RP2)	Assessing Individual Vulnerability To Shift Work and Integrated Interventions For Alertness Management in the Healthcare Setting.	Monash University, Australia	01-Mar-18
8	Kelsey Bickley	01-Feb-15	Sleep Disorder Phenotyping (RP3)	To perform a comprehensive investigation of daytime functioning in individuals with insomnia across a range of insomnia subtypes.	Flinders University, Australia	31-Jan-18

No	Name	Date Commenced	Research Project (Program Number#)	Research Title	Research Organisation	Expected Completion Date
9	Lauren Booker	21-Dec-15	Healthcare (RP2)	Impact of Insomnia, shift work and OSA management on individual outcomes in healthcare shift workers.	Monash University, Australia	20-Dec-18
10	Lauren Bulfin	03-Jul-17	Group Work Scheduling (RP2)	Development of software system for work group scheduling	Monash University, Australia	30-Jun-20
11	Leilah Grant	01-Feb-14	Laboratory (RP1)	Identification And Validation of Biological And Physiological Biomarkers of The Alertness State.	Monash University, Australia	09-Feb-17
12	M S Zobaer	01-May-15	Modelling (RP1)	Proposal on Evoked Potentials and K Complexes in Sleep: Underpinning of Potential Biomarkers.	The University of Sydney, Australia	30-Apr-18
13	Marie Jinny Collet	27-Jan-16	Laboratory (RP1)	Specific vulnerability of attention mechanisms due to sleep loss, circadian misalignment and age.	Monash University, Australia	26-Jan-19
14	Megan Mulhall	01-Mar-16	Healthcare (RP2)	Assessing Individual Vulnerability To Shift Work and Integrated Interventions For Alertness Management in the Healthcare Setting.	Monash University, Australia	01-Mar-19
15	Melissa Aji	01-Feb-18	Sleep Health Management (RP3)	Development of a sleep restriction therapy “Sleep Right Tonight” App for behavioural management of insomnia (“SleepFix”)	The University of Sydney, Australia	30-Jun-20

5 Appendices

No	Name	Date Commenced	Research Project (Program Number#)	Research Title	Research Organisation	Expected Completion Date
16	Rohit Philip	01-Feb-15	Sleep Disorder Phenotyping (RP3)	To determine the vulnerability to alertness failure (impaired driving performance and vigilance function) in OSA patients, using an extended wakefulness challenge paradigm; to develop and validate electrophysiological biomarkers (EEG and ECG) to distinguish between patients who are vulnerable to alertness failure; and, to validate this laboratory phenotyping approach against real world questionnaire outcomes.	Flinders University, Australia	31-Jan-18
17	Sachinkumar Nilkantha Wasnik	01-Sep-14	Sleep Disorder Phenotyping (RP3)	Across modelling/data fusion and phenotyping projects with potential value in biomarkers and healthcare.	The University of Sydney, Australia	31-Aug-17
18	Saranea Ganesan	22-Jan-15	Healthcare (RP2)	Cognitive Markers of Shift Work Vulnerability.	Monash University, Australia	21-Jan-18
19	Simon Joosten	01-Sep-14	Laboratory (RP1) & Sleep Disorder Phenotyping (RP3)	Test a simplified method for sub-classifying OSA patients into their underlying causal phenotype.	Monash University, Australia	31-Aug-15
20	Wei Qu	01-Mar-18	Sleep Health Management (RP3)	Insomnia Decision Support Development	The University of Sydney, Australia	30-Jun-20
21	William McMahon	01-May-15	Laboratory (RP1)	Predicting individual vulnerability to alertness challenges following sleep deprivation.	Monash University, Australia	30-Apr-18

denotes:

Research Program 1 (RP1) – Alertness Measurement, Prediction and Testing

Research Program 2 (RP2) – Safety and Productivity Improvements

Research Program 3 (RP3) – Sleep Health

Master Degree Scholarships 2017–18

No	Name	Date Commenced	Research Project (Program Number#)	Research Title	Research Organisation	Expected Completion Date
1	Helenmary McMeekan	22-Jan-15	Sleep Disorder Phenotyping Platform (RP3)	Individual-level Toolkit for Sleep Health Management in Occupational Settings.	Flinders University, Australia	Withdrew in Mar-16
2	Kirsty Dodds	22-Jan-15	Sleep Disorder Phenotyping Platform (RP3)	Cardiovascular markers of autonomic dysregulation in Insomnia Disorder.	The University of Sydney, Australia	21-Jan-17

denotes:

Research Program 1 (RP1) – Alertness Measurement, Prediction and Testing

Research Program 2 (RP2) – Safety and Productivity Improvements

Research Program 3 (RP3) – Sleep Health

5 Appendices

Short term project funding 2017–18

No	Name	Date Commenced	Research Project (Program Number#)	Research Title	Research Organisation	Expected Completion Date
1	Baptiste Jolivet	11-May-15	Modelling and Data Fusion (RP1)	Stretched exponential functions in modelling the effects of chronic sleep restriction on alertness	The University of Sydney, Australia	17-Aug-15
2	Gunther Klobe	16-Nov-15	Modelling and Data Fusion (RP1)	Mechanisms of the variability in the phase angle between DLMO and sleep onset	The University of Sydney, Australia	15-Mar-16
3	Merijn Driessen	10-Jan-16	Modelling and Data Fusion (RP1)	Modelling effects of sleep inertia on alertness in a quantitative model of sleep-wake cycles	The University of Sydney, Australia	9-Jul-16
4	Stephen McCloskey	13-Jan-15	Modelling and Data Fusion (RP1)	Incorporation of the direct alerting effects of white light in the physiologically based model of sleep-wake cycle developed at The University of Sydney	The University of Sydney, Australia	24-Feb-15
5	Thibaut Lacroix	11-May-15	Modelling and Data Fusion (RP1)	Modelling the effects of prophylactic naps on alertness and sleep	The University of Sydney, Australia	10-Aug-15

denotes:

Research Program 1 (RP1) – Alertness Measurement, Prediction and Testing

Research Program 2 (RP2) – Safety and Productivity Improvements

Research Program 3 (RP3) – Sleep Health

Industry Based Learning scholarships 2017–18

No	Name	Date Commenced	Program Number#	Research Organisation	Completion Date
1	Adrienne Bell	27-Jan-15	RP1	Swinburne University, Australia	26-Jan-16
2	Michelle Bravo	27-Jan-15	RP1	Swinburne University, Australia	26-Jan-16
3	Aaron Johnson	27-Jan-15	RP2	Swinburne University, Australia	26-Jan-16
4	Matthew McLaren	27-Jan-15	RP2	Swinburne University, Australia	26-Jan-16
5	Jessica Papaleo	27-Jan-15	RP2	Swinburne University, Australia	26-Jan-16
6	Todd Pickering	27-Jan-15	RP1	Swinburne University, Australia	26-Jan-16
7	Elly Spiteri	27-Jan-16	RP1	Swinburne University, Australia	26-Jan-17
8	Kaitlyn Crocker	27-Jan-16	RP2	Swinburne University, Australia	26-Jan-17
9	Niamh McDonald	27-Jan-16	RP2	Swinburne University, Australia	26-Jan-17
10	Phaybian Penita	27-Jan-16	RP1	Swinburne University, Australia	26-Jan-17
11	David Litewka	27-Jan-16	RP1	Swinburne University, Australia	26-Jan-17
12	Ellen Carter	23-Jan-17	RP1	Swinburne University, Australia	19-Jan-18
13	Karina Tasker	23-Jan-17	RP2 & RP3	Swinburne University, Australia	19-Jan-18
14	Liam Drury	23-Jan-17	RP1 & RP2	Swinburne University, Australia	19-Jan-18
15	Sarah Zivkovic	06-Feb-17	RP2 & RP3	Swinburne University, Australia	02-Feb-18
16	Aleksander Hart	20-Feb-17	RP1 & RP2	Swinburne University, Australia	16-Feb-18

denotes:
Research Program 1 (RP1) – Alertness Measurement, Prediction and Testing
Research Program 2 (RP2) – Safety and Productivity Improvements
Research Program 3 (RP3) – Sleep Health

5 Appendices

Glossary of Terms

ALFA – Adaptive Lighting for Alertness.

Biomarker – short for biological marker, it is a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, disease or the effect of an intervention.

Chemiresistor – a material that changes its electrical resistance in response to changes in the nearby chemical environment.

Circadian rhythms – are physical, mental and behavioural changes that follow a roughly 24-hour cycle, responding primarily to light and darkness in an organism's environment. They are found in most living things including animals and plants.

ECRs – Early Career Researchers.

EEG – An electroencephalogram (EEG) is a test that detects electrical activity in your brain using small, flat metal discs (electrodes) attached to your scalp. Your brain cells communicate via electrical impulses and are active all the time including during sleep.

Electrophysiological – the production of electrical phenomena, particularly in the nervous system, and their consequences in the living organism.

Melatonin – a hormone naturally secreted with the onset of fading natural light which helps tune the circadian rhythm as it moves in to a sleep cycle.

Metabolomics – the non-targeted detection and quantification of small molecules (metabolites) in biological materials (e.g., plasma, urine, tissue, plant and microbial extracts).

Nanoparticle – a particle between 1 and 100 nanometres in size.

Obstructive sleep apnoea (OSA) – when the airway at the back of the mouth is repeatedly partly or completely blocked during sleep reducing or stopping breathing altogether. When oxygen levels fall, the sleeper wakes up briefly and starts breathing again.

Phenotype – the observable characteristics of a person in the context of specific trait, behaviour or susceptibility to a certain condition.

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