

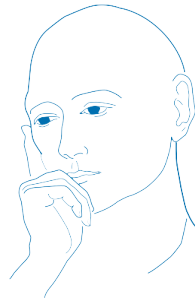


Chronobiology & Sleep Group

Research Updates, May 2009

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OVERVIEW

The Brain & Mind Research Institute, at the University of Sydney, is a unique centre for discovery, innovation and integrative research strategies, clinical product development and actions that translate research into improved treatment and disease prevention strategies. The overall mission of the BMRI is to support a unique partnership between mental health, neurology, neurosurgery and brain-related sciences by bringing together Australian and internationally renowned physicians, surgeons and scientists who are committed to excellence and high impact research combining intellectual muscle and a passion for results.

Located within the BMRI is the Chronobiology & Sleep Group, an internationally recognised research group investigating the neurobehavioural, neuropsychological and neurobiological activities of the circadian and sleep homeostatic systems. The aims of the Chronobiology & Sleep Group include the identification, prevention and management of sleep loss and circadian disruption associated with sleep and circadian disorders, psychiatric disorders (neurodevelopmental and neurodegenerative), insufficient sleep and medical disorders, as well as understanding normal sleep and circadian functioning.

The Chronobiology & Sleep Research Facilities at the Brain & Mind Research Institute include the recently completed Chronobiology & Sleep Laboratory (CSL), which has been designed for 24-hour circadian and sleep studies, longer duration circadian and sleep/sleep deprivation studies, daytime assessments and overnight studies, as well as clinical studies.

The Chronobiology & Sleep Laboratory has 4 separate bedrooms, and performance testing areas. The CSL provides medical coverage, dietician controlled meals and facilities for blood, saliva and urine collection and processing, as well as collection of neurobehavioural, physiological, sleep and circadian data. The laboratories are equipped with ambulatory polysomnographic (PSG) and electroencephalographic (EEG) recording and assessment equipment; actigraphic recorders; ambulatory body temperature recorders; neurobehavioural assessment batteries; driving simulators; and equipment available for physiological monitoring and assessment of subjects and patients. The Chronobiology & Sleep Laboratory is co-located with the BMRI Neurophysiology Laboratory.

CIRCADIAN & SLEEP-WAKE DISTURBANCES IN BIPOLAR DISORDER

Even with appropriate pharmacological and psychological management, the occurrence of relapse in patients with bipolar disorder is high. The underlying mechanisms which lead to relapse in bipolar disorder are not known, and represent an important area of investigation for the development of additional management strategies and interventions to reduce the rate of relapse in these patients.

Both circadian disruption and sleep-wake disturbance have been widely reported to occur in bipolar disorder, and it has been hypothesised that inadequate resolution of these disturbances may contribute to an increased risk of relapse. Despite this, few studies have carefully evaluated alterations in the circadian of sleep-wake systems following commencement of pharmacological and/or psychological interventions to reduce the primary symptoms of bipolar disorder, nor the role that these two systems may play in the occurrence of subsequent relapses.

STUDY 1: ACTIGRAPHIC ASSESSMENT OF SLEEP-WAKE BEHAVIOUR IN PATIENTS WITH BIPOLAR DISORDER

The aim of this study is to characterise and track sleep-wake behaviour in patients with bipolar disorder, studied at various phases of illness.

This study assesses sleep-wake behaviour (timing and quality) across a 2 week period in patients with bipolar disorder, using actigraphy and sleep diaries. Patients also complete a number of questionnaires relating to their sleep and chronotype.

In the sleep diary, participants will be asked to record what time they went to sleep each night, what time they awoke the next day, how long they took to fall asleep, if they woke across the night, and to rate their sleep quality.

STUDY 2: IDENTIFYING POTENTIAL BIOMARKERS FOR EARLY INTERVENTION TO REDUCE RATES OF ONSET AND RELAPSE IN PATIENTS WITH BIPOLAR DISORDER

This study will assess parameters of the sleep-wake and circadian systems in an attempt to define biomarkers of onset of symptoms in at risk individuals and of relapse in patients with bipolar disorder.

One target biomarker is the phase angle between melatonin onset and sleep onset, sleep offset and temperature nadir.

Participants will complete at home actigraphy and light assessments, and then complete two overnight sessions in the lab with polysomnographic assessment of sleep. Participants will then complete a third night where salivary melatonin levels and core body temperature will be assessed to obtain an assessment of circadian phase. The phase angle relationship between the dim light melatonin onset (DLMO) and sleep and temperature variables will then be investigated for changes in circadian and sleep-wake stability, which may then be used as an early biomarker of changes in symptoms and potential relapse or onset of symptoms.

STUDY 3: ASSESSING DAYTIME SLEEPABILITY IN PATIENTS WITH BIPOLAR DISORDER & DEPRESSION

This study will assess the ability of patients with bipolar disorder or unipolar depression to nap during the daytime. In addition, we will assess core and peripheral body temperature, to obtain a measure of physiological hyperarousal, sleep physiology and alertness levels in participants. Data collected from the patient groups will be compared with data collected from a control group undergoing the same protocol.

Participants will complete two weeks of at-home sleep-wake assessment using actigraphy and sleep diaries, as well as questionnaires about their sleep, circadian rhythms and general health. Participants will then attend the Chronobiology & Sleep Lab for one daytime assessment session. Sleep physiology will be assessed using PSG and actigraphy in the lab. Participants' core and peripheral temperatures will be assessed using VitalSense (MiniMitter). Prior to and following a 2-hour nap, participants will complete a number of questionnaires relating to their alertness and fatigue levels, and complete a number of short neurocognitive performance tests.

STUDY 4: ZIPRASIDONE & SLEEP-WAKE INTERVENTIONS FOR PATIENTS WITH BIPOLAR DISORDER (FUNDED BY PFIZER)

This is a single arm study investigating the effects of combining ziprasidone treatment and interventions to reentrain the circadian system and improve sleep-wake timing and sleep consolidation and quality.

At home sleep-wake activity and light exposure will be assessed using wrist actigraphy and daily sleep logs. Actigraphic data will be collected during a baseline period, immediately prior to removing participants from their current medication and commencing them on ziprasidone, during the period of stabilisation on ziprasidone and for 4 weeks following stabilisation.

At 3 months and 6 months following the stabilisation on ziprasidone, participants will again wear the actigraphs and complete sleep diaries for a period of 4 weeks each.

The primary aim of this study is to quantify sleep-wake timing and sleep quality in patients with bipolar disorder who are experiencing an episode of mania or depression and commencing treatment with ziprasidone (80-160mg per day)

The secondary aims of this study are to:

1. examine the effectiveness of combining administration of ziprasidone with education on sleep-wake activity and behavioural interventions to improve sleep-wake behaviour on symptoms and recovery in the short term (4 weeks post commencement of stable treatment with ziprasidone);
 2. examine the effectiveness of combining administration of ziprasidone with education on sleep-wake activity and behavioural interventions to improve sleep-wake behaviour on symptoms and recovery in the long term (3 and 6 months post commencement of stable Treatment with ziprasidone)
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STUDY 5: QUETIAPINE & SLEEP-WAKE INTERVENTIONS FOR PATIENTS WITH BIPOLAR DISORDER (GRANT SUBMITTED)

This study will investigate alterations in the circadian system and sleep-wake behaviour in patients with diagnosed bipolar disorder in conjunction with starting on Quetiapine. Patients will be recruited during an episode for patients in the depressive phase, and immediately following stabilisation for patients in the manic phase. Participants will commence treatment of Quetiapine, combined with education on sleep-wake activity and behavioural interventions to improve sleep-wake behaviour on symptoms.

We will track changes in circadian timing and sleep-wake behaviour across a period of 3-6 months in these patients, to assess changes in the circadian and sleep-wake systems and how these relate to subjective and objective reports of symptoms, and determine if a relationship between the degree of circadian and/or sleep disturbance or remission and the time to relapse exists. These investigations will be conducted both at home (using wrist actigraphy to monitor sleep-wake behaviour and sleep diaries) and in the lab (using polysomnography to assess sleep and melatonin profiles to assess the circadian system).

CIRCADIAN & SLEEP-WAKE DISTURBANCES IN SCHIZOPHRENIA

STUDY 1: CIRCADIAN RHYTHMS AND METABOLIC FUNCTIONING IN SCHIZOPHRENIA

Sleep-wake disturbances and disruption to the circadian timing system are commonly reported in patients with schizophrenia. In addition to the negative effects on mood, alertness and neurocognitive functioning, sleep loss and circadian disruption are also associated with a number of physiological changes and negative health outcomes. For example, sleep loss and circadian disruption have both been associated with changes in metabolic function and weight control. Sleep loss and short sleep durations have been associated with increased risk of weight gain, obesity and metabolic disorders such as diabetes type-2.

Although a number of medications used in the management of schizophrenia are reported to increase weight gain as side effects, schizophrenia alone is reported to increase weight gain and increase the risk of metabolic disorders, independent of the medications.

In a series of studies we aim to investigate the sleep-wake and circadian changes that occur in schizophrenia, and determine if these changes may form part of the underlying mechanisms that contribute to the metabolic changes associated with this disorder.

Initially we will investigate sleep-wake behaviour in patients with schizophrenia using actigraphy and sleep diaries across a number of weeks. We will then assess circadian phase in a sub-set of these patients, using salivary levels of the pineal hormone melatonin, to determine their internal circadian timing. Further investigations will include assessment of a range of compounds related to metabolic function, including glucose, insulin, leptin and ghrelin, as well as other indicators of weight gain and general health in patients admitted for treatment.

CIRCADIAN & SLEEP-WAKE DISTURBANCES IN NEURODEGENERATIVE DISORDERS

STUDY 1: SLEEP-WAKE DISTURBANCES IN OLDER PEOPLE WITH NEUROPSYCHIATRIC DISORDERS (ALZHEIMERS, PARKINSONS, FRONTOTEMPORAL DEMENTIA, LATE ONSET DEPRESSION, MILD COGNITIVE IMPAIRMENT) (NHMRC GRANT SUBMITTED)

This project is conducted in collaboration with the Ageing Brain Centre, with Dr Sharon Naismith and Dr Simon Lewis.

Sleep-wake disturbances are commonly found in patients with neurodegenerative disorders, including Parkinson's Disease (PD), Mild Cognitive Impairment (MCI), Alzheimer's Disease (AD), late onset depression and Frontotemporal Dementia (FTD). These disturbances are often associated with neuropsychiatric (e.g. cognitive, psychiatric) symptoms, raising the possibility of a common underlying pathological correlate. Although the fundamental cause of these sleep-wake disturbances remains unclear, it may reflect disruptions within the circadian system, a regulator of sleep-wake cycle timing. However, in neurodegenerative disorders, no formal studies have concurrently examined both sleep and circadian disturbance using the techniques of polysomnography (PSG), actigraphy and assessment of melatonin profiles (as a circadian marker) in association with detailed neurological and neuropsychological assessment. This study will objectively evaluate circadian rhythms and sleep-wake physiology in a range of differing older patient cohorts as well as in healthy controls to examine the role of the circadian system in these disorders. Specifically, the aims are to;

1. Determine whether specific neurodegenerative diseases have distinct patterns of circadian disturbance as recorded by their endogenous melatonin levels;
2. Describe the relationship between circadian disturbances and the profile of sleep disturbance as recorded by the techniques of polysomnography and actigraphy within and between specific disease groups; and,
3. Determine whether circadian and sleep-wake disturbances are associated with neuropsychiatric symptoms in neurodegenerative disease.

Participants' sleep-wake patterns and light exposure will be assessed at home using actigraphy and a light sensor. Further assessment of sleep using PSG will be conducted across two nights in the lab, followed by a third overnight testing session for collection of salivary melatonin levels, to assess circadian phase, and neurocognitive performance assessments.

STUDY 2: CIRCADIAN & SLEEP-WAKE PATTERNS IN PATIENTS WITH MS (GRANT SUBMITTED TO MS RESEARCH AUSTRALIA)

Patients with MS suffer with prominent, although likely under-recognised, cognitive dysfunction which can have serious impact on their functioning, especially in the workplace. Additionally, debilitating fatigue is an extremely common symptom in MS patients. The pathophysiology of early cognitive dysfunction and fatigue in MS is largely unknown and therapies, largely designed to promote wakefulness, are poorly effective. Questionnaire-based studies indicate that sleep disturbance is a frequent manifestation of MS, however formal studies of circadian rhythms in this population are lacking. Exploring the relationship between disturbances of circadian rhythm, fatigue and cognitive dysfunction in MS will provide new pathophysiological data and, potentially, avenues for the development of novel therapies to combat these symptoms.

The present study aims to evaluate circadian rhythms in people with MS compared to healthy controls. The study will have the following aims:

1. To test the hypothesis that, compared with healthy controls, patients with MS will show differing and characteristic patterns of delayed circadian phase, as assessed by salivary dim light melatonin onset (DLMO);
2. To assess the relationship between circadian system disturbance and cognitive decline in these patient groups;
3. To assess the relationship between circadian system disturbance and psychiatric disturbance in these patient groups;
4. To determine the relationship between circadian rhythm disturbance and fatigue in MS patients.
5. To determine the predictive capacity of circadian rhythm changes for cognitive decline and disease progression longitudinally

CIRCADIAN & SLEEP-WAKE DISTURBANCES IN DEPRESSION

STUDY 1: ACTIGRAPHIC ASSESSMENT OF SLEEP-WAKE BEHAVIOUR IN PATIENTS WITH DEPRESSION

The aim of this study is to characterise and track sleep-wake behaviour in patients with depression, studied at various phases of illness.

This study assesses sleep-wake behaviour (timing and quality) across a 2 week period in patients with depression, using actigraphy and sleep diaries. Patients also complete a number of questionnaires relating to their sleep and chronotype.

In the sleep diary, participants will be asked to record what time they went to sleep each night, what time they awoke the next day, how long they took to fall asleep, if they woke across the night, and to rate their sleep quality.

SLEEP-WAKE PATTERNS ACROSS AGES

STUDY 1: ASSESSING SLEEP-WAKE PATTERNS IN ADULTS

Sleep loss and circadian disruption are endemic in our global 24-7 society. Contributors to sleep loss and circadian disruption include increased work hours and shiftwork; sleep and other medical conditions; and family or social demands; often with more than one factor co-occurring. As a result, millions of individuals commonly experience reduced neurocognitive functioning with decreased alertness and increased fatigue, putting them at increased risk for errors, injuries, traffic accidents, personal conflicts and drug use. In addition, numerous alterations in 'normal' physiology occur, increasing the risk of numerous health complaints, including increased weight gain, cardiovascular disorders, mood disorders and mortality. Disruption to these two systems may also underlie other medical disorders (e.g., depression and other affective disorders), contributing to the occurrence and severity of symptoms.

Despite recommendations based on scientific evidence that adults should obtain 8 hours of sleep per night to maximise waking functions, sleep durations tend to be consistently less than this. In a study of more than 1.1 million Americans, approximately 20% reported getting 6.5 hours or less sleep per night. In Australia, chronic sleep restriction is also common, with around 18% of NSW adults reporting that they sleep 6 hours or less per night, as assessed by questionnaire.

In order to better understand the nature of the sleep restriction occurring in the local population, including the actual sleep durations and sleep-wake timing, we aim to objectively assess sleep-wake behaviour in adults living in Sydney using wrist actigraphy. In conjunction with this objective measure of sleep-wake timing, sleep duration and sleep quality, we will also collect subjective estimates of sleep durations and sleep quality using subjective sleep diaries. Participants will also complete a number of questionnaires regarding their sleep-wake patterns, general health and circadian preference.

These data will provide us with important information regarding typical sleep-wake behaviour in adults living in the local area. These data will also provide information on a 'healthy control' group for studies conducted in patient populations. This information will assist in our understanding of the role that changes in the sleep-wake and circadian systems play in disease severity and symptomatology that are disease specific, and separate from changes caused by lifestyle induced changes in sleep-wake duration and timing.

STUDY 2: ASSESSING SLEEP-WAKE PATTERNS IN SCHOOL STUDENTS

Sleep is essential for learning and memory function, as well as being a time during which normal growth and development occur in adolescents. During the teenage years changes in the circadian system, resulting in changes in sleep-wake timing and sleep need occur, likely due to pubertal development. In addition, the teenage years is also the predominant time for the onset of many mood disorders, that may be preceded by significant changes in sleep-wake behaviour.

In order to better understand the nature of sleep-wake patterns and behaviour in this age group, including sleep length and sleep-wake timing, we aim to objectively assess sleep-wake behaviour in school aged children living in Sydney and attending a local school using wrist actigraphy and subjective sleep diaries. Participants will also complete a number of questionnaires regarding their sleep-wake patterns, general health and circadian preference.

In addition we are developing an educational program with various aspects aimed at teachers, students and parents that will be delivered as part of this project.

STUDY 3: LONGITUDINAL ASSESSMENT OF SLEEP-WAKE PATTERNS IN SCHOOL STUDENTS DURING PUBERTAL DEVELOPMENT

Sleep is essential for learning and memory function, as well as being a time during which normal growth and development occur in adolescents. During the teenage years changes in the circadian system, resulting in changes in sleep-wake timing and sleep need occur, likely due to pubertal development. In addition, the teenage years is also the predominant time for the onset of many mood disorders, that may be preceded by significant changes in sleep-wake behaviour.

As an extension of our study examining sleep-wake patterns in school students, we aim to follow a group of students across a number of years to track changes in sleep-wake timing and sleep quality throughout pubertal development. At each assessment time point (12 months apart) we will assess sleep-wake behaviour using wrist actigraphy, subjective sleep diaries and a range of questionnaires relating to sleep, circadian rhythms and general health.

POST CANCER FATIGUE

STUDY 1: Development of an optimised multidisciplinary intervention for post-cancer fatigue (NHMRC/Cancer Council grant submitted)

Collaboration with UNSW, LifeStyle Clinic, BMRI

Earlier diagnosis and improved therapies have resulted in a markedly increased number of people successfully treated for cancer. It is estimated that there are 22 million cancer survivors worldwide, and 300,000 in Australia. Despite the fact that these individuals are cured of their cancer, many survivors face prolonged physical, emotional and social consequences resulting from their illness and its treatment. Prolonged fatigue is one of the most common and distressing symptoms reported by patients with cancer both during, and after, completion of treatment. As such cancer-related fatigue has substantive impacts on quality of life, it is a major focus of survivorship research.

The hypothesis underling this proposal is that a CBT program based on interventions for disturbances in activity patterns, sleep-wake cycle, and mood will significantly reduce symptom severity, and improve quality of life as well as functional status in patients with PCF. Furthermore, it is proposed that this program can be implemented widely via the application of a training and operations manual.

The overall aim of the project is therefore to establish an effective and reproducible CBT intervention for PCF, which can be implemented nationally and then internationally.

The specific aims are:

To optimise assessment tools and intervention strategies for three CBT modules targeting disturbances in exercise/activity patterns, sleep-wake cycle, and mood in patients with PCF.

To conduct a randomised controlled trial of optimised CBT versus a simple education program for patients with PCF.

To develop a training package and an operations manual for the CBT program for PCF.

SHIFTWORK

STUDY 1: RANDOMISED CONTROLLED TRIAL OF A LIGHT INTERVENTION TO ENHANCE ALERTNESS AND PERFORMANCE IN NIGHT SHIFTWORKERS (NHMRC PROJECT GRANT)

Collaboration between BMRI, Monash Uni, UniSA, Adelaide Uni and Harvard Medical School

The aim of this study is to test the effectiveness of a novel light exposure on alertness and neurocognitive performance in shiftworkers.

Shiftworkers will wear actigraphs for two weeks prior to the study to assess sleep-wake timing and light exposure. Participants will then stay overnight in the lab and complete a range of neurobehavioural performance tasks, repeated at hourly intervals across the night. During part of the night shiftworkers will be randomised to receive either high colour temperature light exposure or low colour temperature light exposure. Salivary samples will be collected every hour and subsequently analysed for melatonin.

We hypothesise that:

- 1) night shiftworkers participating in a simulated night shift with high colour temperature light exposure (active condition; 17,000K, 200 lux) will show improved subjective alertness and neurobehavioural performance levels compared to individuals exposed to low colour temperature light (control condition; 4,100 K, 200 lux);
- 2) exposure to high colour temperature light exposure (17,000 K, 200 lux) will attenuate the night-time increase in electroencephalogram (EEG) correlates of sleepiness (delta/low theta, 0.5- 5.5 Hz) and enhance EEG-correlates of alertness (high alpha 9.5-10.5 Hz) compared to low colour temperature light (4,100 K, 200 lux) exposure;
- 3) responsiveness to high colour temperature light exposure (i.e., neurobehavioural performance level during light exposure as a percentage of baseline level) will vary according to genetic differences and differences in the circadian phase of light administration.

STUDY 2: COMMUTING IN THE MINING INDUSTRY (CFMEU FUNDED)

In Queensland, Australia, many mine workers are required to live on site during their roster cycle. For most, the commute distance to return home is long. A challenge facing industry and workers is how best to manage the effects of fatigue during the commute, and reduce prevalence of drowsy driving accidents. Addressing these challenges requires a better understanding of work hours, commute lengths and attitudes towards fatigue management. The aim of this study is to investigate commuting distances and fatigue management strategies related to commuting in mine workers.

STUDY 3: FATIGUE MANAGEMENT IN THE MINING INDUSTRY (CFMEU FUNDED)

In recent years, reforms in OH&S requirements for shiftwork regarding fatigue have prompted considerable changes in fatigue management policies in many industries in Australia. Some reforms are aimed at decreasing fatigue related accidents during the commute to and from work. The aim of this study is to examine the views of workers regarding some proposed changes in hours of work that would impact on fatigue management in the coal mining industry, using questionnaires.

STUDY 4: ASSESSING SLEEP-WAKE PATTERNS ACROSS ROSTER CYCLES (CFMEU FUNDED)

This study will examine sleep-wake patterns in shiftworkers working in the Queensland coal mining industry across a roster cycle, including night and day shifts. During a roster cycle many workers live in camps, away from family and close to their mine sites, and then return home during their time off between roster cycles. Other workers live in mining towns, and reside with their families throughout their roster cycles as well as during their time off. We wish to examine differences in sleep quantity, sleep quality and sleep patterns in workers living at different locations during their roster cycle, and how this is related to fatigue/alertness levels during work periods.

Sleep-wake timing and sleep quality will be assessed in workers using wrist actigraphy and sleep diaries. Participants will also complete a number of questionnaires regarding their sleep-wake patterns, general health and circadian preference.

NAPPING

STUDY 1: SLEEPING ON THE JOB: INCREASING ALERTNESS & PRODUCTIVITY IN THE WORKPLACE

Despite recommendations to sleep 8 hours per night for optimal performance during the day, many people regularly get less than 8 hours per night. Consequently, a daytime nap may be beneficial to maintain or increase alertness and performance across the day. Even in those who obtain 'adequate' night-time sleep, a daytime nap can have a positive effect on alertness, productivity and neurocognitive functioning during the working day. Few studies have focussed on the benefits of napping in non-shiftworking workers.

There is considerable interest in workplace napping, with a number of industries not involved in shiftwork seeking ways to maximise workers' alertness throughout the day, especially with extended work hours becoming common in many employment sectors.

We aim to investigate the effects a 30 minute nap has on alertness, productivity and memory in day-workers. We are also investigating people's subjective feelings about their nap sleep. This study is being conducted using a specially designed napping pod (MetroNaps), which creates a sleep conducive environment inside a semi-enclosed pod.

STUDY 2: INVESTIGATING THE EFFECTIVENESS OF MODAFINIL TO REDUCE THE NEUROCOGNITIVE EFFECTS OF SLEEP INERTIA FOLLOWING A DAYTIME NAP (SUPPORTED BY CSL)

Sleep loss is common in many individuals throughout society. In many cases long work hours and long commutes contribute to the sleep loss. Napping may provide a means to increase overall sleep per twenty four hours, and to increase alertness, neurocognitive performance, work productivity and safety in workers. One shortcoming associated with napping is the period of time immediately following the end of the nap, where alertness and performance levels may be lower than prior to the nap. This feeling is termed sleep inertia. Previous research has shown that sustained caffeine administration can attenuate the effects of sleep inertia on neurocognitive function during sleep deprivation, although the caffeine had negative effects on sleep propensity and sleep physiology. We aim to investigate whether administration of the wake promoting compound modafinil prior to a nap period is able to reduce the effects of sleep inertia following the end of the nap period, without having a detrimental effect on the nap sleep.

After 2 weeks of actigraphic and sleep diary assessment, participants will attend the Chronobiology & Sleep Laboratory on two separate occasions. On both days participants will complete questionnaires relating to their alertness levels and complete neurocognitive performance tasks. Participants will then have a two hour nap, followed by repeated neurocognitive assessments to track the time course and magnitude of sleep inertia and its dissipation. 30 minutes prior to the nap participants will be administered either modafinil (100mg) or placebo in a randomised, double-blind cross-over fashion., such that all participants will complete both drug conditions.

ROTARY FELLOWSHIP

We have received funding from Nathan's Bequest and Rotary Australia to fund a fellowship for research into depression and sleep.

ABSTRACTS & PRESENTATIONS

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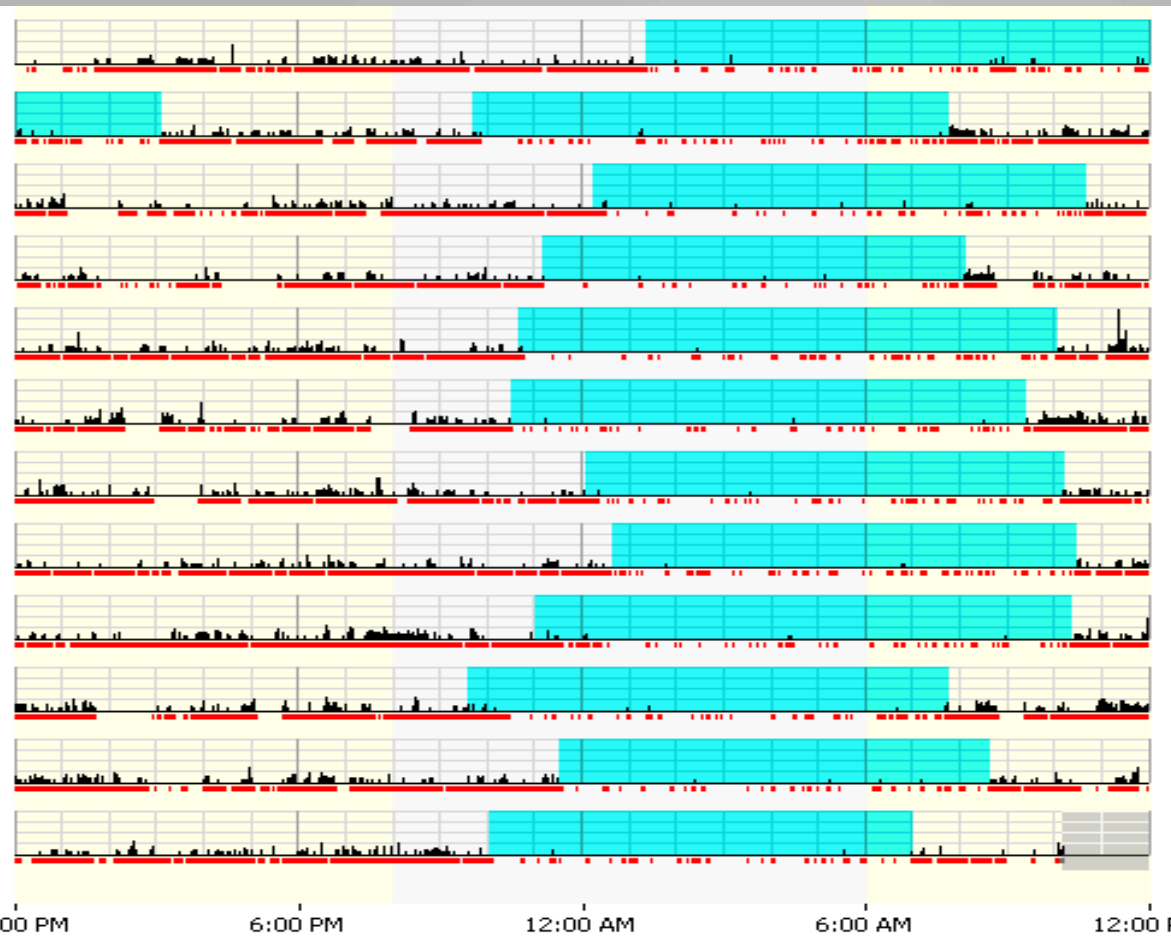
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