2023

CENTRE FOR
SLEEP & COGNITION

ANNUAL REPORT

WEARABLES

SENSORS

ACTIVITY LEVELS

HEART RATE

PORTABLE EEG

PHONE USAGE

MOVEMENT PATTERNS

MACHINE LEARNING
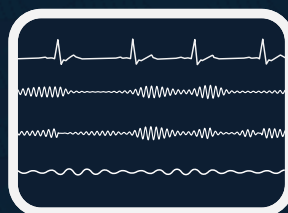
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COGNITIVE TASKS

CSC '23

ELECTROENCEPHALOGRAM

MAGNETIC RESONANCE IMAGING

Prof. Michael Chee

*Director, Centre for Sleep
and Cognition*

The course we set ourselves last year played out beyond expectations in 2023. We made notable appearances in Nature, Annual Review of Psychology, Trends in Neurosciences, PNAS and Neurology.

Among the highlights of our scientific output was Helen Zhou's work on decoding what participants were seeing from brain MR signals. The work appeared in a top Computer Vision journal and garnered worldwide attention that made Helen a global star. She appeared on NBC, Reuters Video and Hunan TV, among multiple other media spots.

Thomas Yeo remained on the 'Highly Cited Researchers' list by Clarivate Analytics, and was joined by myself, and Helen in Elsevier's list of the top 2% of most highly-cited researchers in the world. Thomas' group made a tilt into the mental health intervention sector by partnering with Dr. Phern-Chern Tor of IMH to perform functional connectivity-guided targeting of brain stimulation for depression.

My lab had a banner year for strategic publications — our multi-country characterization of sleep variability in collaboration with Oura Health allowed us to make novel observations about sleep variability patterns across countries and their possible cultural underpinnings. Our use of fingertip PPG signals to infer vascular stiffness and blood pressure will hopefully be the foundation for bigger things. Finally, we have gained recognition as the go-to scientists for the study of napping.

June Lo showed herself to be well on her way to being a notable independent investigator through her partnership with the Queenstown Health District to study how young children's sleep is affected by e-devices. She has also developed a new collaboration with Dr. Jason Lee and UC Berkeley to study the effect of environmental temperature on sleep.

The Centre had a commanding presence at scientific meetings. At OHBM and World Sleep, faculty as well as fellows and research assistants featured prominently on the podium. At World Sleep in Rio, Singapore punched way above its weight, bagging a keynote lecture and numerous strategic symposia. Adding to the good news, ISMRM will be held in Singapore in 2024 and World Sleep in 2025.

The Centre was more highly featured in the international media this year than ever. Aside from Helen's prolific engagements, my team and I were featured in the Economist, New Scientist and Scientific American, and recent engagements will lead to lead stories in Sweden and France as well. June also featured on local TV.

None of these achievements would have been possible without the great teamwork and camaraderie that has become a hallmark of the Centre and something that is very precious. In all, we can safely state that the Centre, small but potent, has grown from strength to strength in 2023 and that we can look forward to more in the coming years.

DIRECTOR'S MESSAGE

Editorial Team

Prof. Michael Chee
Tara Hsiao-Wen Martin
Chua Xin Yu
Nicole Nazareth

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Centre for Sleep & Cognition
https://medicine.nus.edu.sg/csc/

SCL
SLEEP & COGNITION LABORATORY

SLEEP & COGNITION LABORATORY

CENTRE FOR SLEEP & COGNITION

Sleep & Cognition Laboratory
https://sleepcognition-lab.org/

The Sleep and Cognition Lab (SCL) consolidated its efforts to characterize sleep along multiple dimensions, in varied samples both in Singapore and around the world. Transcending multiple obstacles, we worked with Oura to report on sleep habits in 220,000 persons from 35 countries, covering over 50 million nights of data. The work presented a unique cultural perspective on what underlies continental differences in sleep duration, variability, and efficiency.

Our partnership with Prof. Koh Woon Puay's SG70 study enabled us to characterize elderly Singaporeans' sleep over a period of at least a month per participant. When combined with cognitive testing, anthropometric, social interaction, and vascular health data, we expect the findings to significantly further our understanding of how sleep relates to health, wellbeing, and cognition in an Asian community. These efforts are critical as over 85% of all sleep research currently reflects observations made by Westerners.

Prof. Michael Chee
SCL Principal Investigator

Mental wellbeing is increasingly recognized as a major challenge of modern life. To contribute to reducing this burden, we collected data from students as well as PGY1 residents. From our students, Alyssa Ng, herself a graduate student, discovered that deviation from one's own average sleep duration on a given night has clear effects on mood, motivation, and sleepiness the next day. In contrast, that person's average sleep duration did not predict this behavior.

Working with colleagues from NUH, notably A/Prof. Marion Aw and Dr. Nicholas Ng, Research Asst. Prof. Stijn Massar led a heroic effort to collect data from ~90 busy PGY1 residents, elucidating their sleep patterns, markers of mental wellbeing, physical activity, and glucose levels on a day-to-day basis.

The entire team worked tirelessly to launch NUS1000, a study examining how navigating freshman life affects sleep, wellbeing, scholastic performance, social interactions and more over a 6-month period. The integration of information from different sources will make this an invaluable study.

Dr. Gizem Yilmaz reported on proxy changes in arterial stiffness in different sleep stages and, with A/Prof. Thomas Yeo's team, also devised a machine learning approach to estimating blood pressure accurately from fingertip pulse data. Dr. Ruth Leong's work on naps helped map out the benefits of different afternoon nap durations. The team was very well represented at World Sleep in Rio De Janeiro, where Research Asst. Prof. Ju Lynn Ong made 2 oral presentations on her contributions to using wearable technology to understand sleep health.

We solidified our partnership with Oura Health with financial benefits and made presentations for Nestlé. We developed new collaborations with overseas partners and deepened our partnerships with local investigators.

In all, it was a stellar year that started with some clouds but ended off with brilliant outcomes.

RESEARCH HIGHLIGHTS

A Year in Review: Sleep and its Relationship with Cognition and Wellbeing

Our lab has primarily focused on generating original work but in the last year, we contributed two reviews that will hopefully shape thinking on sleep and its relationship with cognition or wellbeing. A grand overview about the influence of sleep on cognition from adolescence into mature adulthood took the form of an invited review that appeared in Annual Review of Psychology. In this prestigious assignment, Dr. Ruth Leong and Prof. Michael Chee made some fresh points about a future where a more inclusive and deeper characterization of sleep habits around the world using consumer sleep trackers would help establish new, culturally contextualized sleep norms. Critical comments were made about the efforts to augment slow wave sleep to improve cognition, as well as the role sleep plays in improving memory. Another review, written with Dr. Shuo
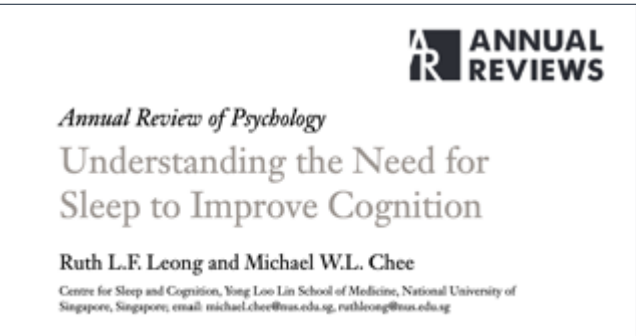

Figure 1. *Understanding the Need for Sleep to Improve Cognition by Dr. Ruth Leong and Prof. Michael Chee, Annual Review of Psychology.*

Qin, highlighted what is known and what remains to be discovered regarding how objectively measured sleep parameters relate to cognition in healthy older adults. One of the key findings of the meta-analysis was that lower motor restlessness in such persons was predictive of better memory performance.

Exploring Sleep-Stage Dependent Arterial Elasticity: Insights from Nocturnal PPG Waveform Features

A wise scientist once remarked that we are only as young as our arteries. This is because ageing is accompanied by increased stiffness or loss of elasticity of these blood vessels. Elastic arteries cushion pulsatile forces that could otherwise damage end-organs such as the brain and kidneys. Currently, the reference device used to measure arterial stiffness is expensive and not portable. Methods using photoplethysmography (PPG) have been developed before but are not widely used. Dr. Gizem Yilmaz used PPG waveform features recorded from some of our nocturnal recordings to show how arterial elasticity changes with sleep stage in young persons, finding that arterial relaxation is greatest during deep sleep. These changes were significantly attenuated with age although there was significant inter-individual variation.
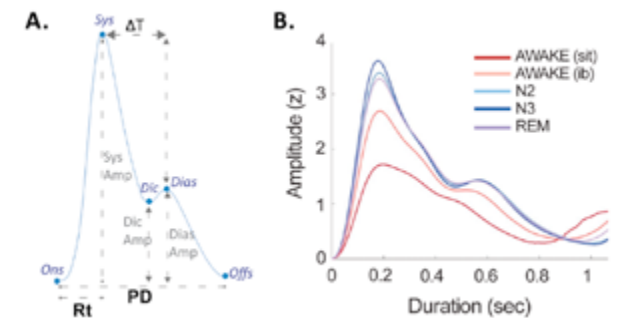

Figure 2. *(A) PPG pulse waveform and fiducial points used to identify PPG features. Ons: Onset, Sys: Systolic Peak, Dic: Dicrotic Notch, Dias: Diastolic Peak, Offs: Offset, PD: Pulse Duration, Sys Amp: Systolic Amplitude of PPG pulse, Dias Amp: Diastolic Amplitude of PPG pulse, ΔT: time difference between systolic and diastolic peaks, Rt: Rise time from onset to systolic peak. (B) Mean pulse waveform for each stage in a healthy young adult. Pulse onsets were aligned at 0 amplitude for visualization.*

We trust that this work will lead to interest in incorporating arterial stiffness measurement in consumer sleep trackers to examine nocturnal dynamics in vascular physiology.

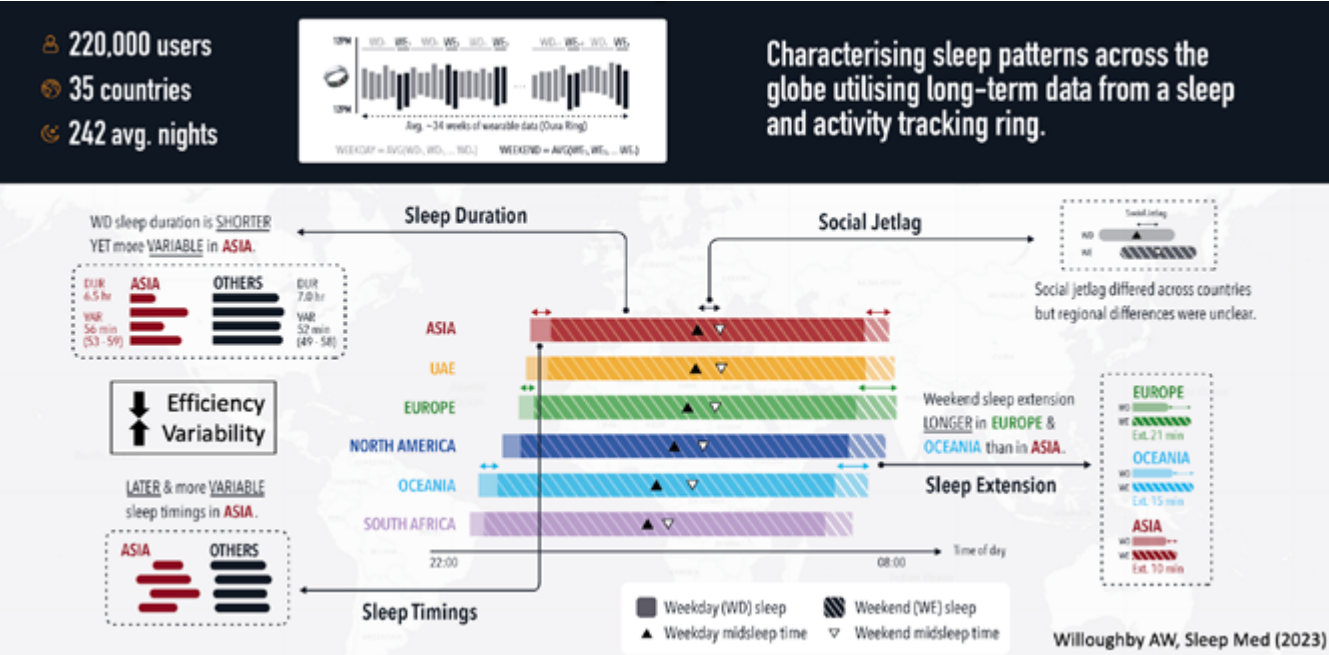## Characterizing Sleep Habits Across Countries: Differences in Nocturnal Sleep Variability and Weekend Sleep Extension

Figure 3. *Graphical abstract for Willoughby et al., 2023 (Country differences in nocturnal sleep variability: Observations from a large-scale, long-term sleep wearable study).*

Perhaps the most challenging but also satisfying work published this year was our multi-country survey on sleep habits of 220,000 persons across 35 countries helmed by Dr. Adrian Willoughby. The work involved close partnership with Oura to obtain de-identified data from individual users under enhanced privacy protection regulations. Therein we found that persons in Asia, beyond sleeping less and later, had lower sleep efficiency and greater weekday sleep duration variability. Greater weekday sleep variability was related to shorter weekend sleep extension. As a result, East Asians may be catching up on sleep whenever they can on week-

days. We pointed out that these effects could not be simply explained by latitude differences as suggested by prevailing views. We found similar sleep patterns in Singapore and Japan despite their being 35 degrees of latitude apart. In contrast, Australia and Japan, which at about the same latitude south and north of the equator respectively, have vastly different sleep habits. We suggested that culture, particularly work culture, is a significant driver of sleep pattern differences. These findings were featured in The Economist and The New Scientist, in addition to several other venues.

SHL
SLEEP & HEALTH LABORATORY

Asst. Prof. June Lo
SHL Principal Investigator

All of us have experienced and are familiar with the immediate consequences of sleep deprivation. Pulling an all-nighter or simply sleeping too little for a night causes us to become sleepier, slower, less sharp, and crankier the following day. Yet, for various reasons, many of us still do not obtain sufficient sleep.

Given the escalating prevalence of sleep curtailment in many modern societies and the unanimous reports of its diverse negative consequences, such as impaired attention in students and increased risks for dementia in older adults, the team at the Sleep and Health Laboratory (SHL) has been characterizing the contribution of sleep to cognitive, physical, and psychological wellbeing in various age groups. We have also been studying factors that lead to voluntary sleep curtailment. Our hope is to improve sleep health, and thereby enhance brain and cognitive functions as well as psychological wellbeing. We envision our research leading to better identification of individuals at risk for short and poor sleep, and providing novel and practical ways to maximise cognitive potential and improve quality of life across the lifespan.

CENTRE FOR SLEEP & COGNITION

Sleep & Health Laboratory
https://sites.google.com/site/sleepandhealthlab/

RESEARCH HIGHLIGHTS

Sleep Variability Across Nights – Is It Good or Bad for Neurobehavioural Functions when Young Adults Do Not Have Enough Time to Sleep?

When faced with limited sleep opportunities, some people cope by sleeping more whenever they can, thereby increasing the night-to-night variability in their sleep; whereas others stick to a fixed bedtime and wake time, for a more regular, albeit restricted, sleep schedule. We conducted a 16-day laboratory-based experiment to compare the effects of a variable versus a stable short sleep schedule on neurobehavioural functions. Successive cycles of sleep restriction on simulated weekdays led to compounding vigilance deficits in young adults, even with intervening weekend nights of extended

sleep opportunities. Such deficits might be reduced by increasing night-to-night variability in sleep duration which allowed for nights of prophylactic and/or recovery sleep on weekdays. However, such a variable short sleep schedule might still slow practice-based improvement in processing speed as much as, if not more prominently, than having the same short time-in-bed every night. Critically, having a time-in-bed within the age-specific recommended range every night appeared to be the only way to optimise all the neurobehavioural functions studied.
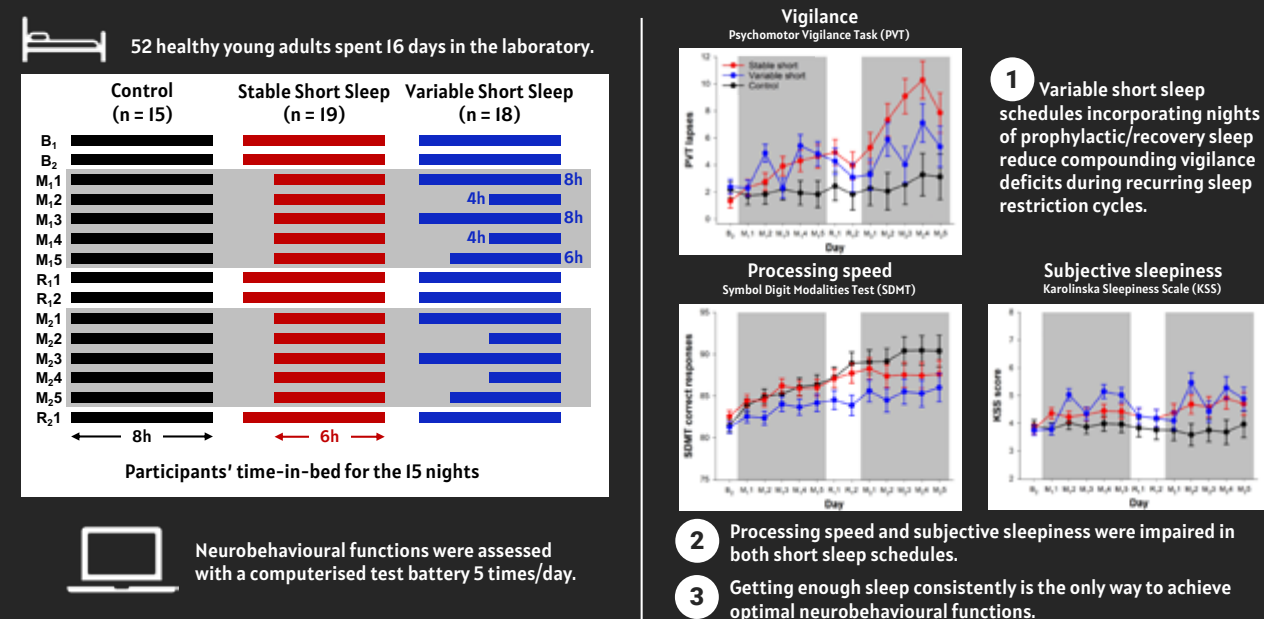

Figure 1. *Graphical abstract summarizing study findings.*

School-Age Children's Sleep and Neurobehavioural Functions during Recurrent Periods of Sleep Restriction on School Nights and Extension on Weekends

In the past few years, we have characterised how various neurobehavioural functions change during recurrent periods of sleep restriction in adolescents and young adults.

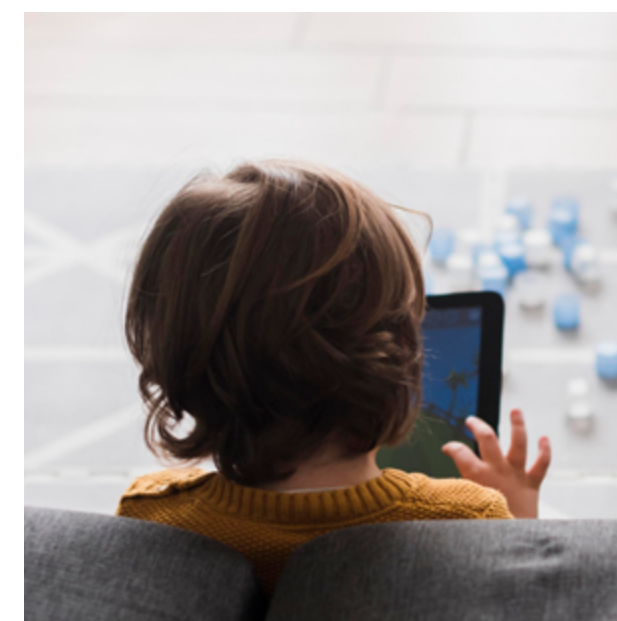The study aims to investigate the neurobehavioural deficits and recovery dynamics of two weeks of sleep restriction on weekdays and extension on weekends among school-age children during term time. These data will be compared against those collected during school holidays when night-to-night variability in sleep is more unpredictable.

Reducing Children's Screen Use for Better Sleep, Mental, and Brain Health: A Personalised Approach

In Singapore, 64.4% of school-age children sleep less than the minimum recommended duration of 9 hours on school nights, and hence, may be at risk for mental, cognitive, and brain health.

We are investigating the effectiveness of curtailing media use (particularly social media, gaming, and TV/video) with a scalable, personalised approach in increasing sleep and improving neurobehavioural functions in school-age children.

MNL
MULTIMODAL NEUROIMAGING LABORATORY

Multimodal Neuroimaging Laboratory

Multimodal Neuroimaging Laboratory
https://neuroimaginglab.org

Assoc. Prof. Helen Zhou
MNL Principal Investigator

2023 was another year full of fun and excitement for everyone in the Multimodal Neuroimaging in Neuropsychiatric Disorders Lab (MNL). Thanks to the multidisciplinary team, we have made some scientific breakthroughs. In parallel, we resumed annual lab outings and reunited with our alumni with much enthusiasm and joy.

This year, the lab has made significant progress in neuroscience as well as AI in neuroscience. Leveraging on local data in Singaporean elderly, our study in Neurology underscores the importance of brain-heart axis in predicting future cognitive decline (Neurology article and editorial). In parallel, our study on GUSTO data highlights how brain functional hierarchy relates to mental health in preschool children (JAACAP article and editorial). Both works improve our understanding of brain network phenotypes, the central theme in the lab, paving the way for imaging biomarkers in preventive medicine.

Our breakthroughs in brain decoding (CVPR and NeurIPS) gained high international visibility and media coverage, including NBC. We are excited about the possibility to reconstruct images, videos, text, and even thoughts from non-invasive brain recordings. We are in the process of collecting local data to facilitate multimodal brain decoding and improve its inter-subject generalizability.

Young scientists from the lab continue to gain recognition from the international community. Zijiao Chen, PhD student, received the scholar award and gave an oral presentation for her work on video reconstruction from brain functional MRI at NeurIPS (the top 0.6% among >12,000 submissions). Yu Xiao's work on brain structural connectome-based prediction of disease progression was selected as an oral presentation in the research highlights of the Alzheimer's Association International Conference (AAIC).

The flagship projects in the lab, like SG70 and SINGER, are all on track. The latter received positive feedback from the external scientific advisory board during its mid-term review. Thanks to the hard work by our post-doc and research assistant team. They tirelessly recruit participants and perform high-quality brain imaging and neuropsychological experiments every day.

Another new initiative is brain-body connection. I have secured the Healthy Longevity Catalyst Award from NMRC to study this in Singaporean elderly, which is organized by the National Academy of Medicine, USA. The lab also channelled its scientific expertise to benefit Singaporeans through sharing our recent work on brain aging via local media including CNA938 and Channel 8.

Working together with colleagues from CSC and the larger NUS/NUHS community, 2024 will be even more exciting and impactful for us!

RESEARCH HIGHLIGHTS

Associations of Blood Cardiovascular Biomarkers with Brain Free Water and its Relationship to Cognitive Decline in Singaporean Elderly

In this study (published in Neurology), we found higher brain free water entirely mediated the associations of blood cardiovascular biomarkers with longitudinal cognitive decline over 5 years in Singaporean elderly. The patterns in brain white matter were widespread while the cortical grey matter exhibited a network-specific pattern. Higher grey matter free water in the executive control network was responsible for executive function impairment, while grey matter free water in the default mode network mediated the relationship with memory dysfunction.

Our study provides new evidence for brain-heart interactions, suggesting that brain network-specific free water increases together with blood cardiovascular abnormalities could be developed further for prediction of domain-specific cognitive decline. This will pave the way for precise stratification and intervention strategies to slow down or prevent cognitive decline.
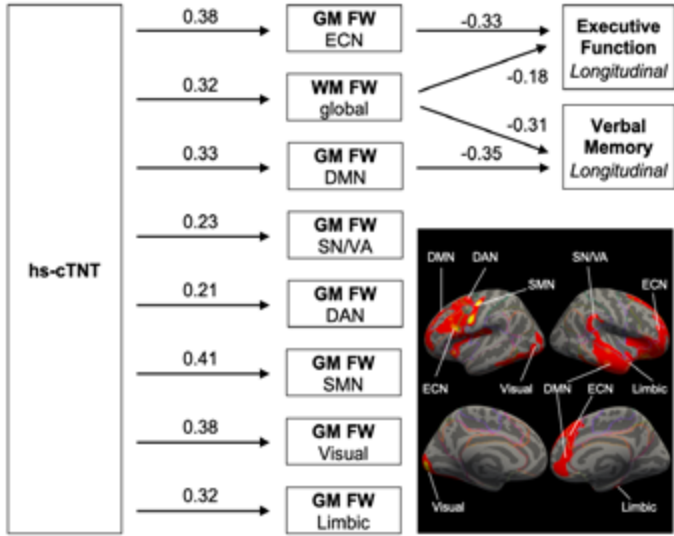

Figure 1. *Effects of circulating cardiovascular biomarker levels on longitudinal executive function and memory decline through free water mediators. Bottom right: the coloured-boundary of the free water mediators. Rates of changes in executive and memory domains over time (5 years) were treated as outcomes. DAN = dorsal attention network; DMN = default mode network; ECN = executive control network; FW = free water; GM = gray matter; hs-cTnT = high-sensitivity cardiac troponin-T; SMN = somatomotor network; SN/VA = ventral attention network; WM = white matter.*

Seeing Beyond the Brain: Conditional Diffusion Model with Sparse Masked Modeling for Vision Decoding

This year, our lab has made significant progress in brain decoding. Our PhD student Zijiao Chen's work on Mind-Vis and Mind-Video were presented in two top machine learning conferences: Conference on Computer Vision and Pattern Recognition (CVPR) and Conference on Neural Information Processing Systems (NeurIPS) (oral presentation and scholar award).

For the first time, our proposed approach is capable of decoding functional MRI-based brain activities and reconstructing images/videos with not only plausible details but also accurate semantics and image features, pushing this domain a considerable step forward.
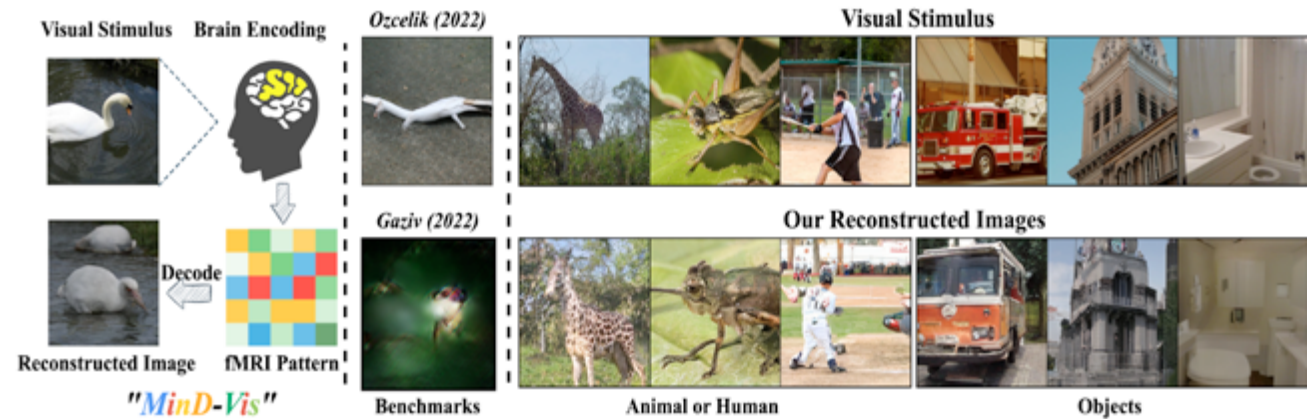

Figure 2. *Brain Decoding and Image Reconstruction. Left: Task overview. Middle: Comparison with benchmarks. Right: More reconstruction examples.*

Brain Tokenized Graph Transformer (Brain Token GT) published in MICCAI 2023

In this work, we proposed the first interpretable framework for brain FC trajectory embedding with applications to neurodegenerative disease diagnosis and prognosis, namely Brain Tokenized Graph Transformer (Brain TokenGT). We conducted extensive experiments on two public longitudinal fMRI datasets of the AD continuum (ADNI and OASIS-3) for three tasks, including differentiating MCI from controls, predicting dementia conversion in MCI, and classification of amyloid positive or negative cognitively normal individuals.

Based on brain FC trajectory, the proposed Brain TokenGT approach outperformed all the other benchmark models and at the same time provided excellent interpretability.

Variations in Cortical Functional Gradients Relate to Dimensions of Psychopathology in Preschool Children

Our PhD student Thuan Tinh Nguyen published her work in the Journal of the American Academy of Child & Adolescent Psychiatry.

Leveraging on GUSTO data, our study outlines how brain functional hierarchy is organized in preschool children for the first time and its link to mental health.

The work was also featured in an Editorial Highlight.

CBIG

COMPUTATIONAL BRAIN IMAGING GROUP

Computational Brain Imaging Group
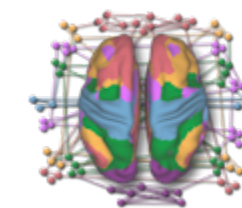
Assoc. Prof. Thomas Yeo
CBIG Principal Investigator

One key thrust of the Computational Brain Imaging Group (CBIG) is the development of machine learning algorithms to estimate brain networks from functional MRI (fMRI). Our brain atlases are widely used and have been collectively referenced more than 10,000 times. This year, we took an important step to push our algorithms towards clinical significance. Together with Dr. Phern-Chern Tor from the Institute of Mental Health, we started two clinical trials to evaluate the efficacy of individualized targets for transcranial magnetic stimulation of treatment-resistant depression. The individualized stimulation targets are obtained using multi-session hierarchical Bayesian models developed by our group, which can estimate highly accurate individual-specific network-level and areal-level parcellations even with limited quantity of fMRI data. Funded by the Temasek Foundation and National Medical Research Council, pilot data is being collected and patient recruitment will start early next year.

With scientific publishing moving towards greater open access, many journals have converted to a pay-to-publish model, in which scientists pay for their research studies to be published. However, the rise in publication fees have become unsustainable in the past few years. Therefore in April 2023, together with more than 40 editors from NeuroImage and NeuroImage: Reports, I resigned from my position as a senior editor of NeuroImage (Impact Factor 7.4) over the high publication fees. All editors agreed to start a new lower-cost open access journal Imaging Neuroscience with MIT Press. Since accepting new submissions in July 2023, we have received more than 400 submissions with almost 50 high quality articles accepted.

Finally, CBIG members once again received international recognition for their achievements. Dr. Csaba Orban gave an invited talk at the University of Zurich and organized a symposium at OHBM. Dr. Ruby Kong joined the editorial board of Imaging Neuroscience and the OHBM program committee. Dr. Sina Mansour was the runner-up of the Irv and Helga Cooper Foundation Open Science Prize organized by McGill University. CBIG PhD student Shaoshi Zhang gave an educational talk at OHBM and an invited talk at the Gradient Workshop organized by McGill University.

CENTRE FOR SLEEP & COGNITION

Computational Brain Imaging Group
https://sites.google.com/view/yeolab

RESEARCH HIGHLIGHTS

A New Homotopic Cerebral Cortical Parcellation

Our group previously developed a highly influential set of cerebral cortical parcellations, known as the Schaefer parcellations. The Schaefer parcellations are widely used to study the human brain and have accumulated almost 2000 citations. However, the lack of homotopic correspondence between left and right Schaefer parcels has limited their use for brain lateralization studies. We recently extended our model to derive homotopic parcellations (published in NeuroImage). Using resting-fMRI and task-fMRI across diverse scanners, acquisition protocols, preprocessing and demographics, we show that the resulting homotopic parcellations are as homogeneous as the Schaefer parcellations, while being more homogeneous than five publicly available parcellations. Finally, the homotopic parcellations agree with the boundaries of a number of cortical areas estimated from histology and visuotopic fMRI, while capturing sub-areal (e.g., somatotopic and visuotopic) features. Overall, these results suggest that the homotopic parcellations represent neurobiologically meaningful subdivisions of the human cerebral cortex and will be a useful resource for future studies.

Figure 1. *400-region homotopic areal-level parcellations assigned to 17 large-scale cortical networks.*

TEAM CBIG

Comparison Between Gradients and Parcellations for Functional Connectivity Prediction of Behavior

Resting-state functional connectivity (RSFC) is widely used for predicting behavioral measures. Here, we compare parcellation and gradient approaches for RSFC-based prediction of a broad range of behavioral measures. We found that most parcellation approaches have similar prediction performance. However, the popular principal gradient approach requires at least 20 to 40 gradients to perform as well as parcellation approaches. Since most principal gradient studies utilize only a single gradient, our results suggest that these studies might be missing out on a significant amount of behaviorally-relevant information.
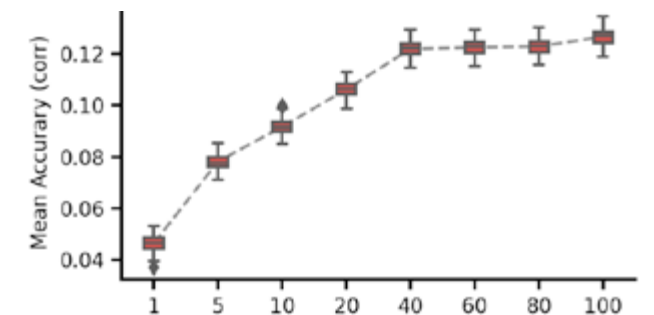
This study is published in NeuroImage.

Figure 2. *The principal gradient approach (Margulies et al., PNAS, 2016) requires at least 40 gradients to perform as well as parcellation approaches in the Human Connectome Project.*

There is No Tradeoff Between Prediction Accuracy and Feature Importance Reliability

Predictive models are often interpreted by the computation of feature importance, which quantifies the predictive relevance of an imaging feature. Here, we show empirically and mathematically that feature importance reliability is closely related to prediction accuracy. Furthermore, because reliability does not imply validity, feature importance reliability is necessary, but not sufficient, for low feature importance error. Overall, it is possible to achieve both high prediction accuracy and high feature importance reliability.
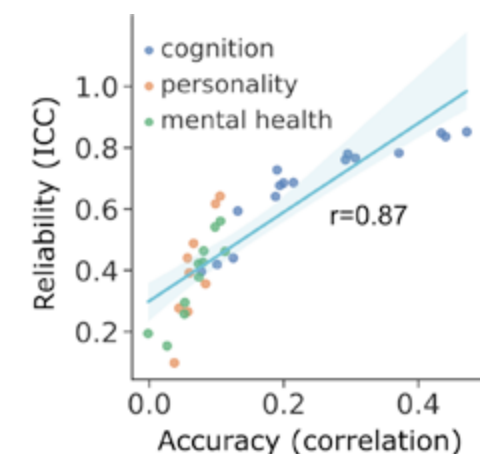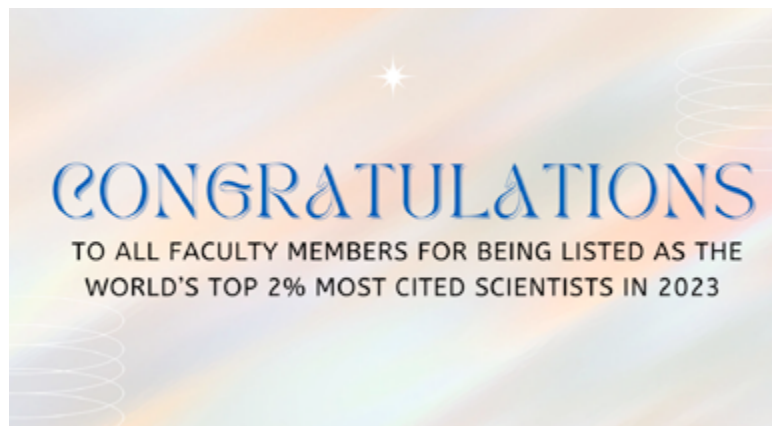
This study is published in NeuroImage.

Figure 3. *Feature importance reliability is strongly correlated with prediction accuracies across behavioral traits.*

YEAR IN REVIEW

THE CSC TIMES, 2023

CONGRATULATIONS
TO ALL FACULTY MEMBERS FOR BEING LISTED AS THE WORLD'S TOP 2% MOST CITED SCIENTISTS IN 2023

Stanford University-Elsevier: World's top 2% of highly-cited researchers in 2023

Prof. Michael Chee, A/Prof. Thomas Yeo and A/Prof. Helen Zhou were featured in Stanford University's world's top 2% of highly-cited researchers list, published in October 2023 by Elsevier.

INTERVIEWS

From brain waves, this AI can sketch what you're picturing

A/Prof. Helen Zhou and Zijiao Chen (PhD student, MNL) were featured on NBC News for their brain decoding project.
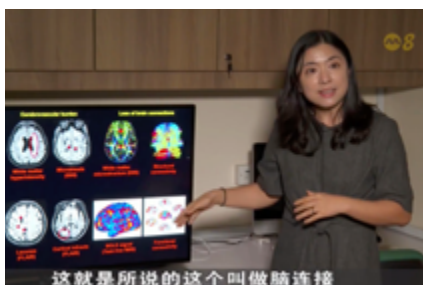
NBC News Article | Video

How can teens sleep smart and dream big?

Asst. Prof. June Lo talked about adolescents' sleep in a video for AIA Voices, a platform serving to educate, motivate and inspire people to make positive behavioural changes on their health and wellness journey.

AIA Voices Video

狮城有约｜解密大脑

A/Prof. Helen Zhou was featured on Channel 8 for her work in brain imaging and, in a separate segment, talked about the SINgapore GERiatric intervention study to reduce physical frailty and cognitive decline (SINGER).

Channel 8 Video 1 | Video 2

Which countries get the best night's sleep?

Using anonymised data collected from a wearable device, NUS researchers (Prof. Michael Chee and Dr. Adrian Willoughby [senior research fellow, SCL]) and Oura Health analysed the sleep habits of more than 220,000 people across 35 countries.

The Economist Article

Short Naps Have Major Benefits for Your Mind

A light midday snooze boosts memory and other types of cognition—and your mood. An article featuring Prof. Michael Chee and Dr. Ruth Leong (research fellow, SCL).

Scientific American Article

How to Nap

Whether it's to recover after a late night or to boost your learning abilities, there's a science to napping effectively. A guide by Prof. Michael Chee and Dr. Ruth Leong (research fellow, SCL).
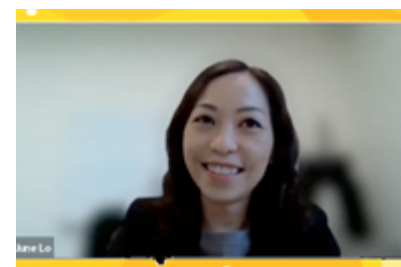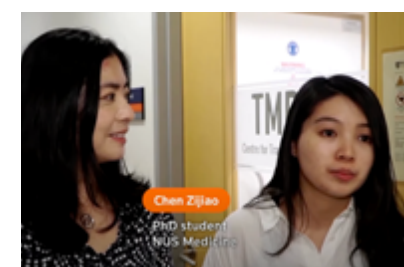
Psyche Article

Clarivate Reveals World's Influential Researchers in Highly Cited Researchers 2023 List

A/Prof. Thomas Yeo was listed as a Clarivate Analytics Highly Cited Researcher for a fifth consecutive year.

STUDENT ACHIEVEMENTS

1. Zijiao Chen (PhD student, MNL) received the Scholar Award for her paper Cinematic Mindscapes: High-quality Video Reconstruction from Brain Activity.
2. Yu Xiao (PhD student, MNL) won the outstanding PhD student award from the Quantitative Biology and Medicine (QBM) program at the Duke-NUS Medical School.
3. Thuan Tinh Nguyen's (PhD student, MNL) paper on brain functional gradient in preschool children and its link to mental health published in the Journal of the American Academy of Child & Adolescent Psychiatry was highlighted by the editorial comment. Link
4. Shaoshi Zhang (PhD student, CBIG) gave an invited talk at the Gradient Workshop at McGill University.

Ask the Experts: Adolescents and Sleep
Featuring Asst. Prof. June Lo, Centre for Fathering Video

How can AI 'read minds'?
Featuring A/Prof. Helen Zhou and Zijiao Chen (PhD student, MNL), Reuters Video

如何将大脑信号转化成具体的视频？
Featuring A/Prof. Helen Zhou and Zijiao Chen (PhD student, MNL), Hunan TV Video

Daily Cuts - Should you hit the snooze button?
An interview with Prof. Michael Chee, CNA938, Daily Cuts

Health Matters
An interview with A/Prof. Helen Zhou covering MNL's fMRI-Image decoding project, CNA938, Health Matters

STAFF ACCOLADES

1. A/Prof. Helen Zhou received the Healthy Longevity Catalyst Award from the National Medical Research Council for her brain-body connection study, a worldwide initiative organized by the National Academy of Medicine, USA.
2. Dr. Fang Ji's (senior research fellow, MNL) paper on brain-heart connection has been highlighted by Neurology with an editorial letter. Link
3. Dr. Sina Mansour (research fellow, CBIG) is the runner-up of the Irv and Helga Cooper Foundation Open Science Prize organized by McGill University.
4. Dr. Ruby Kong (research fellow, CBIG) joined the editorial board of Imaging Neuroscience.
5. Dr. Ruby Kong (research fellow, CBIG) gave an invited talk at BHII science talks at Cornell.
6. Dr. Csaba Orban (research fellow, CBIG) gave an invited talk at the University of Zurich.

MENTORSHIP

A/Prof. Helen Zhou mentored one clinician scientist from NUH, Dr. Ching Hui Sia, to secure a Transition award from the National Medical Research Council (NMRC) for brain-body connection work in patients with acute myocardial infarction.

CONFERENCES

In 2023, members of our Centre travelled around the globe to share our research and foster collaborations with esteemed scientists around the world. We are delighted to present a glimpse of our remarkable journey through some notable highlights from the conferences we had the privilege to attend.

World Sleep 2023, Rio de Janeiro, Brazil

- Prof. Michael Chee (PI, SCL) gave a keynote address titled "Consumer sleep tech and sleep transformation"

- Dr. Ju Lynn Ong (research assistant professor, SCL) gave two symposium talks titled "Utility of Oura Ring, Fitbit, and phone app in sleep research" and "Sleep in Singapore"

- Dr. Stijn Massar (research assistant professor, SCL) gave a symposium talk on incentive-based interventions

- Dr. Adrian Willoughby (senior research fellow, SCL) gave an oral presentation on country differences in nocturnal sleep patterns

- Dr. Ruth Leong (research fellow, SCL) gave an oral presentation on nocturnal sleep and naps

- Alyssa Ng (PhD student, SCL) gave an oral presentation on the effect of daily sleep variability on readiness (mood, motivation, and sleepiness)

View here: SCL WS2023 Microsite

- Asst. Prof. June Lo (PI, SHL) gave a symposium talk titled "Deficits in neurobehavioral function in sleep-restricted adolescents"

- Tiffany Koa (PhD student, SHL) gave an oral presentation on sleep duration variability during short sleep schedules and vigilance

- Yu Xiao (PhD student, MNL) gave an oral presentation at the **Alzheimer's Association International Conference (AAIC)** research highlights, Amsterdam, Netherlands, 2023

- Zijian Dong (PhD student, MNL) published the first interpretable framework for brain FC trajectory embedding with application to neurodegenerative disease diagnosis and prognosis, namely the Brain Tokenized Graph Transformer (Brain TokenGT), in the **Medical Image Computing and Computer Assisted Interventions (MICCAI) conference, Vancouver, Canada, 2023**

- Zijiao Chen's (PhD student, MNL) paper "Cinematic Mindscapes: High-quality Video Reconstruction from Brain Activity" was accepted by **NeurIPS 2023 (Conference on Neural Information Processing Systems)** for an oral presentation

- Zijiao Chen's (PhD student, MNL) paper was presented at the **Conference on Computer Vision and Pattern Recognition (CVPR), Vancouver, Canada, 2023**

- Prof. Michael Chee (PI, SCL) gave a keynote address titled "Napping: A contemporary review of an age old practice" at **INS 2023 Taiwan Meeting (The International Neuropsychological Society Meeting)**

OHBM2023, Montreal, Canada

- A/Prof. Helen Zhou (PI, MNL) gave a keynote talk on "Novel applications of neuroimaging to study the effects of sleep and lifestyle factors on cognitive health" at OHBM Satellite Symposium

- Dr. Ruby Kong (research fellow, CBIG) joined the OHBM program committee

- Dr. Csaba Orban (research fellow, CBIG) organized a symposium

- Dr. Shuo Qin (research fellow, SCL) presented a poster abstract

- Shaoshi Zhang (PhD student, CBIG) gave an education talk

- A/Prof. Helen Zhou (PI, MNL) gave an invited talk titled "Brain network breakdown underlying cognitive decline in neurological disorders: targeting early stages" at **Cell Symposia: Neurometabolism in Health and Disease, 2023**

- A/Prof. Helen Zhou (PI, MNL) gave an invited talk titled "Brain network phenotype in neuropsychiatric disorders: targeting early stage" at **University College London Max Planck Computational Psychiatry Talk, UK, 2023**

- A/Prof. Helen Zhou (PI, MNL) gave an invited talk titled "Brain network phenotypes relate to cognition and psychopathology in the developing and aging brain" at the **6th International Conference on Human Brain Development, Beijing, China, 2023**

CSC SEMINARS

This year, we have been truly honored to host a series of seminars featuring distinguished speakers who have graciously shared their latest research insights with our team. These esteemed scientists have not only enriched our knowledge of their respective fields, but have also contributed to the vibrant exchange of ideas that bolstered the collaborative spirit of our Centre.
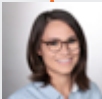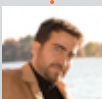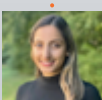
Dr. Dilara Yüksel
SRI International

Dr. Massimiliano de Zambotti
SRI International

Dr. Fiona Baker
SRI International

Asst. Prof. Mohamad Habes
University of Texas Health San Antonio

Asst. Prof. Elvisha Dhamala
Feinstein Institutes for Medical Research

Asst. Prof. Shan Siddiqi
Harvard Medical School
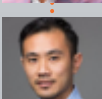
Dr. Jia-Hou Poh
Duke University
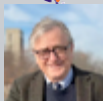
Prof. Till Roenneberg
Ludwig-Maximilian University (LMU), Munich

Prof. Francesca Siclari
Netherlands Institute for Neuroscience

A/Prof. Wei Cheng
Fudan University

Prof. Raymond Chan
Chinese Academy of Sciences

A/Prof. Andrew Phillips
Monash University

A/Prof. Luca Cocchi
QIMR Berghofer Medical Research Institute

Prof. Till Roenneberg
Professor of Chronobiology at LMU, Munich, and President of the World Federation of Societies for Chronobiology

Seminar: Actimetry – A Microscope for Temporal Behaviour

Prof. Francesca Siclari
Group Leader at the Netherlands Institute for Neuroscience, Amsterdam, and Invited Professor at University of Lausanne, Switzerland
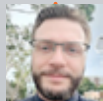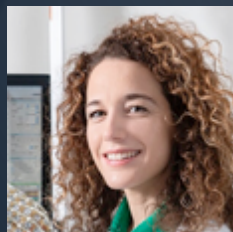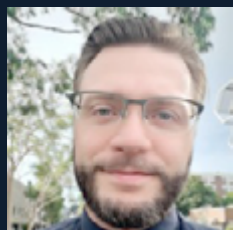
Seminar: The Dreaming Brain

A/Prof. Luca Cocchi
Head of the Clinical Brain Networks Group at QIMR Berghofer Medical Research Institute

Seminar: Precision Brain Network Therapeutics

A/Prof. Andrew Phillips
*Associate Professor in the Turner Institute for Brain and Mental Health at Monash University*

Seminar: Individual Differences in the Human Circadian System -- How Do We Personalize Interventions?

A/Prof. Wei Cheng
Principal Investigator at the Institute of Science and Technology for Brain-Inspired Intelligence, Fudan University
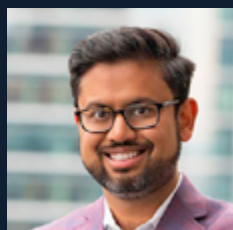
Seminar: Neuroimaging Biomarkers of Schizophrenia
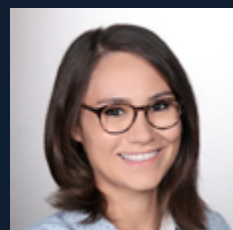
Dr. Dilara Yüksel
Research Scientist in the Human Sleep Research Program at SRI International
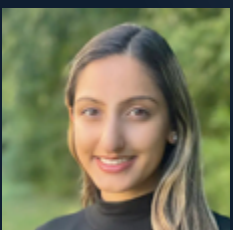
Seminar: The Use Of Sleep Technology To Advance The Study Of Insomnia In Adolescence

Asst. Prof. Shan Siddiqi
Assistant Professor of Psychiatry at Harvard Medical School, Director of Psychiatric Neuromodulation Research at Brigham and Women's Hospital

Seminar: Deriving Brain Stimulation Targets using Causal Mapping of Human Brain Function

Asst. Prof. Elvisha Dhamala
Assistant Professor of Psychiatry at the Feinstein Institutes for Medical Research and Director of the Brain-Based Predictive Modeling Laboratory at Zucker Hillside Hospital

Seminar: Predictive Modeling for the Study of Brain-Behavior Relationships Across Health and Disease
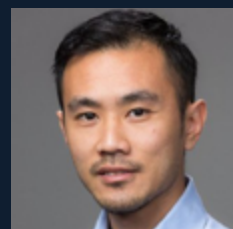
Dr. Jia-Hou Poh
Postdoctoral Associate at the Duke Center for Cognitive Neuroscience

Seminar: Neuromodulatory Regulation of Neural Context for Motivated Learning and Adaptive Memory
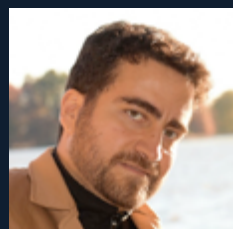
Asst. Prof. Mohamad Habes
Assistant Professor of Radiology and Epidemiology at the University of Texas Health San Antonio, and Director of Biggs Institute Neuroimaging Core

Seminar: Cutting Edge Neuroimaging and Machine Learning Methods Capture Alzheimer's Disease and Related Dementia Patterns

Prof. Raymond Chan
Principal Investigator and Professor of Neuropsychology and Applied Cognitive Neuroscience at the Chinese Academy of Sciences

Seminar: Affective Forecasting in Subclinical Populations: Evidence from Behavioural and Functional Imaging Findings

EXTERNAL FUNDING

Our work at the Centre is supported by the invaluable contributions of various funding bodies and companies. Their unwavering commitment and financial backing have been the cornerstone of our ability to conduct cutting-edge research and make meaningful strides in our respective fields.

Prof. Michael Chee

Nestlé
Nutritional Intervention to Improve Sleep Quality and Improve Next-day Benefits

Lee Foundation
Making Sleep Count In A Post-Pandemic World

Health Promotion Board (HPB)
HPB hiSG-Sleep Health Study: Incentivizing Good Sleep for Better Health

Oura Health Oy
Performance Evaluation and Cross-country Evaluation of Sleep Patterns

A/Prof. Helen Zhou

National Medical Research Council
Healthy Longevity Catalyst Award

A/Prof. Thomas Yeo

Temasek Foundation

NIH Research Project Grant [NIH R01]

National Medical Research Council

Asst. Prof. June Lo

National Research Foundation
HEATS: Heat Exposure, AcTivity, and Sleep

INTERNATIONAL COLLABORATORS

Our Centre has established impactful collaborations with revered international partners, forging strong ties with leading institutions around the globe.

NEW COLLABORATIONS

CHARITÉ – UNIVERSITÄTSMEDIZIN BERLIN
Prof.Thomas Penzel
Prof. Thomas Penzel is the Director of Research of the Interdisciplinary Sleep Medicine Centre at the Charité Universitätsmedizin Berlin, Germany, and the President of the German Sleep Society (DGSM). The collaborative research with Prof. Thomas Penzel, titled "Nocturnal Blood Pressure Estimation from Sleep Plethysmography Using Machine Learning" has recently been published in Sensors.

HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH
A/Prof. JP Onnela
A/Prof. JP Onnela is an Associate Professor of Biostatistics and Director of the Master's Program in Health Data Science at Harvard T.H. Chan School of Public Health. His innovative work in digital phenotyping has been applied in collaboration with SCL's NUS1000 Study, focusing on first-year university students at NUS.

MONASH UNIVERSITY
A/Prof. Bei Bei
A/Prof. Bei Bei is a Clinical Psychologist and the Research Lead at Monash University Healthy Sleep Clinic, and an Associate Professor at Turner Institute for Brain and Mental Health. A recent study in collaboration with Dr Bei Bei titled "Assessing 'readiness' by tracking fluctuations in daily sleep duration and their effects on daily mood, motivation, and sleepiness" was published in Sleep Medicine.

EXISTING COLLABORATIONS (PARTIAL LIST)

CITY UNIVERSITY OF HONG KONG
Asst. Prof. Kei Hang Katie Chan

LEIDEN UNIVERSITY
Asst. Prof. Arko Ghosh

MACQUARIE UNIVERSITY
A/Prof. Christopher Gordon

PEKING UNIVERSITY
Prof. Yanjie Su

UNIVERSITY OF CALIFORNIA, BERKELEY
Dr. Hui Zhang
Prof. Stefano Schiavon

UNIVERSITY OF PITTSBURGH
A/Prof. Osea Giuntella

UNIVERSITY OF STRASBOURG
Dr. Antoine Viola

UNIVERSITY OF SYDNEY
Prof. Sharon Naismith
Dr. Thomas Parkinson

PARTNERSHIPS

Our Centre has cultivated robust connections with a diverse network of both academic and industrial partners. These external partnerships have played a pivotal role in amplifying the impact of our initiatives and broadening the scope of our research endeavours.

SG70

CSC faculty have been contributing to the brain health and sleep aspects part of the SG70 study on longitudinal aging, led by Prof. Koh Woon Puay.

This year, in addition to the extensive neuroimaging and psychometric characterization performed by A/Prof. Helen Zhou's team, Prof. Michael Chee's team completed the collection of at least one month of sleep and physical activity data from ~800 participants. Some participants also provided daily mood, wellbeing and sleepiness ratings.

Integrating Prof. Ling's work on vascular stiffness in aging with wearable device derived PPG signals, the SCL team is currently looking into how such data can be used to conveniently assess vascular aging and its modulation by lifestyle and social factors.

ENIGMA

The Centre's involvement with ENIGMA started with the investigation of structural brain alterations in those at clinical high risk for psychosis. This has resulted in several significant publications and will continue to be a means by which data originally collected over 15 years ago can be re-purposed to generate new insights.

A new ENIGMA program on Sleep was launched in 2021. Fifteen countries formed a large-scale multi-centre effort in order to increase the number of samples and harmonize the methods of data collection, preprocessing and analysis using well-established protocols. We have participated both in giving talks and in sharing imaging data on sleep deprived brains.

SINGER

Partnering with the Memory, Ageing, and Cognition Centre of NUHS (led by A/Prof. Christopher Chen), our CSC faculty (comprising A/Prof. Helen Zhou and A/Prof. Thomas Yeo) is at the forefront of evaluating whether a multidomain lifestyle intervention, involving dietary advice, exercise, cognitive training, and vascular risk factors management, is effective in reducing cognitive decline and physical frailty in older adults with increased risk of dementia.

This study, the SINgapore GERiatric intervention study (SINGER), is part of the World Wide FINGERS initiative and is supported by a large collaborative grant from the National Medical Research Council (2020-2024, led by A/Prof. Chen). Leveraging on high-resolution Magnetic Resonance Imaging, the CSC team endeavors to answer questions that may be unique to Singaporean/Asian phenotypes with regard to vascular cognitive impairment. The study aspires to establish a foundation for robust and explainable personalized preventive medicine.

To date, we have successfully collected MRI scans from over 700 participants. The team has recently concluded a midterm review, overseen by an external scientific advisory board, which yielded positive feedback and strong support for our program.

MCGILL UNIVERSITY

A/Prof. Helen Zhou's team has initiated two projects with McGill University examining the effects of tau and amyloid-beta on functional connectivity, as well as its associations with mild behavioral symptoms and cognitive impairments in preclinical and prodromal AD. The team has completed the data analysis and has the manuscript underway.

POND (UCL)

A/Prof. Helen Zhou's team is collaborating with the Progression of Neurodegenerative Disease (POND) group at University College London (UCL) on modelling the progression of neuroimaging biomarkers of Alzheimer's disease using machine learning approach. The approach can simultaneously discover progression trajectories and subtypes with clinical relevance. The team has completed the data analysis and has the manuscript underway.

UNIVERSITY OF PENNSYLVANIA

A/Prof. Thomas Yeo has initiated a collaboration with Prof. Raquel Gur and A/Prof. Theodore Satterthwaite from the University of Pennsylvania to apply computational techniques developed by his group to the Philadelphia Neurodevelopmental Cohort (PNC).

It is widely believed that the balance of excitation and inhibitory neural activity is critical for healthy brain function. Disruption to the excitation-inhibition (E/I) balance is thought to play an important role in the onset of psychiatric disorders. However, the E/I balance is typically measured in animals with invasive techniques and cannot be easily investigated in human participants.

A/Prof. Yeo and his PhD student Shaoshi Zhang recently developed a biophysical model that allows the estimation of E/I balance in human participants using just functional MRI data. It is widely believed that the E/I balance is heterogeneous across the cortex and decreases during development as the result of the maturing GABAergic inhibitory circuitry. They are currently investigating whether their model can detect reduction in E/I balance during development and whether E/I balance can be a sensitive marker of healthy development.

NEW TOWN PRIMARY SCHOOL & QUEENSTOWN PRIMARY SCHOOL

Asst. Prof. June Lo has initiated a project with New Town Primary School and Queenstown Primary School to test the effectiveness of reducing screen use in increasing sleep and improving neurobehavioual functions in school-age children.
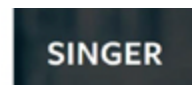
NUHS

The National University Health System (NUHS) is one of three public healthcare clusters in Singapore, and an integrated Academic Health System and Regional Health System. Members of NUHS comprise tertiary, acute and community hospitals, national specialty centres, polyclinics, a medical centre as well as academic health sciences institutions.

In 2022, the Sleep and Cognition Laboratory embarked on a study to understand the impact of different rotating shift schedules, among Postgraduate Year 1 (PGY1) doctors at NUHS. The traditional "on-call" schedules require junior doctors to go through frequent 24-30 hour overnight shifts. NUHS has implemented an alternative "float" schedule in several departments, where overnight shifts are less frequent but are concentrated in a week of consecutive 12-hour night shifts, known as "night-float". Using state of the art wearable and mobile technology, we aim to understand the sleep patterns, metabolic response, and wellbeing of the doctors, and hope to provide insights to guide scheduling within NUHS for the betterment of present and future doctors.

HPB

The Health Promotion Board (HPB) is a statutory board under the Ministry of Health, with goals to promote healthy living in Singapore. In an effort to tailor its health promotion policies and programmes, HPB launched the "Health Insights Singapore (hiSG)" population health study five years ago, to better understand health behaviours of Singapore residents using wearable technology.

This year, we published findings showing how work-from-home (WFH) practices continue to influence sleep and physical activity patterns 2 years after the onset of COVID-19, with WFH days being robustly associated with later bed and wake times and longer sleep durations, but lower daily step counts. Starting mid this year, we have also expanded analyses of this dataset to longitudinally characterize and understand factors associated with short sleep and poor wellbeing outcomes in this young working adult cohort as well as a second, older adult cohort.

QUANTACTIONS

QuantActions is a Swiss company focused on cognitive assessment through daily smartphone interactions. Their TapCounter app has been a staple in many of our research projects and publications, providing insights into how smartphone use affects sleep and mood.

By combining smartphone usage information with sleep data obtained from wearables and self-reports, the team demonstrated how technology use in bed can be used to fine-tune sleep identification and enhance the understanding of behaviours surrounding bed and wake times. This year, TapCounter is helping us understand the physical and mental wellbeing challenges faced by NUS freshmen as they go through the highs and lows of their first semester of university.

NESTLÉ

The Clinical Research Unit of Nestlé, the Swiss multinational food and beverage conglomerate, sponsored CSC to conduct a clinical trial to test whether sleep quality could be improved by a dietary intervention, using mulberry leaf extract to lower postprandial glucose of the evening meal and tryptophan to support endogenous melatonin production.

Both objective and subjective assessments showed reduced sleep onset latency compared to the placebo. The treatment was also associated with better cognitive performance in terms of vigilance and working memory throughout the following day. These findings were recently presented at the Asian Congress of Nutrition. We are working closely with Nestlé to understand how reducing postprandial glucose levels and overnight glucose variation led to better sleep and next-day cognition.

OURA HEALTH

Oura Health is a Finnish health technology company that created the Oura Ring, a wearable sleep and activity tracker that leverages on multi-sensor measurements to deliver personalized health insights.

The SCL team began our involvement with Oura Health in Dec 2019 to conduct a full-scale multi-night validation study on adolescents using Oura Rings and polysomnographic recordings. A second validation study on adults in a home-based setting was conducted between Dec 2020 - Apr 2021, followed by a third, in-lab, validation study in Aug-Dec 2021. These results were used to further improve Oura's sleep algorithms.

This year, SCL conducted a new lab-based validation study evaluating Oura's latest sleep staging algorithm alongside other research-grade and consumer-based sleep trackers, and sleep-stage classification accuracies. These results were used to identify three consumer facing recommendations on how to choose a sleep tracker according to one's needs.

The SCL team also collaborated with Oura to analyze large scale trends in sleep behavior with over 50 million nights of sleep from 35 different countries in Oura's global user base. We showed that not only was nocturnal sleep shorter and later in Asia than in other regions, but it was also less efficient and more variable particularly during the weekdays, suggesting that some 'catch-up' sleep could also be occurring during the weekdays in Asia. These findings were highly publicized in numerous media channels, including the Economist, NewScientist and ScienceDaily.

In the coming year, the SCL team will continue to work with Oura to evaluate new technologies and further understand sleep patterns and their consequences from Oura's global user base.

FEATURED
STAFF & STUDENTS

Our Centre comprises a diverse and exceptionally talented group of individuals with varied backgrounds. Each year, we select a handful of our outstanding staff members and students to share their research endeavors and personal interests with us.

RESEARCH ASSISTANT PROFESSOR
DR. STIJN MASSAR

Dr. Stijn Massar is a Research Assistant Professor from the Sleep and Cognition Laboratory.

COULD YOU BRIEFLY DESCRIBE YOUR BACKGROUND?

I grew up in the Netherlands, where I received all my education. In undergrad, I wanted to pursue Mathematics, but I failed dramatically and dropped out of freshmen year. I switched to Psychology, which was a better fit for my talents. I originally trained in Industrial Psychology and later transitioned to Cognitive Neuroscience for my PhD. After that, I moved to Singapore to join the Sleep and Cognition lab (then known as the Cognitive Neuroscience lab).

WHAT IS YOUR AREA OF RESEARCH?

When I first joined the lab, we were studying the neural mechanisms of sleep deprivation. Currently, we are more focused on remote sleep tracking in real-world situations. My personal research focus is on the influence of sleep on mental wellbeing, motivation, and cognitive performance.

WHY IS THIS WORK IMPORTANT?

With everyone being busy and stressed, sleep often takes a backseat in our priorities. This may seem like a necessary way (or even the only way) to get ahead, but it takes a toll on one's physical and mental health. People often don't value sleep until they cannot sleep well anymore.

WHAT INSPIRED YOU TO CHOOSE THIS FIELD OF STUDY, AND WHY DID YOU CHOOSE TO DO YOUR RESEARCH HERE?

As a student in Industrial Psychology, I learned how poor sleep and fatigue affect our performance and wellbeing. With my background in Cognitive Neuroscience, I learned how brain function can be disrupted as well. This lab was the perfect place to study the two in combination.

WHAT ARE THE LONG-TERM GOALS OF YOUR RESEARCH?

I hope that our research finds its way to real-world applications. After spending so much time studying the importance of sleep, it would be even more important that people can use this information to improve their sleep health. I try to contribute to public awareness through newsletter writing, media contributions, and being active in the Singapore Sleep Society.

WHAT ARE SOME OF THE BEST EXPERIENCES THAT YOU HAVE HAD IN THE LAB?

The best part of the lab is the team spirit. There is a strong sense of cooperation and camaraderie. People generally help each other and cover for each other. This is a great condition for learning and growth.

WHAT ARE SOME HOBBIES THAT YOU DO IN YOUR SPARE TIME?

Haha, my spare time is mostly taken up by my kids. I bring my son to martial arts class, and my daughter to choir practice. For myself, I try to keep to a daily swimming routine. That is my exercise, meditation, and therapy, all in one.

DR. FANG JI

SENIOR RESEARCH FELLOW

Dr. Fang Ji is a Senior Research Fellow from the Multimodal Neuroimaging in Neuropsychiatric Disorders Laboratory.

COULD YOU BRIEFLY DESCRIBE YOUR BACKGROUND?

My academic pursuits have been centered around neuroimaging, neuroscience, and medicine. This interdisciplinary approach has allowed me to explore the intricate workings of the human brain and how its complex functions can be affected by various conditions.

WHAT IS YOUR AREA OF RESEARCH?

I am deeply involved in researching dementia, cerebrovascular disease and the heart-brain connection. These areas are interconnected in the way they impact cognitive functions and overall brain health.

WHY IS THIS WORK IMPORTANT?

The importance of this research lies in its potential to change lives of older adults. Dementia and cerebrovascular diseases are major contributors to disability and dependence. Understanding these conditions better can lead to improved treatments and preventative strategies, ultimately enhancing life quality for many.

WHAT INSPIRED YOU TO CHOOSE THIS FIELD OF STUDY?

My inspiration stemmed from growing up in a family of doctors. I've always been intrigued by the human brain, arguably the most complex organ. The challenge of unlocking its mysteries was a call I felt deeply compelled to answer.

WHY DID YOU CHOOSE TO DO YOUR POSTDOC HERE?

Following the completion of my PhD, I decided to further my engagement with neuroimaging here. Working with my mentor, Helen Zhou, has been an enriching experience that has greatly contributed to my research journey.

WHAT ARE THE LONG-TERM GOALS OF YOUR RESEARCH?

My long-term goals are to fully understand the complexity of the human system and to find viable solutions for dementia and Alzheimer's disease. It's about pushing the boundaries of our knowledge to foster breakthroughs in treatment.

WHAT ARE SOME OF THE BEST EXPERIENCES THAT YOU HAVE HAD IN THE LAB?

One of the most rewarding aspects has been the collaborative environment. Discussing research questions with my team often leads to those great moments where a complex problem begins to unravel, which is both thrilling and profoundly satisfying.

WHAT ARE SOME HOBBIES THAT YOU DO IN YOUR SPARE TIME?

I find balance in being active. Playing basketball and tennis allows me to unwind and stay fit. And, of course, spending time with my cat is always a joy – pets have a way of bringing a different perspective to life.

Dr. Yapei Xie is a Research Fellow from the Computational Brain Imaging Group.

COULD YOU BRIEFLY DESCRIBE YOUR BACKGROUND?

I'm a research fellow with the Computational Brain Imaging Group. I completed my PhD in Psychology at Beijing Normal University before joining A/Prof. Thomas Yeo's laboratory.

WHAT IS YOUR AREA OF RESEARCH?

My research focuses on individual differences in brain functional network development. I am particularly interested in understanding how variations in longitudinal brain functional development underlie individual differences in cognitive functions and behavioral patterns.

WHY IS THIS WORK IMPORTANT?

This work is fundamental to advancing our understanding of the principles of individual brain development, and how individual variations in brain development contribute to individual differences in cognitive abilities and behavioral responses. Furthermore, insights gained from this work have the potential to guide education policymaking, as well as to inform the early identification and intervention of neurodevelopmental disorders.

WHAT INSPIRED YOU TO CHOOSE THIS FIELD OF STUDY?

I have always been deeply intrigued by the concepts of personalized education and medicine. The pivotal realization that delving into the principles of individual brain development could unlock significant insights in these domains profoundly shaped my academic and professional journey.

WHY DID YOU CHOOSE TO DO YOUR POSTDOC HERE?

I was drawn to our lab due to the synergy between my expertise in brain network research and my strong interest in Thomas' research topics. Additionally, Singapore's reputation as a dynamic and supportive environment for scientific research presents an ideal backdrop for my work.

WHAT ARE THE LONG-TERM GOALS OF YOUR RESEARCH?

The long-term goals of my research are to apply our understanding of individual brain development principles to guide tailored educational strategies for unique learning needs, and to facilitate early identification and intervention of neurodevelopmental disorders.

WHAT ARE SOME OF THE BEST EXPERIENCES THAT YOU HAVE HAD IN THE LAB?

The highlight of our lab is the weekly 'brain tea' sessions. These regular events have played a crucial role in fostering team cohesion and collaborative spirit.

WHAT ARE SOME HOBBIES THAT YOU DO IN YOUR SPARE TIME?

In my spare time, I enjoy a variety of hobbies including playing tennis, watching movies, and listening to audiobooks.

DR. YAPEI XIE

RESEARCH FELLOW

DR. SINA MANSOUR

RESEARCH FELLOW

Dr. Sina Mansour is a Research Fellow from the Computational Brain Imaging Group.

COULD YOU BRIEFLY DESCRIBE YOUR BACKGROUND?

Upon finishing my undergraduate studies in Electrical Engineering and Computer Sciences, I ventured into a PhD program in Biomedical Engineering at the University of Melbourne, Australia. This academic journey fostered my expertise in computational models of brain connectivity, shaping my current focus on understanding the intricacies of the brain's connectome.

WHAT IS YOUR AREA OF RESEARCH?

I am interested in harnessing the benefits of cutting-edge computational algorithms, particularly in the realm of human brain research. My primary focus is on developing pioneering computational technologies aimed at unraveling the organization of the human brain and understanding its connections to cognition, behavior, and mental health.

WHY IS THIS WORK IMPORTANT?

The fusion of emerging computational technologies with neuroscience, psychiatry, and psychology presents unparalleled opportunities. My research aims to offer impactful insights and solutions to unravel the complexities of the human brain and contribute to a deeper understanding of mental health. This pursuit resonates profoundly with the potential to decode the mechanisms of the human mind, with promises to advance current approaches in personalized psychiatry.

WHAT INSPIRED YOU TO CHOOSE THIS FIELD OF STUDY?

The prospect of translating cutting-edge theoretical computer science knowledge into tangible real-world applications in mental health technologies serves as the primary motivation propelling my current research pursuits.

WHY DID YOU CHOOSE TO DO YOUR POSTDOC HERE?

The Computational Brain Imaging Group at the Centre for Sleep and Cognition is a renowned global research leader, consistently spearheading high-caliber and impactful studies in the field of human brain research. Being a part of such pioneering research endeavors is a privilege and an honor.

WHAT ARE THE LONG-TERM GOALS OF YOUR RESEARCH?

My overarching vision is to make significant contributions to the field of computational neuroscience, building a deeper understanding of the intricacies of the human brain. This journey seeks to unveil fundamental connections between brain connectivity and mental health, with the potential to deliver innovative healthcare solutions.

WHAT ARE SOME OF THE BEST EXPERIENCES THAT YOU HAVE HAD IN THE LAB?

During my time here, engaging in multifaceted discussions on current trends in human brain research has been an enriching experience. These conversations have significantly contributed to my perspective on brain organization and the importance of computational tools in unraveling the mysteries of the brain.

WHAT ARE SOME HOBBIES THAT YOU DO IN YOUR SPARE TIME?

Outside research, I indulge in various activities including sports (tennis, yoga, hiking, and chess), and find solace in reading poetry and binge-watching TV shows.

Zijiao Chen is a PhD student from the Multimodal Neuroimaging in Neuropsychiatric Disorders Laboratory.

COULD YOU BRIEFLY DESCRIBE YOUR BACKGROUND?

I'm originally from China and graduated with a Bachelor's degree in Electrical Engineering from the University of Sydney in 2020.

WHAT IS YOUR AREA OF RESEARCH?

My research is focused on developing machine learning algorithms to decode brain signals from fMRI scans into what people are actually seeing or listening to.

WHY IS THIS WORK IMPORTANT?

This research is important as it could potentially lay the foundation for advanced brain-machine interfaces. It also offers a deeper understanding of individual brain patterns.

WHAT INSPIRED YOU TO CHOOSE THIS FIELD OF STUDY?

Initially, we were fascinated by the fantasy of "reading" or "seeing" what people are thinking. As we went deeper, we saw the huge potential in this technology. With the advent of Large Language Models, we believe this research could be pushed to a new level.

WHY DID YOU CHOOSE TO DO YOUR PHD HERE?

The decision to start my PhD in Singapore was influenced by several factors. A/Prof. Zhou's reputation in the neuroimaging field was a significant draw, as my interest in medical image analysis aligned perfectly with her expertise. Also, Singapore seemed to be a great place to live and study.

WHAT ARE THE LONG-TERM GOALS OF YOUR RESEARCH?

Looking ahead, we hope to achieve multi-modal and multi-domain portable brain decoding in the future. We hope this would be helpful for the neuroscience and medical community.

WHAT ARE SOME OF THE BEST EXPERIENCES THAT YOU HAVE HAD IN THE LAB?

Our lab has a great sense of community. We often hang out together, and during my first two years, we frequently gathered at my place. The COVID period restricted travel, so we spent many holidays like New Year's, Christmas, and Mid-Autumn Festival together.

WHAT ARE SOME HOBBIES THAT YOU DO IN YOUR SPARE TIME?

I'm a cat lover and enjoy spending time with my two cats. I'm pretty outdoorsy too – I like traveling, hiking, and kayaking. Lately, I've been enjoying some quiet time, like meditating and listening to music.

ZIJIAO CHEN

PHD STUDENT

Celeste Koh is a final year Psychology undergraduate completing her Honours Thesis under the guidance of Asst. Prof. June Lo at the Sleep and Health Laboratory.

CELESTE KOH

UNDERGRADUATE

COULD YOU BRIEFLY DESCRIBE YOUR BACKGROUND?

I am a final year undergraduate reading psychology at the National University of Singapore.

WHAT IS YOUR AREA OF RESEARCH?

My research focuses on the inter-individual differences in sleep, also known as sleep variability, related to cognitive and emotional outcomes in school-age children. While studies have largely focused on average sleep parameters and outcomes per participant, one of the main research questions I have is whether a child sleeping more on a particular day leads to better cognitive performance on the following day.

WHY IS THIS WORK IMPORTANT?

This work may help to inform sleep interventions by redefining positive outcomes, and further the field on sleep variability in this age group.

WHAT INSPIRED YOU TO CHOOSE THIS FIELD OF STUDY?

I chose to study sleep psychology in children after gaining experience through internships. Sleep seemed like a very interesting field, especially with my psychology background. I was especially keen on discovering the effects of sleep interventions in early childhood, and how long these effects last in adolescence.

WHY DID YOU CHOOSE TO DO YOUR FYP HERE?

I first met Asst. Prof. June Lo at the Neuroscience Singapore Conference in 2022 and was inspired by her work showing that delaying school start times leads to improved child outcomes. I also took her class PL4244 (Sleep: A Neurocognitive Perspective) and was keen to work with her.

WHAT ARE THE LONG-TERM GOALS OF YOUR RESEARCH?

I hope this research project can act as a springboard for me to better understand child sleep, which could potentially further inform my knowledge of the field. With these new insights, I hope to pursue a PhD related to sleep and child development in the future!

WHAT ARE SOME OF THE BEST EXPERIENCES THAT YOU HAVE HAD IN THE LAB?

It would be hard to pick one but I have enjoyed the lab meetings at SHL. Other than discussing the projects we have so that everyone is on the same page, I have learnt a lot from the presentations conducted by our lab members as well!

WHAT ARE SOME HOBBIES THAT YOU DO IN YOUR SPARE TIME?

When I have free time, I like to do some knitting or crocheting to calm my mind.

Eunicia Hoy is a final year Psychology undergraduate completing her Honours Thesis under the guidance of Asst. Prof. June Lo at the Sleep and Health Laboratory.

COULD YOU BRIEFLY DESCRIBE YOUR BACKGROUND?

I'm a 4th year undergraduate studying Psychology in the Faculty of Arts and Social Sciences at the National University of Singapore (NUS). I did my Honours Thesis under the supervision of Asst. Prof. June Lo, with assistance from PhD student, Tiffany Koa, in the Sleep and Health Laboratory.

WHAT IS YOUR AREA OF RESEARCH?

My primary focus is on intra-individual sleep variability, investigating whether a variable or stable short sleep schedule is more effective in minimizing neurobehavioral deficits caused by recurrent sleep restriction.

WHY IS THIS WORK IMPORTANT?

Obtaining adequate sleep can be challenging, particularly in many modern societies where sleep curtailment is prevalent due to competing wake activities. In situations when sleep opportunities are limited, some individuals cope by sleeping more whenever possible, resulting in increased night-to-night sleep variability. In contrast, others adhere to a more regular sleep schedule with a fixed bedtime and wake time. However, the effects of intra-individual sleep variability in the context of chronic sleep restriction remain largely unexplored. A better understanding of such sleep schedules would greatly contribute to providing more nuanced recommendations.

WHAT INSPIRED YOU TO CHOOSE THIS FIELD OF STUDY?

I've always wondered how much more efficient life could be without spending so many hours sleeping. With a keen interest in cognitive neuroscience, I naturally wanted to delve deeper into the effects of short sleep and explore novel, practical ways to improve sleep health that may effectively maximize cognitive potential and meet the demands of school and work.

WHY DID YOU CHOOSE TO DO YOUR FYP HERE?

Sleep and Health Laboratory was the perfect place that aligns with my vision because they are studying the contribution of sleep to neurobehavioral functions.

WHAT ARE THE LONG-TERM GOALS OF YOUR RESEARCH?

It is perhaps the hope that our research will have a meaningful impact on the way people strive to attain better sleep.

WHAT ARE SOME OF THE BEST EXPERIENCES THAT YOU HAVE HAD IN THE LAB?

I particularly liked the freedom that allowed me to explore my interests,

EUNICIA HOY

UNDERGRADUATE

fostering a balance between challenges and skills, and appreciated how everyone works hard to support each other.

WHAT ARE SOME HOBBIES THAT YOU DO IN YOUR SPARE TIME?

I am learning tricking, and training to incorporate it into Taekwondo under a category called freestyle poomsae/demonstration. Despite the high risk of injury, I find it very fulfilling and enjoy it a lot!

PUBLICATIONS

2023

For us, publishing 'well' involves the genesis and dissemination of innovative ideas to measure, inform, assess risk, educate, and evaluate outcomes related to human performance, health, and wellbeing. From student projects to complex multi-year, multi-party collaborations, we seek to make a difference in thinking, practice, and lives. Our roster of scientific publications is testament to this philosophy.

Sleep & Cognition Lab

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Multimodal Neuroimaging in Neuropsychiatric Disorders Lab

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