



MONASH University

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Introduction to Mindfulness: why attention matters in education and IT

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Mind wandering and happiness

- “In conclusion, a human mind is a wandering mind, and a wandering mind is an unhappy mind. The ability to think about what is not happening is a cognitive achievement that comes at an emotional cost.”
 - » Killingsworth MA, Gilbert DT. A Wandering Mind Is an Unhappy Mind. *Science* 12 November 2010: Vol. 330. no. 6006, p. 932 DOI: 10.1126/science.1192439

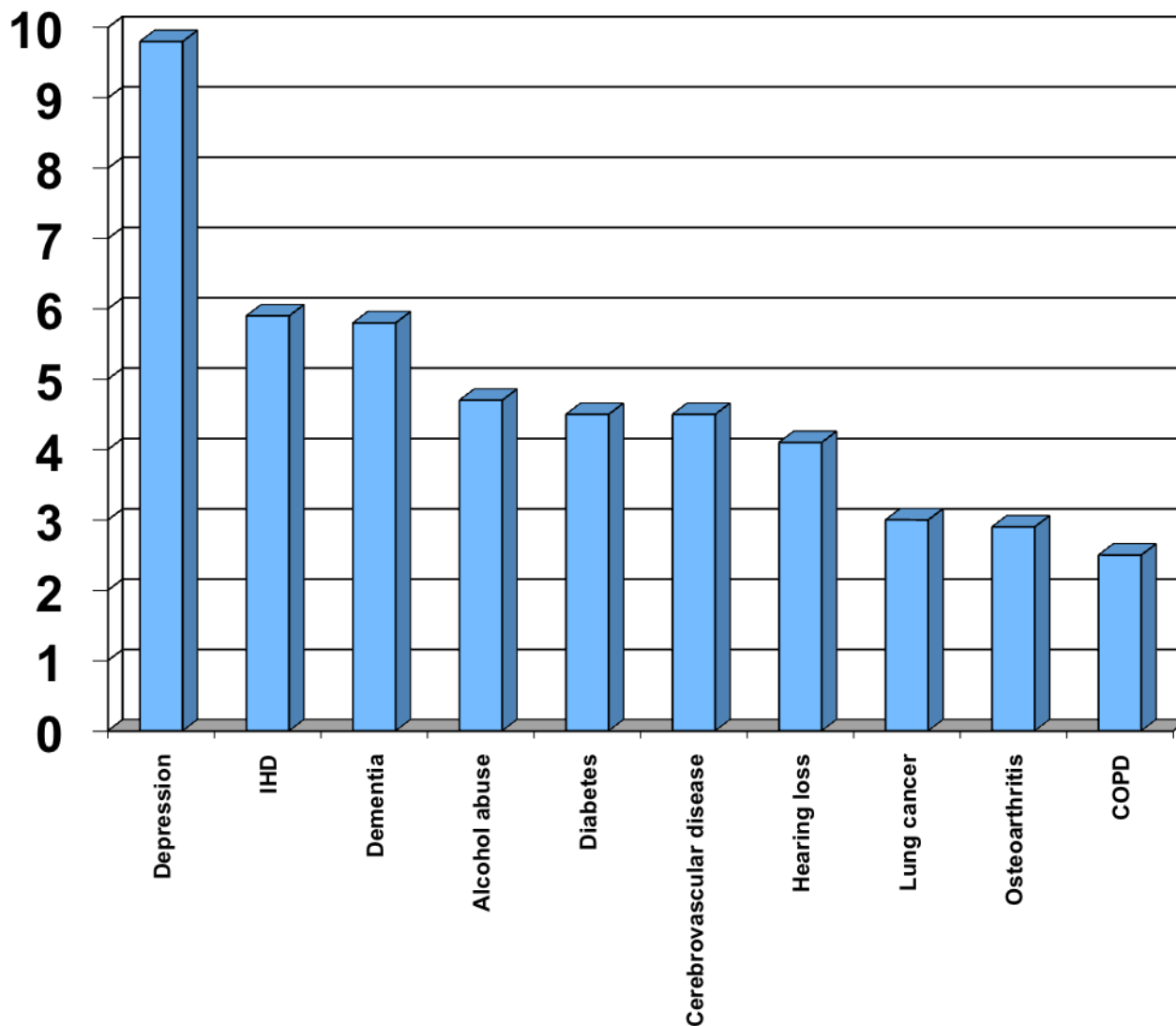
SAQ

- Why do companies like Google and IBM encourage mindfulness training for their employees?
- Expands Leadership Capacity
 - Increases effectiveness, decision-making capacity, and ability to create positive culture.
- Improves Performance & Collaboration
 - Enhances strength in brain regions associated with focus, working memory, and executive function. Encourages greater empathy and ease in relationships.
- Enhances Wellbeing & Resilience
 - Improves emotional resilience, stress management, happiness, and job satisfaction. Minimises stress symptoms and sick days.
 - <http://searchinsideyourself.com.au/>
 - <http://www.theaustralian.com.au/life/health-wellbeing/how-ibm-nab-companies-are-encouraging-mindfulness-among-staff/news-story/1fe71c7e386620faf7d808bd284b1657>



Allostatic load

- Prolonged stress leads to wear-and-tear on the body (allostatic load)
 - Mediated through the Sympathetic Nervous System
- Allostatic load leads to:
 - Impaired immunity, atherosclerosis, metabolic syndrome, bone demineralization
 - Atrophy of nerve cells in the brain
 - **Hippocampal formation:** learning and memory
 - **Prefrontal cortex:** working memory, executive function
 - Growth of **Amygdala** mediates fear response
- Many of these processes are seen in chronic depression and anxiety
 - McEwen BS. Ann N Y Acad Sci. 2004;1032:1-7.



Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med. 2006 Nov;3(11):e442.

■ Leading causes of DALYs in high income countries (%)

Screen time and attention

- Higher TV watching at 3 y/o associated with higher ADHD at age 7
 - Friedland RP et al. Proc Nat Acad Sci USA, 10.1073/pnas.061002998
 - Scarmeas N et al. Neurology 2001;57(12):2236-42.
 - Swing EL, Gentile DA, Anderson CA, Walsh DA. Television and video game exposure and the development of attention problems. Pediatrics. 2010 Aug;126(2):214-21. doi: 10.1542/peds.2009-1508. Epub 2010 Jul 5.

Falling attention spans

- According to a Microsoft Canada report, the average human's attention span is below that of a goldfish (8 sec vs. 9 sec)
- “We are moving from a world where computing power was scarce to a place where it now is almost limitless, and where the true scarce commodity is increasingly human attention”
 - Satya Nadella
 - <file:///Users/craighassed/Downloads/microsoft-attention-spans-research-report.pdf>

Attention span and academic achievement

- Study on relation b/w preschool children's attention span-persistence (ability to stay with a task or form of play for long period) and later school achievement and college completion
- Children's age 4 attention span-persistence significantly predicted:
 - Math and reading achievement at age 21
 - Odds of completing college by age 25
- Children who were rated one standard deviation higher on attention span-persistence at age 4 had 48.7% greater odds of completing college by age 25.
 - McClelland MM, Acock AC, Piccinin A, Rhea SA, Stallings MC. Relations between Preschool Attention Span-Persistence and Age 25 Educational Outcomes. *Early Child Res Q.* 2013 Apr 1; 28(2): 314–324. Published online 2012 Aug 3. doi: 10.1016/j.ecresq.2012.07.008

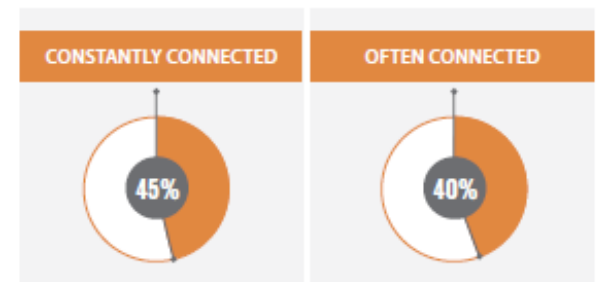
Stress in America 2017: Technology and Social Media

- The “constant checker” — those who constantly check their emails, texts or social media accounts (now 43% of Americans)
- This attachment to devices and the constant use of technology is associated with higher stress levels
- 86% say they constantly or often check their emails, texts and social media accounts
 - www.apa.org/news/press/releases/stress/2017/technology-social-media.PDF

CONSTANT DIGITAL CONNECTION

TYPICAL WORK DAY

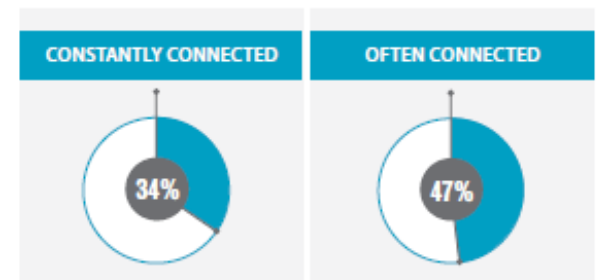
% (of Employed) Often or Constantly Connected to at Least One Device



For employed respondents.

TYPICAL NON-WORK DAY

% Often or Constantly Connected to at Least One Device



*For unemployed respondents: Typical day.
For employed respondents: Typical day off from work.*

Social media use and depression

- Social media (SM) use is increasing among U.S. young adults
- Study assessed association b/w SM use and depression in 1,787 adults ages 19 to 32
- SM use was assessed by self-reported total time per day spent on SM, visits per week, and a global frequency score (Pew Internet Research Questionnaire)
- Compared to those in the lowest quartile of total time per day spent on SM, participants in the highest quartile had significantly increased odds of depression (AOR = 1.66)
- Compared with those in the lowest quartile, individuals in the highest quartile of SM site visits per week and those with a higher global frequency score had significantly increased odds of depression (AOR = 2.74; AOR = 3.05, respectively)
- All associations between independent variables and depression had strong, linear, dose-response trends
- “SM use was significantly associated with increased depression. Given the proliferation of SM, identifying the mechanisms and direction of this association is critical for informing interventions that address SM use and depression.”

- Lin LY, Sidani JE, Shensa A, et al. Association between social media use and depression among U.S. young adults. *Depress Anxiety*. 2016 Apr;33(4):323-31. doi: 10.1002/da.22466.

Attention Deficit Trait

- Newly recognized neurological phenomenon: attention deficit trait (ADT)
 - Response to hyperkinetic environment
- Trying to deal with too much input, results in:
 - Black-and-white thinking; perspective and shades of grey disappear
 - Difficulty staying organized, setting priorities, and managing time
 - Feel a constant low level of panic and guilt
 - Hallowell EM. Overloaded circuits: why smart people underperform. Harv Bus Rev. 2005 Jan;83(1):54-62, 116.

Mobile phone use and motor vehicle accidents

- Driver's use of a mobile phone within 5 min before a crash associated with fourfold increased likelihood of crashing (OR 4.1)
 - McEvoy SP, Stevenson MR, Woodward M. The contribution of passengers versus mobile phone use to motor vehicle crashes resulting in hospital attendance by the driver. *Accid Anal Prev.* 2007 Nov;39(6):1170-6. Epub 2007 Apr 9.

The performance of extreme multi-taskers

- “These are kids who are doing 5, 6, or more things at once all the time. ... It turns out multi-taskers are terrible at every aspect of multitasking! They get distracted constantly. Their memory is very disorganized. Recent work we’ve done suggests that they’re worse at analytic reasoning. We worry that it may be we’re creating people who may not be able to think well, and clearly.”
 - Dr. Clifford Nass of Stanford University. From Dretzin R, Rushkoff D. “digital_nation life on the virtual frontier.” pbs.org Frontline. Feb. 2010. Web. 14 Apr. 2011.

The Illusion Of Multitasking

- **Attention switching**
 - So fast it *appears* we are doing multiple things simultaneously
- **Attentional blink**
 - **Lag time** of 200 to 500 milliseconds (0.5 second)
 - Increased by **stress**
 - Slatger, Lutz, Greishchar et al. (2007)

Integrated vs. split tasks

- We often engage in two concurrent but unrelated activities
 - E.g. driving on a quiet road while listening to the radio
- fMRI study in experienced drivers engaged in a driving simulator while listening either to GPS instructions (integrated task) or to a radio show (split task)
- Compared with the integrated task, the split task was characterized by reduced functional connectivity between the driving and listening networks
- The integrated information content of the two networks was high in the integrated task and zero in the split task
 - Sasai S, Boly M, Mensen A, Tononi G. Functional split brain in a driving/listening paradigm. www.pnas.org/cgi/doi/10.1073/pnas.1613200113

Interrupting the flow

- Average of **64 seconds** to **recover train of thought** after checking **email**
 - Check **every 5 mins** = waste **8.5 hours per week**
 - Jackson, Dawson & Wilson. (2002)

The distraction of notifications

- Undergraduate university students performed a simple task
- On the second run through, they were split into three groups
 1. Called on the phone
 2. Received a text
 3. Not interrupted
- Participants didn't know they were being contacted as part of the study
- Phone calls were the most distracting (28% more likely to make a mistake)
- Students nearly all had their phones set to vibrate and didn't take them out or look at them during the study
 - Stothart C, Mitchum A, Yehnert C. The Attentional Cost of Receiving a Cell Phone Notification.. Journal of Experimental Psychology: Human Perception and Performance, 2015; DOI: 10.1037/xhp0000100

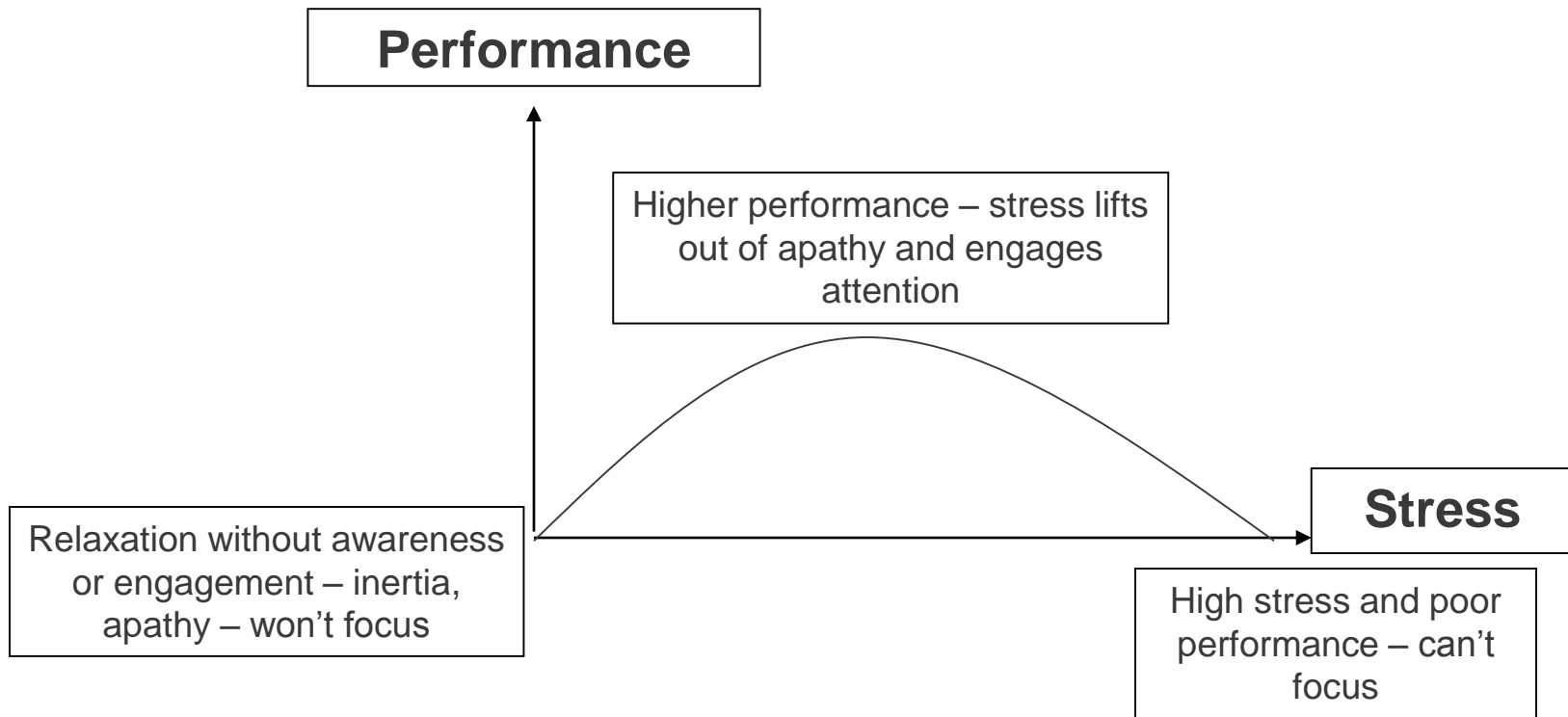
Overloaded circuits

- “Bain and Company, the consultancy, has estimated that executives in the 1970s had to deal with fewer than 1,000 phone calls, telexes and telegraphs a year from people outside their company. These days, 30,000 external communications clog managers’ inboxes annually. As Henry Mintzberg asks in his 2009 book, *Managing*: “Might the internet, by giving the illusion of control, in fact be robbing managers of control? In other words, are the ostensible conductors becoming more like puppets?”
 - Financial Times, UK March 5, 2016.

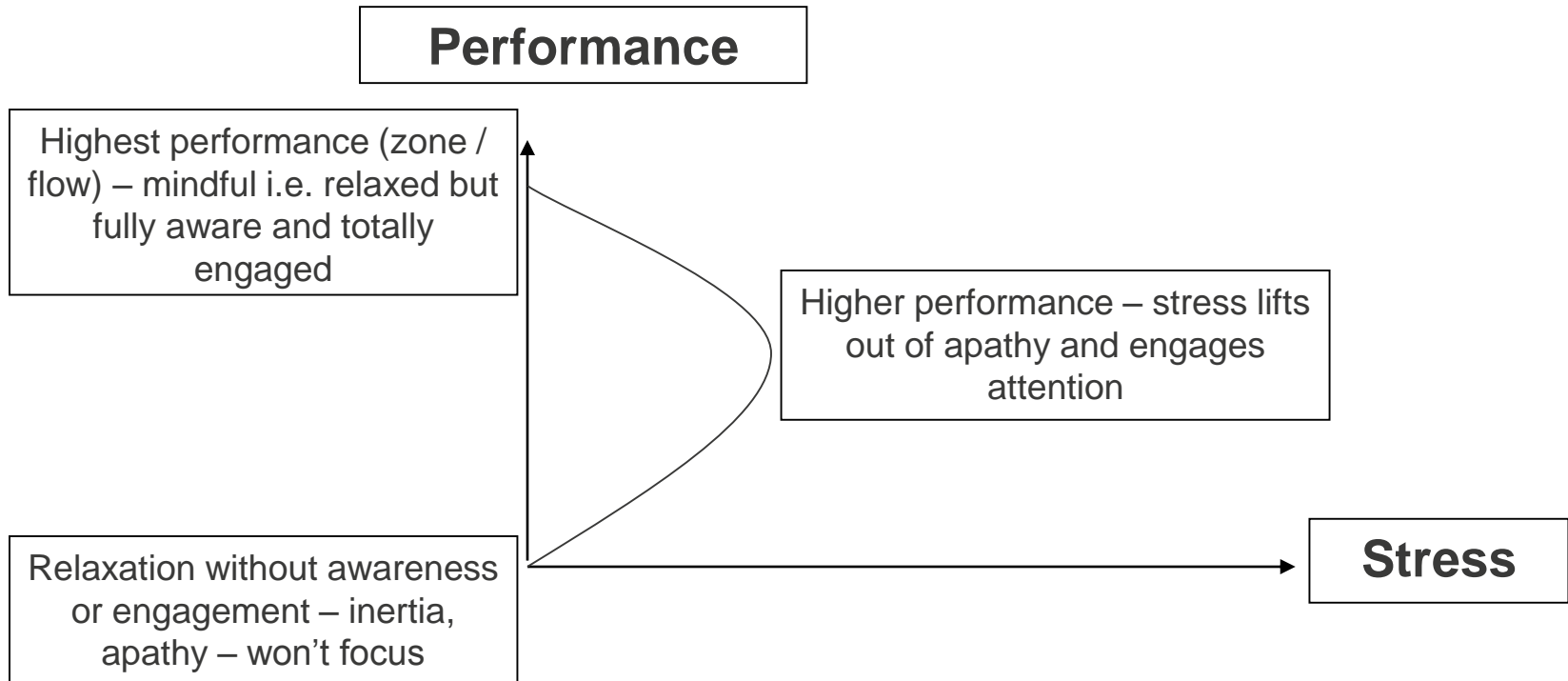
Mental overload and creativity

- Three experiments: subjects performed a free-association task while the level of a simultaneous cognitive load was manipulated in various ways
- Subjects with low-load provided significantly more diverse and original associations c/w subjects with high-load who exhibited high consensus
- Increased semantic priming of immediate associations under high load and of remote associations under low load
- Findings imply that activation of associations is an exploratory process by default, but is narrowed to exploiting the more immediate associations under conditions of high load
 - Baror S, Bar M. Associative Activation and Its Relation to Exploration and Exploitation in the Brain. Psychol Sci. 2016 Jun;27(6):776-89. doi: 10.1177/0956797616634487.

Yerkes-Dodson Stress-performance curve

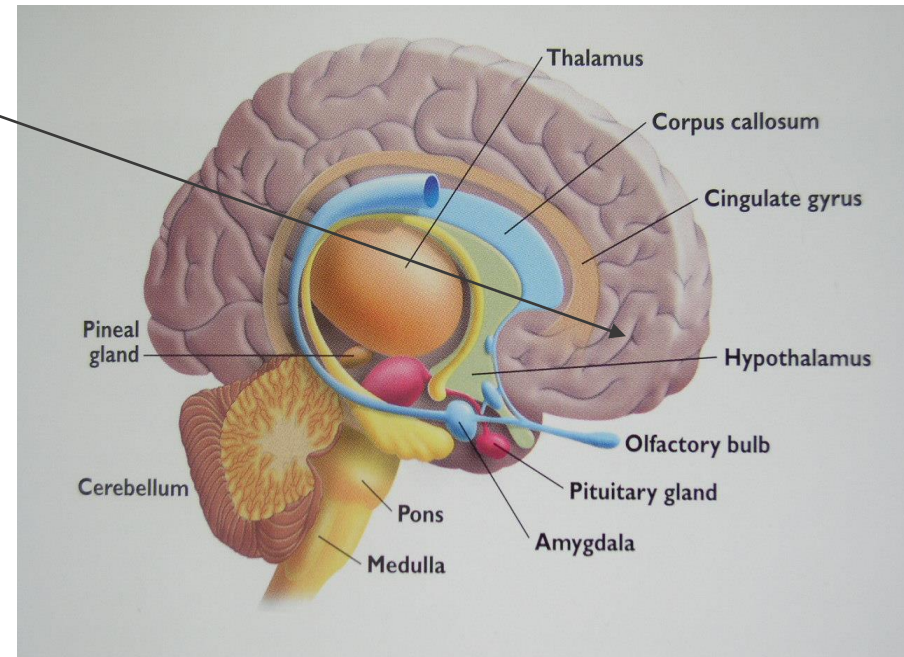


Mindfulness stress-performance curve



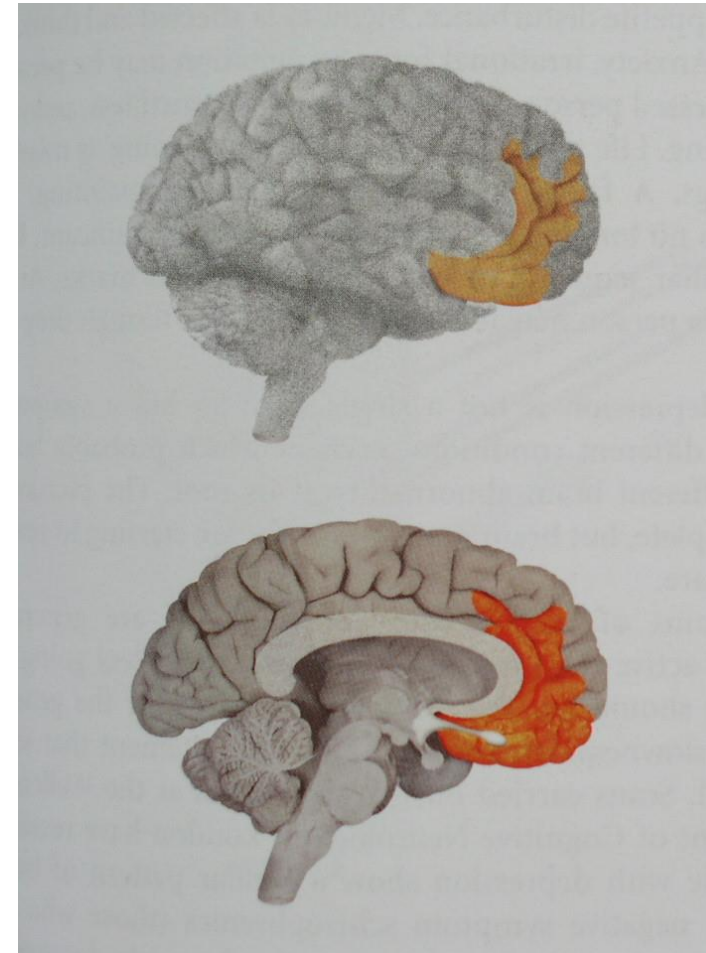
Executive functioning

- Frontal lobes (prefrontal cortex) centre for executive functioning e.g.
 - Attention regulation
 - Working memory
 - Self-awareness
 - Reasoning
 - Decision making
 - Regulating other brain regions
 - Emotional regulation
 - Appetite regulation
 - Impulse control
- Limbic system – emotion centre
- Mesolimbic reward system – appetites

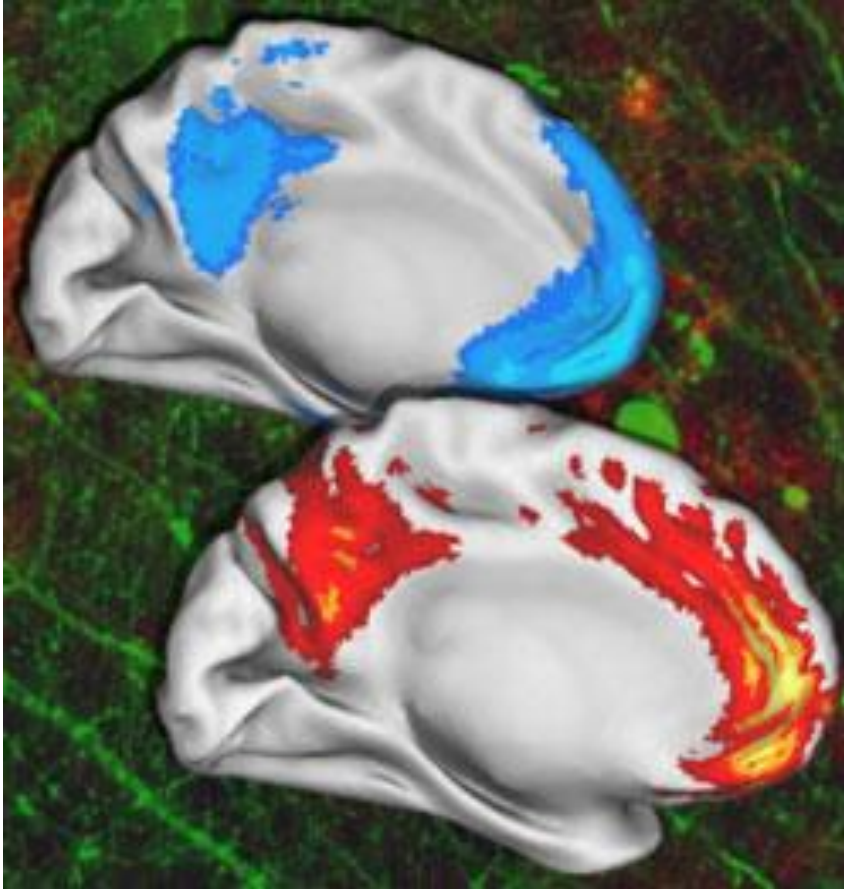


Exam stress and performance

- High math anxiety led to smaller working memory
 - Ashcraft MH, Kirk EP. J Exp Psychol Gen. 2001 Jun;130(2):224-37.
- “Performance pressure harms individuals most qualified to succeed by consuming the working memory capacity that they rely on for their superior performance.”
 - Beilock SL, Carr TH. Psychol Sci. 2005;16(2):101-5.



The Default Brain



- Mindful
 - Associated with paying attention
 - Brain efficient and quiet
 - Attention and executive functioning centres working well
- Default state (mode)
 - Mind inattentive, distracted, idle, recalling past, daydreaming
 - Areas active in default mode similar to areas affected by Alzheimer's Disease

The Default Brain associated with:

- **Stress** (Brewer et al., 2011)
- **Anxiety** (Zhao et al., 2007)
- **Depression** (Greicius et al., 2007)
- **ADHD** (Uddin et al., 2008a)
- **Schizophrenia** (Pomarol-Clotet et al., 2008)
- **Autism** (Kennedy & Courchesne, 2008)
- **Alzheimer's disease** (Firbank et al., 2007)
- **Criminal recidivism** (Aharoni et al., 2013)
- **Reduced performance** (Brewer et al., 2011)

- “The faculty of voluntarily bringing back a wandering attention over and over again, is the very root of judgment, character, and will. No one is compos sui if he have it not. An education which should improve this faculty would be the education par excellence.”

- William James, Principles of Psychology, 1890

Mindfulness and attention regulation

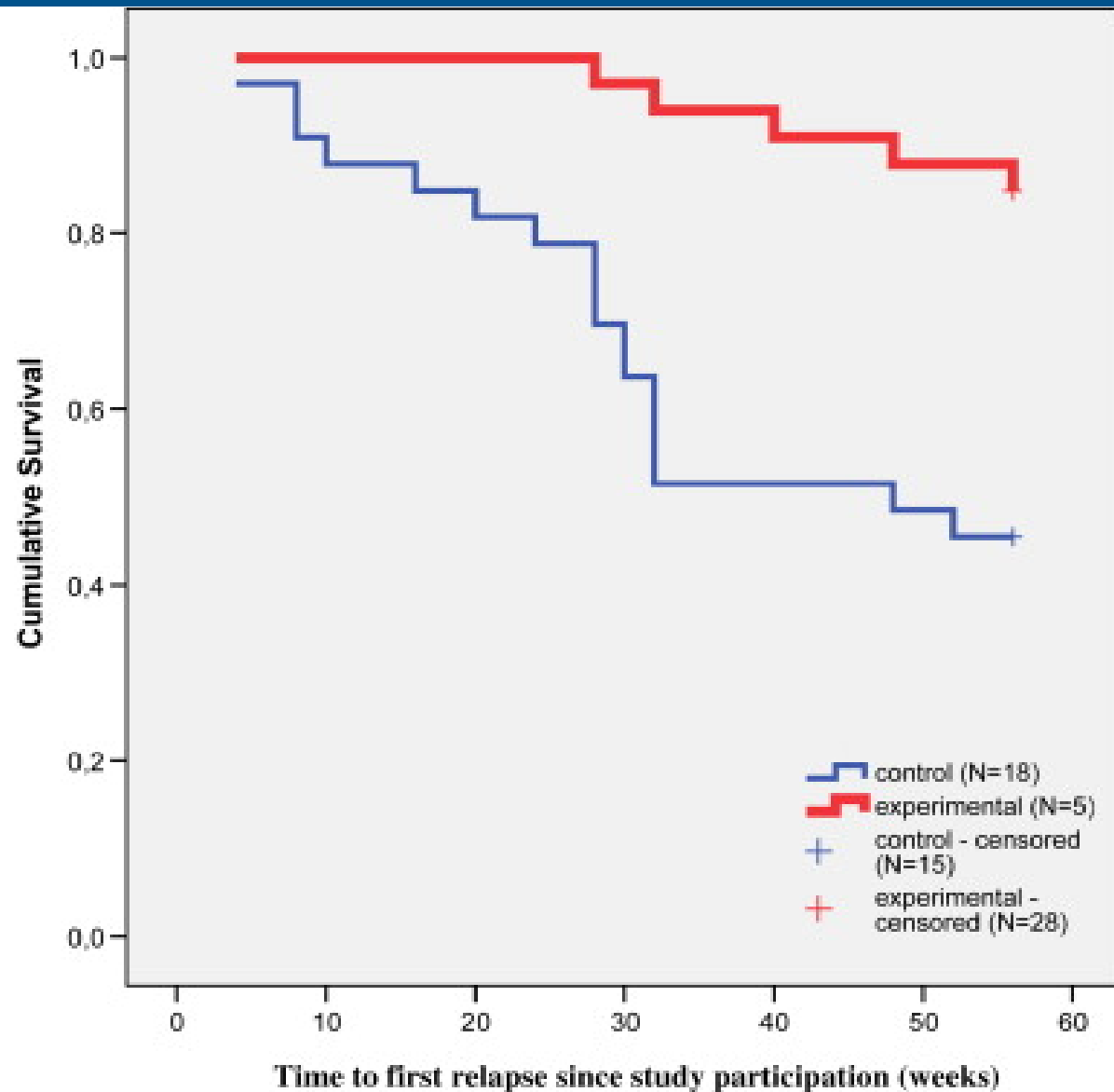
- Mindfulness involves **attention** and **attitude**
- Attention regulation has three aspects
 1. To know where our attention is
 2. To prioritise where the attention needs to be
 3. For the attention to go there and stay there
- Mindful attitude
 1. Openness
 2. Curiosity
 3. Acceptance
 4. Self-compassion

Applications of mindfulness

- **Mental health:** E.g. therapeutic application for depression, anxiety, panic disorder, stress, emotional regulation, addiction, sleep problems, eating disorders, psychosis, ADHD, autism, reduced burnout, greater resilience
- **Neuroscience:** E.g. structural and functional changes in the brain, stimulation of neurogenesis, possible prevention of dementia and cognitive decline, down-regulating the amygdala, improved executive functioning and working memory, reduced default mental activity, improved self-monitoring and cognitive control, improved perception of sensory input
- **Clinical:** E.g. therapeutic applications for pain management, symptom control, coping with chronic illness (e.g. cancer and MS), metabolic and hormonal benefits (e.g. reduced allostatic load, cortisol), facilitating lifestyle change (e.g. weight management, smoking cessation), improved immunity (e.g. improved resistance, reduced inflammation), improved genetic function and repair, slower ageing as measured by telomeres
- **Performance:** E.g. sport, academic, leadership qualities, mental flexibility and problem solving, decision-making, sunk-cost bias
- **Education:** E.g. improved problem-solving, executive functioning and working memory, better focus, less behavioural problems, fostering growth mindsets
- **Relationships:** E.g. greater emotional intelligence and empathy, improved communication, reduced vicarious stress and carer burnout
- **Spiritual**

MBCT and depression

- RCT investigated the effects of Mindfulness-based cognitive therapy (MBCT) on the relapse in depression, time to first relapse and the quality of life
 - 106 recovered depressed patients with a history of at least 3 depressive episodes
 - Treatment as usual (TAU) vs MBCT plus TAU 1 year f/up
- Relapse/recurrence significantly reduced and the time until first relapse increased in the MBCT plus TAU c/w TAU
- MBCT plus TAU group also showed a significant reduction in both short and longer-term depressive mood, better mood states and quality of the life
 - Godfrin KA, van Heeringen C. The effects of mindfulness-based cognitive therapy on recurrence of depressive episodes, mental health and quality of life: A randomized controlled study. Behav Res Ther. 2010 Aug;48(8):738-46.



Godfrin KA, van Heeringen C. Behav Res Ther. 2010 Aug;48(8):738-46.

Mindfulness, adolescents and mental health

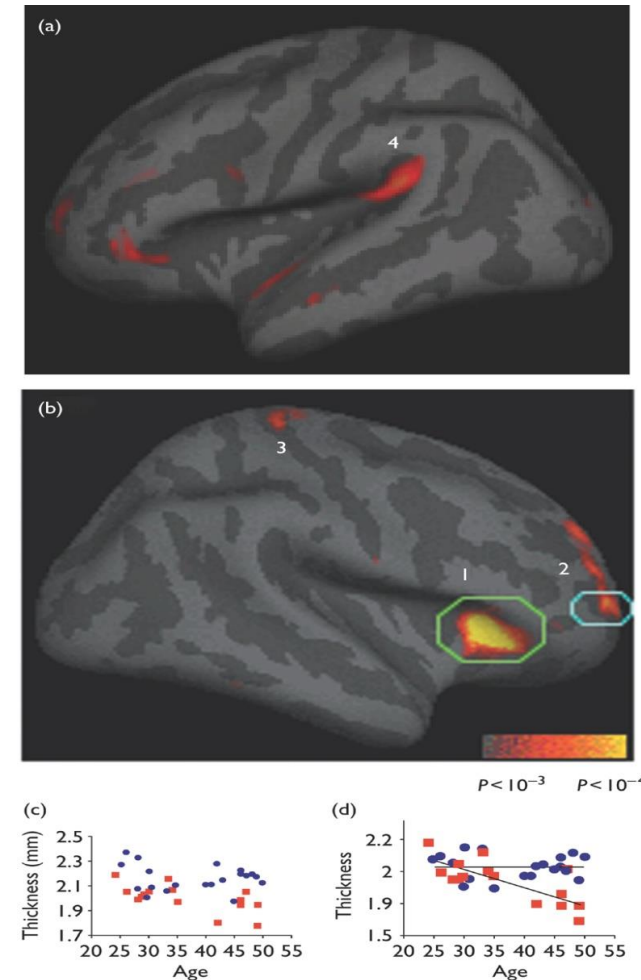
- “Mindfulness-based stress reduction (MBSR) program for adolescents age 14 to 18 years with heterogeneous diagnoses in an outpatient psychiatric facility.
- Relative to treatment-as-usual control participants, those receiving MBSR self-reported reduced symptoms of anxiety, depression, and somatic distress, and increased self-esteem and sleep quality.”
 - Biegel et al. Mindfulness-based stress reduction for the treatment of adolescent psychiatric outpatients: A randomized clinical trial. Journal of consulting and clinical psychology (2009) vol. 77 (5) pp. 855-66
<http://dx.doi.org/10.1037/a0016241>

Online mindfulness course

- Randomized waitlist control study aimed to assess:
 - Internet-based instructor-led mindfulness intervention for its effect on work-related rumination, fatigue, and sleep quality
 - different facets of mindfulness (i.e. acting with awareness, describing, non-judging, and non-reacting)
- Participants in mindfulness intervention reported significantly lower work-related rumination and fatigue, and significantly higher levels of sleep quality compared with waitlist control
- Effects maintained at 6-month follow-up: medium to large effect sizes
- Acting with awareness most important factor
 - Querstret D, Cropley M, Fife-Schaw C. Internet-Based Instructor-Led Mindfulness for Work-Related Rumination, Fatigue, and Sleep: Assessing Facets of Mindfulness as Mechanisms of Change. A Randomized Waitlist Control Trial. J Occup Health Psychol. 2016 Apr 7. [Epub ahead of print]

Mindfulness and the brain

- Mindfulness training improves functioning in areas related to executive functioning, attentional control, self-regulation, sensory processing, memory and regulation of the stress response
 - Thickening of cortex in regions associated with attention, self-awareness and sensory processing thicker in meditators
 - “The regular practice of meditation may have neuroprotective effects and reduce the cognitive decline associated with normal aging.”
 - Hölzel BK, Carmody J, Evans KC, et al. Stress reduction correlates with structural changes in the amygdala. *Soc Cogn Affect Neurosci*. 2010 Mar;5(1):11-7.
 - Hölzel BK, Carmody J, Vangel M, et al. Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Res*. 2011 Jan 30;191(1):36-43.
 - Kilpatrick LA, Suyenobu BY, Smith SR, et al. Impact of Mindfulness-Based Stress Reduction training on intrinsic brain connectivity. *Neuroimage*. 2011 May 1;56(1):290-8.
 - Lazar SW, Kerr CE, Wasserman RH, et al. *Neuroreport*. 2005;16(17):1893-1897.
 - Pagnoni G, Cekic M. *Neurobiology of Aging*. 2007;28(10):1623-7.

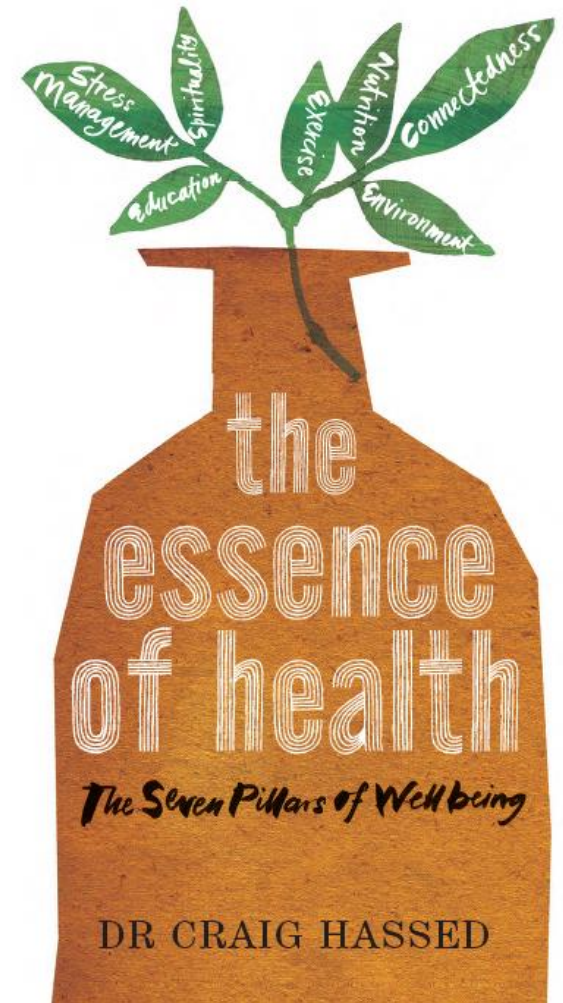


Default mode network

- Default mental activity flourishes in various forms of psychopathology including depression, anxiety, schizophrenia and autism
- Default activity decreased or deactivated when paying attention (e.g. experienced meditators)
- In experienced meditators but not novices, even when the default mode network is active, brain regions associated with self-monitoring and cognitive control are co-activated
 - Reduces vulnerability to default thinking
 - Brewer JA, Worhunsky PD, Gray JR, et al. Meditation experience is associated with differences in default mode network activity and connectivity. Proc Natl Acad Sci U S A. 2011 Dec 13;108(50):20254-9.

Essence program and student wellbeing

- Study of 2006 cohort of medical students found that 90.5% of students personally applied strategies
- Improved student wellbeing noted on all measures of wellbeing even in the pre-exam period
 - Reduced depression, hostility and anxiety subscale
 - Improved psychological and physical quality of life
 - Hassed C, de Lisle S, Sullivan G, Pier C. Adv Health Sci Educ Theory Pract. 2008 May 31. [Epub ahead of print]



Mindfulness and student wellbeing

- Study investigated relationships among engagement in self-care behaviours, dispositional mindfulness, and psychological distress
 - 207 Australian medical students aged across the 5 years of the Monash University medical course
 - Online survey: demographics, the Five Facet Mindfulness Questionnaire, the Health-Promoting Lifestyle Profile II, and the DASS
- Significant correlations between distress and both mindfulness and self-care
- Dispositional mindfulness a significant moderator of the relationship between self-care and psychological distress
- “The present study points to the potential of self-care and mindfulness to decrease medical student distress and enhance well-being.”
 - Slonim J, Kienhuis M, Di Benedetto M, Reece J. The relationships among self-care, dispositional mindfulness, and psychological distress in medical students. Med Educ Online. 2015 Jun 24;20:27924. doi: 10.3402/meo.v20.27924.

Mindfulness and student performance

- Three studies examined the effects of mindfulness meditation on the knowledge retention of tertiary students
- Participants from three introductory psychology courses randomly received either brief meditation training or rest
- Then listened to a class lecture and took a post-lecture quiz that assessed students' knowledge of lecture material
- Results indicated that meditation improved students' retention of the information conveyed during the lecture in each of the three experiments
 - Jared T. Ramsburg, Robert J. Youmans. Meditation in the Higher-Education Classroom: Meditation Training Improves Student Knowledge Retention during Lectures. *Mindfulness*, 2013; DOI: [10.1007/s12671-013-0199-5](https://doi.org/10.1007/s12671-013-0199-5)

Mindfulness and exam anxiety

- Reduction of anxiety and improved performance of students on high stakes exams through the application of mindfulness training
- Probably because mindfulness frees up working memory sources occupied by anxious preoccupation
 - Bellinger DB, DeCaro MS, Ralston PA. Mindfulness, anxiety, and high-stakes mathematics performance in the laboratory and classroom. *Conscious Cogn.* 2015 Sep 12;37:123-132. doi: 10.1016/j.concog.2015.09.001.

Mindfulness and mental flexibility

- Mindfulness leads to:
 - reduced cognitive rigidity via the tendency to be "blinded" by experience
 - “a reduced tendency to overlook novel and adaptive ways of responding due to past experience, both in and out of the clinical setting.”
 - Greenberg J, Reiner K, Meiran N. "Mind the trap": mindfulness practice reduces cognitive rigidity. PLoS One. 2012;7(5):e36206. Epub 2012 May 15.

Mindfulness and doctor wellbeing

- An 8-week mindfulness program: improvements on all measures of wellbeing including:
 - Mindfulness
 - Burnout (emotional exhaustion; depersonalization; personal accomplishment)
 - Empathy and responsiveness to psychosocial aspects
 - Total mood disturbance
 - Personality (conscientiousness; emotional stability)
- Improvements in mindfulness correlated with improvements on other scales
 - Krasner MS, Epstein RM, Beckman H, et al. JAMA. 2009;302(12):1338-40.

Roots of Decision Errors

- Various forms of unconscious bias impair decision making
 - Confirmation bias: the pursuit of data that support a diagnosis over data that refute it
 - Anchoring bias: a resistance to adapting appropriately to subsequent data that suggest alternative diagnoses
- Mindfulness helps people to be aware of bias and not take bias as fact
 - Sibinga EM, Wu AW. Clinician Mindfulness and Patient Safety. JAMA 2010;304(22):2532-3.

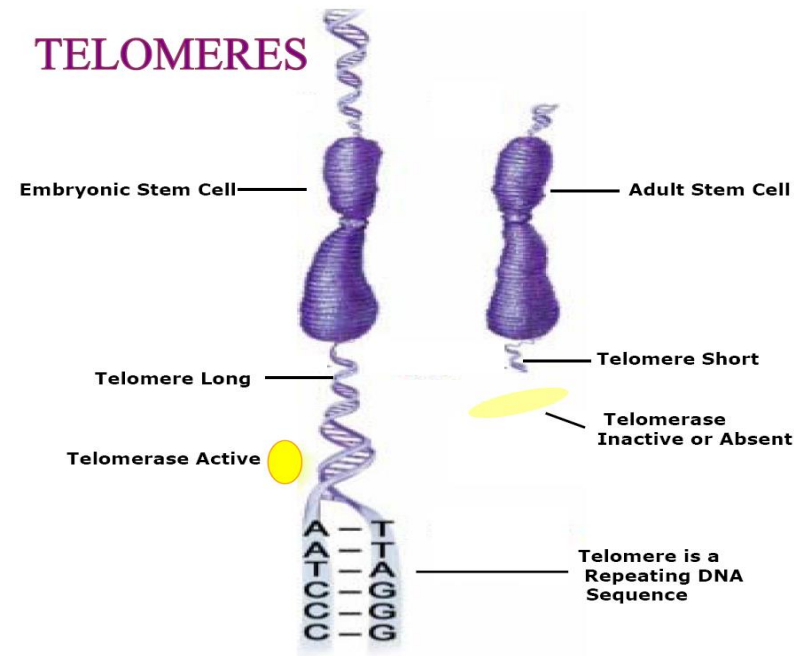
Emotional Intelligence & mindfulness

- Mindfulness related to aspects of personality and mental health
 - Lower neuroticism, psychological symptoms, experiential avoidance, dissociation
 - Higher emotional intelligence and absorption
 - Baer RA, et al. Assessment. 2004;11(3):191-206.

EI	Definition
Self-awareness	Ability to recognise and understand emotions, drives and effects
Self-regulation	Can control or redirect disruptive impulses, can think before acting
Motivation	Passion for work that goes beyond money or status, energy and persistence
Empathy	Ability to understand emotions of others, skill in interacting with others
Social skill	Can manage relationships and build networks, can find common ground, rapport

Mindfulness and cellular ageing

- Meditation may slow genetic ageing and enhance genetic repair
 - “...we propose that some forms of meditation may have salutary effects on telomere length by reducing cognitive stress and stress arousal and increasing positive states of mind and hormonal factors that may promote telomere maintenance.”
 - Epel E, Daubenmier J, Moskowitz JT, Folkman S, Blackburn E. Can meditation slow rate of cellular aging? Cognitive stress, mindfulness, and telomeres. Ann N Y Acad Sci. 2009 Aug;1172:34-53.



Applying mindfulness at university

- Formal practice (meditation)
 - Full stops: 5-10 minutes twice a day
 - 15-60 seconds as required
- Informal practice
 - The senses are a gateway to the present moment: listening, eating, walking, reading, learning, communicating...
 - Move through the day one step, moment, job at a time
 - Avoid multitasking
 - Use screen-time discerningly
- Cultivate a mindful attitude
 - E.g. open, curious, flexible, non-attached...
 - Do things in non-habitual ways
 - Look for novelty / differences
- Mindfulness-based cognitive practices
 - Perception
 - Letting go
 - Acceptance
 - Presence of mind
- Contextualise and integrate it into daily life

co-author of the bestselling *Mindfulness for Life*

DR CRAIG HASSED
& DR RICHARD CHAMBERS

mindful learning

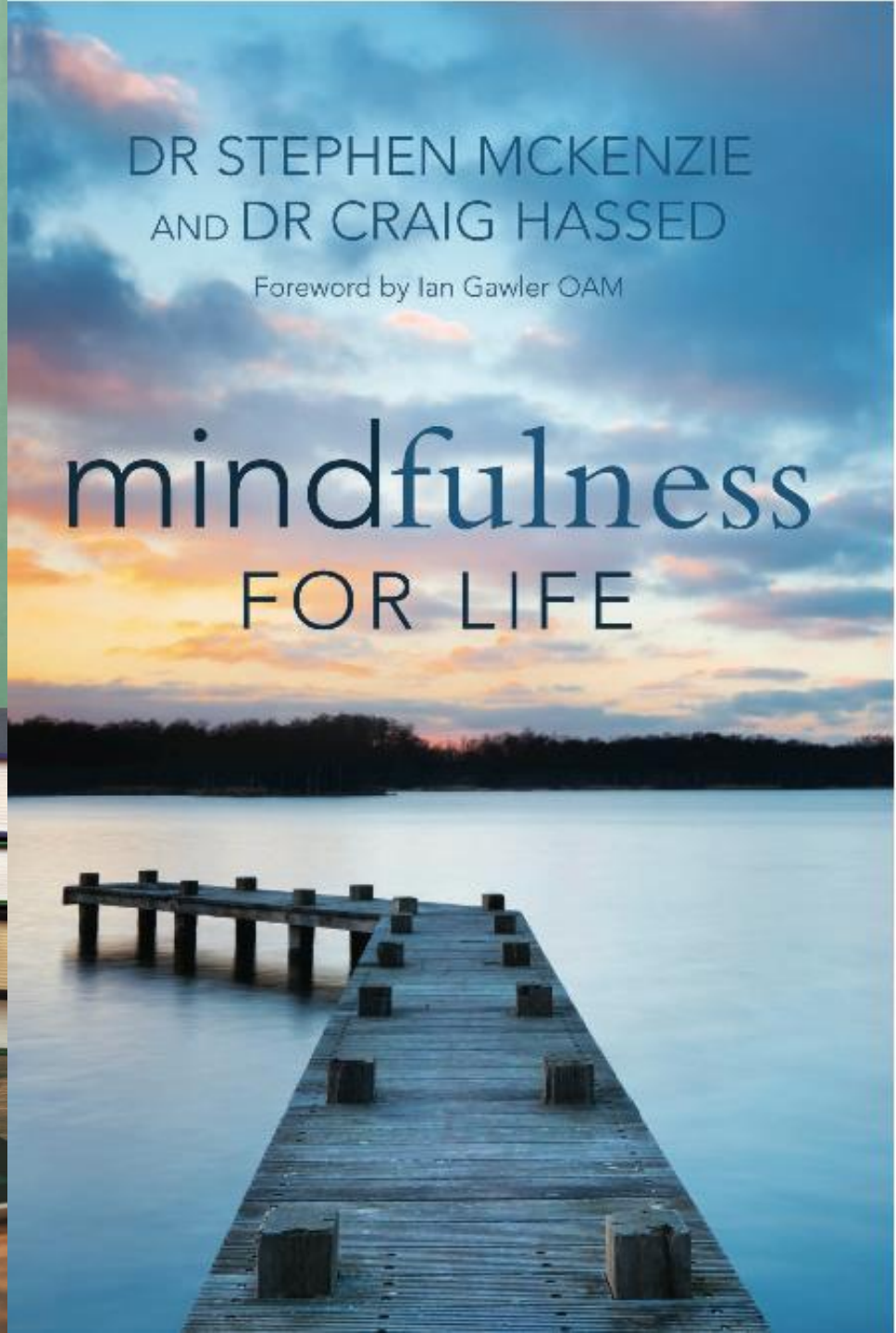
Reduce stress and improve brain
performance for effective learning



DR STEPHEN MCKENZIE
AND DR CRAIG HASSED

Foreword by Ian Gawler OAM

mindfulness FOR LIFE



Free 6-week online mindfulness course

- <https://www.futurelearn.com/courses/mindfulness-wellbeing-performance>
- Collaboration between Monash University and FutureLearn (UK)