

**Brainclinics**<sup>®</sup>  
F O U N D A T I O N

# WORKSHOP DIAGNOSTIEK EN BEHANDELING VAN SLAAP BINNEN DE PSYCHIATRIE: KORTE INTRODUCTIE EN VOORBEELD

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Brainclinics Foundation  
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Department of Psychiatry (Location AMC)

Faculty of Psychology & Neuroscience  
Maastricht University

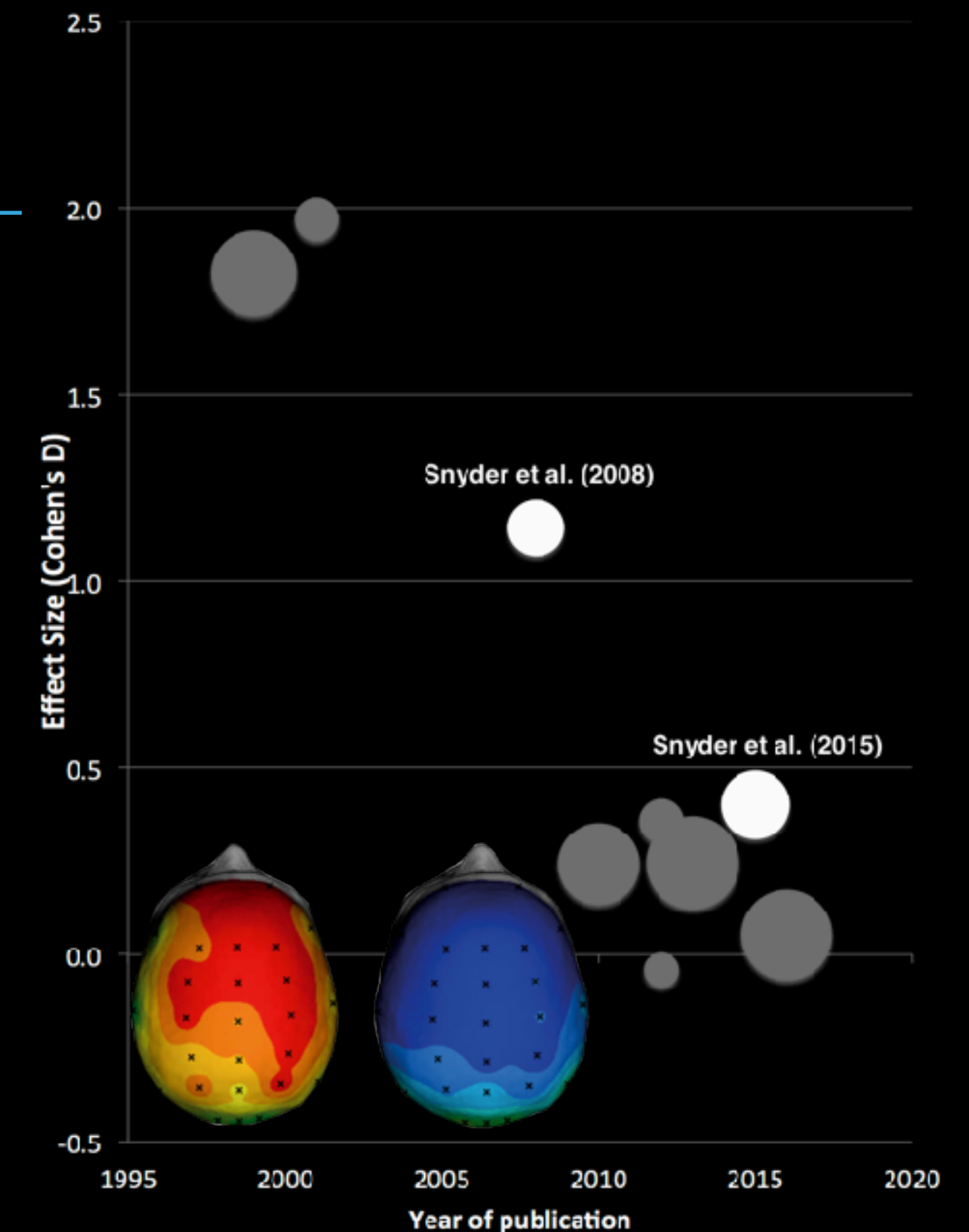
# DISCLOSURES

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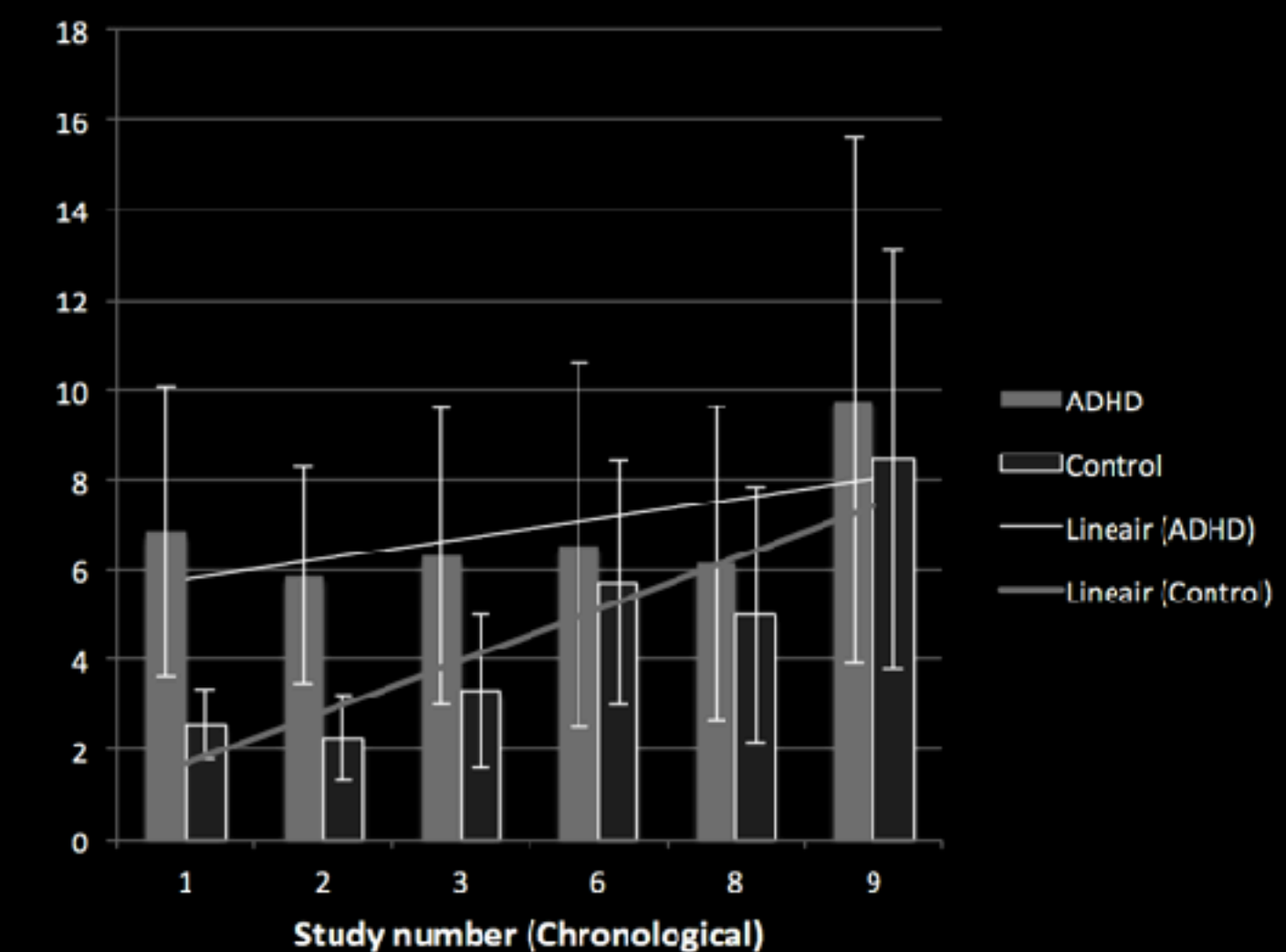
- Unpaid Research Director at Brainclinics Foundation (non-profit)
- Adviser and shareholder (<5%) at neuroCare Group
- Co-inventor on 4 patent applications but no royalties.
- Brainclinics has received research funding of NIMH, Brain Resource, UrgoTech and neuroCare Group and equipment support from Deymed Diagnostic, neuroConn and MagVenture.

# SLEEP DURATION AND SLEEP RESTRICTION

- Sleep duration associated with school performance+, executive function+ and internalizing- and externalizing- behavior (Astill, van der Heijden, van Ijzendoorn & van Someren, 2012: Meta-analysis: N=35.936 children)
- Sleep duration for children decreased across the last 100 years (Matricciani, Olds & Petkov, 2012; Meta-analysis N=690.747 children)



Theta/Beta ratio (with SD) 6-18 yrs.

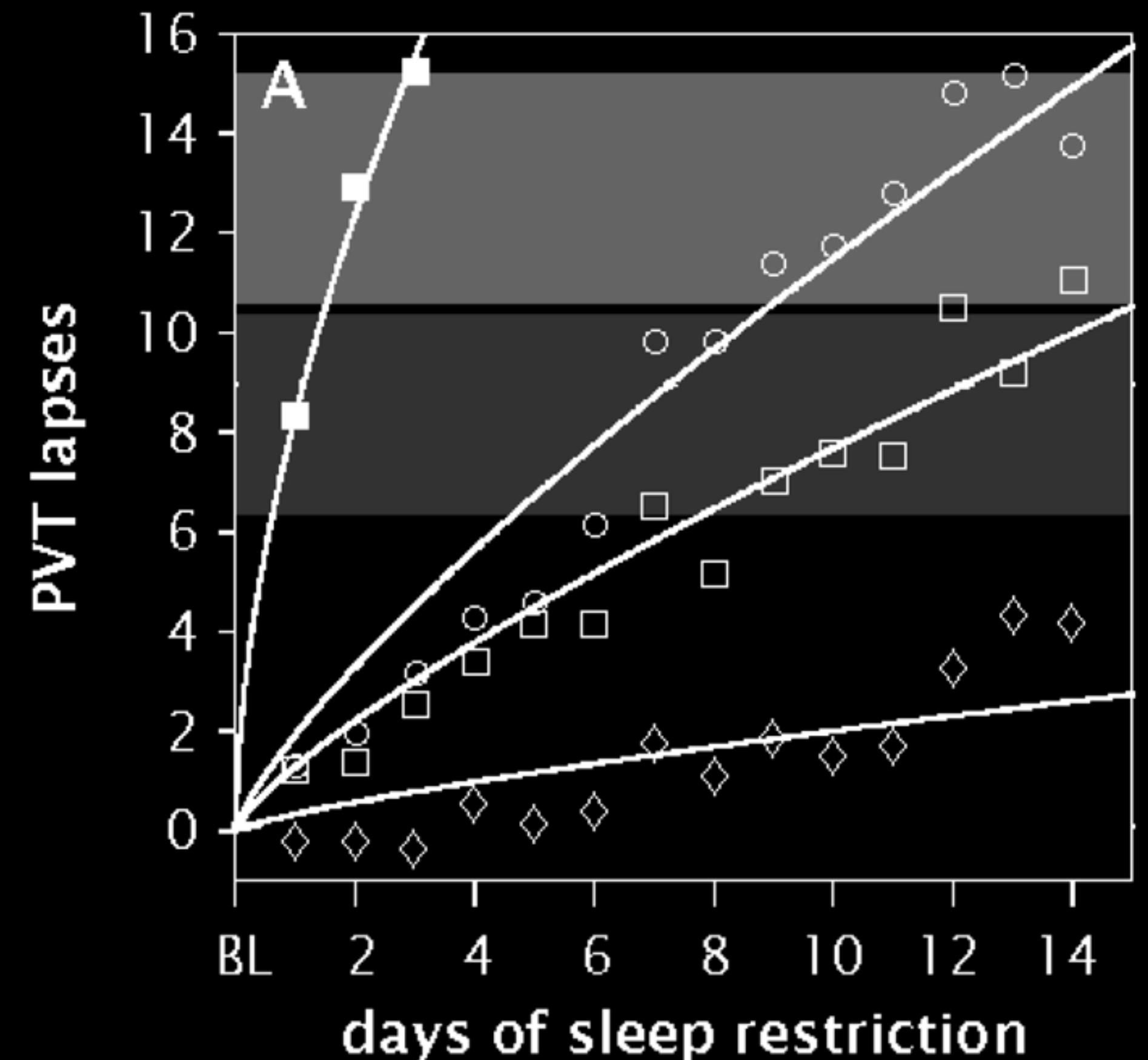


# SLEEP RESTRICTION AND CONCENTRATION

The Cumulative Cost of Additional Wakefulness: Dose-Response Effects on Neurobehavioral Functions and Sleep Physiology From Chronic Sleep Restriction and Total Sleep Deprivation

Hans P.A. Van Dongen, PhD<sup>1</sup>; Greg M. Slinn, MS, MA<sup>1</sup>; Janet M. Mullington, PhD<sup>2</sup>; David F. Dinges, PhD<sup>1</sup>

**Conclusions:** Since chronic restriction of sleep to 6 h or less per night produced cognitive performance deficits equivalent to up to 2 nights of total sleep deprivation, it appears that even relatively moderate sleep restriction can seriously impair waking neurobehavioral functions in healthy adults. Sleepiness ratings suggest that subjects were largely unaware of these increasing cognitive deficits, which may explain why the impact of chronic sleep restriction on waking cognitive functions is often assumed to be benign. Physiological sleep responses to chronic restriction did not mirror waking neurobehavioral responses, but cumulative wakefulness in excess of a 15.84 h predicted performance lapses across all four experimental conditions. This suggests that sleep debt is perhaps best understood as resulting in additional wakefulness that has a neurobiological “cost” which accumulates over time.



# ADHD AND SLEEP

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Many sleep problems affecting sleep duration and sleep efficiency are more prevalent in ADHD:

- 20% prevalence of sleep breathing disorders/sleep apnea (Silvestri et al., 2009)
- 70-80% sleep onset insomnia (SOI) characterized by delayed circadian phase (van der Heijden et al., 2005; 2007; van Veen et al., 2010): Circadian pathway
- ...

Treat these as ‘Sleep Phenotypes of ADHD’? (Miano, Parisi & Villa, 2012)

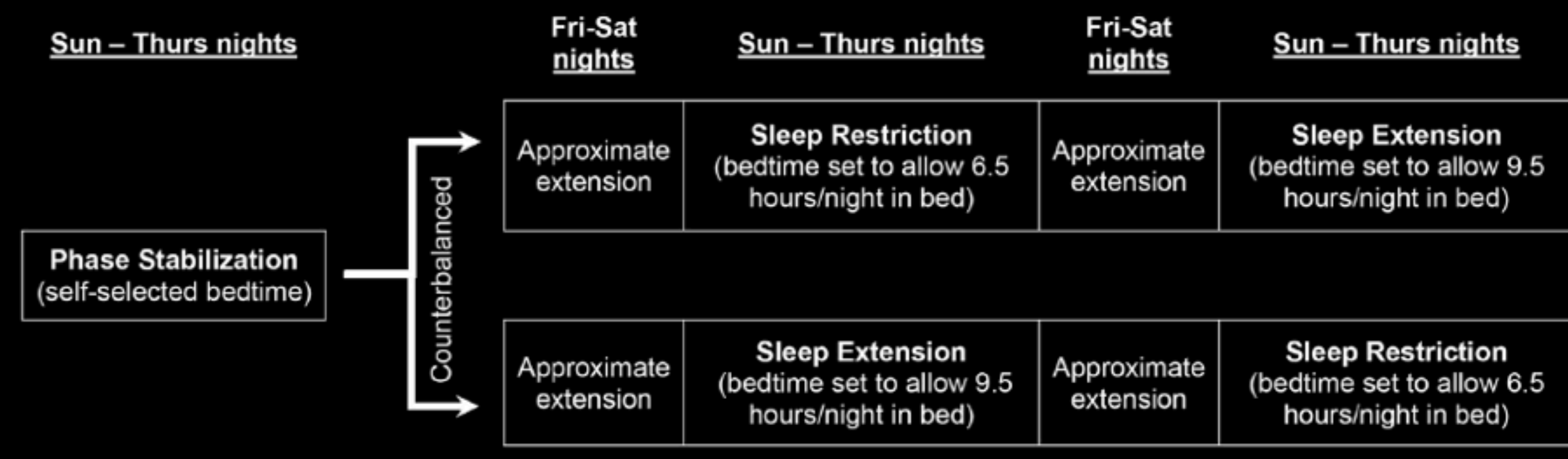
- Treatment of sleep apnea (adenotonsillectomy) resulted in substantial improvement on attention and ‘ADHD behavior’ (Huang et al., 2007).
- Chronobiological treatments for SOI in ADHD: LT Melatonin (Hoebert et al., 2009) and early morning bright light (Rybak et al., 2006)
- SMR Neurofeedback.

# SLEEP RESTRICTION AND CONCENTRATION IN ADHD

## Shortened Sleep Duration Causes Sleepiness, Inattention, and Oppositionality in Adolescents With Attention-Deficit/Hyperactivity Disorder: Findings From a Crossover Sleep Restriction/Extension Study

Stephen P. Becker, PhD, Jeffery N. Epstein, PhD, Leanne Tamm, PhD, Alina A. Tilford, MEd, Clair M. Tischner, BA, Paul A. Isaacson, MA, John O. Simon, MA, Dean W. Beebe, PhD

**FIGURE 1** Sleep Restriction/Extension Protocol Using a Within-Person Counterbalanced Design



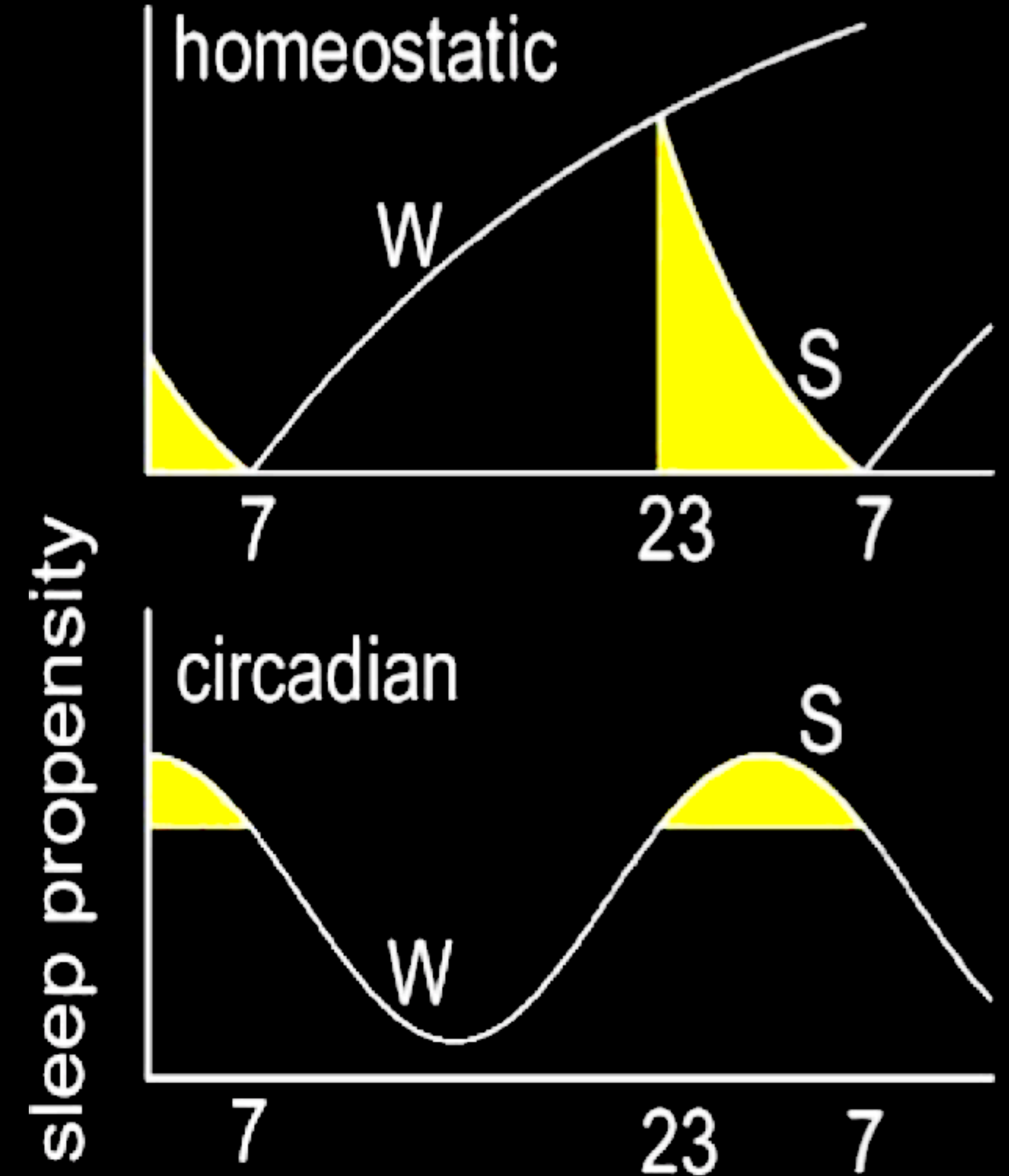
- Already low baseline sleep duration
- Healthy volunteers, for longer periods?

**TABLE 2** Differences in Daytime Sleepiness, Attention, and Behavior Ratings and Cont Performance During Sleep Restriction (SR) and Sleep Extension (SE)

	SR	SE	<i>d</i>
	Mean ± SD	Mean ± SD	
Daytime sleepiness			
Sleep diary (parent) <sup>a</sup>	1.24 ± 0.75	0.33 ± 0.36	1.51
Sleep diary (adolescent) <sup>a</sup>	0.93 ± 0.68	0.41 ± 0.47	1.00
PDSS (adolescent)	1.85 ± 0.78	1.08 ± 0.72	1.05
Attention			
IOWA-10 IN (parent) <sup>a</sup>	1.42 ± 0.81	1.13 ± 0.80	0.53
VADPRS ADHD-IN (parent)	1.57 ± 0.72	1.25 ± 0.77	0.60
Conners-3 ADHD-IN (adolescent)	7.48 ± 4.22	7.38 ± 4.67	0.04
SCT (parent)	1.50 ± 0.95	0.73 ± 0.74	1.00
SCT (adolescent)	0.83 ± 0.63	0.64 ± 0.49	0.44
Behavior			
IOWA-10 HI (parent) <sup>a</sup>	0.66 ± 0.70	0.69 ± 0.69	0.08
VADPRS ADHD-HI (parent)	0.58 ± 0.63	0.58 ± 0.70	0.01
IOWA-10 ODD (parent) <sup>a</sup>	0.58 ± 0.56	0.38 ± 0.54	0.43
VADPRS ODD (parent)	0.65 ± 0.59	0.49 ± 0.58	0.33
Conners-3 ADHD-HI (adolescent)	4.44 ± 3.40	5.13 ± 3.55	0.41

# TWO-PROCESS MODEL OF SLEEP REGULATION

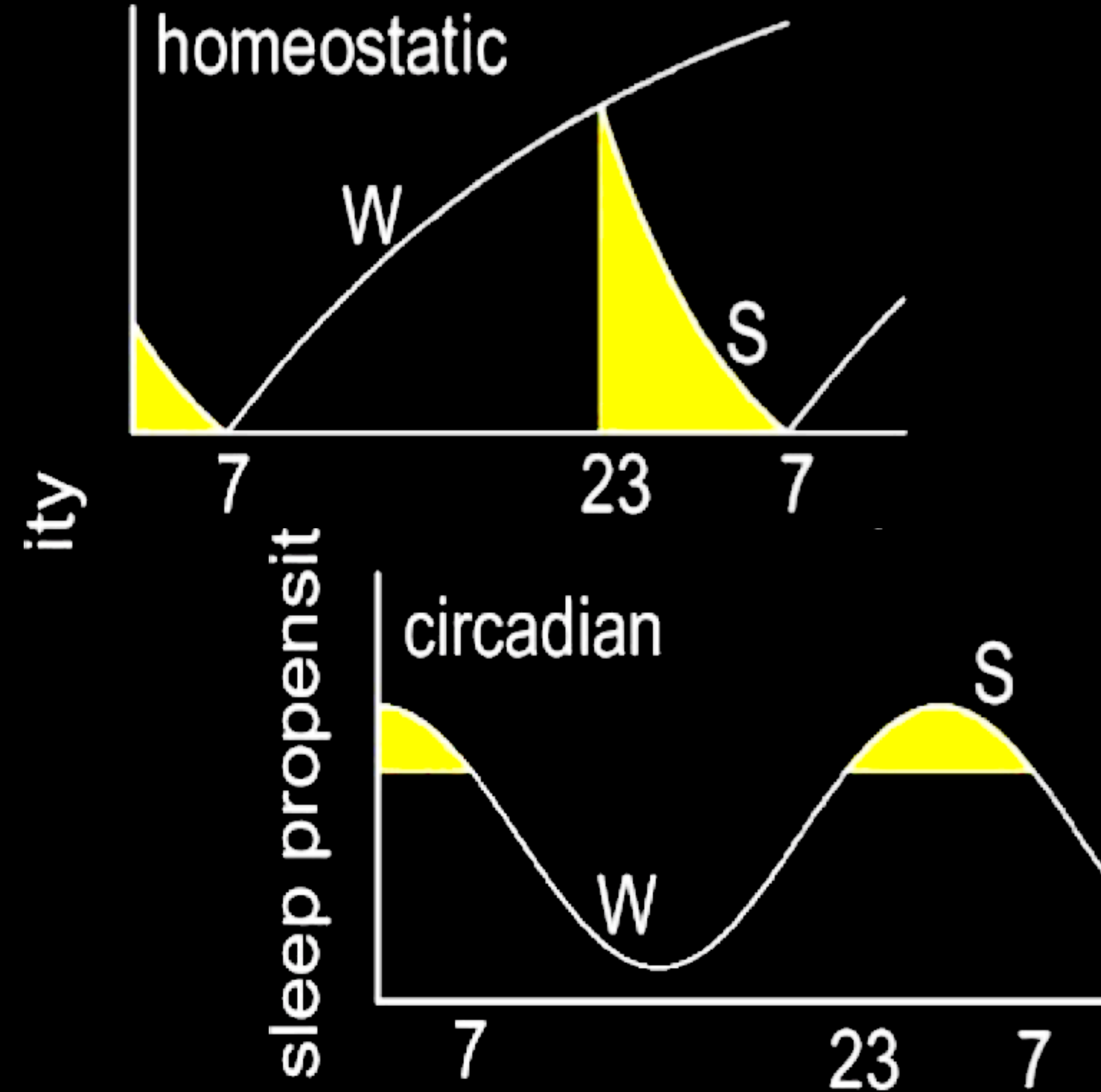
- Homeostatic process is responsible for the rise of sleep propensity during waking and its dissipation during sleep
- Circadian process is basically independent of prior sleep and waking (day-night)



- Hypersomnia: Not enough sleep pressure, rigid vigilance regulation: Difficulty falling asleep
- Delayed circadian phase: Difficulty falling asleep:

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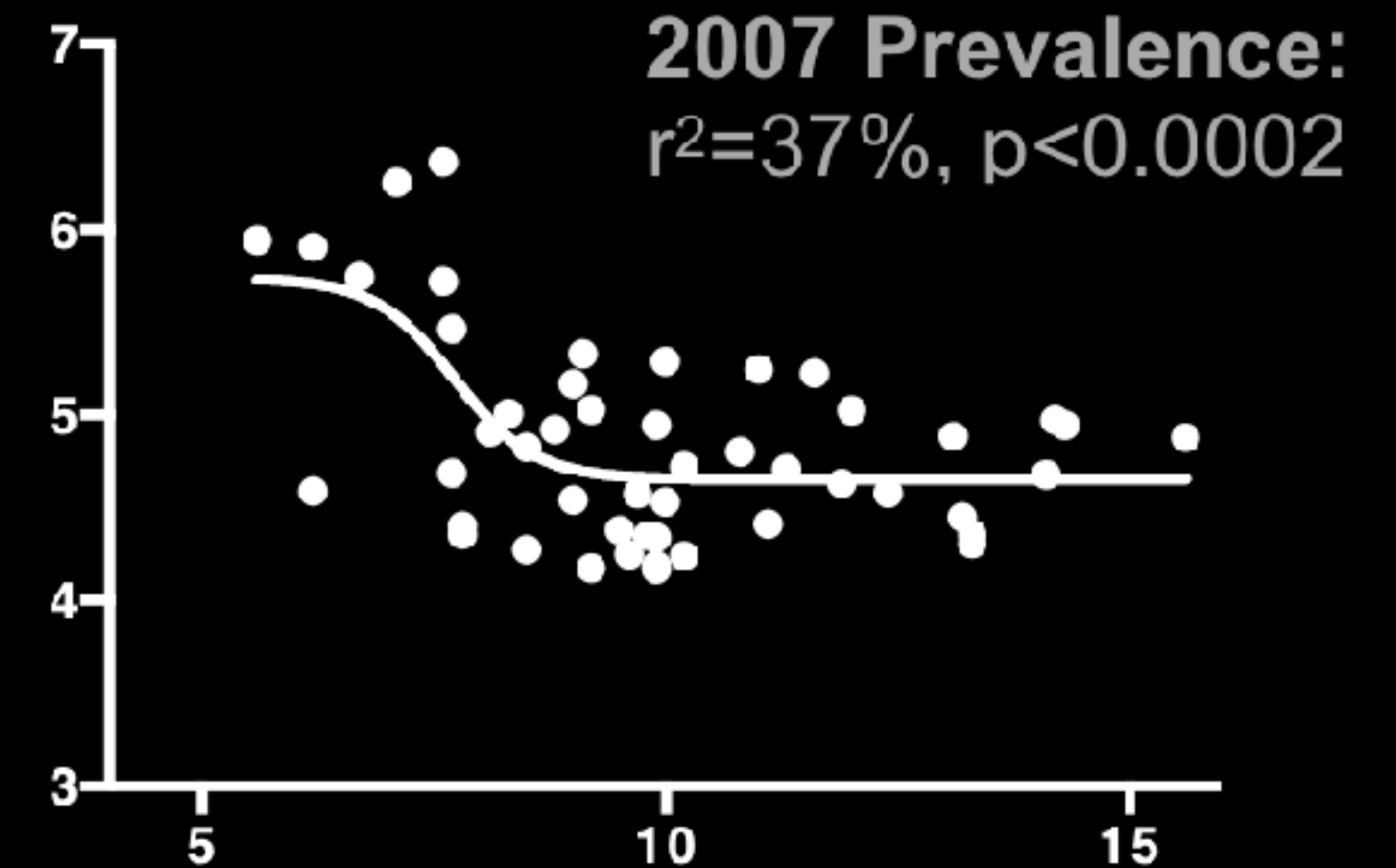
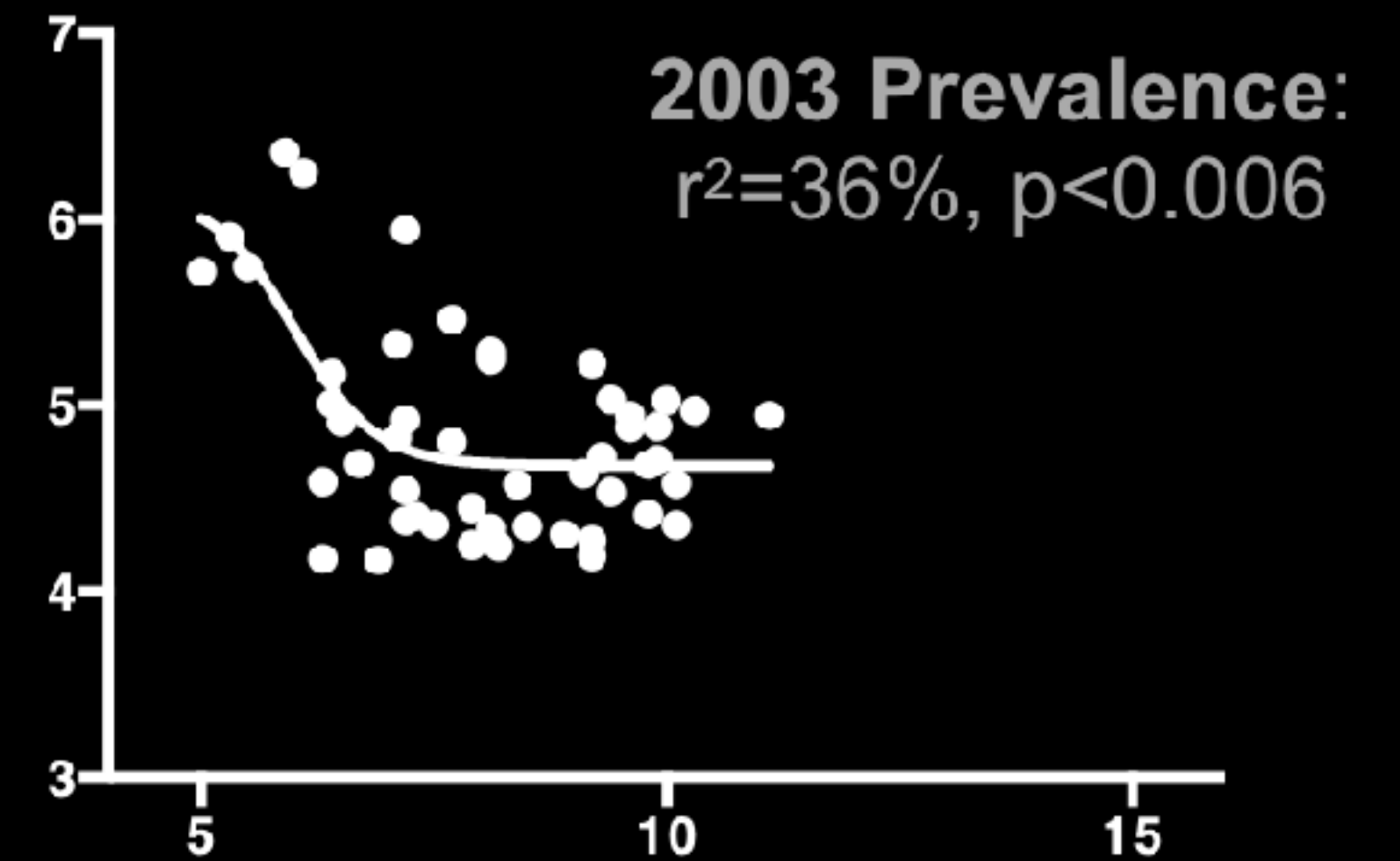
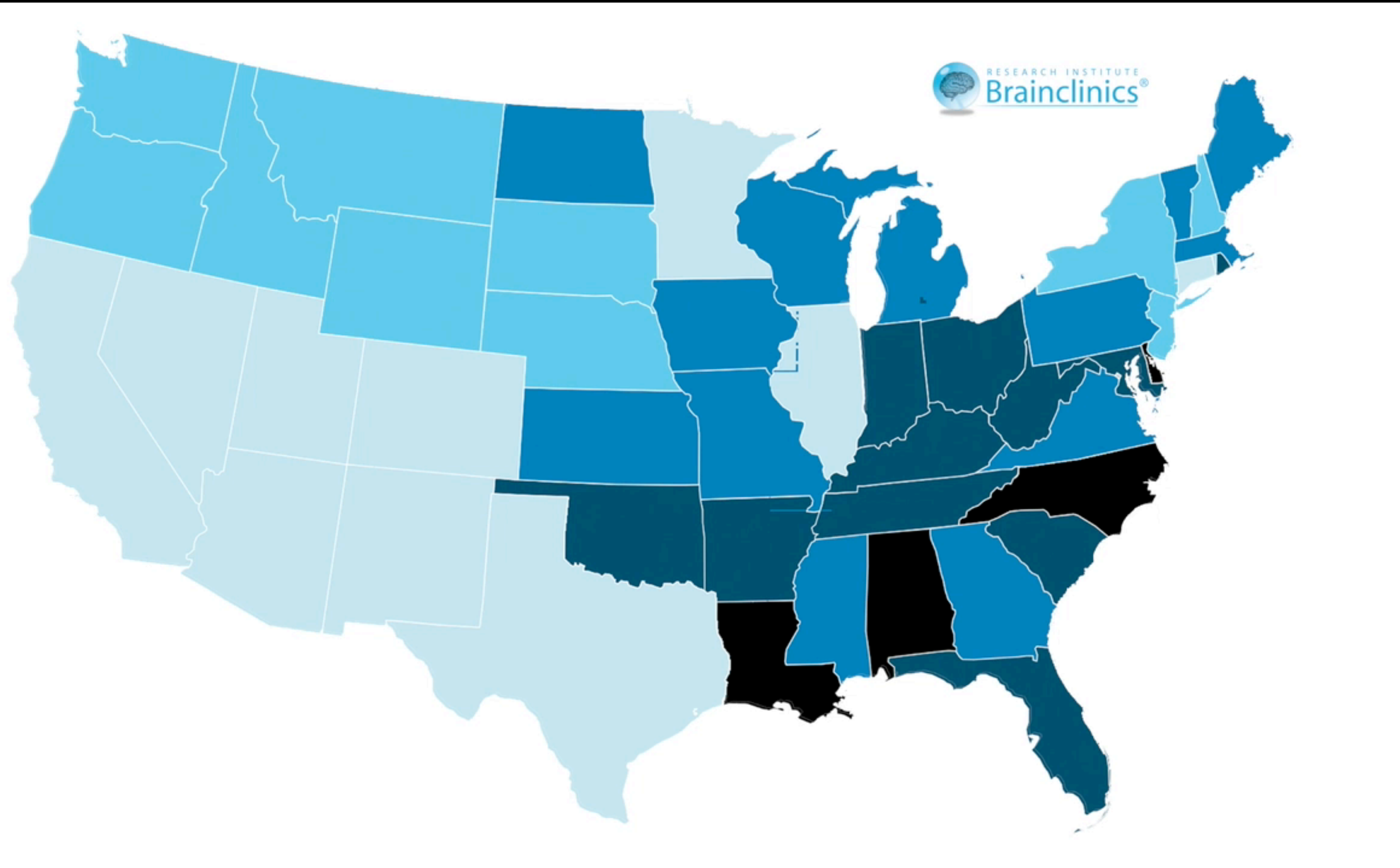


# SUNLIGHT INTENSITY AND ADHD PREVALENCE

ARCHIVAL REPORT

## Geographic Variation in the Prevalence of Attention-Deficit/Hyperactivity Disorder: The Sunny Perspective

Martijn Arns, Kristiaan B. van der Heijden, L. Eugene Arnold, and J. Leon Kenemans

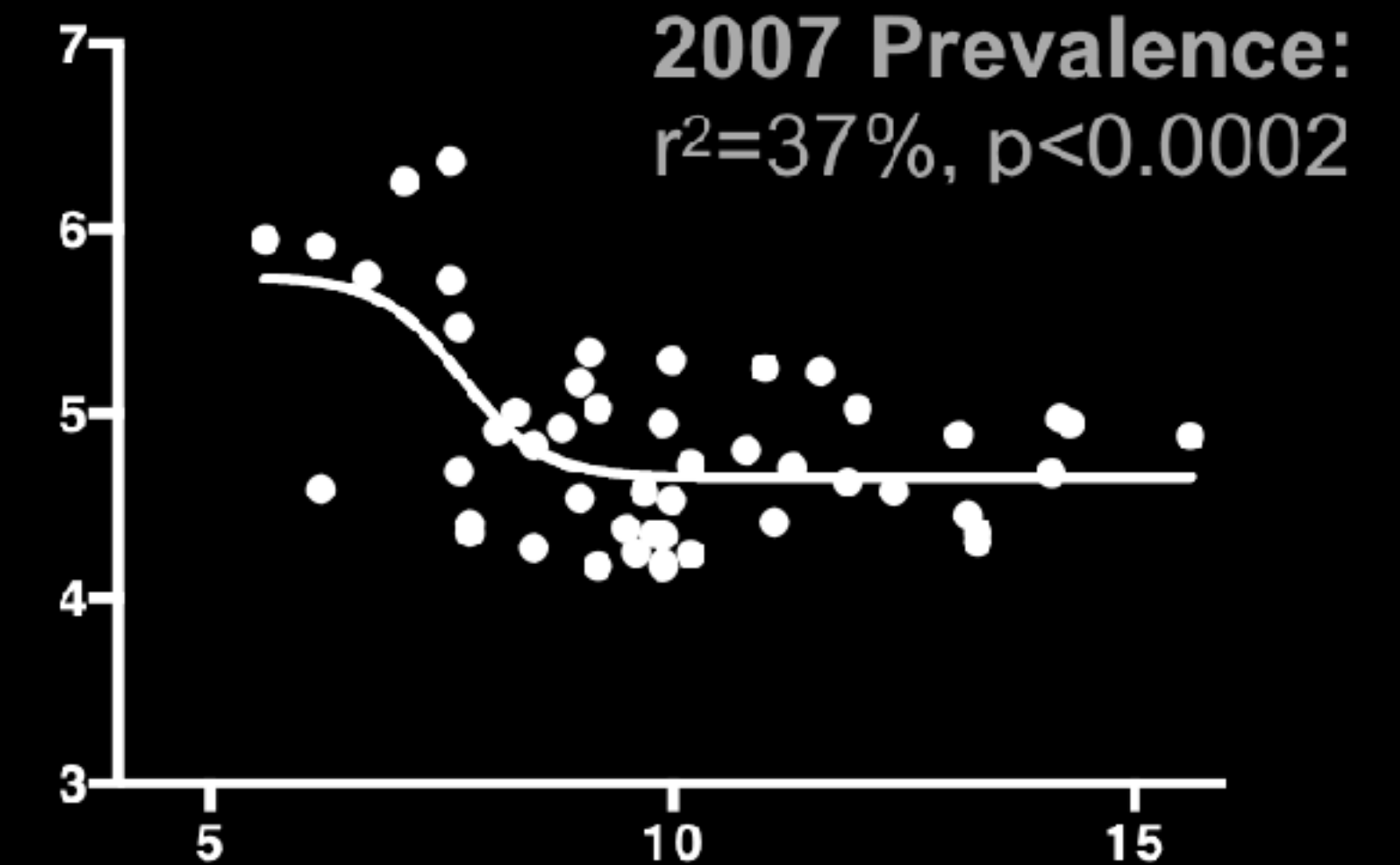
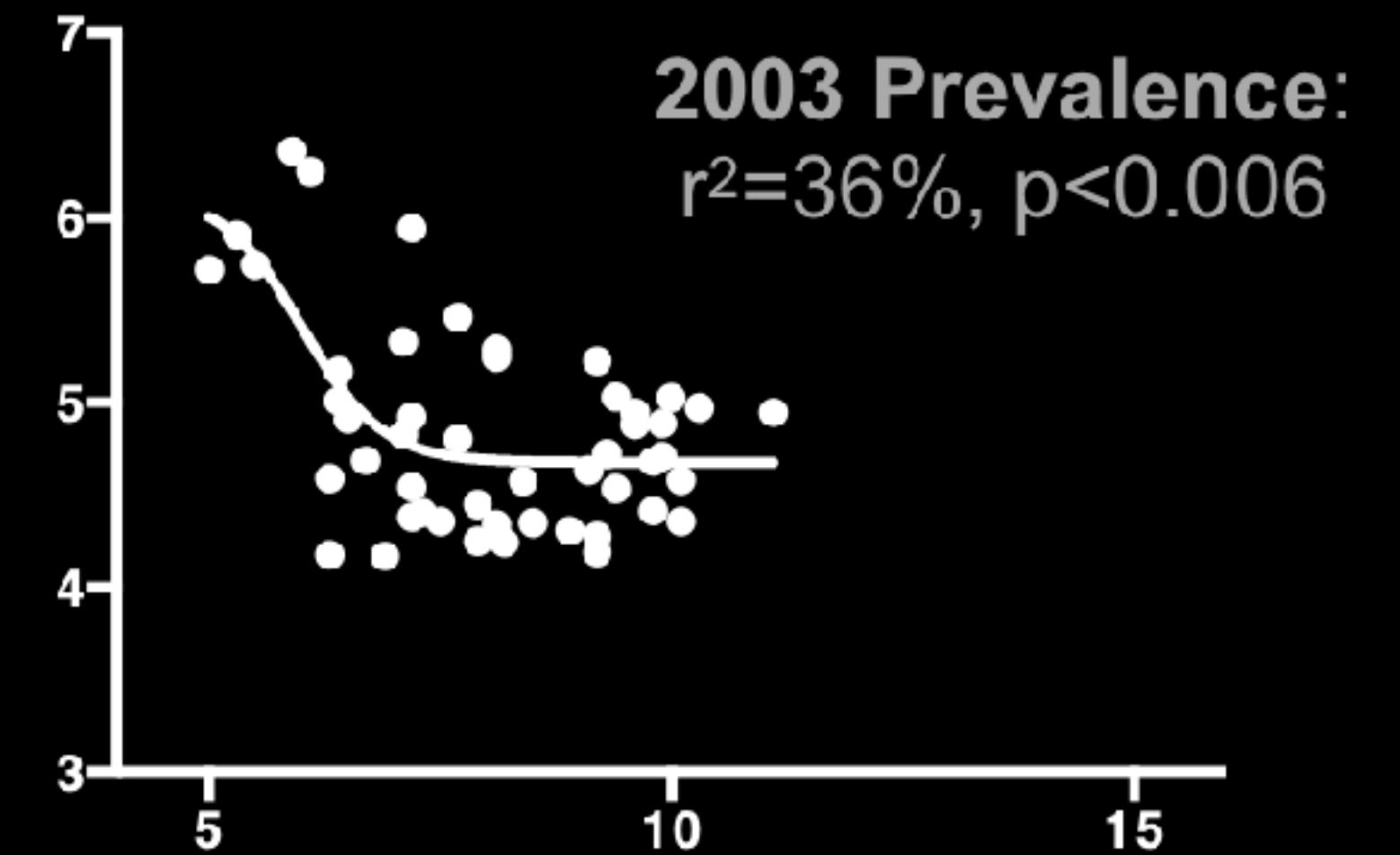
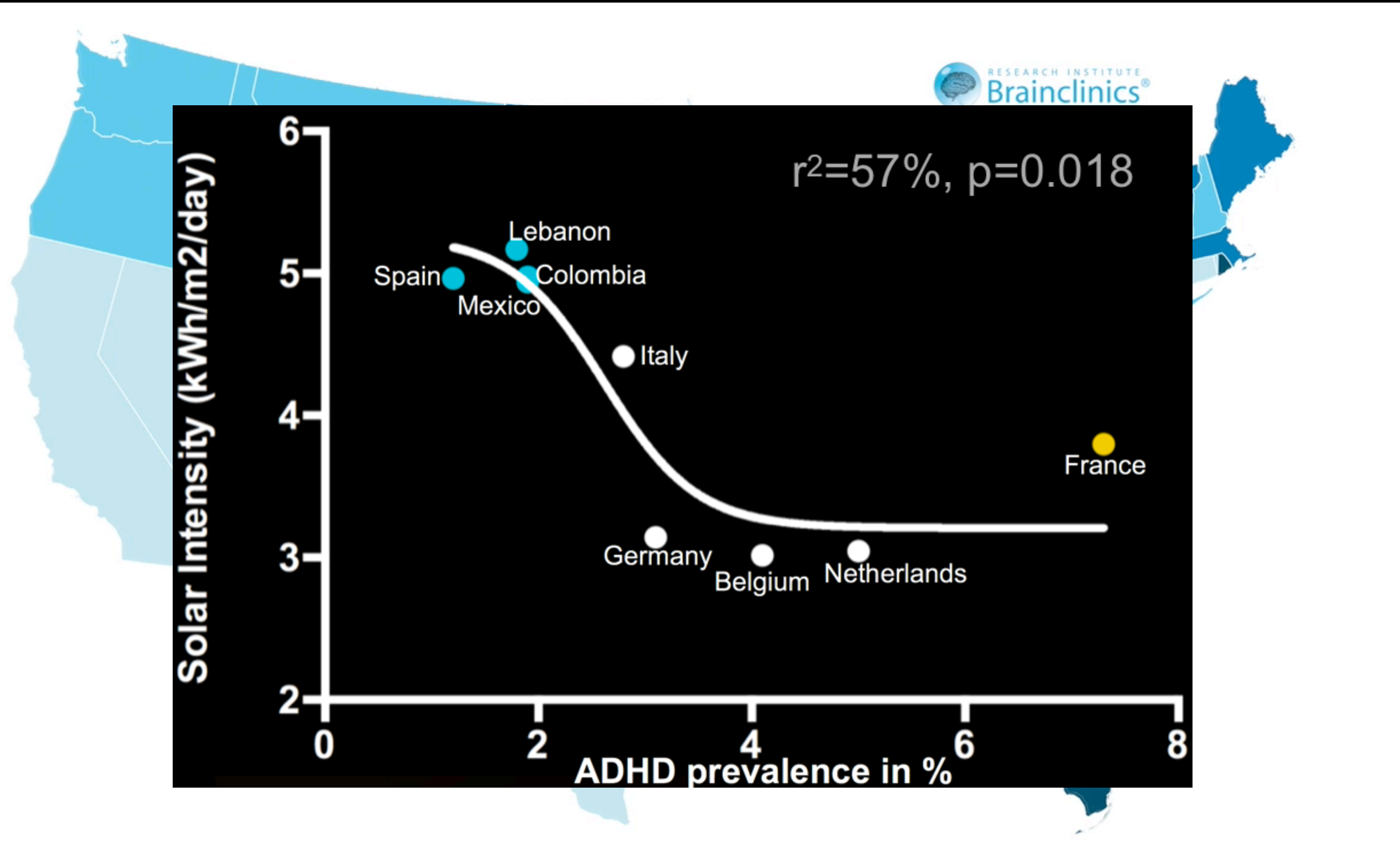


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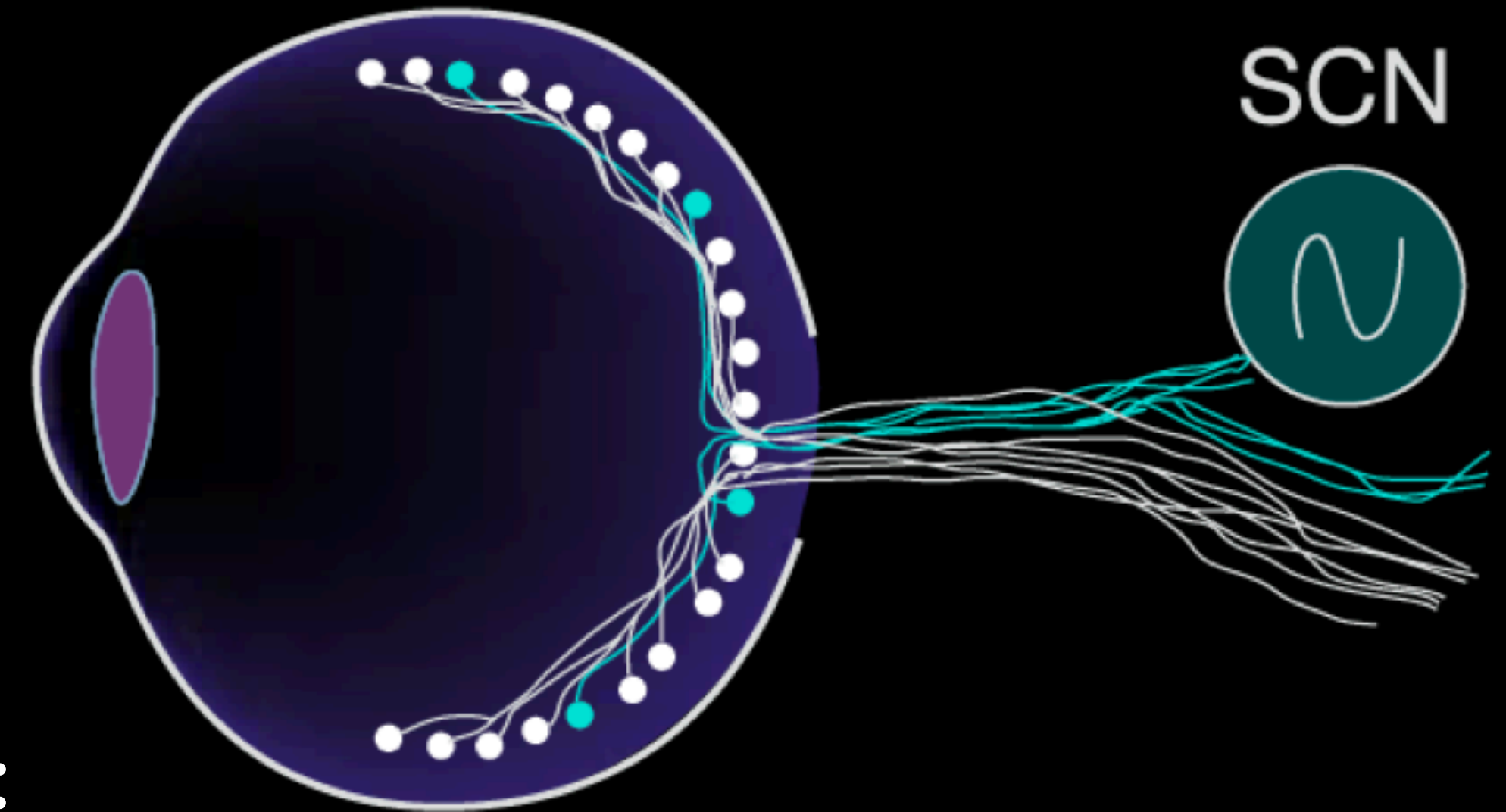
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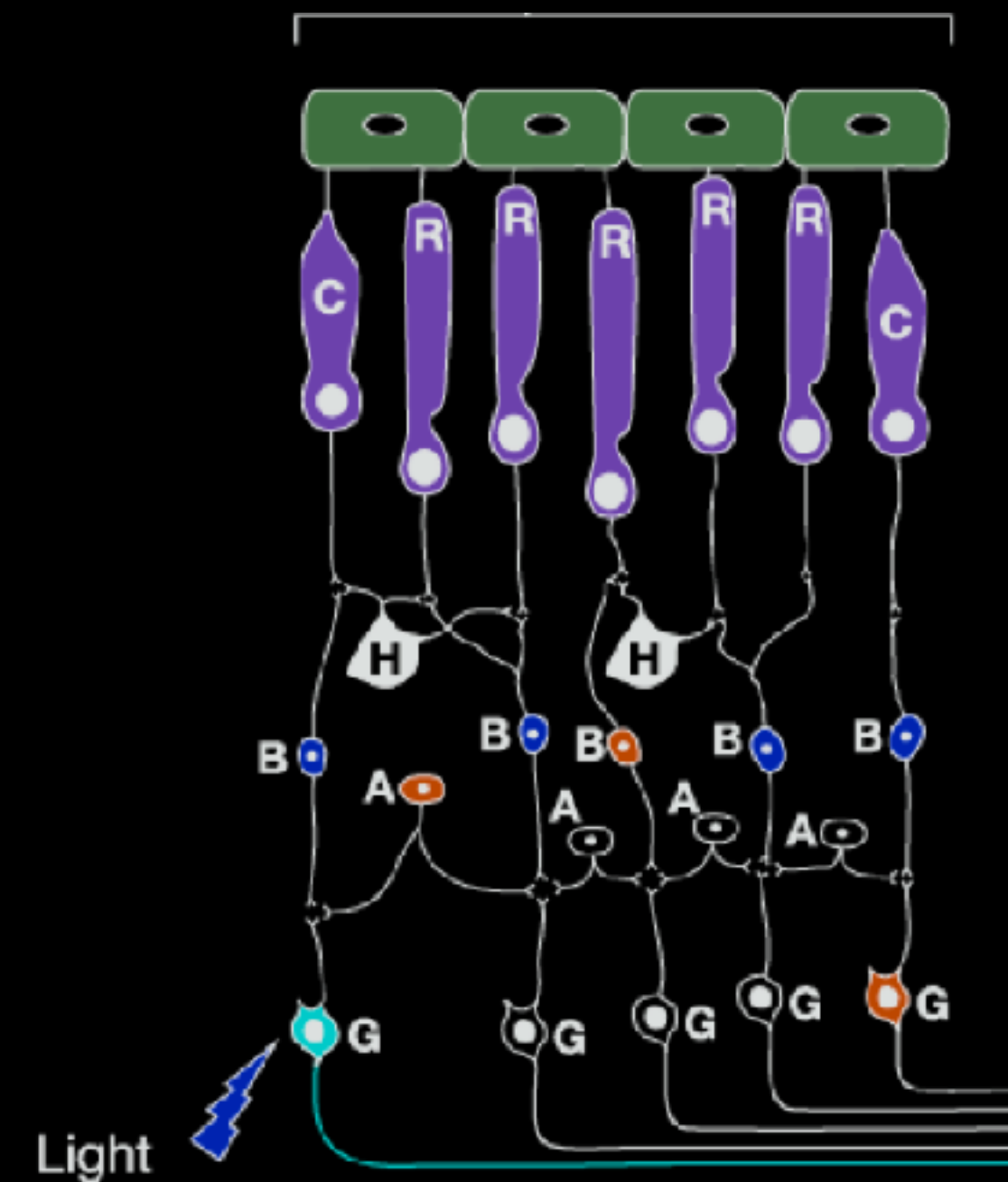
Martijn Arns, Kristiaan B. van der Heijden, L. Eugene Arnold, and J. Leon Kenemans



# BLUE LIGHT AND SCN

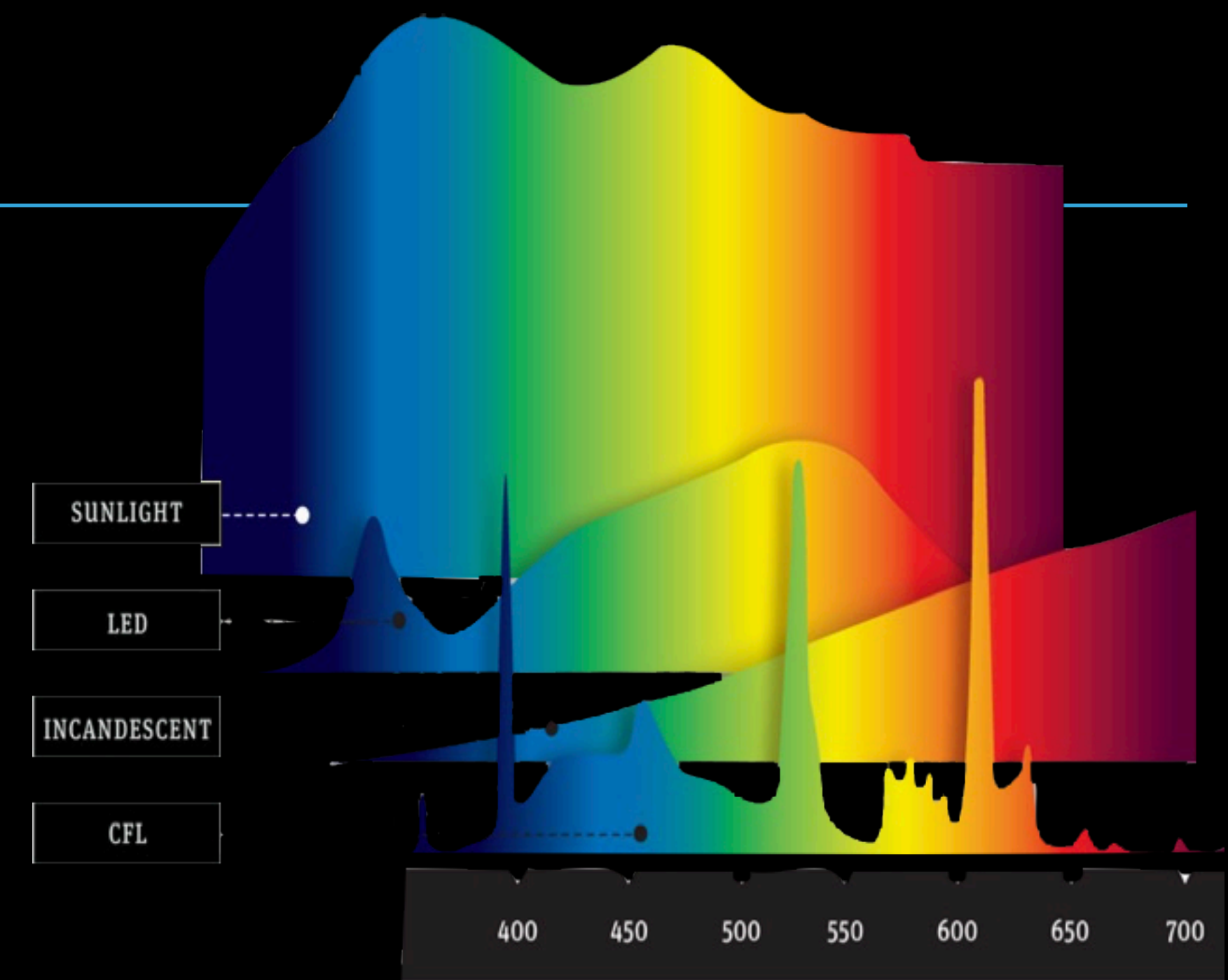


- Melanopsin → SCN: Non-image forming light detection: Only sensitive to blue spectrum (Reppert & Weaver, 2002; and ultraviolet: van Oosterhout et al. 2012)

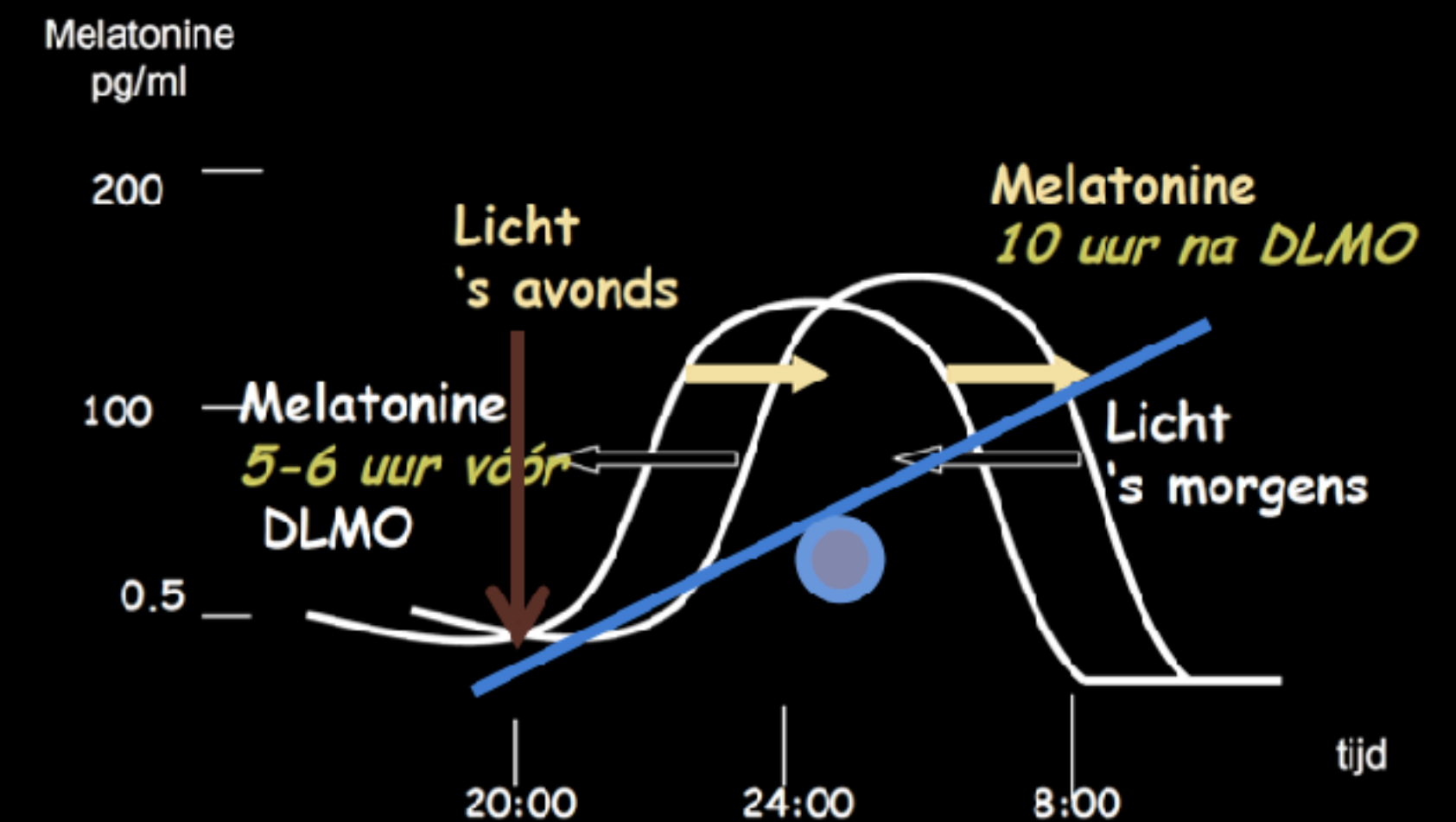


# LIGHT AND ADHD?

- Not explained by Vitamin-D  
(Arns, van der Heijden, Arnold & Kenemans, In Press)
- Evening use of iPads, mobile phones, PC's
  - Delayed sleep onset (Custers et al., 2012; van den Bulck et al., 2004)
  - Shorter sleep duration (van den Bulck et al., 2004)
  - Melatonin suppression (Wood et al., 2012; Cajochen et al., 2011)
- LED and CFL lamps have a peak in the blue light spectrum  
(Incandescent lamps prohibited in EU!)
- Prevention: Install skylights in schools?

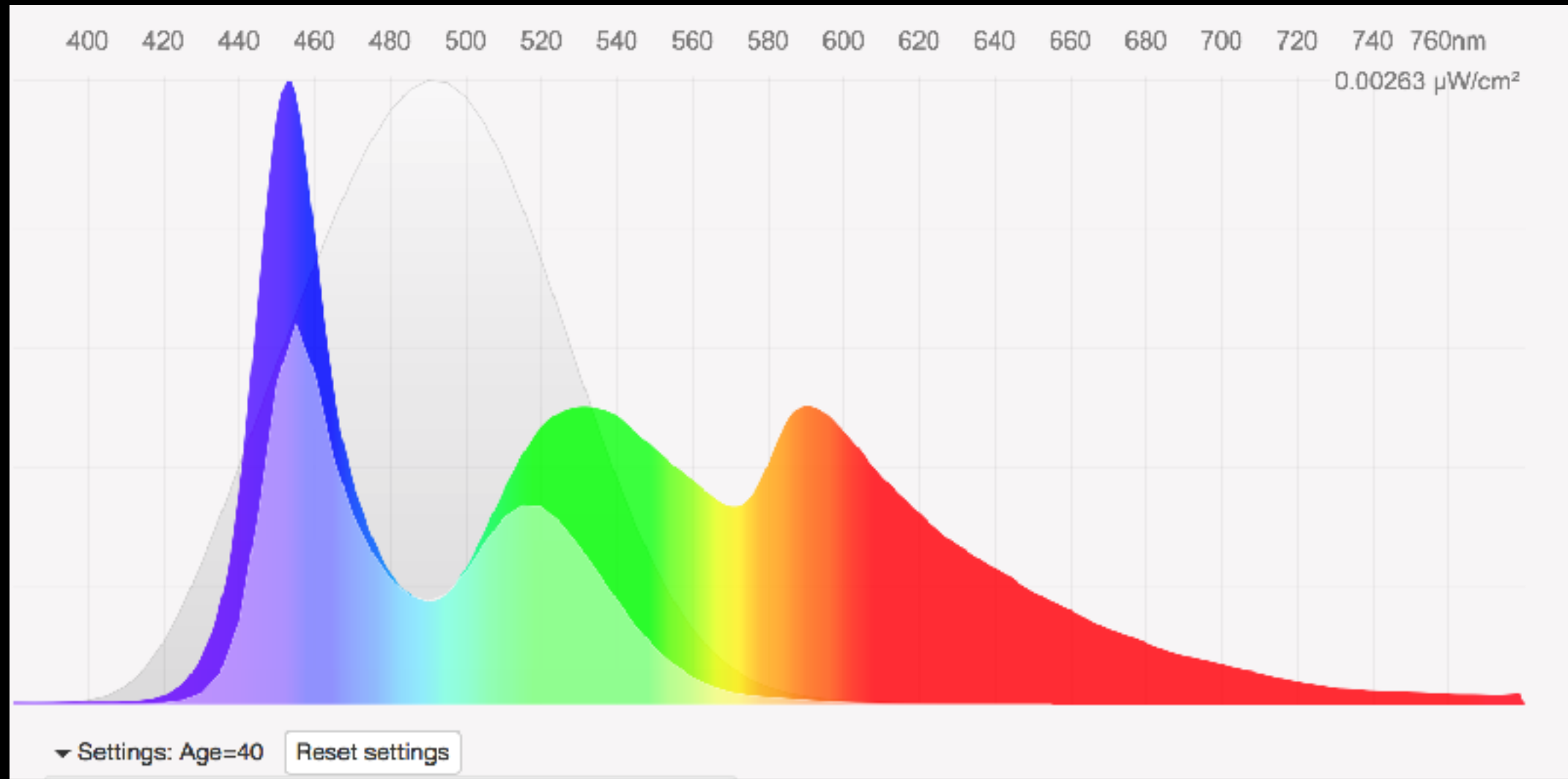


24-uurs melatonine ritme



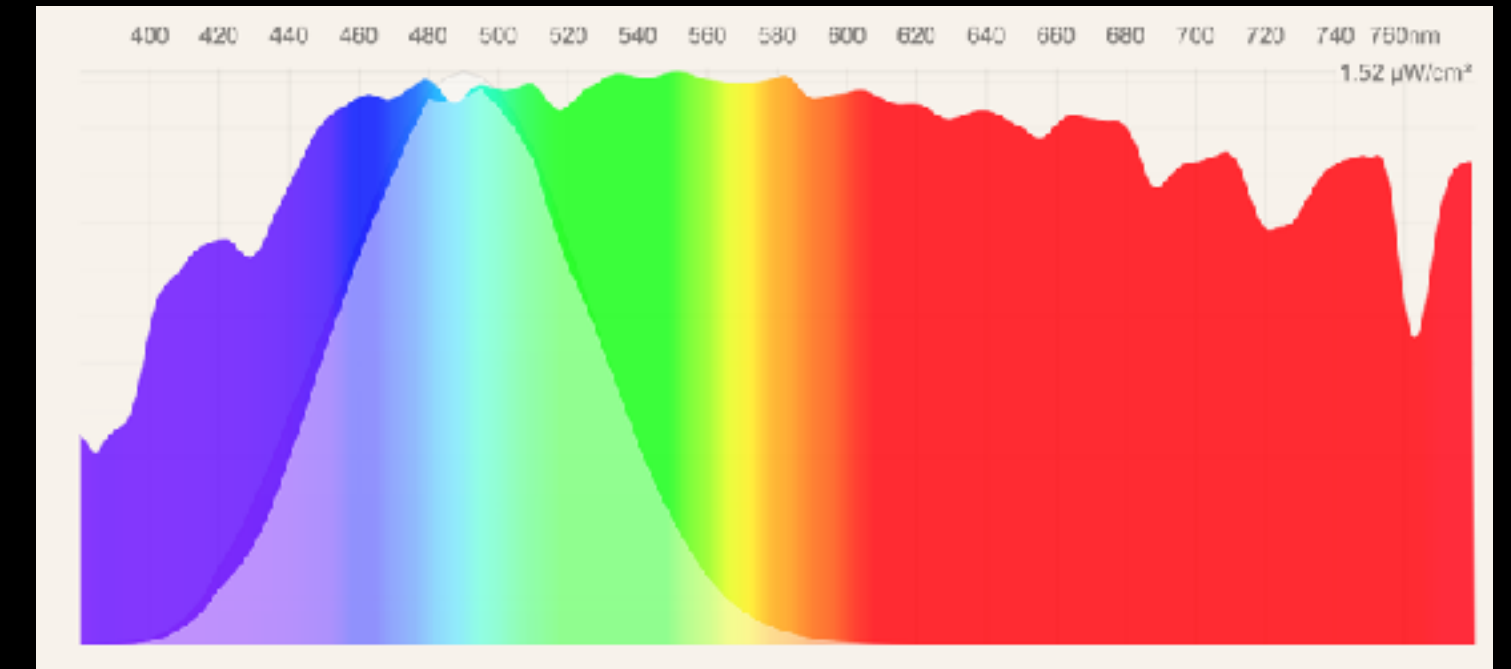
From: Marcel Smits: [www.melatoninecheck.nl](http://www.melatoninecheck.nl)

# LIGHT SPECTRAL PROFILES

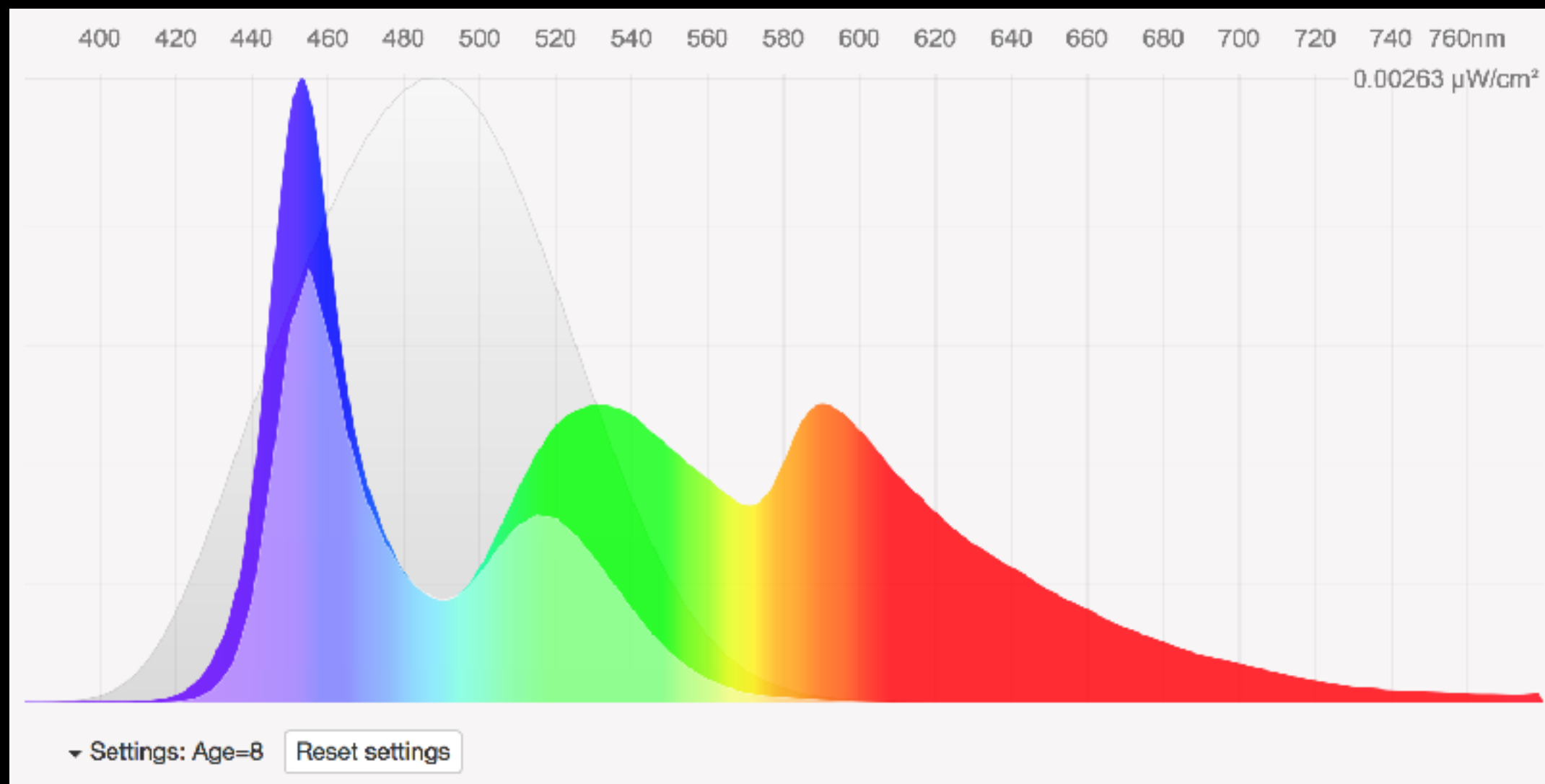
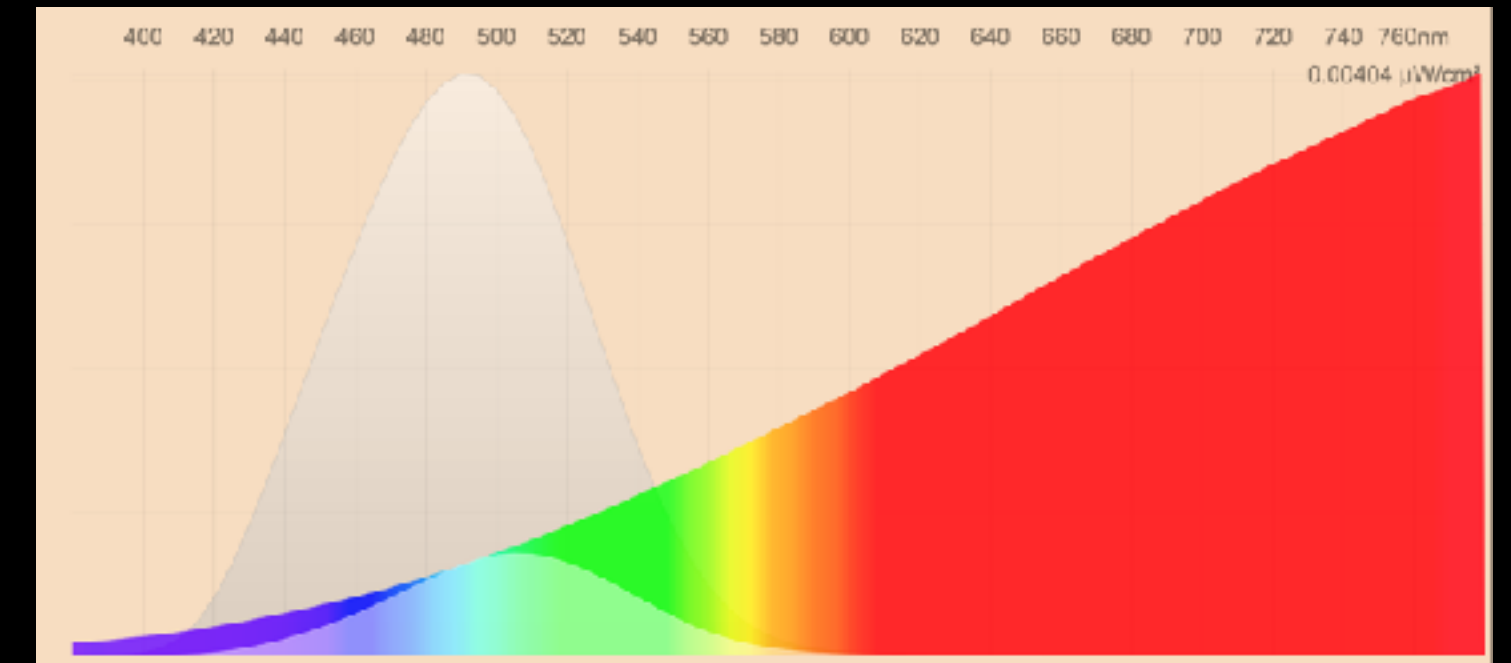


iPad 2

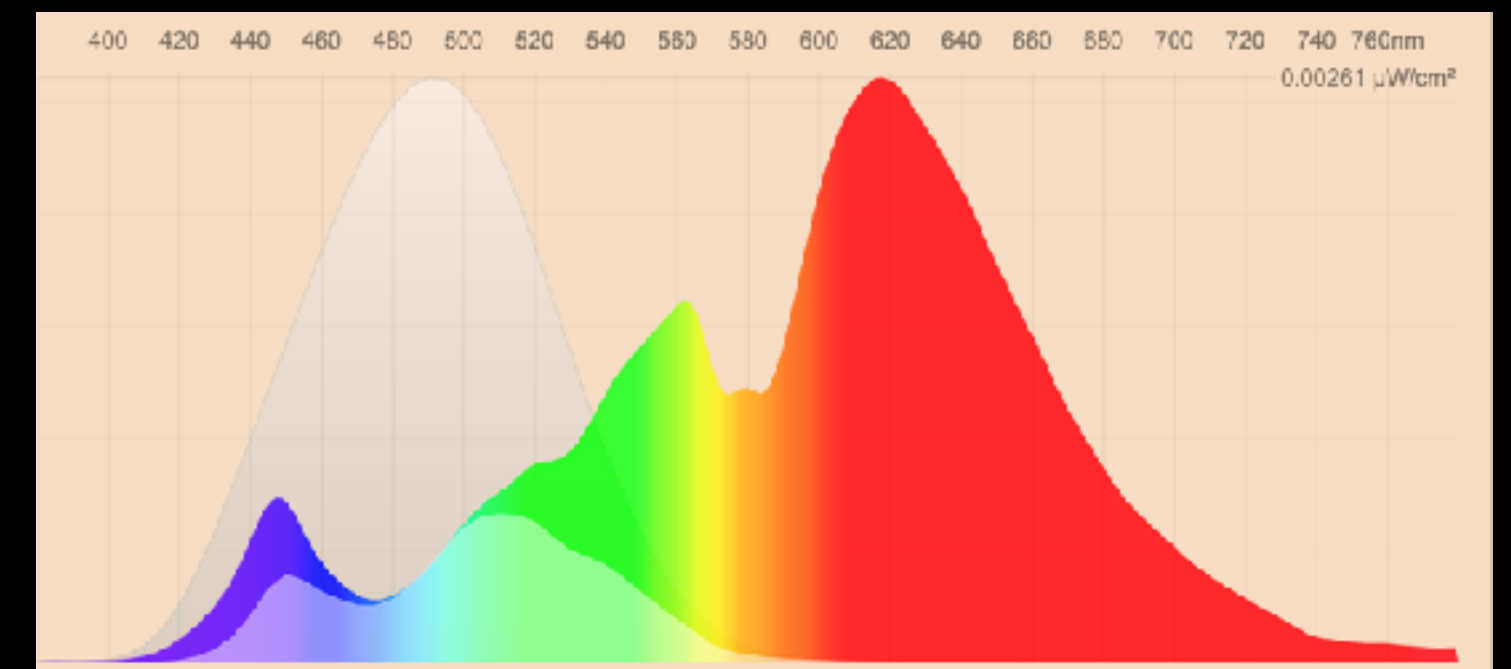
outdoors10 AM LA



Incandescent lightbulb



Cree LED lamp



# LIGHT AND SLEEP?

iOS 9.3 Preview

- Not explained (Arns, van der H)

- Evening use
  - Delayed
  - Shorter s
  - Melatoni

- LED and CFL (Incandesc

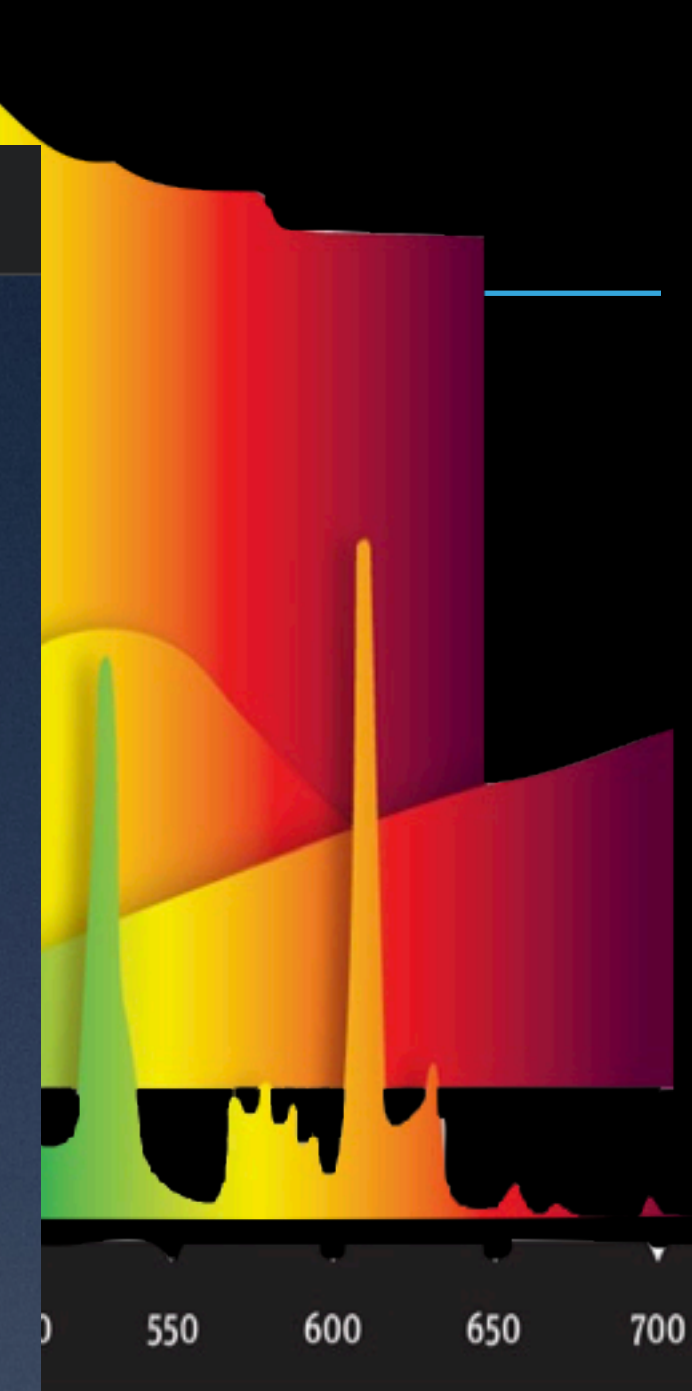
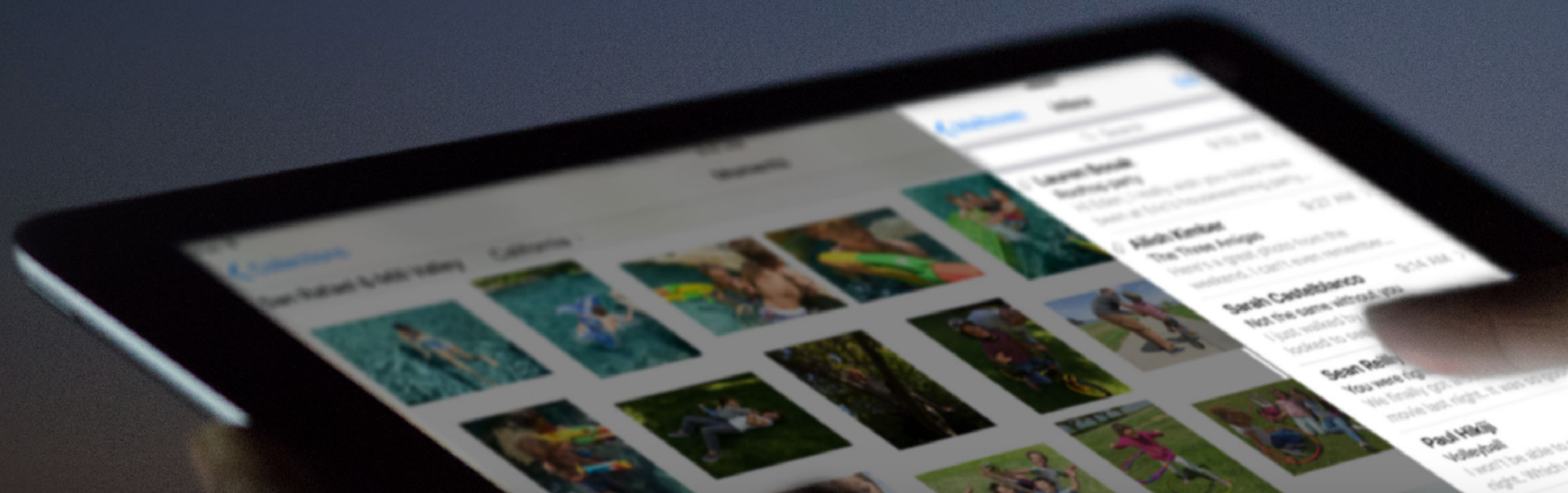
- Prevention



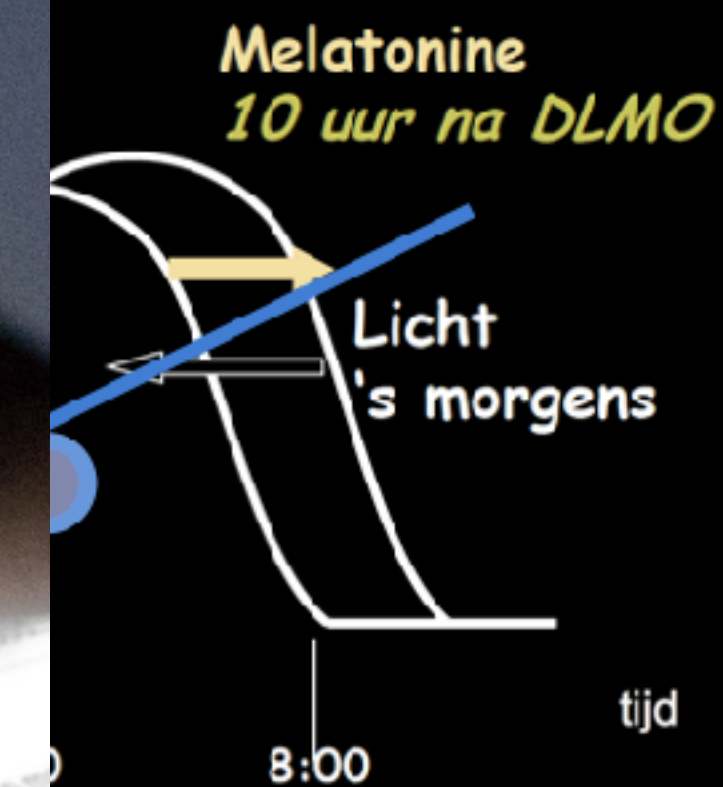
## Night Shift

A lot of waking hours went into thinking about sleep.

Many studies have shown that exposure to bright blue light in the evening can affect your circadian rhythms and make it harder to fall asleep. Night Shift uses your iOS device's clock and geolocation to determine when it's sunset in your location. Then it automatically shifts the colors in your display to the warmer end of the spectrum, making it easier on your eyes. In the morning, it returns the display to its regular settings. Pleasant dreams.

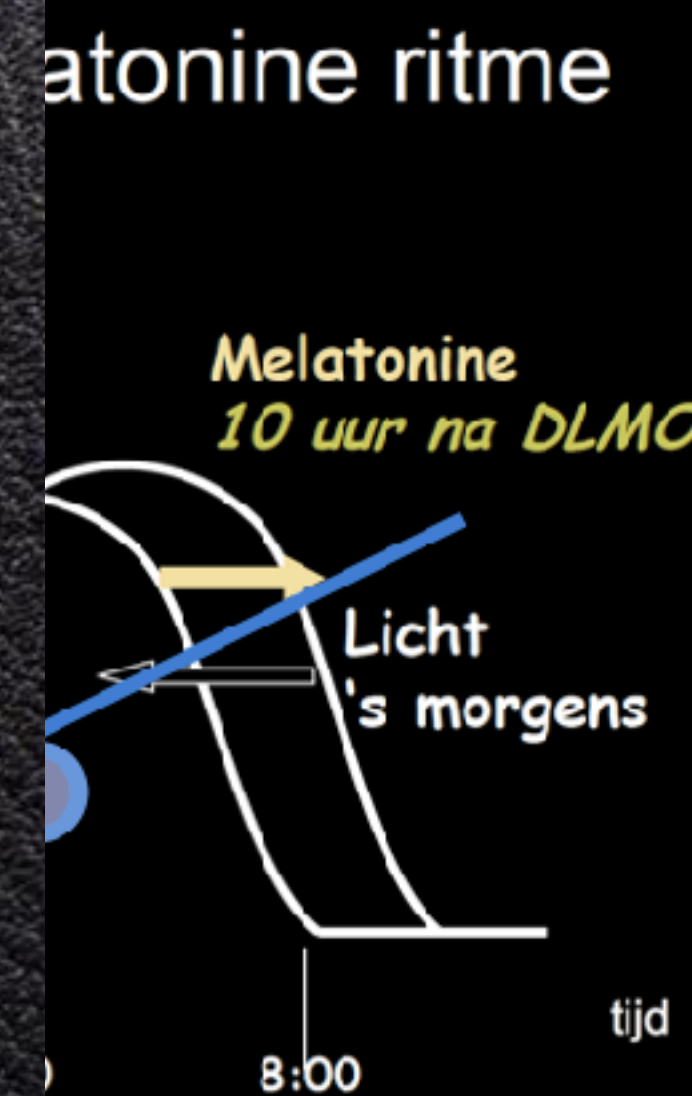
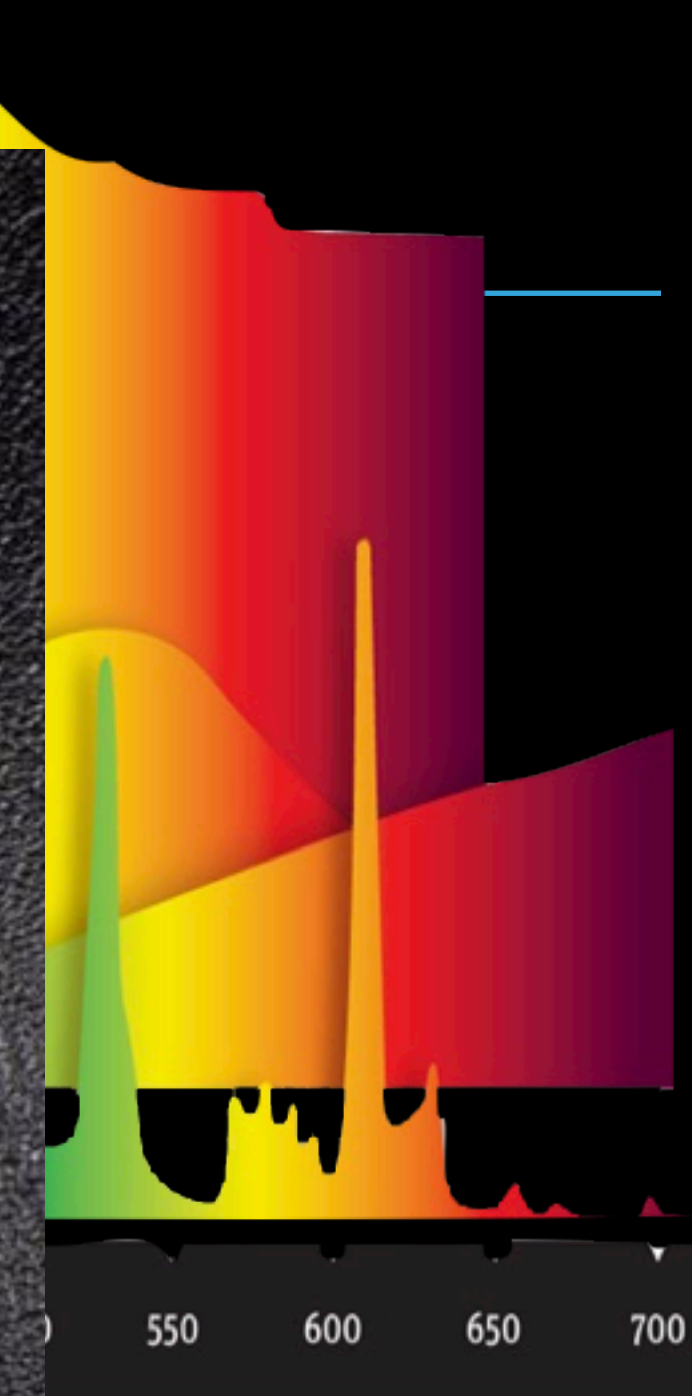


atonine ritme



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- Chronobiological treatments for SOI in ADHD: LT Melatonin (Hoebert et al., 2009) and early morning bright light (Rybak et al., 2006)
- SMR Neurofeedback effective in ADHD mediated via SOL normalization (Arns et al., 2012)



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**MEER INFORMATIE?**

**[HTTPS://BRAINCLINICS.COM/SLEEP-MATERIALS/](https://brainclinics.com/sleep-materials/)**

**[HTTPS://BRAINCLINICS.COM/ADHD-SLAAP-TABLETS-EEN-ANDER-LICHT-OP-ADHD/](https://brainclinics.com/adhd-slaap-tablets-een-ander-licht-op-adhd/)**