

The impact of light on well-being

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Circadian rhythm

= Internal biological rhythm lasting approximately one day

- Fundamental property of human, animal and plant life
- Influences multiple aspects



Central clock synchronisation

How do we stay in sync with the natural day-night rhythm?

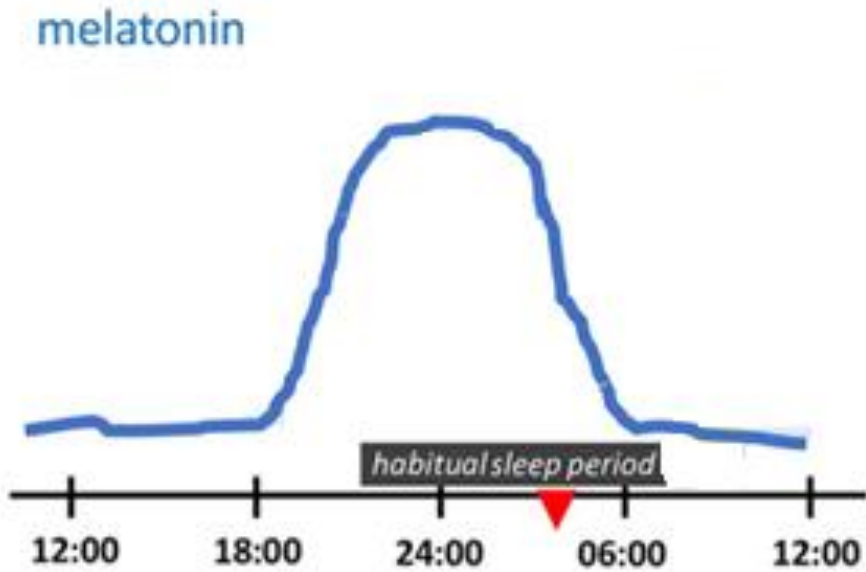


<https://enlightenyourclock.org/>

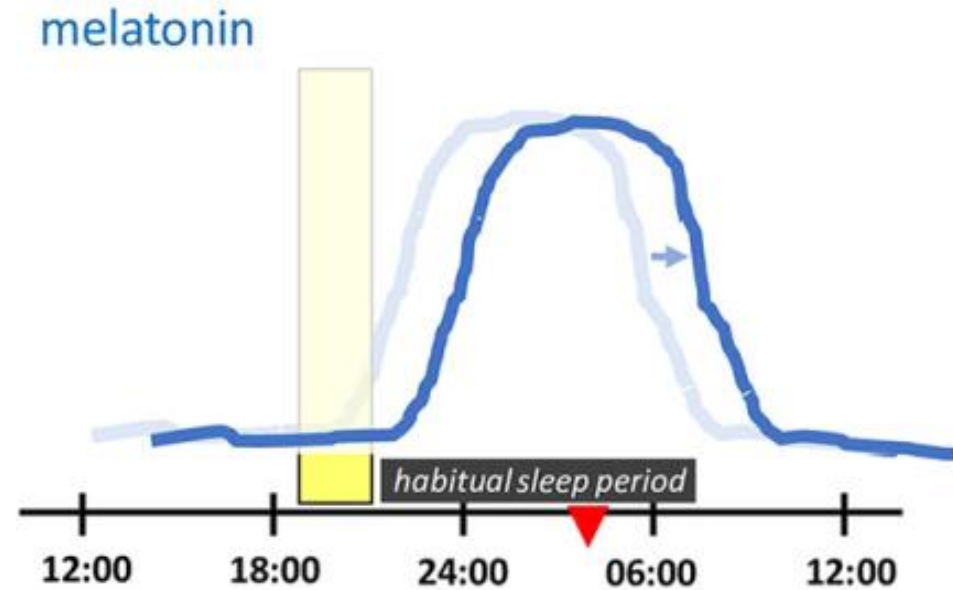
- SCN (master clock) responds to “zeitgebers”
- Light = strongest environmental cue (zeitgeber) to align our central clock with the natural day/night rhythm

Influence on sleep

Normal pattern



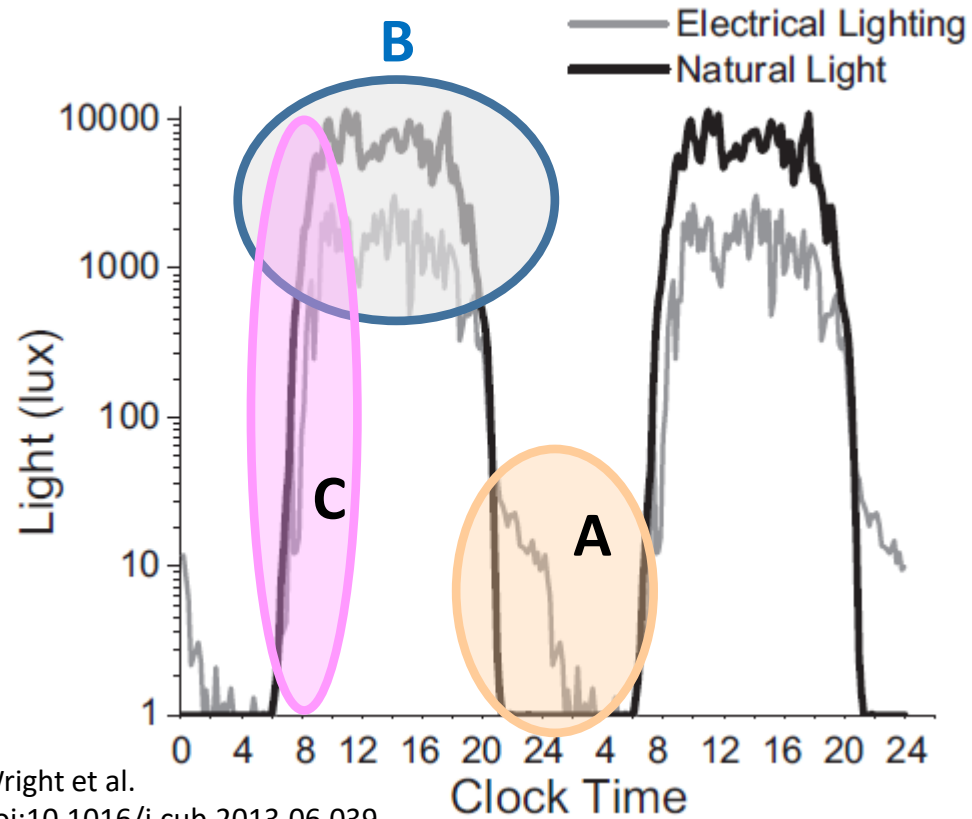
Evening light



A: More light at night
Suppresses melatonin

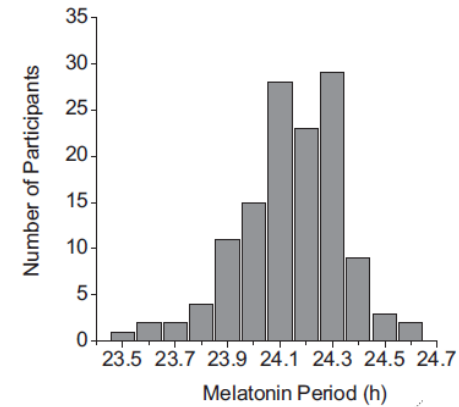
B: Less light during the day
Diminishes melatonin at night

C: Less light in the morning
Delay body clock & sleep

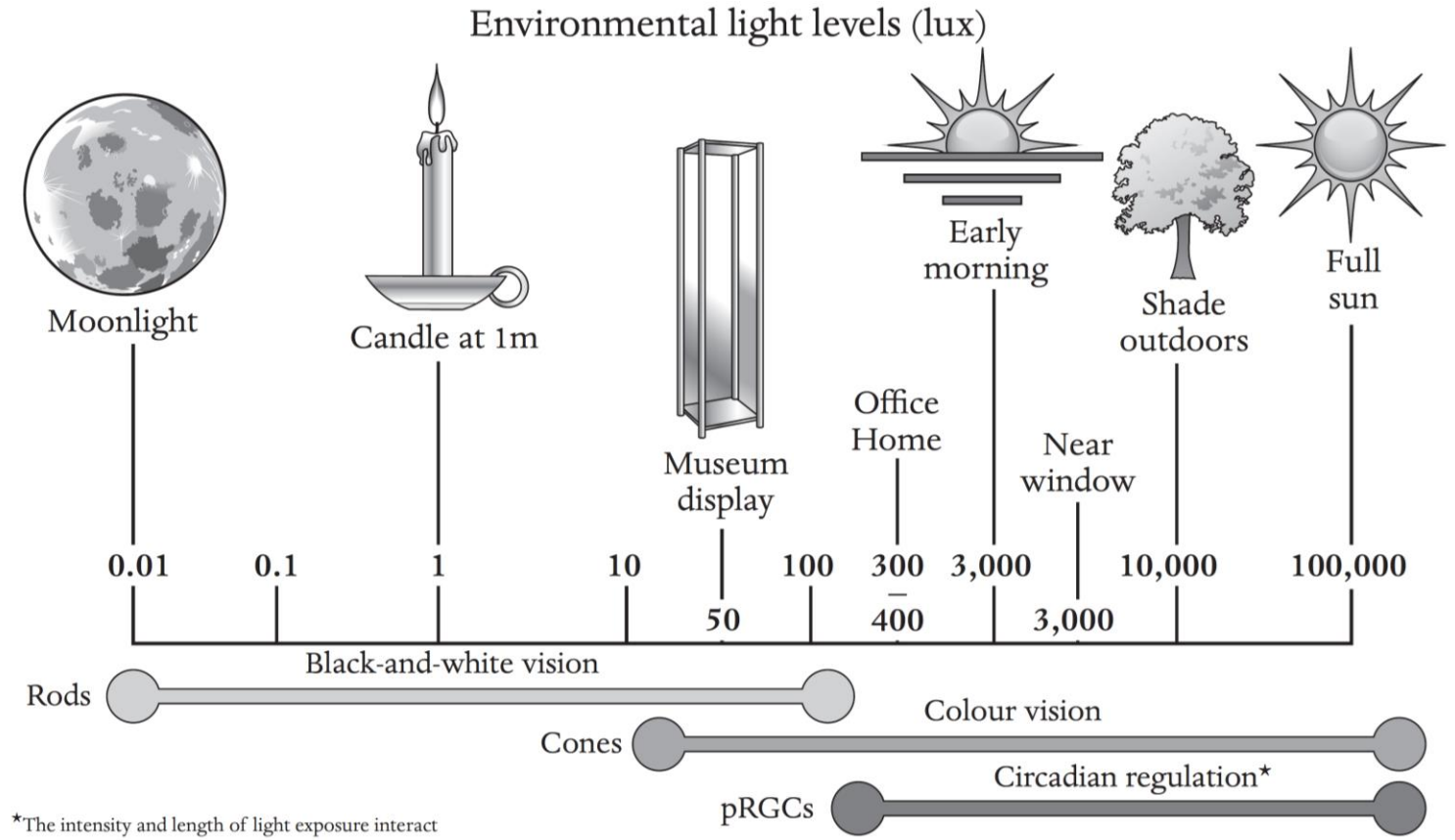


Wright et al.
doi:10.1016/j.cub.2013.06.039

Period sleep-wake rhythm $\approx 24\text{h}10$



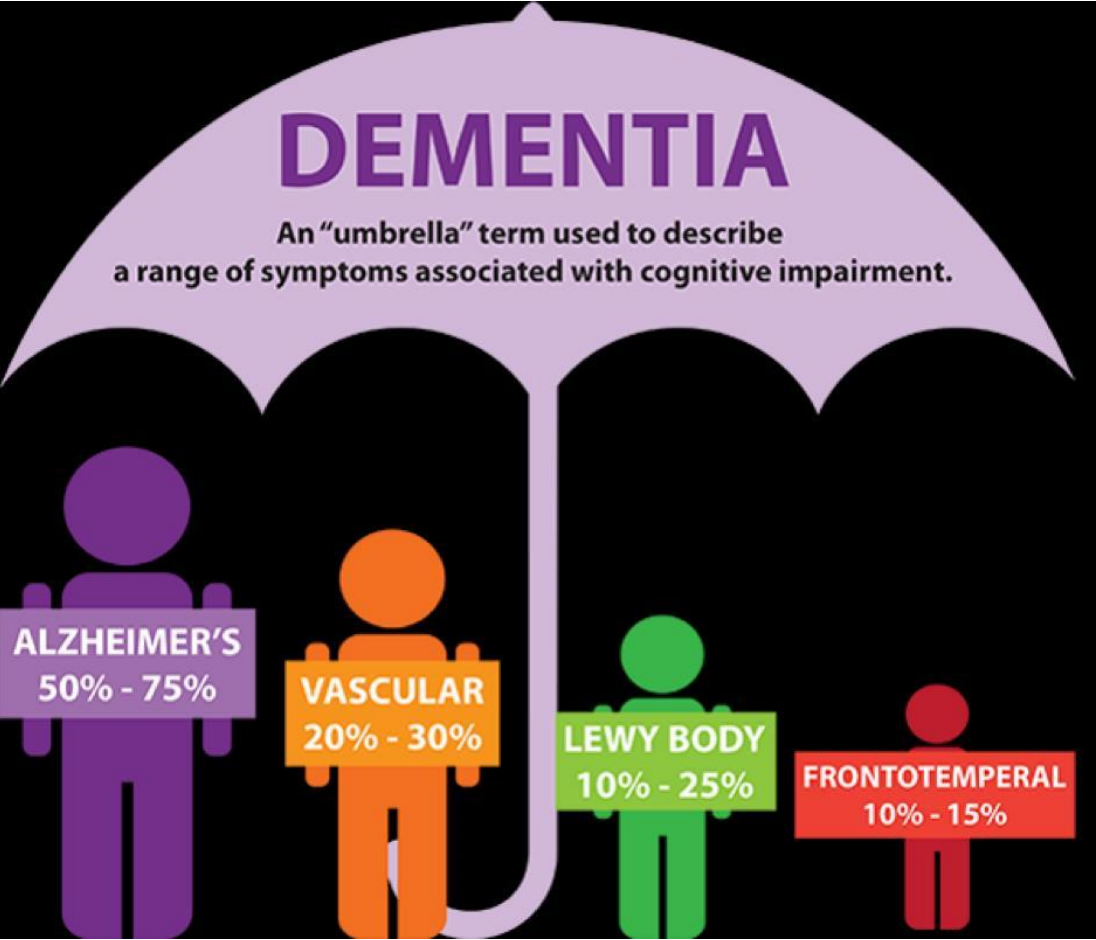
Biological darkness



*The intensity and length of light exposure interact

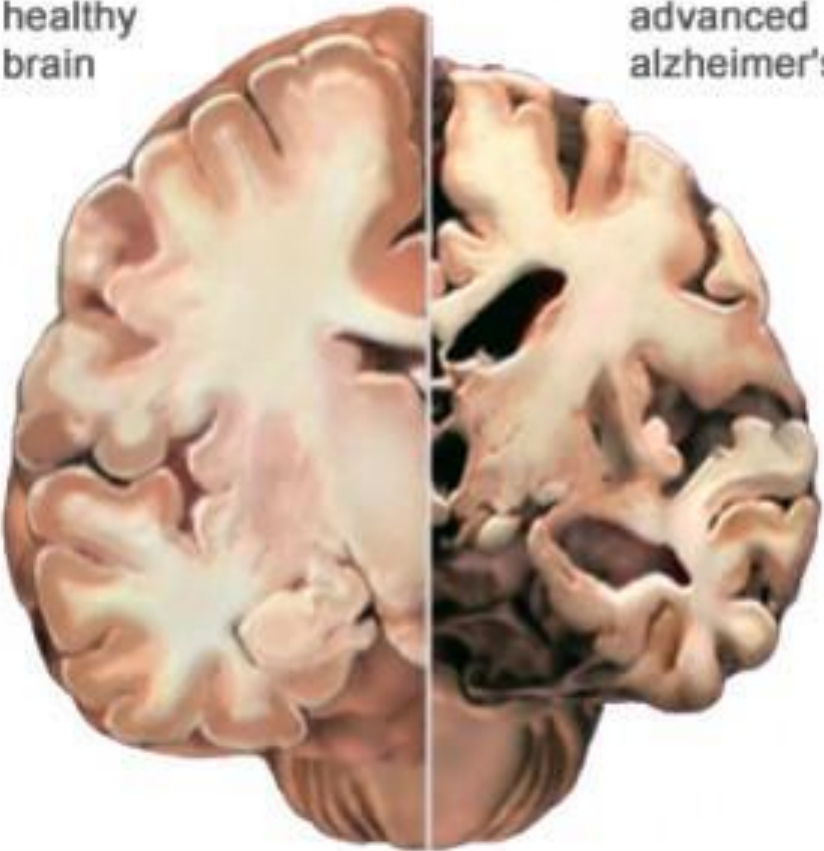
Foster – Life Time

Dementia



healthy brain

advanced alzheimer's



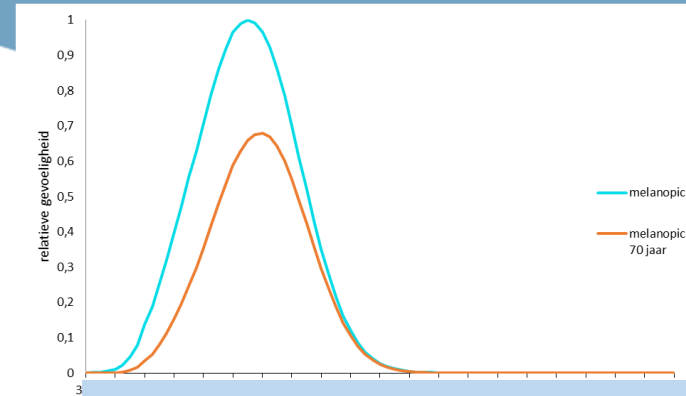
Dementia

Elderly:

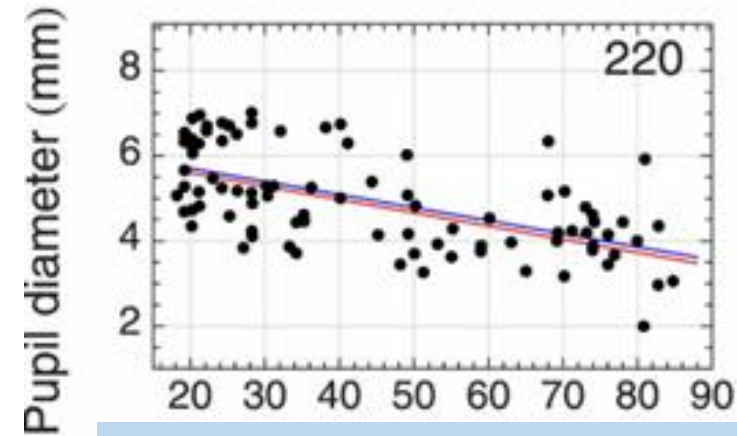
- Reduced sensitivity due to lens yellowing
- Smaller pupil area
- Neurological changes

Elderly with dementia:

- Dementia \leftrightarrow sleeping issues
- 30-50% depressive symptoms
- Reduced exposure to daylight



32j → 70j: 40% less sensitive

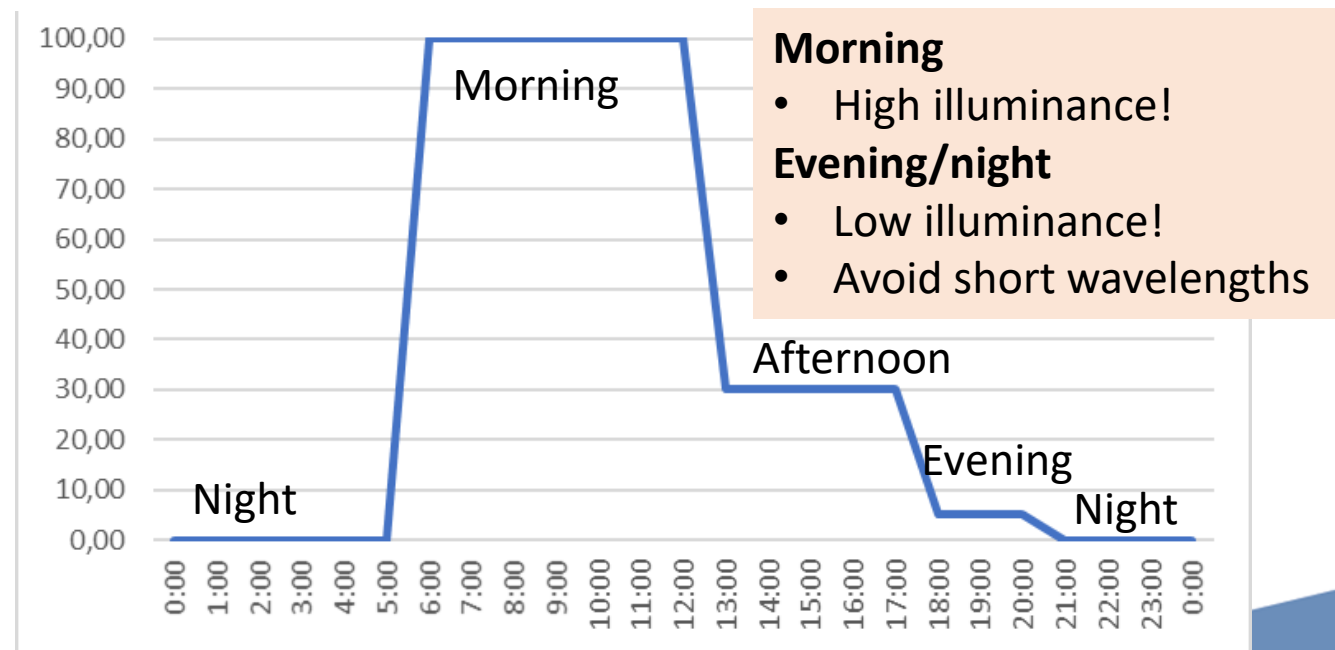


32j → 70j: Pupil area: 41% less light input

Dementia enlightened

Goal:

- Improve lighting installation in living area residents with dementia
- More light during the day/morning, less light in the evening



Dementia enlightened

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Previous studies:

- Reduction of nocturnal restlessness
- Less agitation
- Improvement of depressive symptoms



Riemersma-van der Lek *et al*, 2008
Onega *et al*, 2016

PRE



Lighter/brighter material for floor, ceiling, walls, curtains,...

Temporal differences

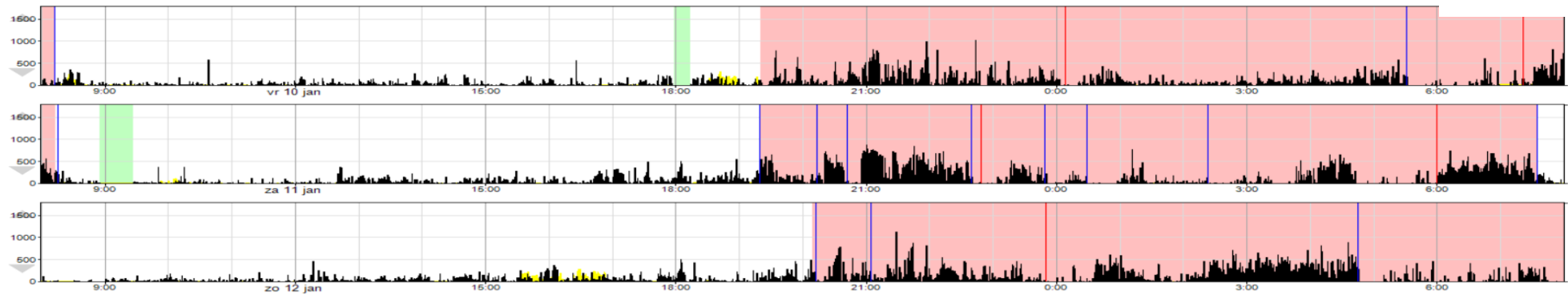
POST



Layers of lighting

Changes in intensity and colour temperature

Monitoring sleep quality



PRE

POST

Importance of daylight

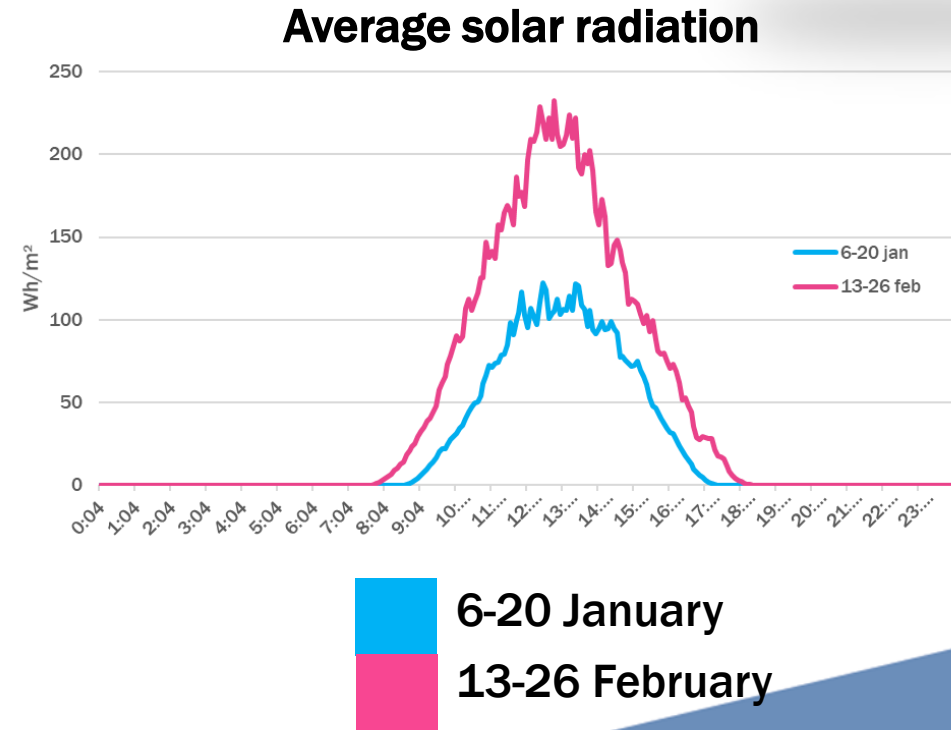


More daylight through

- Orientation
- Bigger windows
- No obstacles

Change in daylight during the year

- Example: January \leftrightarrow February



Conclusion

- Light profoundly impacts sleep through ipRGCs
- In general we need more light in the morning and during the day
- Integrative lighting design in residential care centers can:
 - Decrease depressive symptoms
 - Increase sleep efficiency
 - Improve well-being residents AND staff
 - Reduce workload (during night shift)

Contact

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LABORATORIUM VOOR
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KU LEUVEN GENT

Thank you

IBE-BIV

BELGISCH INSTITUUT voor VERLICHTINGSKUNDE
INSTITUT BELGE de l'ECLAIRAGE
CIE NATIONAL COMMITTEE – NBN SECTOR OPERATOR

 **NBN**

MET DE STEUN VAN
AVEC LE SOUTIEN DU

