

# Sleep, Aging and Dementia

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# INSOMNIA SEVERITY INDEX



- Difficulty falling asleep?
- Difficulty staying asleep?
- Problems with early awakening?

| NONE     | MILD     | MODERATE | SEVERE   | VERY SEVERE |
|----------|----------|----------|----------|-------------|
| <b>0</b> | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b>    |



# INSOMNIA SEVERITY INDEX



- Sleep satisfaction?

| VERY SATISFIED | SATISFIED | MODERATELY | DISSATISFIED | VERY DISSATISFIED |
|----------------|-----------|------------|--------------|-------------------|
| 0              | 1         | 2          | 3            | 4                 |

- How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

| NOT AT ALL | A LITTLE | SOMEWHAT | MUCH | VERY MUCH |
|------------|----------|----------|------|-----------|
| 0          | 1        | 2        | 3    | 4         |



# INSOMNIA SEVERITY INDEX



- How **WORRIED/DISTRESSED** are you about your current sleep problem?

| NOT AT ALL | A LITTLE | SOMEWHAT | MUCH     | VERY MUCH |
|------------|----------|----------|----------|-----------|
| <b>0</b>   | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b>  |

- Does a sleep problem to **INTERFERE** with your **daily functioning** (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) **CURRENTLY?**

| NOT AT ALL | A LITTLE | SOMEWHAT | MUCH     | VERY MUCH |
|------------|----------|----------|----------|-----------|
| <b>0</b>   | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b>  |



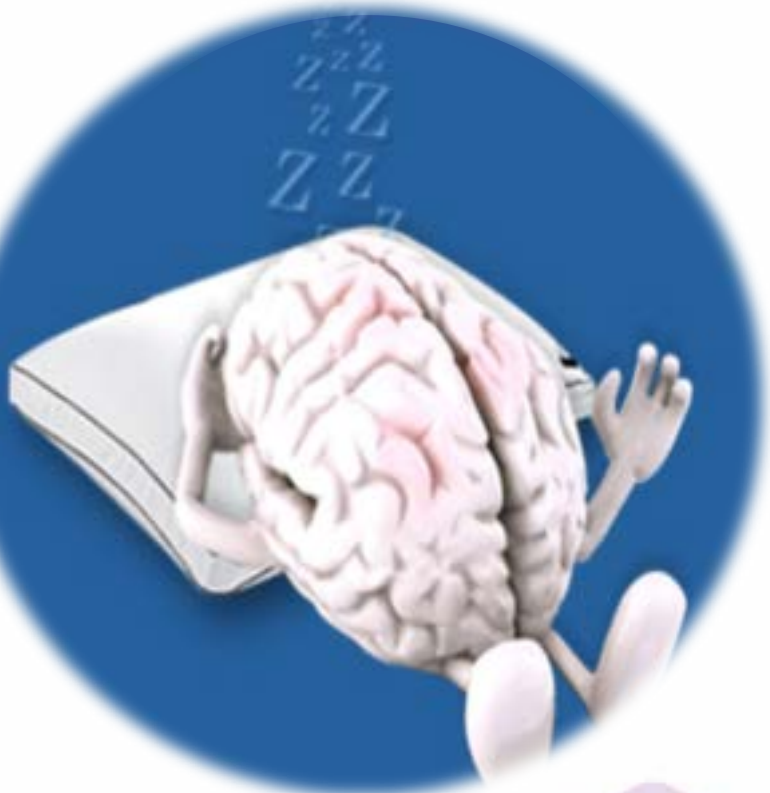
# SCORES



- Total score categories:
- 0–7 = No clinically significant insomnia
- 8–14 = Subthreshold insomnia
- 15–21 = Clinical insomnia (moderate severity)
- 22–28 = Clinical insomnia (severe)



# WHY SLEEP?



## Multiple Functions

- Restorative
  - Repair
  - Toxin Removal
  - Immune system enhancement
- Adaptive
  - Energy conservation
  - Predator avoidance
- Cognitive
  - Memory consolidation
  - Learning
  - Mood

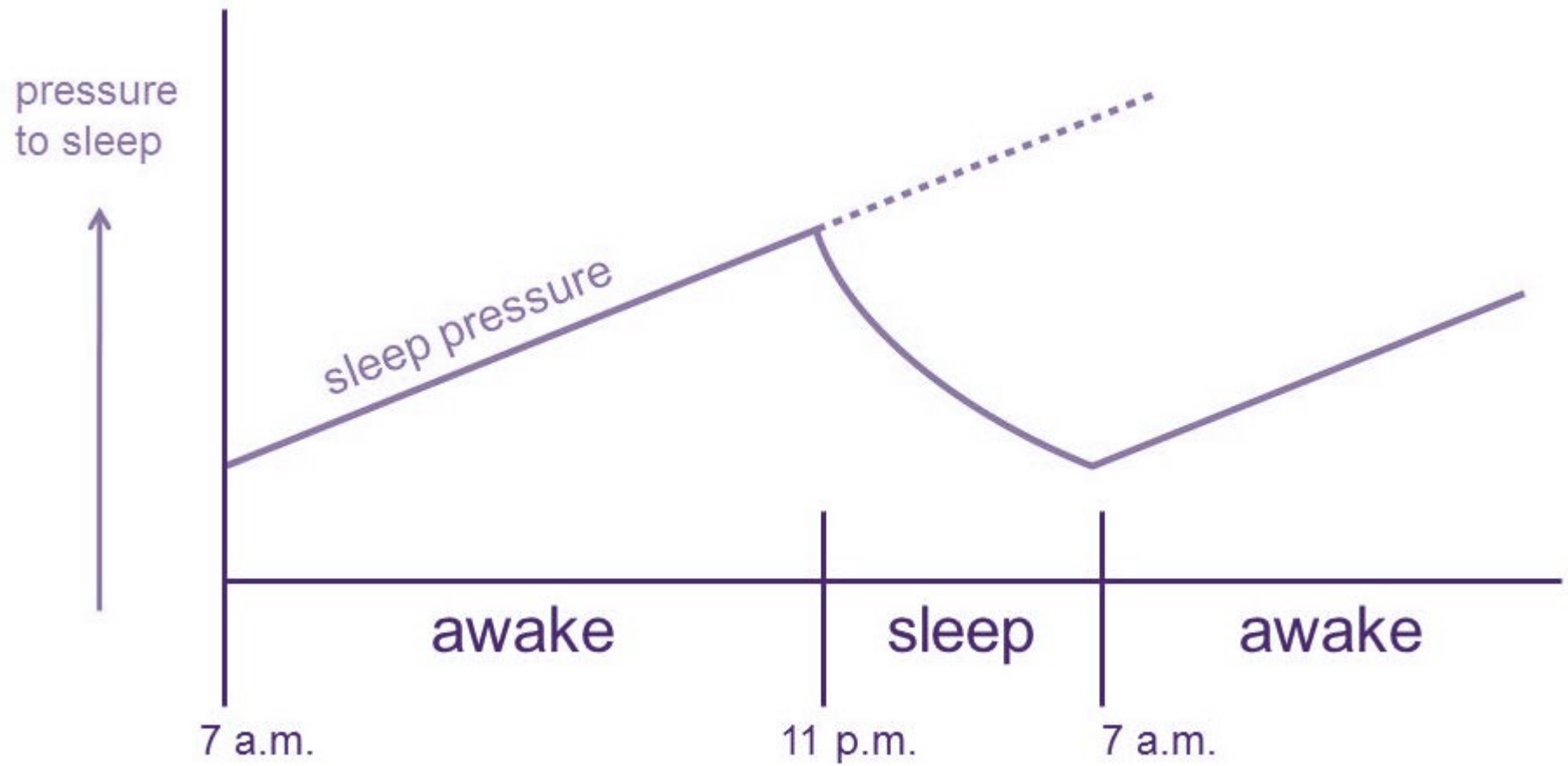
## Sleep Deprivation

- Death (Animal study)
- Mood
- Safety

## Poor Sleep

- Heart Disease
- Diabetes
- Depression
- Cancer
- Colds
- Dementia

# HOMEOSTATIC SLEEP DRIVE

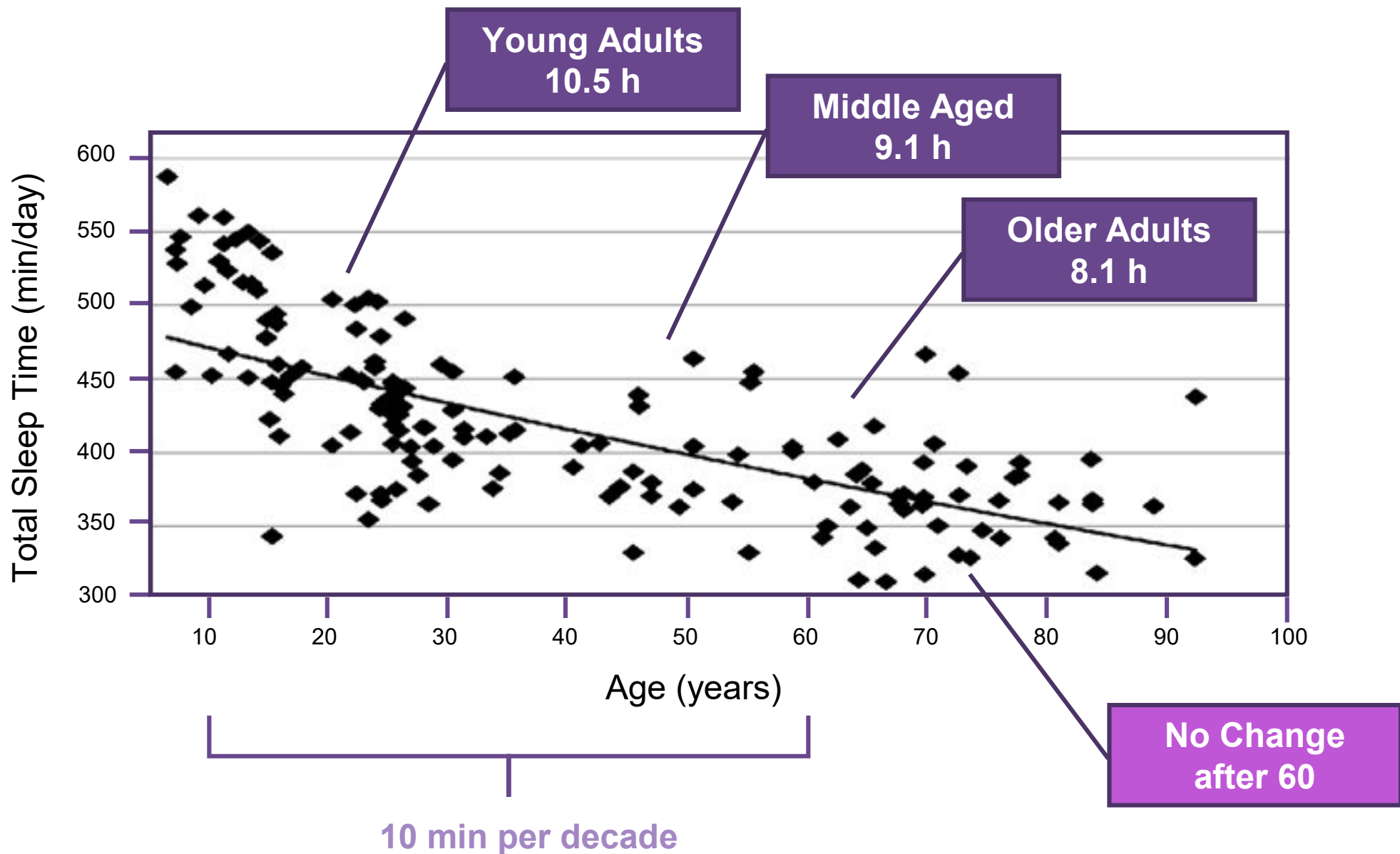


# AGE-RELATED SLEEP CHANGES



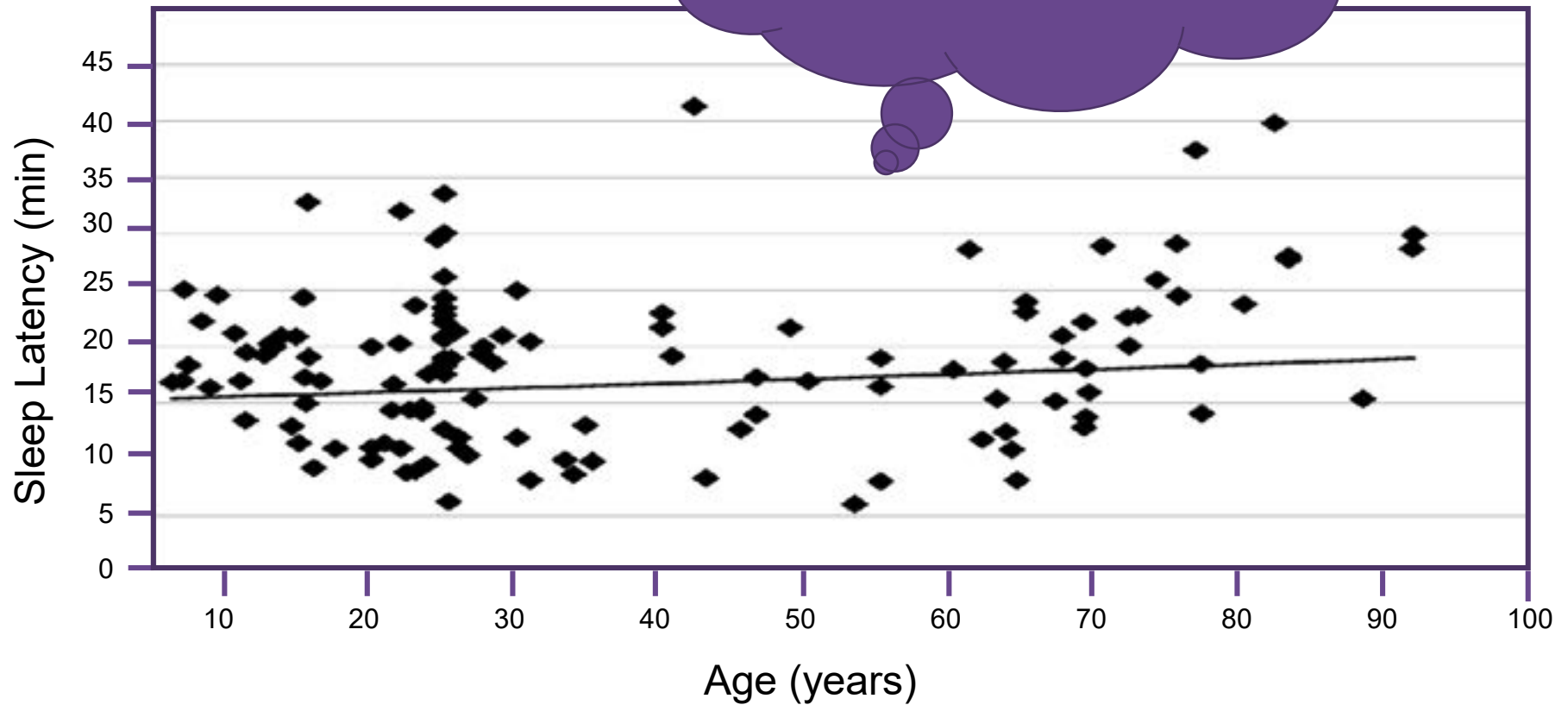


# SLEEP DURATION - AGING



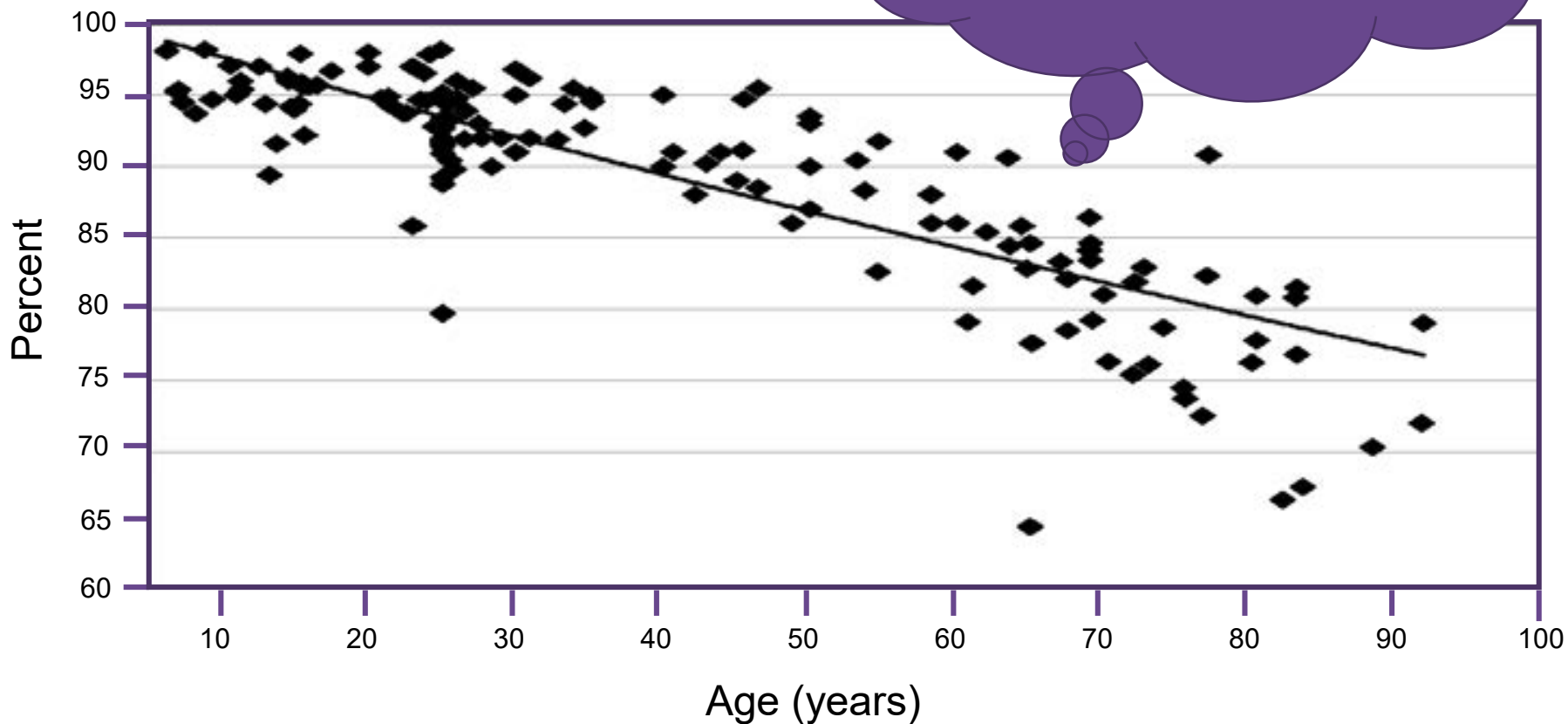
# SLEEP LATENCY - AGING

No Change



# SLEEP EFFICIENCY - AGING

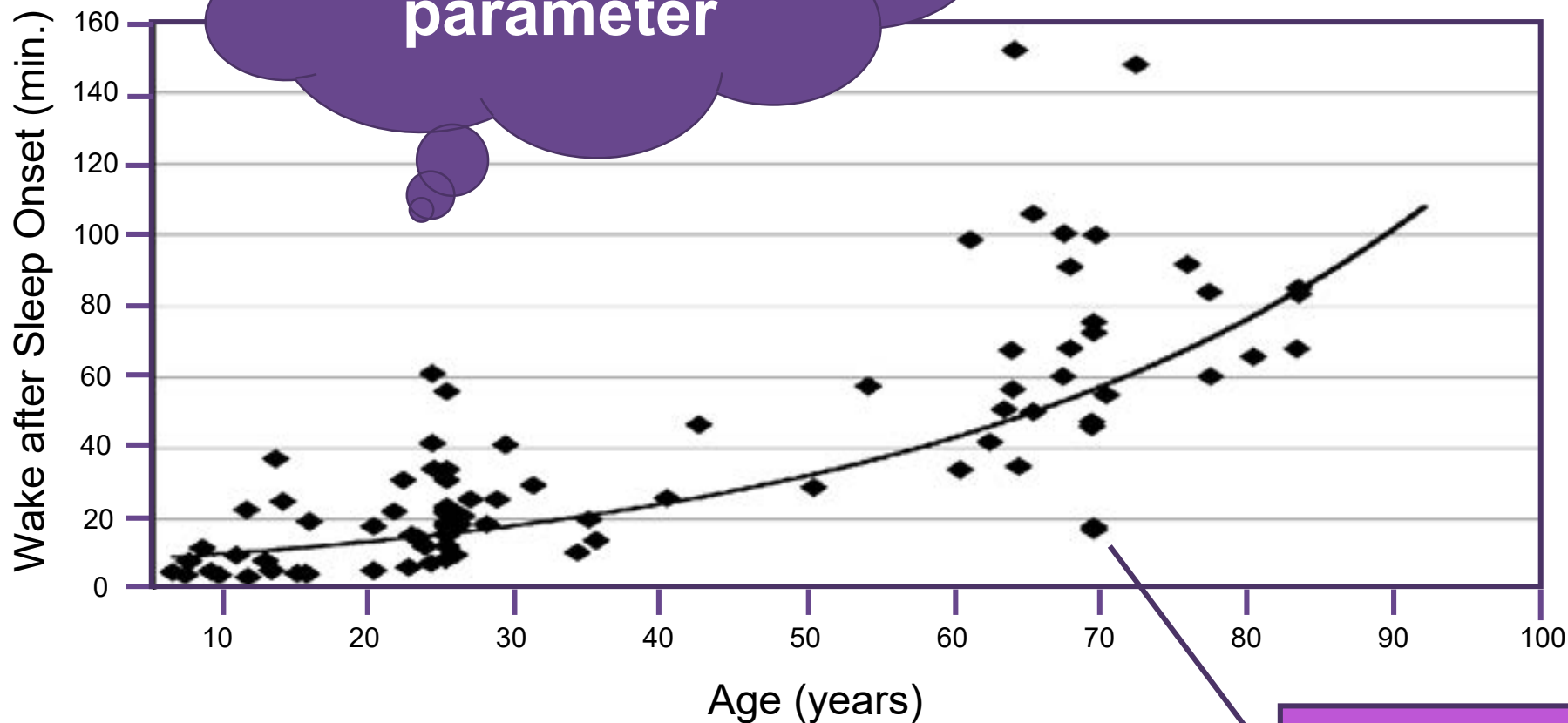
Continues to decline after 60



# SLEEP MAINTENANCE - AGING



**Largest  
Change of any  
parameter**

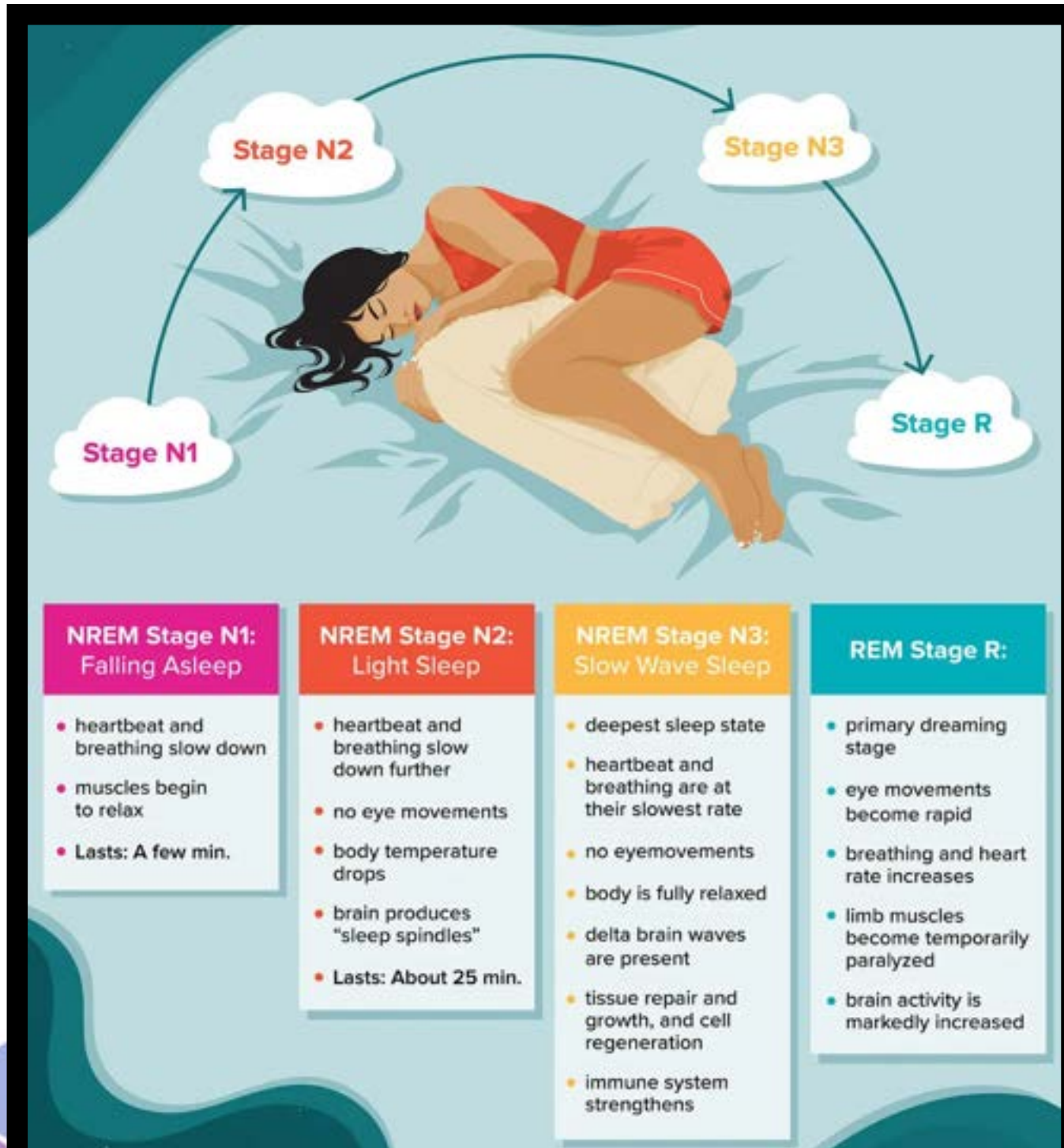


**10 min per decade**

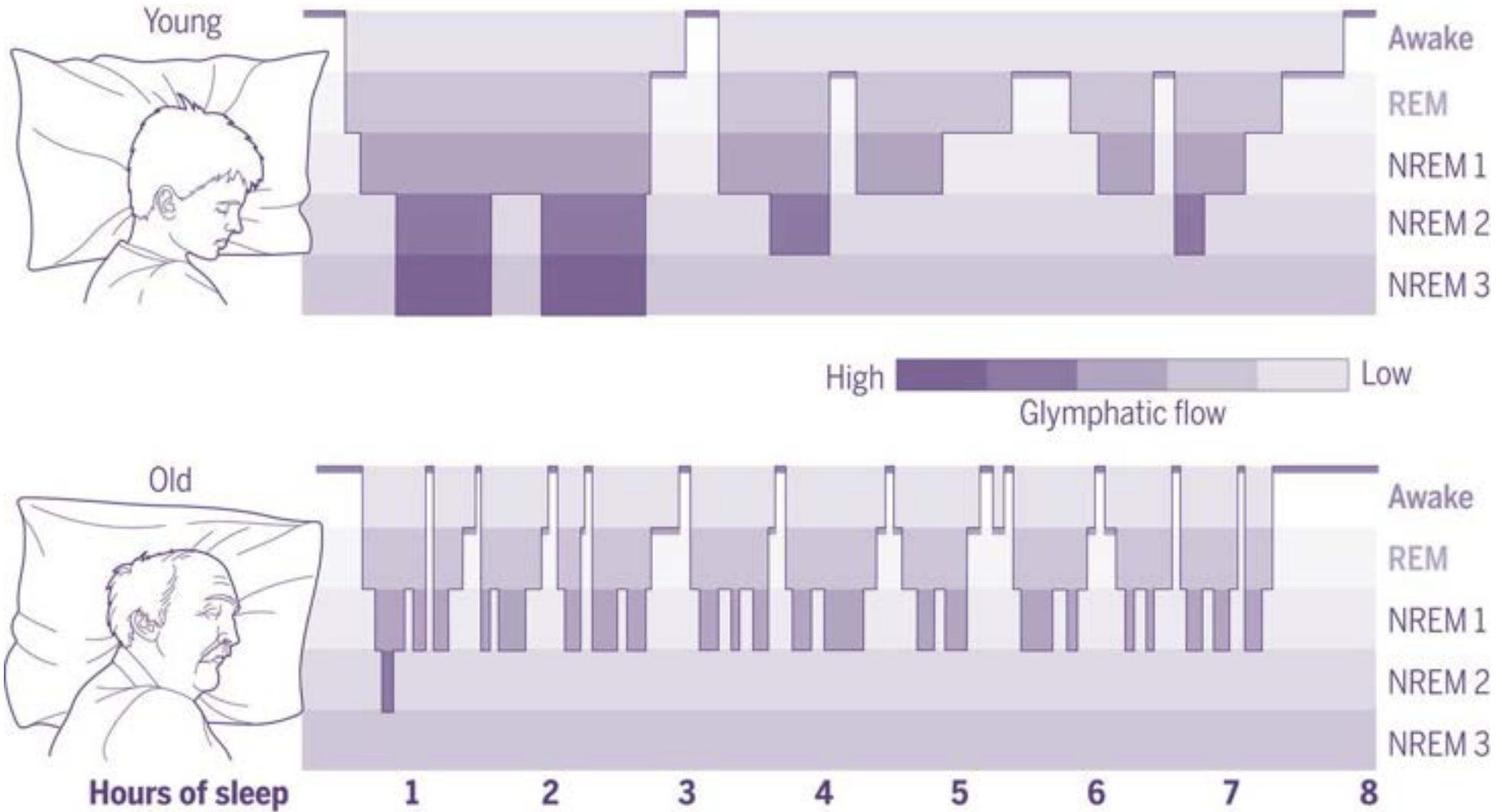
**Little Change  
after 70**



# SLEEP STAGES



# SLEEP Stages - AGING



# NAPS, SLEEPINESS, QUALITY - AGING

## NAPS

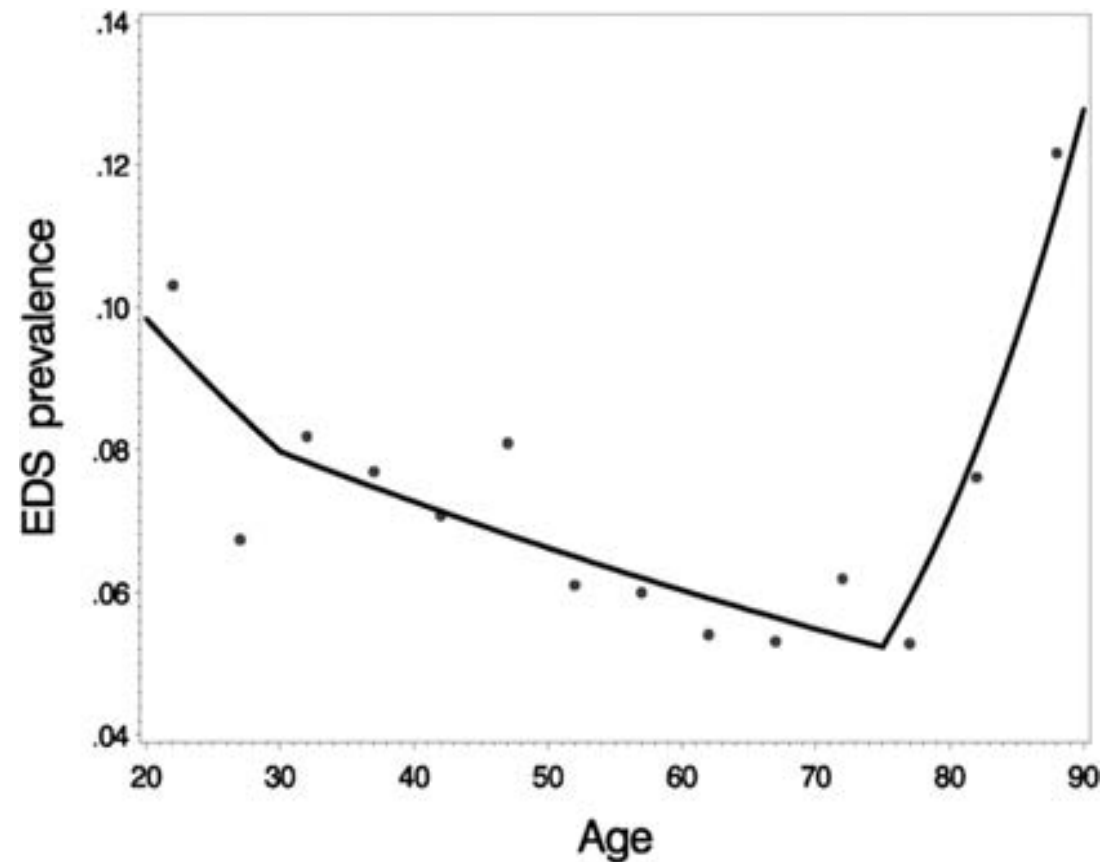
- Cultural
- Common across lifespan
- ↑ frequency with age
- Duration = no change

## SELF-REPORTED SLEEP QUALITY

- ↑ with age
- Accept changes
- Older less likely to report problems
- Changes with comorbidities

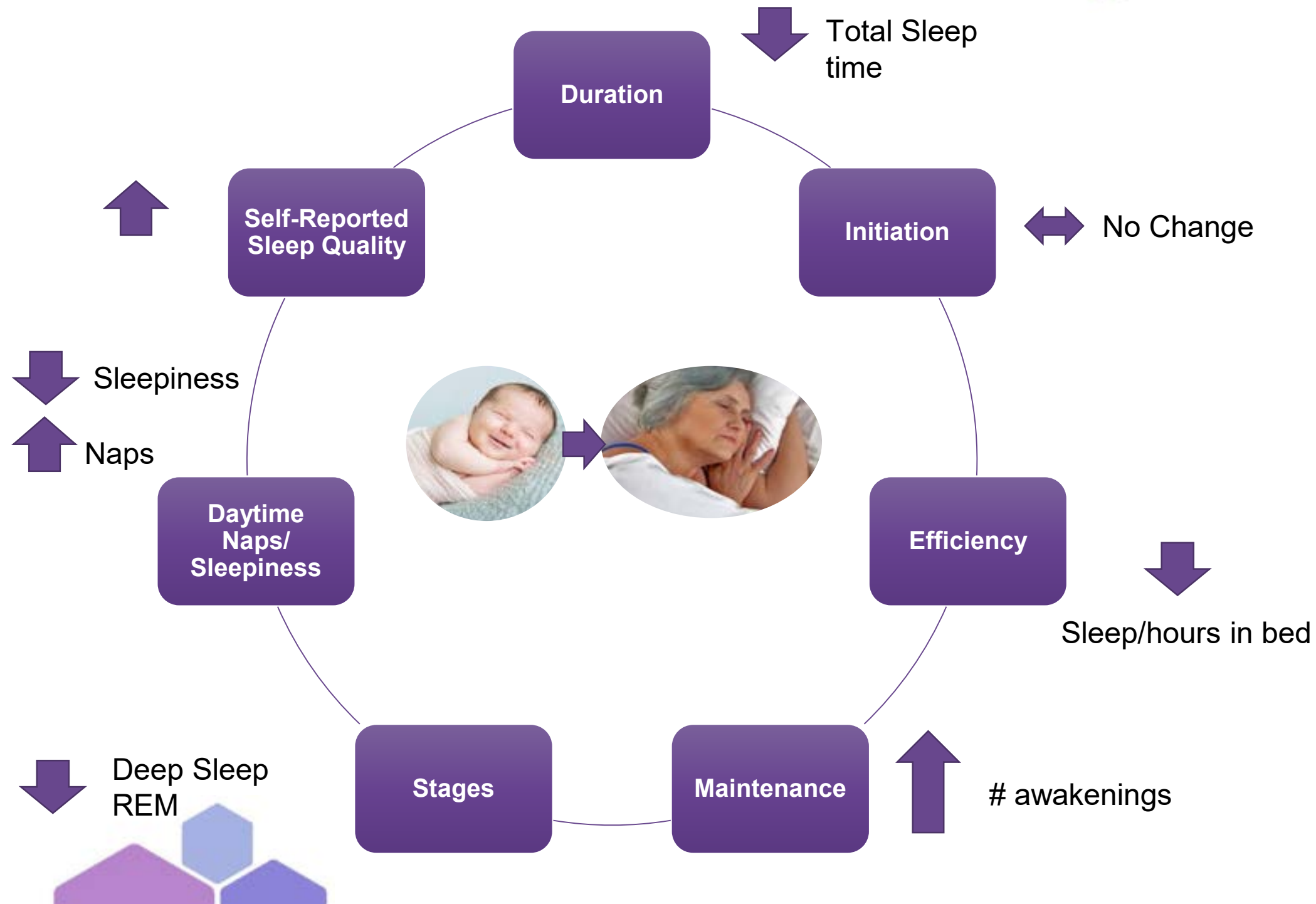
## EXCESSIVE DAYTIME SLEEPINESS

- Indicative of disease



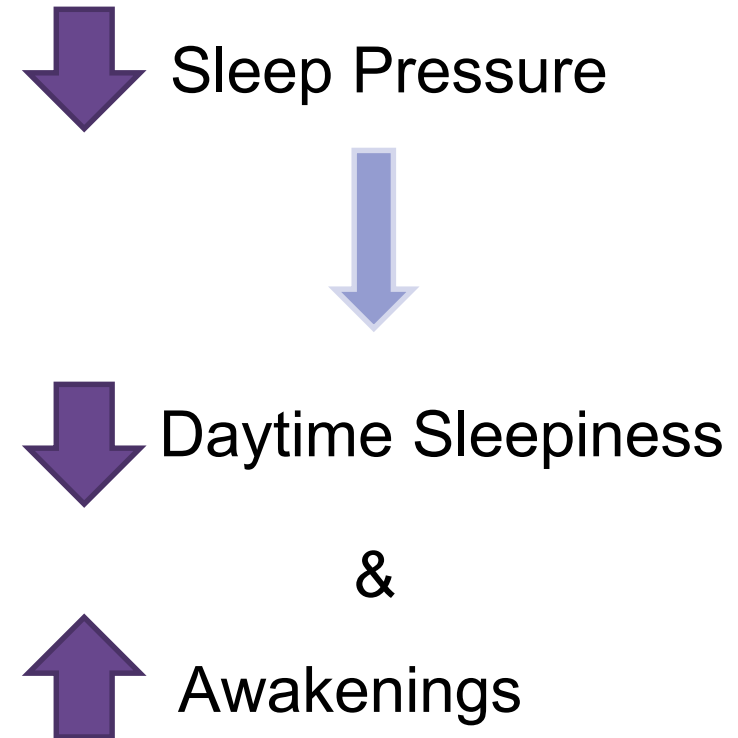
Bixler E, Vgontzas A, Lin H-M, Calhoun S, Vela-Bueno A, Kales A. The Journal of Clinical Endocrinology & Metabolism. 2005; 90(8):4510–4515.

# AGE-RELATED SLEEP CHANGES

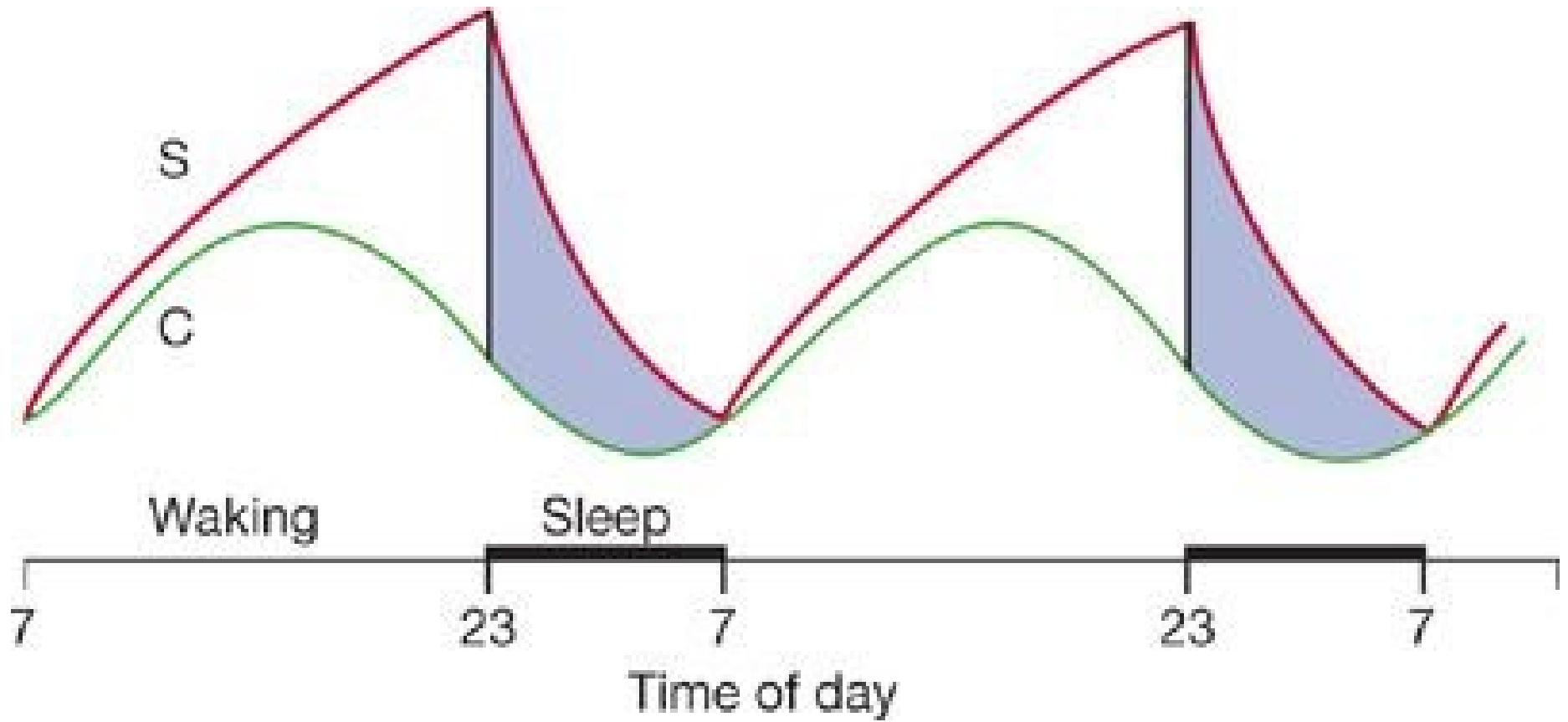




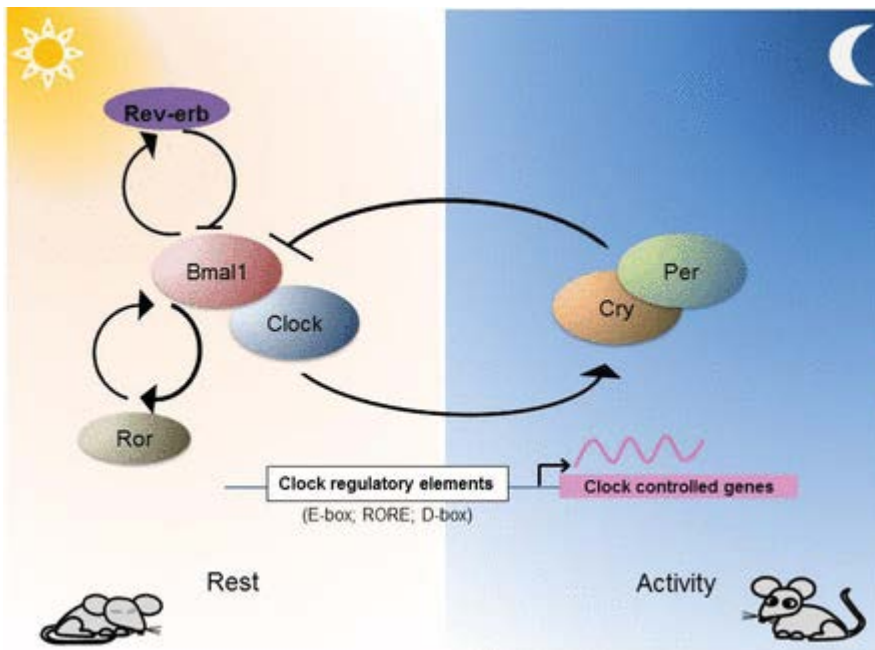
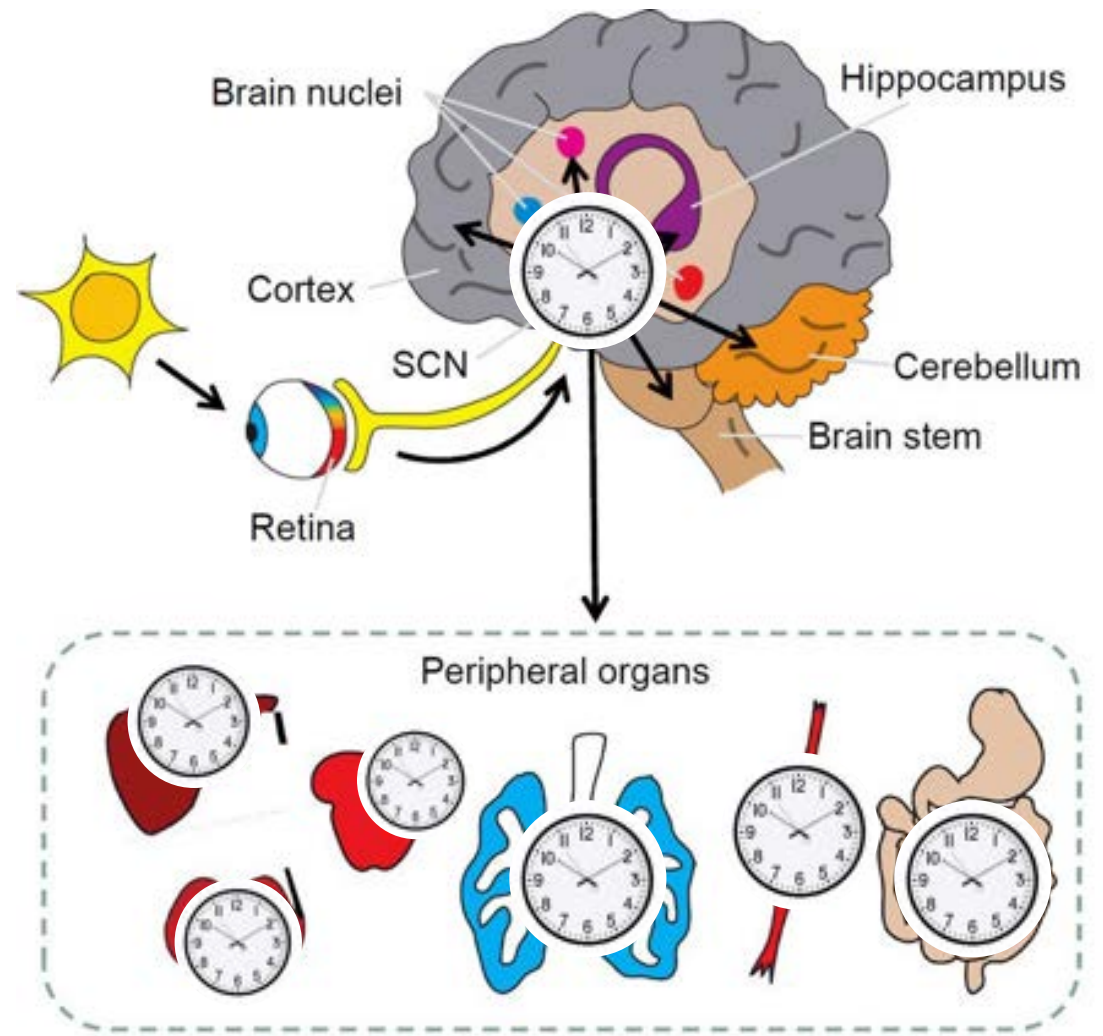
# HOMEOSTATIC SLEEP DRIVE



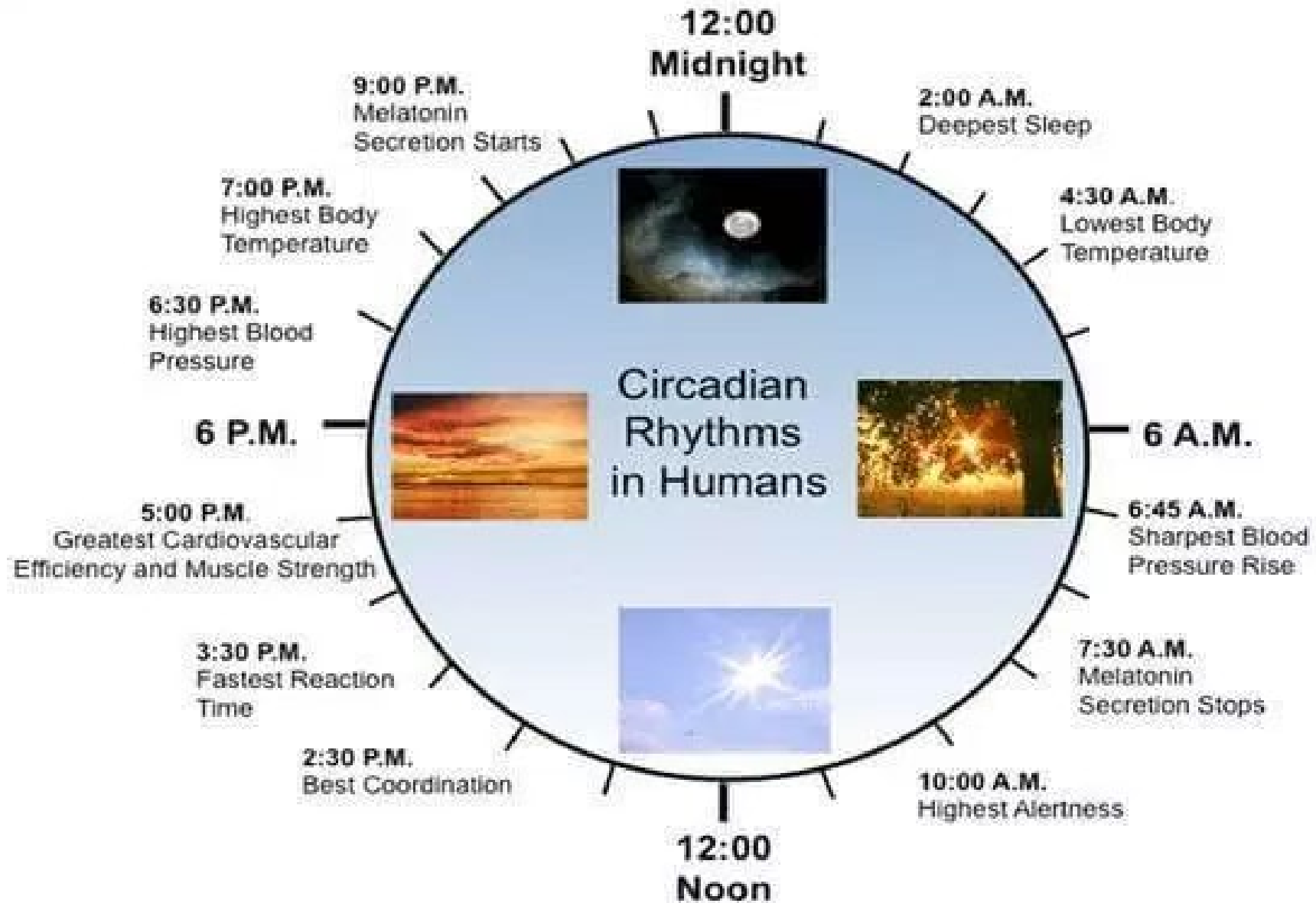
# PHYSIOLOGICAL CONTROL OF SLEEP/WAKE CYCLES



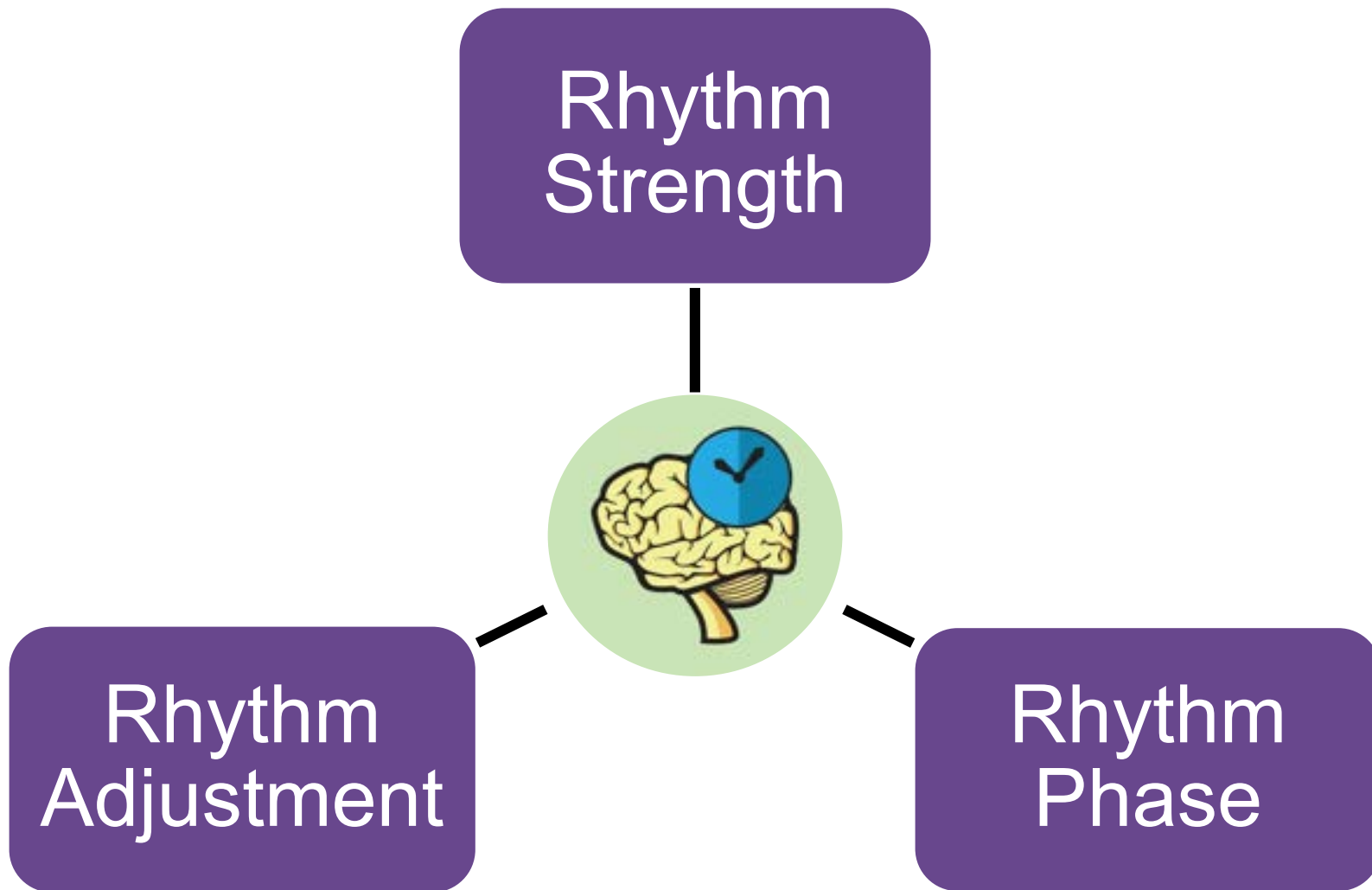
# CIRCADIAN RHYTHMS



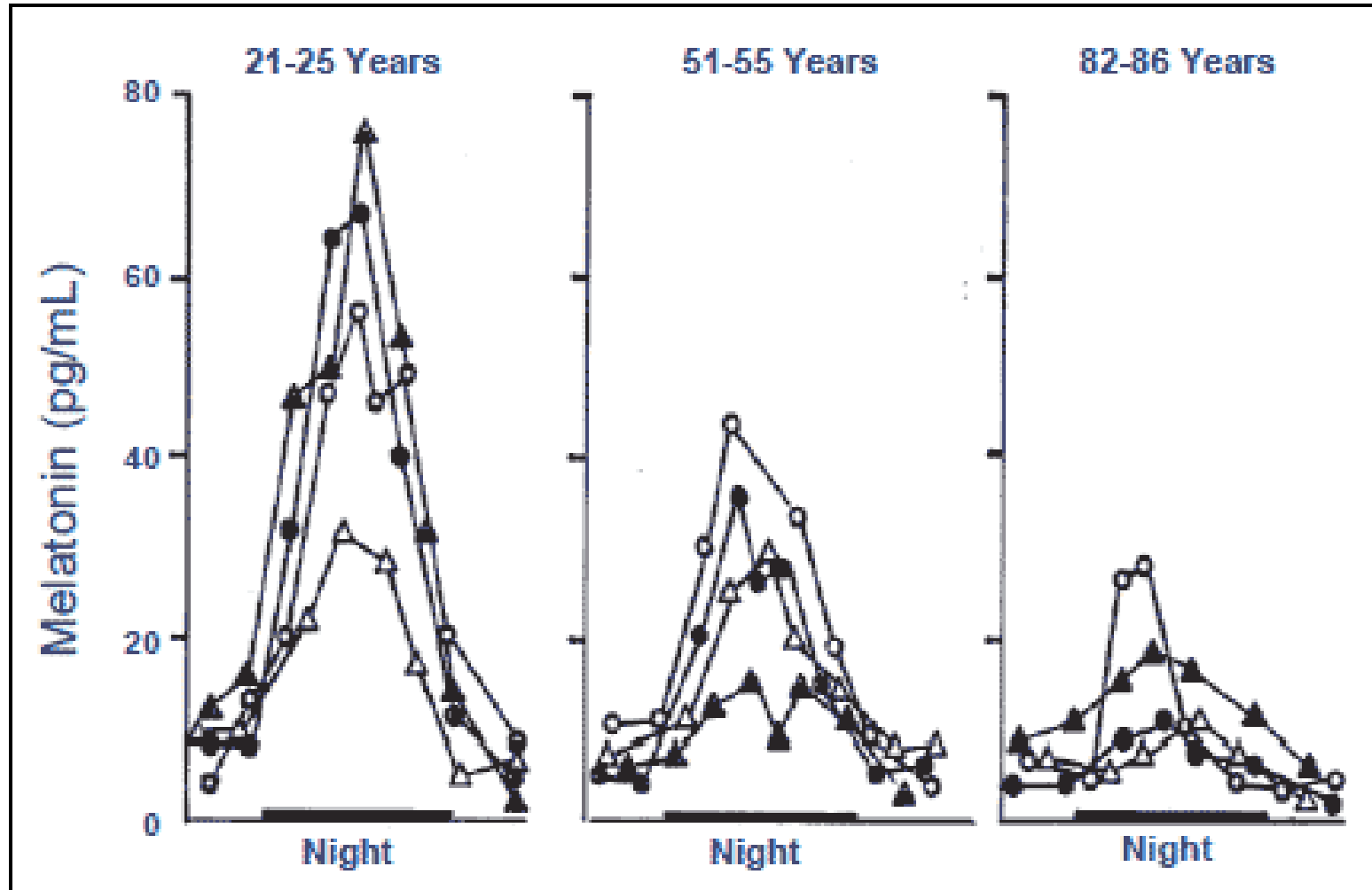
# CIRCADIAN RHYTHMS



# CIRCADIAN RHYTHMS - AGING

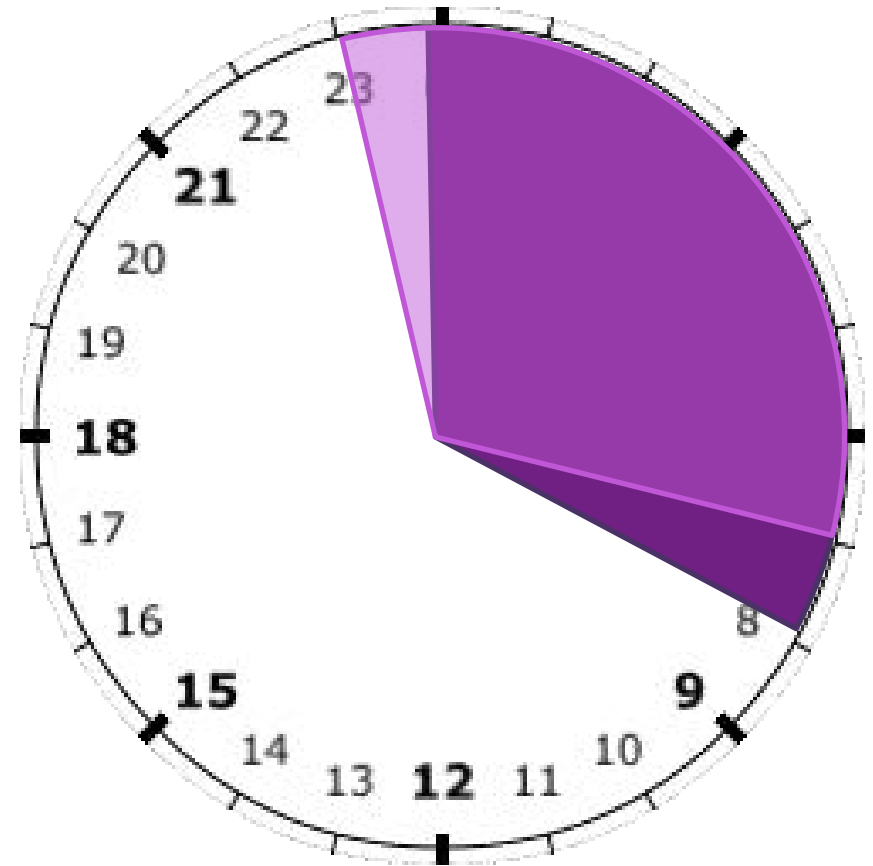
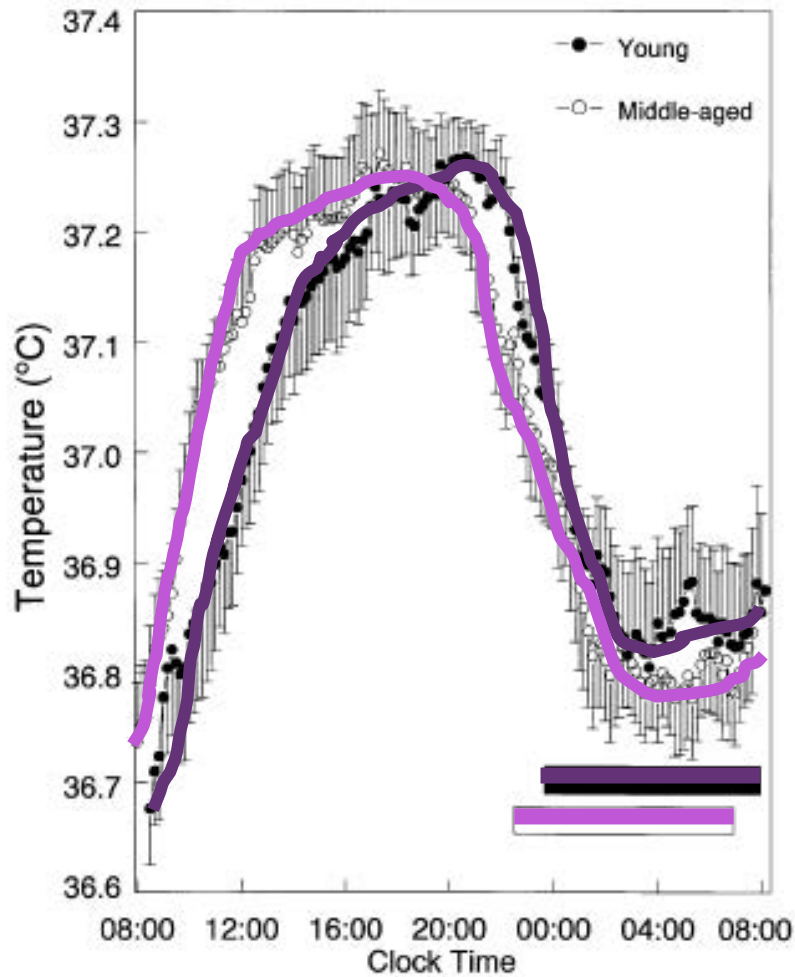


# Rhythm Strength - Aging



Benot S, Goberna R, Garcia-Marino S, Osuna C, Reiter RJ, Guerrero M. Physiological levels of melatonin contribute to the antioxidant capacity of human serum. *J Pineal Res* 1999; 27: 59-64.

# ADVANCED PHASE - AGING



Carrier J, Paquet J, Morettini J, et al. Phase advance of sleep and temperature circadian rhythms in the middle years of life in humans. *Neurosci Lett.* 2002;320:1-4.

# HUMAN JET LAG -AGING



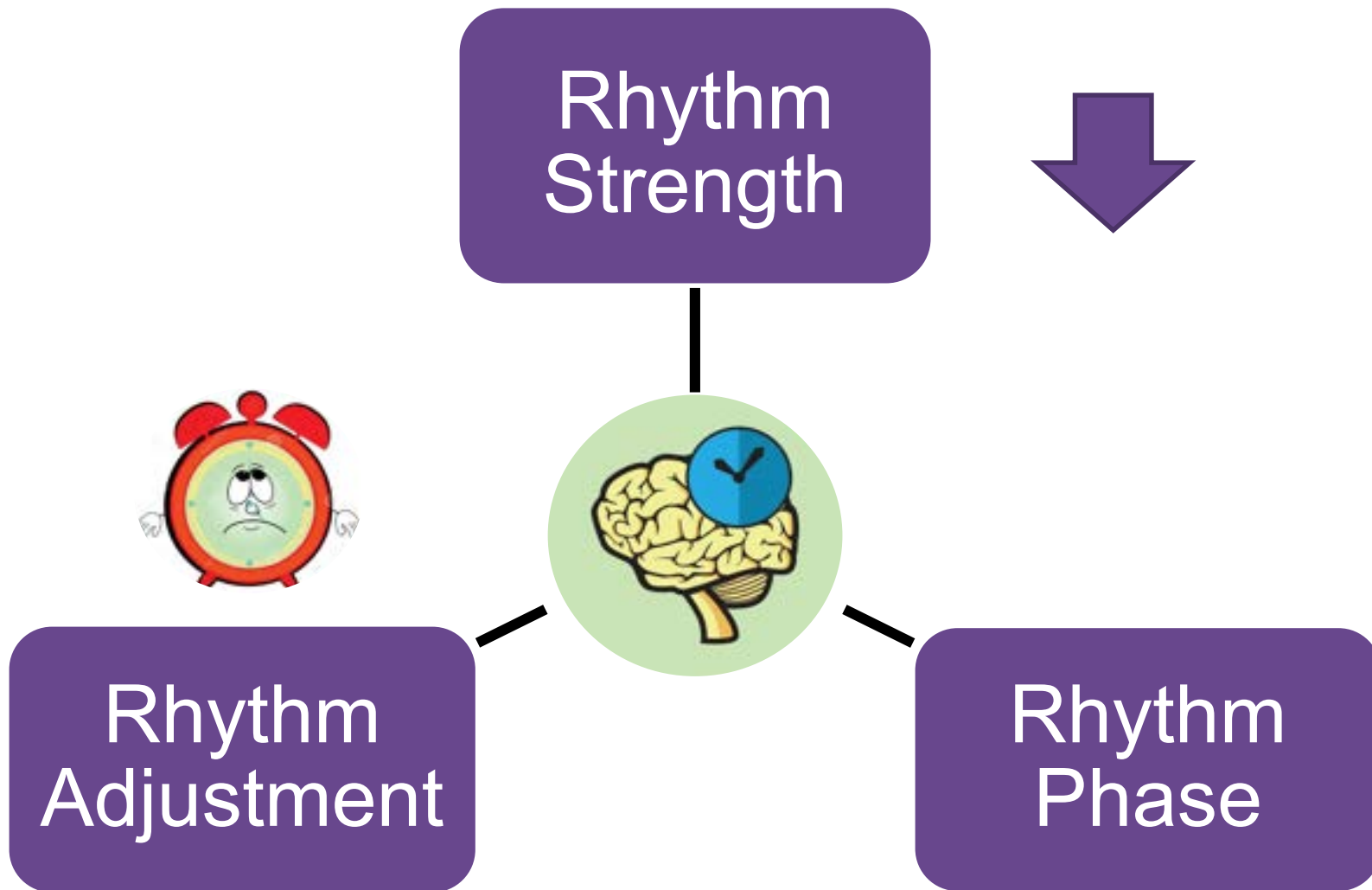
- Young adults (37 years)
- Elderly adults (81 years)
- 6 h phase advance (New York to Paris)
- 6 h phase delay (New York to Hawaii)

## Elderly Response

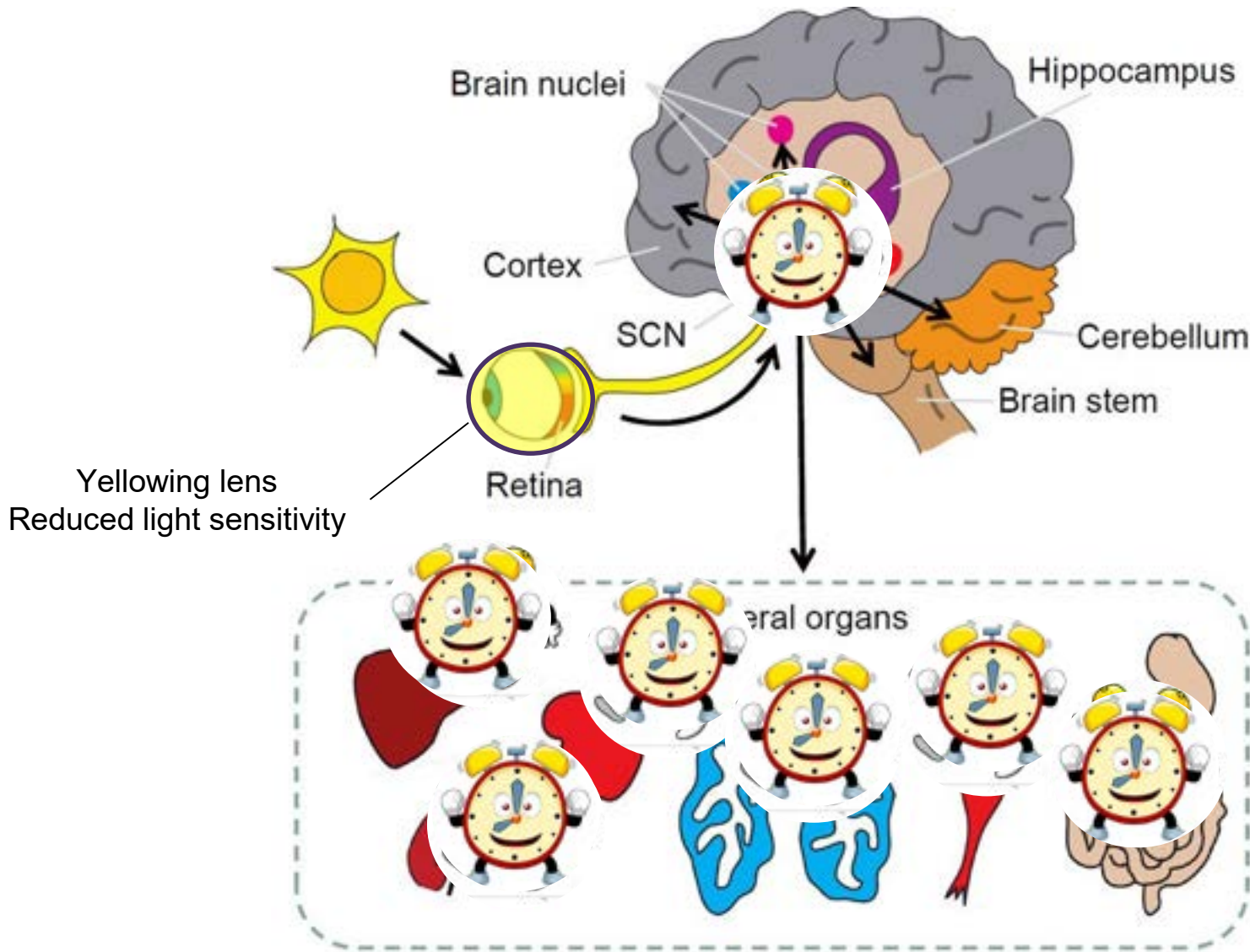
- ↓ Alertness
- ↓ Sleep Efficiency
- ↓ Body Temperature Rhythm
- ↑ Adjustment Time



# CIRCADIAN RHYTHMS - AGING



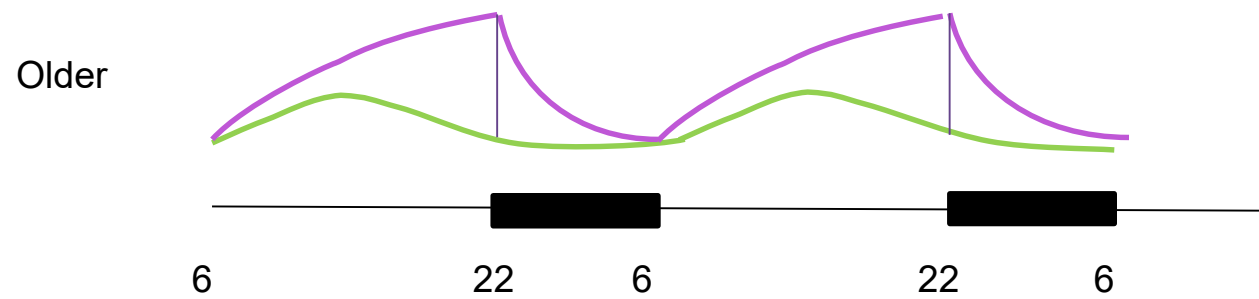
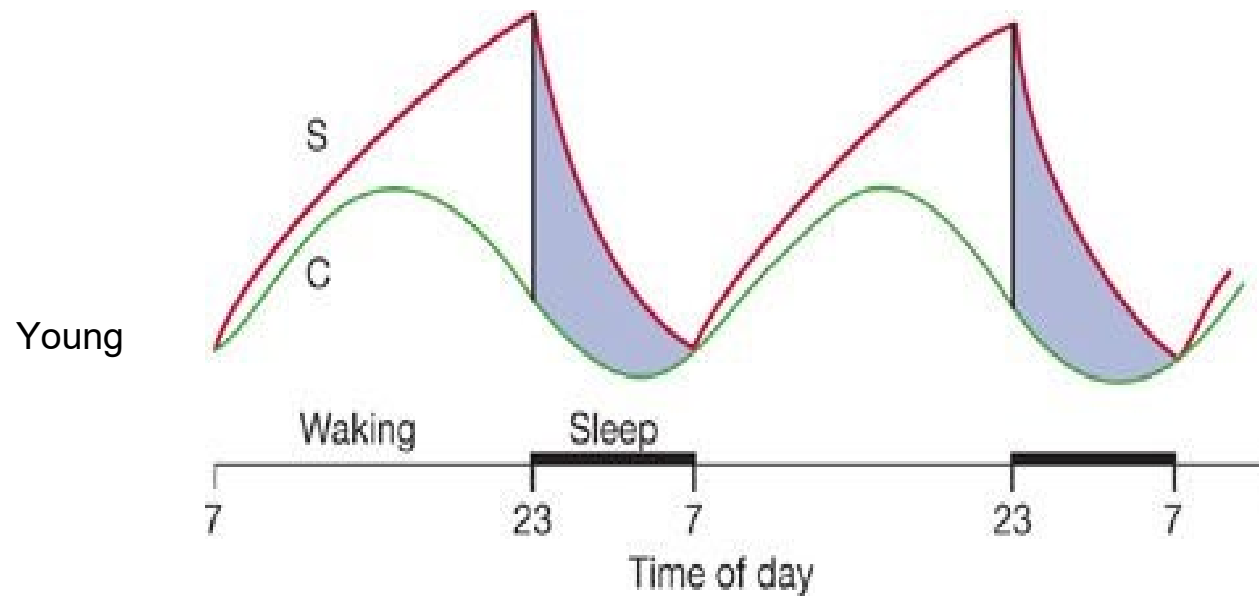
# WHY?



Scheduled Meals



# SLEEP/WAKE CYCLES



# Sleep, Rhythms and Alzheimer's Disease



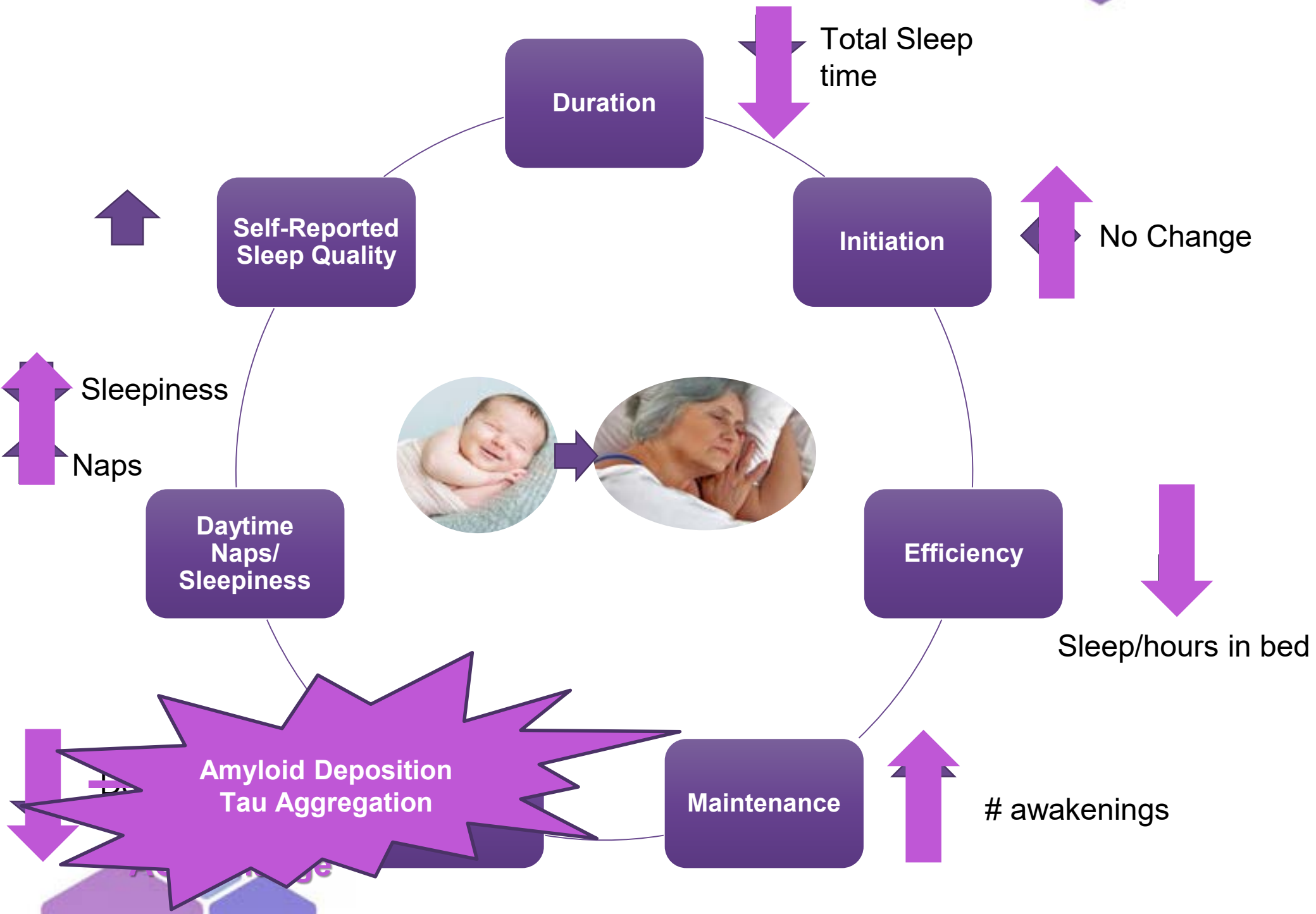
# Sleep Disorders in Dementia



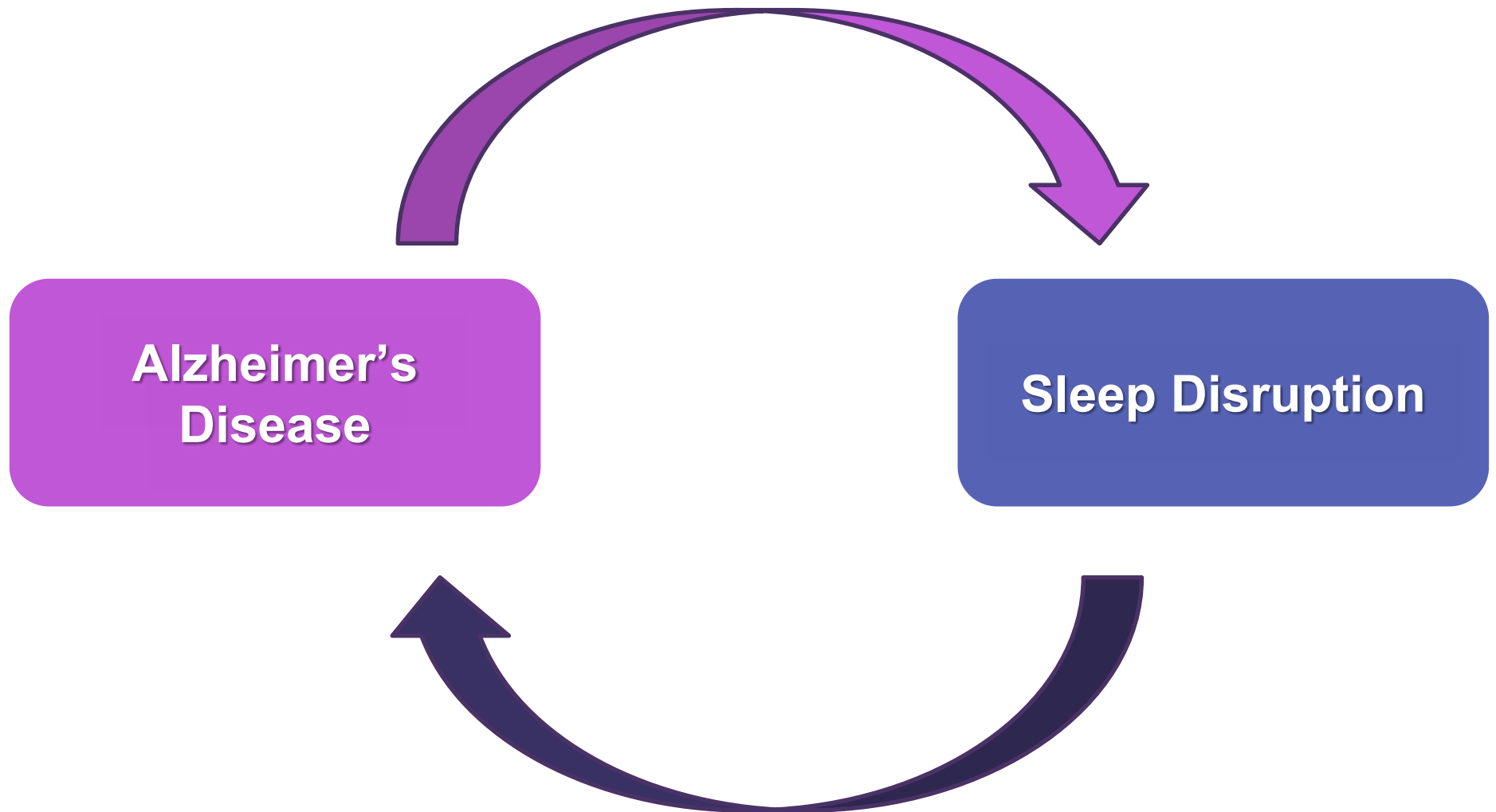
- Restless Legs Syndrome (Lewy Body Dementia)
- Obstructive Sleep Apnea
- REM Sleep Disorder
- Depression
  
- Other Sleep Issues
  - Sundowning
  - Wandering away



# SLEEP DISRUPTIONS IN AD



# SLEEP IN AD



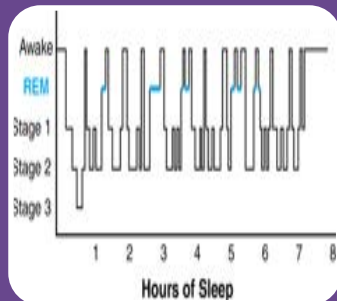
# SLEEP DISRUPTIONS → AD



Sleep disruptions may precede cognitive decline



Self-reported sleep problems associated with increased risk of dementia with 1-9 years



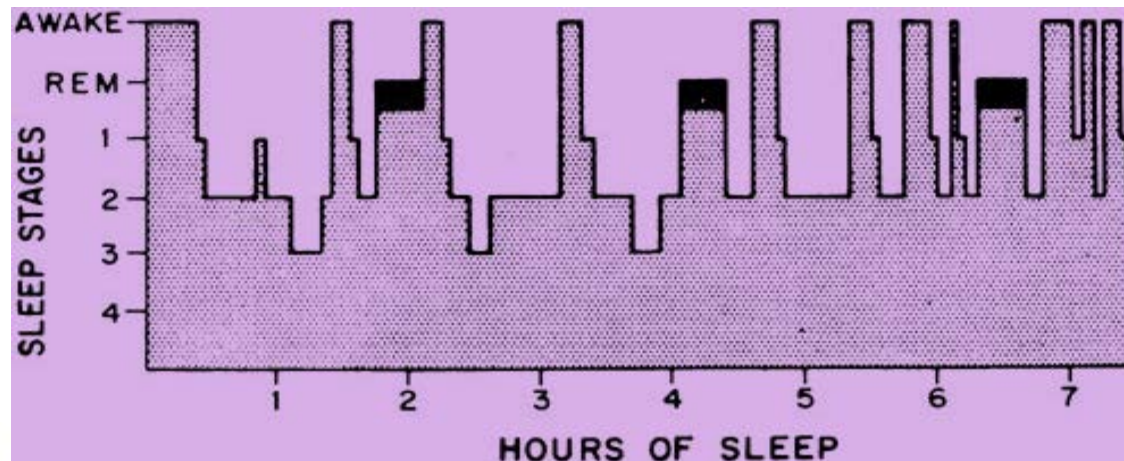
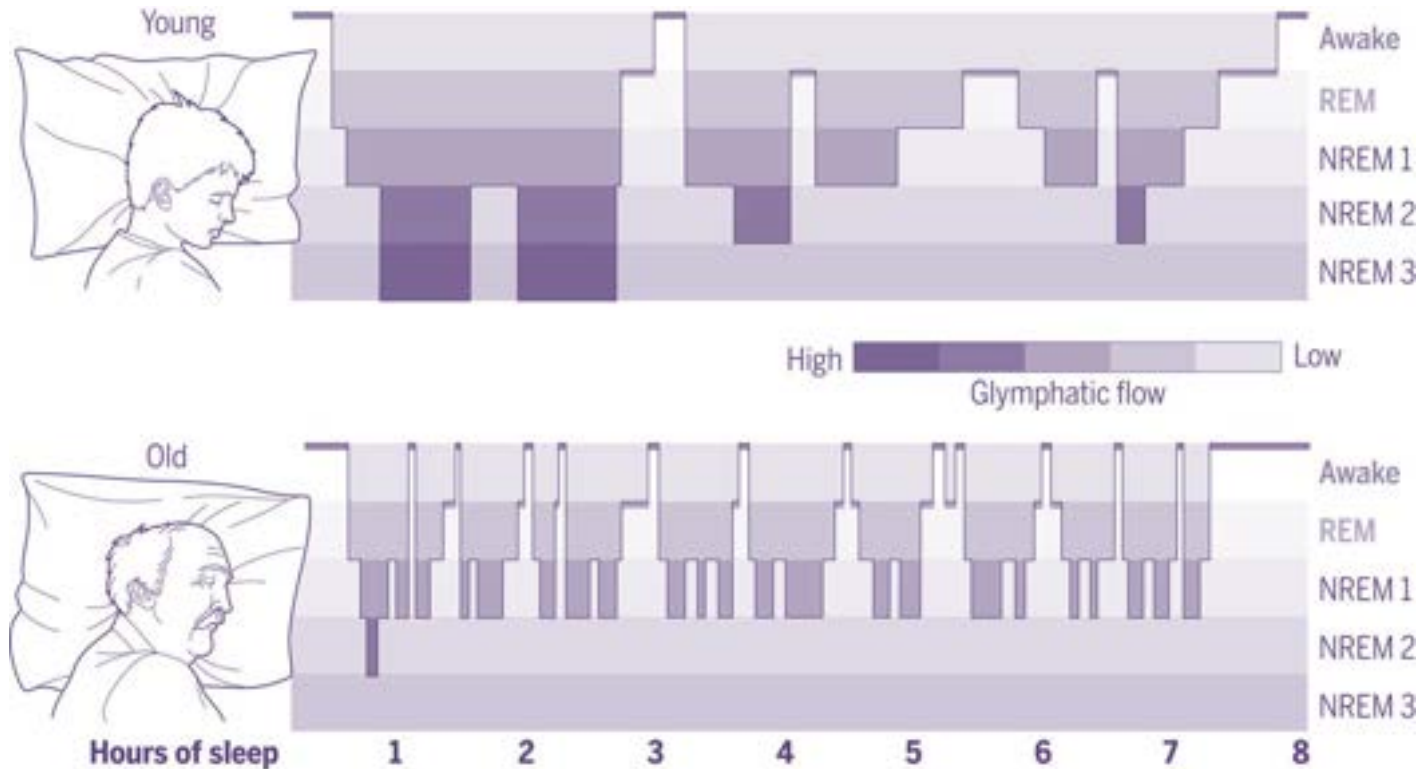
## Sleep Fragmentation

- 1.5 fold increased risk for dementia in 6 years
- Exacerbates effects of apolipoprotein A4 on dementia risk, tau pathology
- Increases amyloid beta deposition

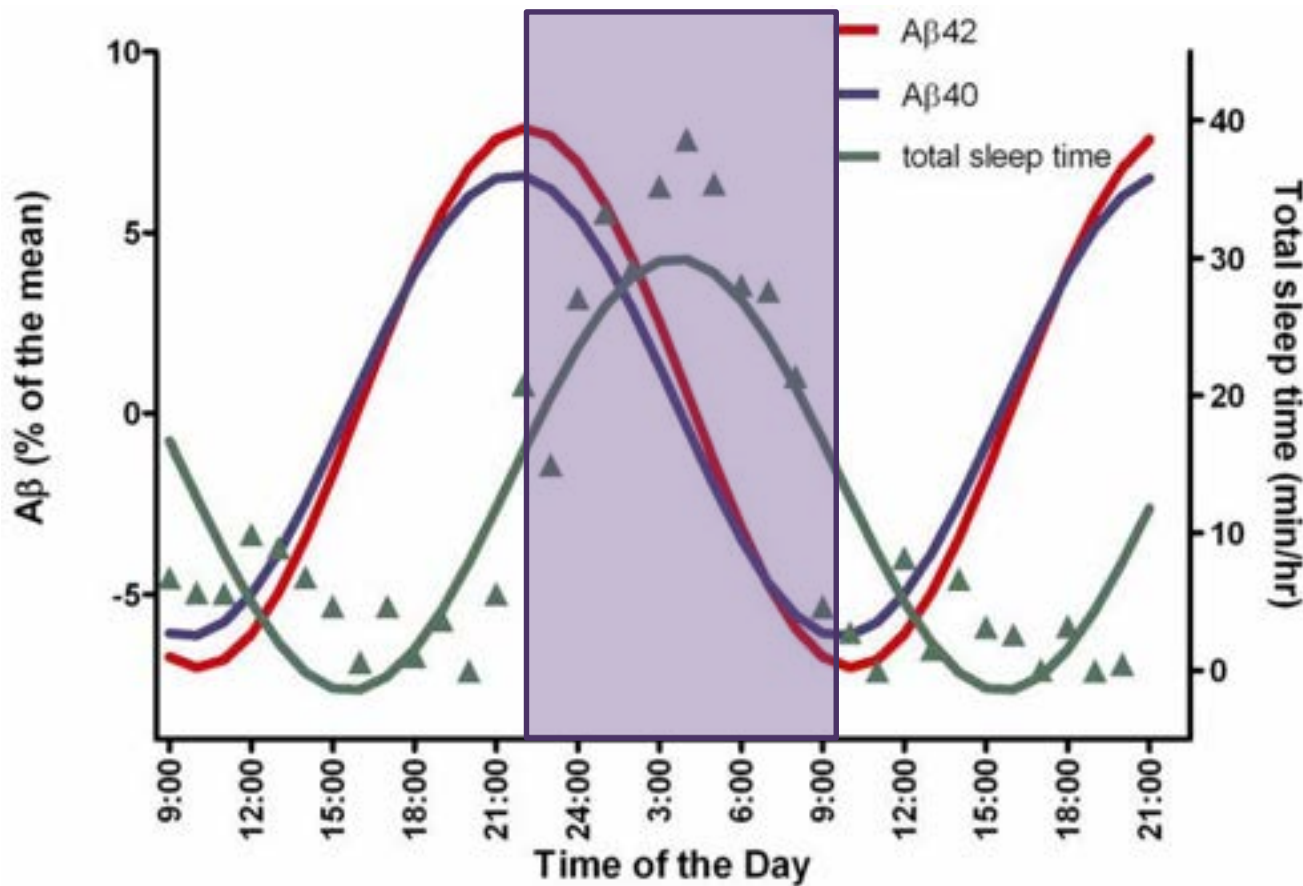




# Sleep Architecture in AD



# SLEEP REMOVES A $\beta$ FROM CSF



A $\beta$  production = wakefulness due to increased neuronal activity

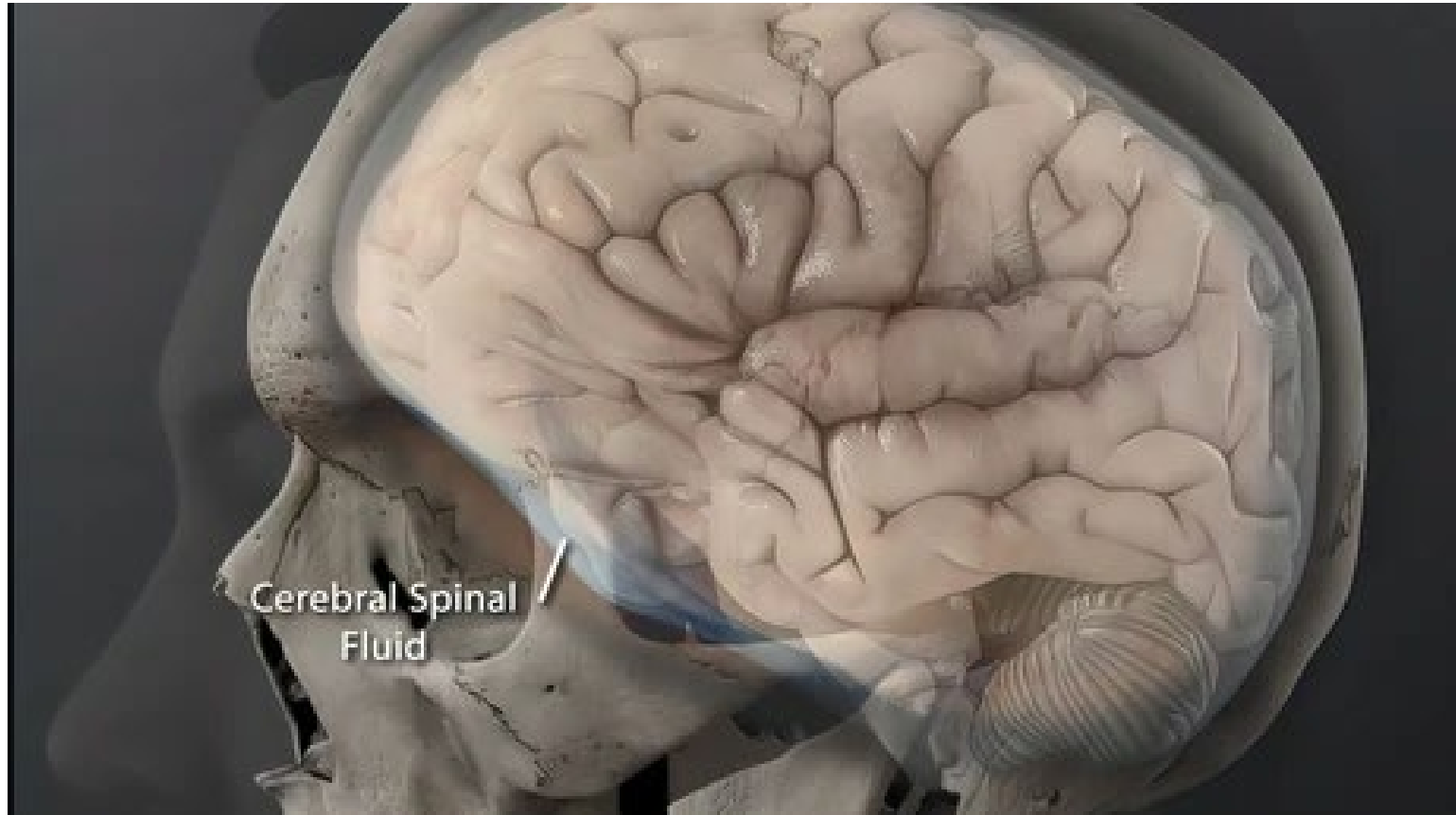
A $\beta$  production reduced during SWS

A $\beta$  cleared by glymphatic flow during sleep

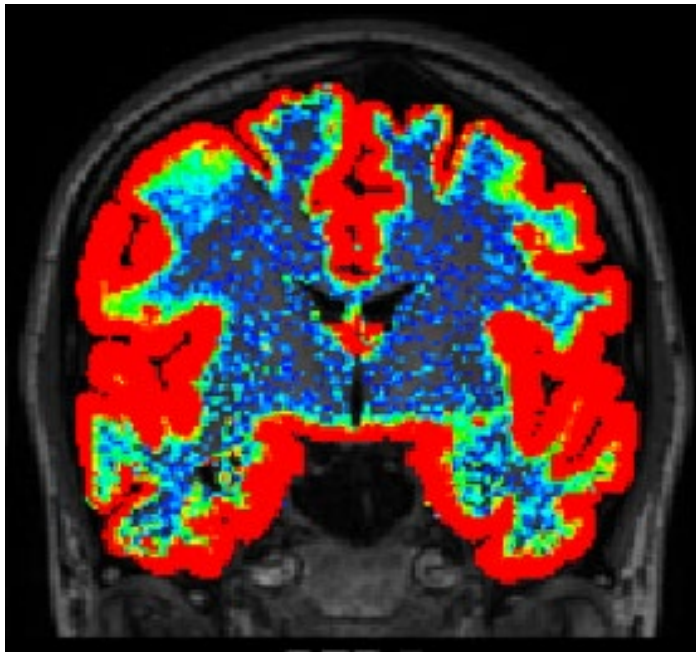
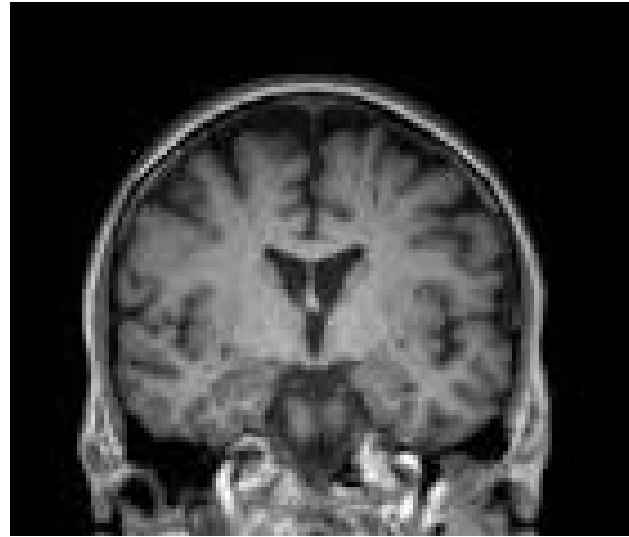
Huang Y, Potter R, Sigurdson W, et al. Effects of age and amyloid deposition on A $\beta$  dynamics in the human central nervous system. *Arch Neurol.* 2011;69(1):51–58. doi:10.1001/archneurol.2011.235



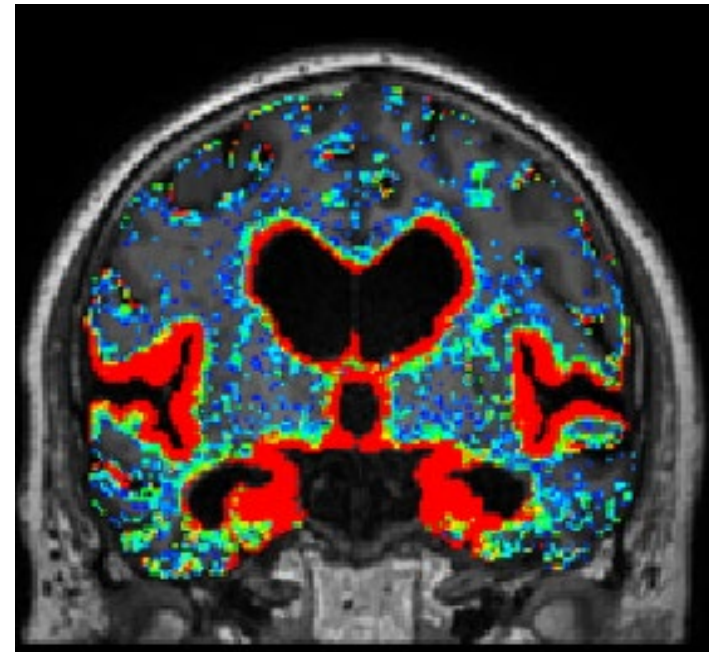
# Cerebrospinal Fluid



# Glymphatic Flow



Healthy

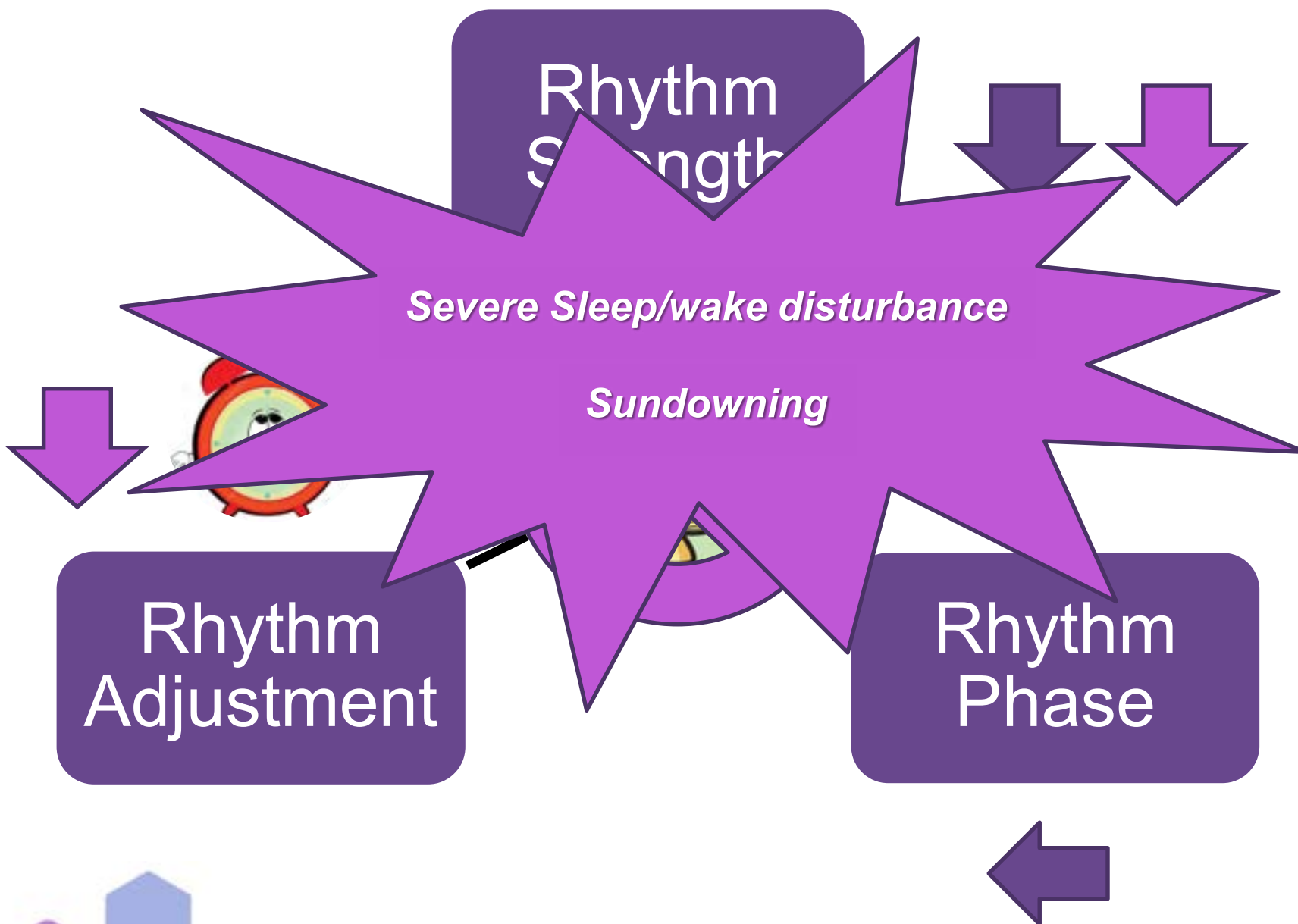


Alzheimer's

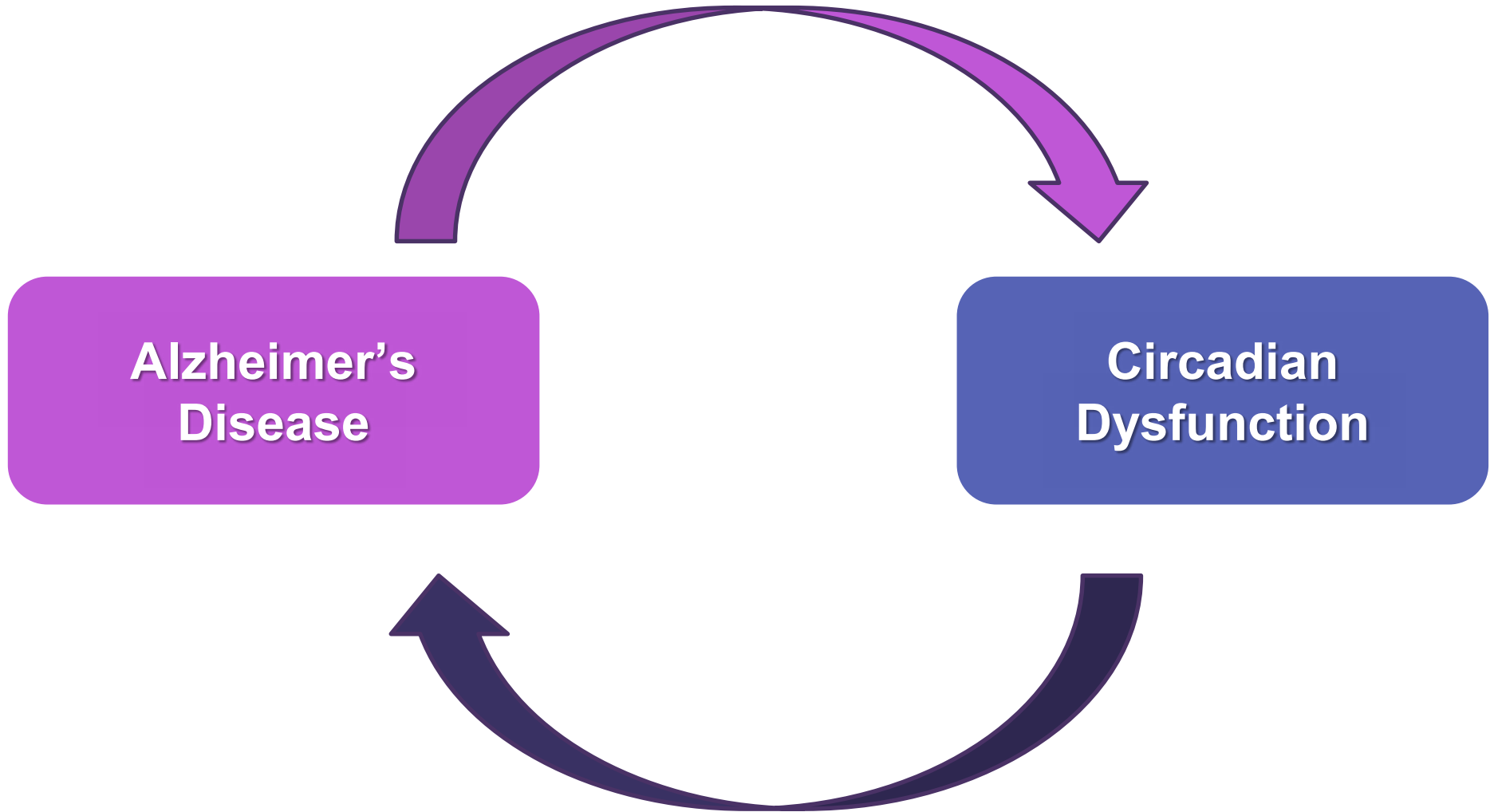




# CIRCADIAN RHYTHMS - AD



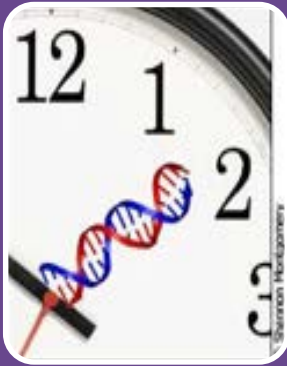
# CIRCADIAN RHYTHMS IN AD



# RHYTHM DISRUPTIONS → AD



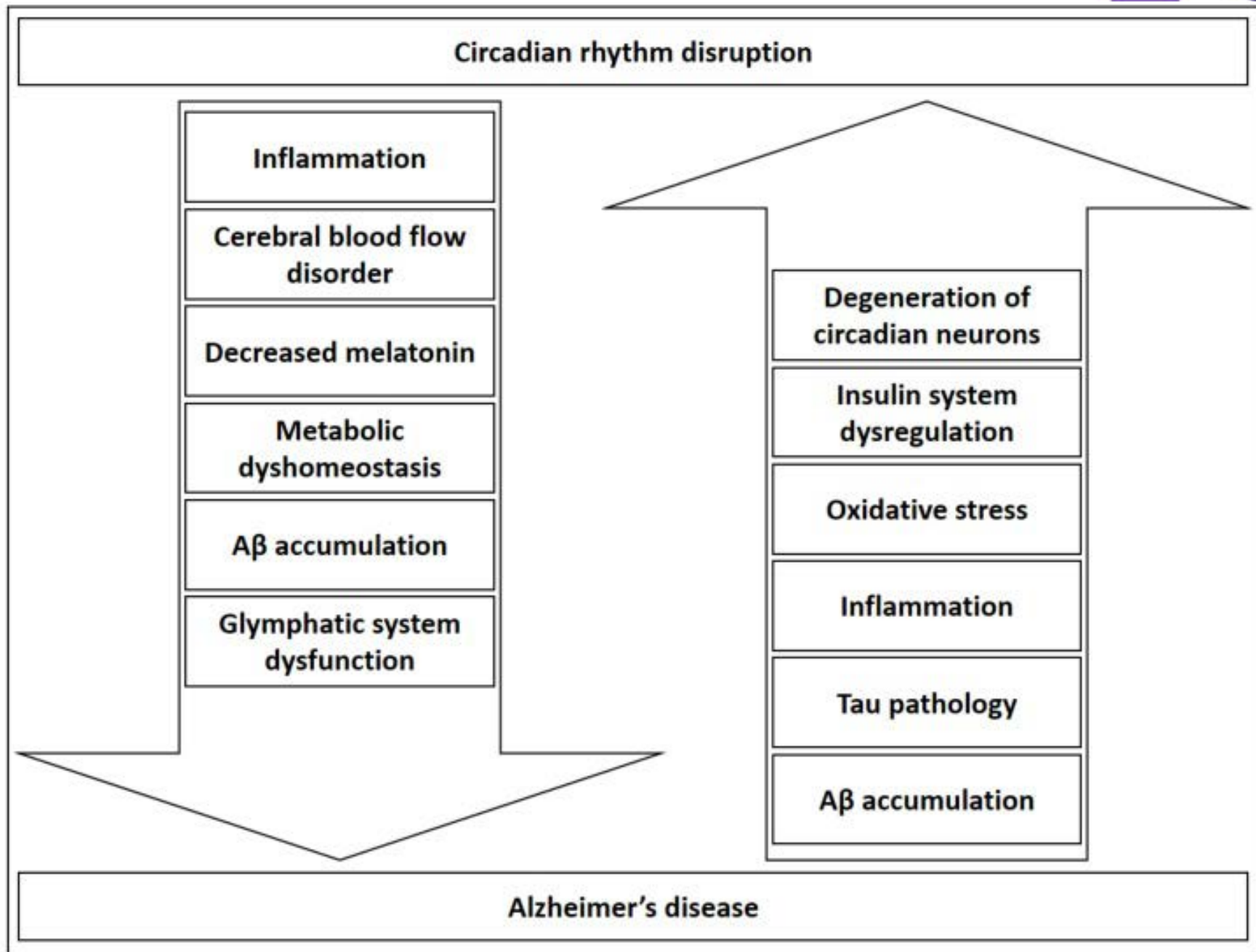
Circadian disruptions may precede cognitive decline



## Clock genes

- Regulate amyloid beta
- Regulate neuroprotective proteins
- Regulate oxidative stress





Homolak J, Mudrovčić M, Vukić B, Toljan K. Circadian Rhythm and Alzheimer's Disease. *Med Sci (Basel)*. 2018;6(3):52. Published 2018 Jun 21.

# Recommendations



## Activities

S

L

E

E

P



# Activities



# Recommendations



Activities

Schedule

L

E

E

P



# Schedule

**POWER NAP**



A SHORT NAP BETWEEN 10-30 MINUTES TO BOOST ENERGY, MEMORY, AND PRODUCTIVITY



# Recommendations



Activities

Schedule

Light

E

E

P



# Light



# Recommendations



Activities

Schedule

Light

Environment

E

P





# Environment



Pink Noise



# Recommendations



Activities

Schedule

Light

Environment

Eat and Drink

P



# Eat and Drink



FOODS TO KEEP IN YOUR KITCHEN FOR...

## SLEEP

- TART CHERRY CONCENTRATE**  
melatonin
- PUMPKIN SEEDS**  
magnesium
- CHAMOMILE TEA**  
flavonoids
- COTTAGE CHEESE**  
tryptophan

@dlatner

# Recommendations



Activities

Schedule

Light

Environment

Eat and Drink

Prescriptions



# Prescriptions



Activities  
Schedule  
Light  
Environment  
Eat and Drink  
Prescriptions



**THANK  
YOU  
and  
KEEP  
SLEEPING**

SLEEPING

KEEP

