

**UCSF** Weill Institute for Neurosciences

Memory and Aging Center

# Sleep In Seniors

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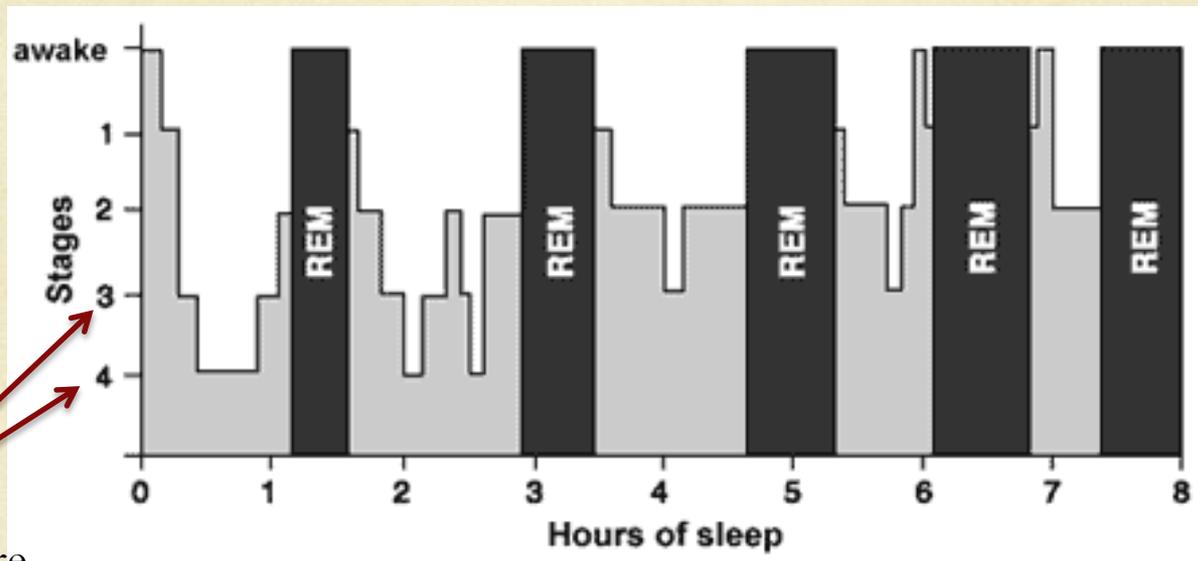
# Outline

- What is sleep
- Sleep and cognition in young adults
- Sleep and cognition in older adults
- Neurodegenerative disease and sleep
  - Amyloid
  - Tau
- Common sleep disorders
- Treatments

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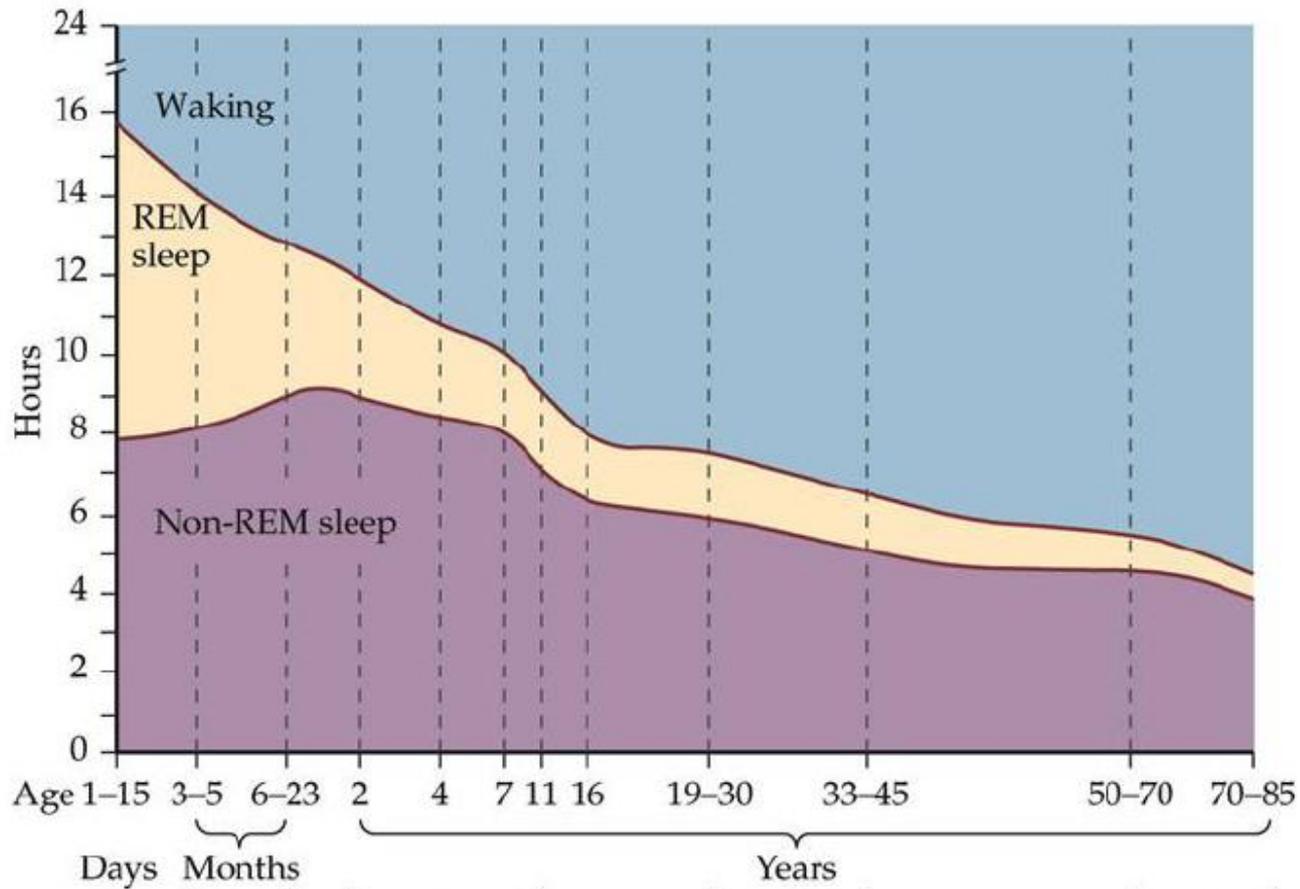
# Hypnogram



Stages 3 & 4 are now referred to as Stage 3

First half of the night is predominantly NREM sleep  
Second half has a greater amount of REM sleep than the first half

# Sleep/wake cycle across the lifespan



Roenneberg et al., 2004

# What is the ideal duration of sleep?

- Guideline: 7-9hrs of sleep AASM
- The right amount for you:
  - You are awake, alert and energetic throughout the day

# Sleep deprived young adults

- Increased sensitivity to pain (Haack et al., 2009)
- Impaired reaction times, coordination and alertness (Dawson & Reid, 2007; Lim & Dinges, 2008 & 2010; Goel et al., 2009)
- Impaired working memory (e.g. Mu et al., 2005; Drummond et al., 2012; Turner et al., 2007)
- Impaired declarative memory (Benedict et al., 2009; Gais & Born, 2004; Lau et al., 2010; Plihal & Born, 1997; Rasch et al., 2007; van der Werf et al., 2011)
- Impaired emotion regulation (Minkel et al., 2011; van der Helm et al., 2010; Anderson et al., 2010; Anderson & Platten, 2011; Tempesta et al., 2010)
- Impaired social skills (McKenna et al., 2007; Anderson & Dickinson, 2010)

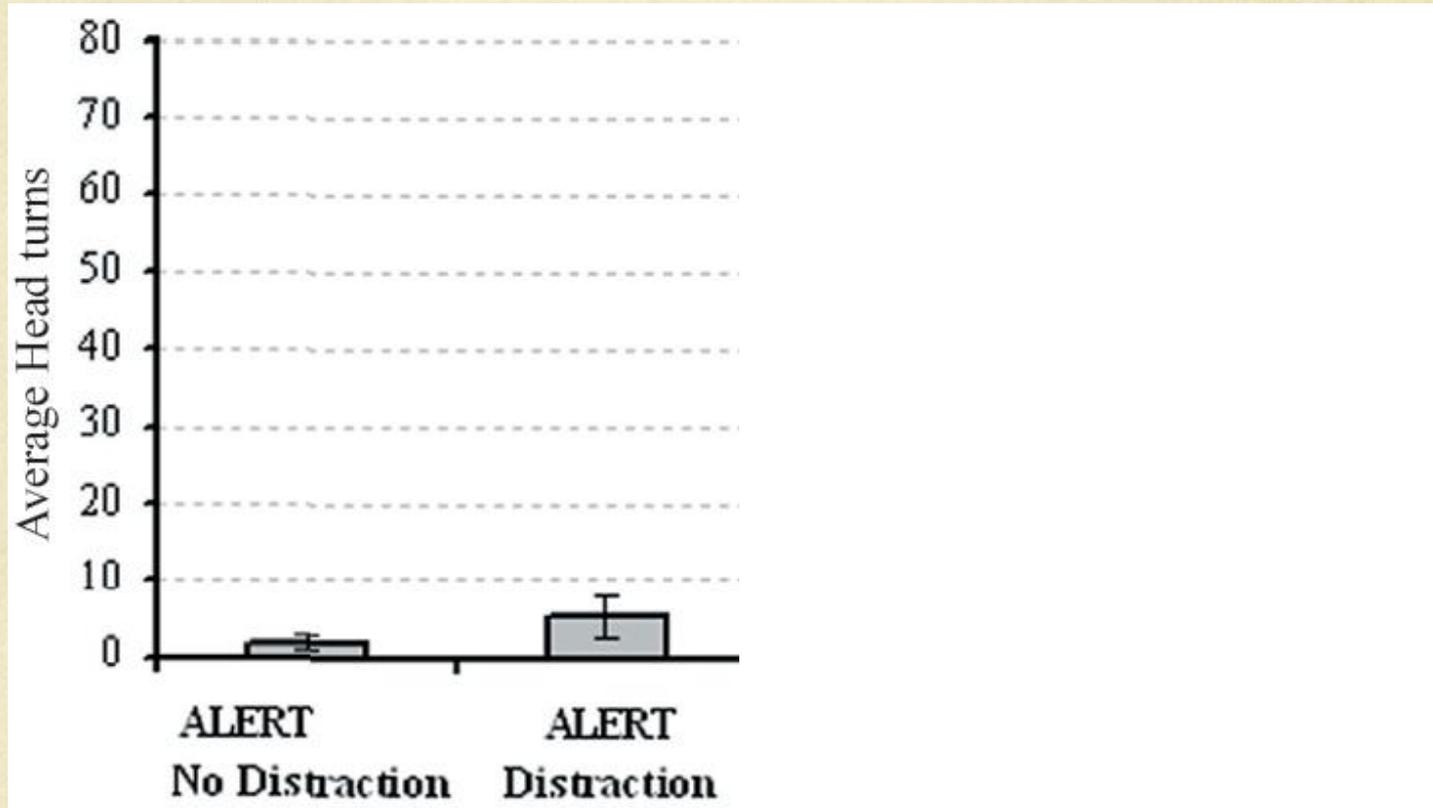
14 days of 6hrs sleep/night

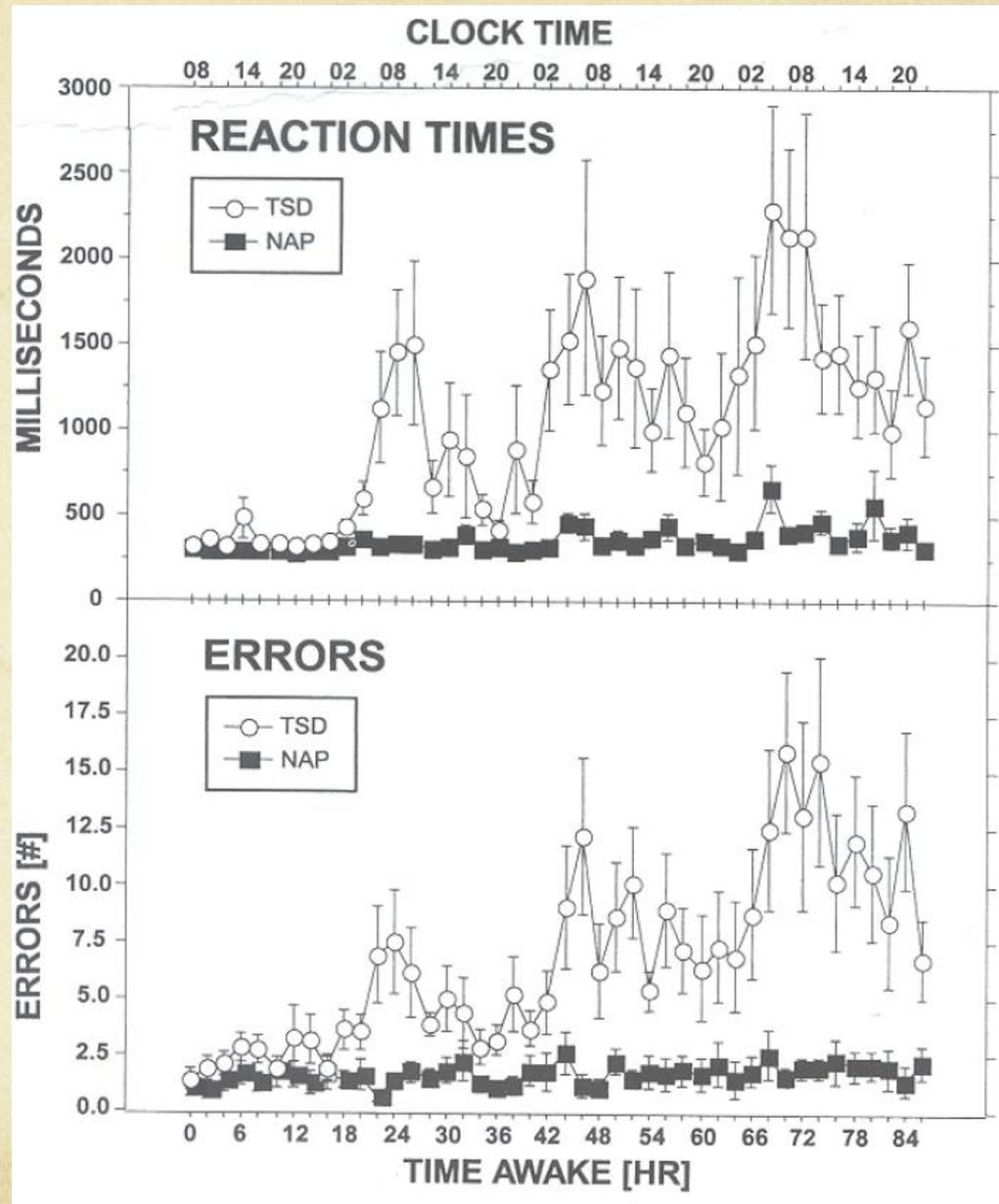
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2 days of complete sleep deprivation

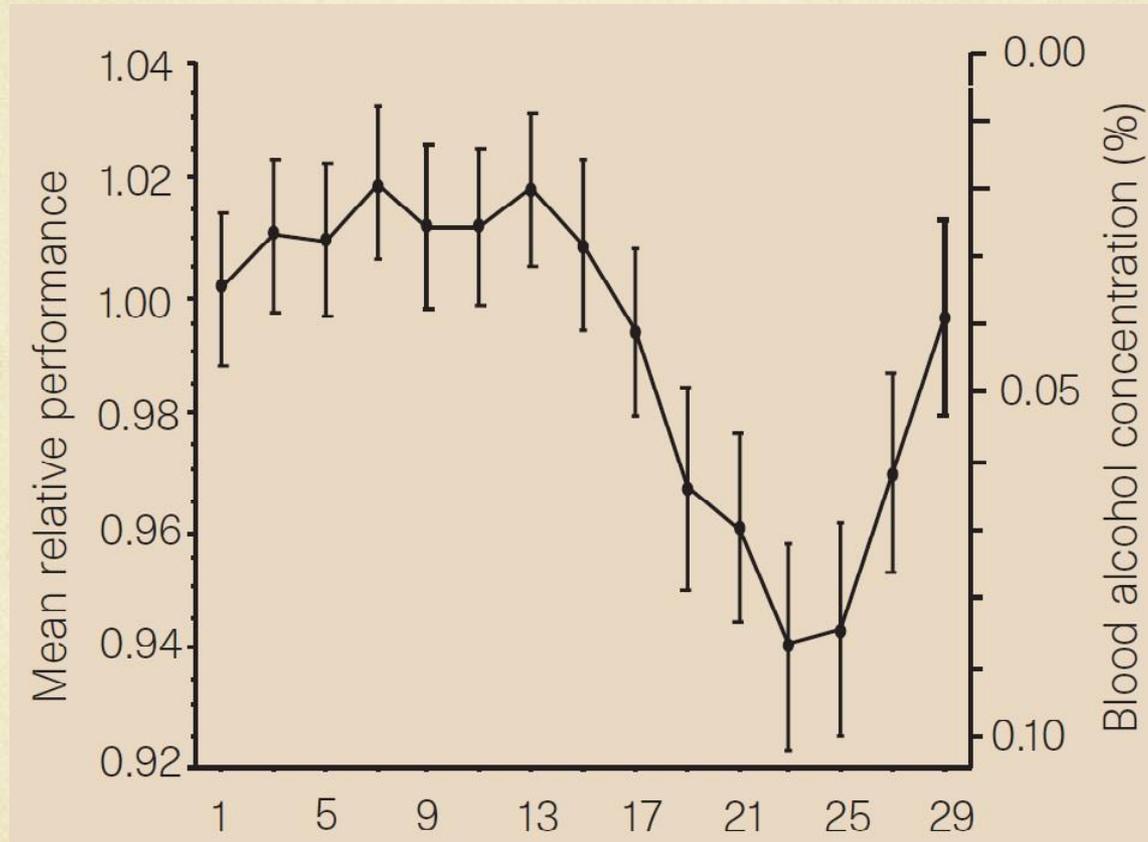
(van Dongen et al., 2003)

# Ever had the TV on while working?





# Hand-eye coordination



8am

1pm Day 2

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~~“Older adults need less sleep”~~

Older adults are less affected by sleep deprivation than young adults (Duffy et al., 2007)

# Current status of studies on sleep and cognition in older adults

- Mixed reports on the relationship between
  - objective and subjective sleep measures (Blackwell et al., 2011; Beaudreau et al., 2012; Parsey et al., 2015)
  - subjective sleep quality and cognition, particularly memory and individual tasks of executive function (Nebes et al., 2009; Blackwell et al., 2011; Beaudreau et al., 2012; Saint Martin et al., 2012)
  - objective sleep measured by actigraphy and cognition (Oosterman et al., 2009; Blackwell et al., 2011; Cochrane et al., 2012; Wilckens et al., 2014)
- Many studies do not
  - identify those with mild cognitive impairment
  - report on a number of individual cognitive assessments

# Sleep & Cognition in Healthy Older Adults

- Working memory is
  - Worse in individuals who think they take longer to fall asleep
  - Worse in those who feel they sleep less
- Processing speed is
  - Slower in individuals with more extreme sleep durations
- Prolonged memory recall is
  - Worse in individuals with more extreme sleep durations

Subjective sleep is associated with cognitive performance

Too much or too little sleep is not a good thing

# Sleep and the brain in healthy older adults

- Higher sleep efficiency is associated with greater parahippocampal brain volumes
- Baseline sleep efficiency predicts the rate of volume loss in the parahippocampus over time (Fox et al., INS 2018)
- Longer time spent in REM sleep was associated with “healthier” white matter in the corpus callosum (Altendahl et al., INS 2018)

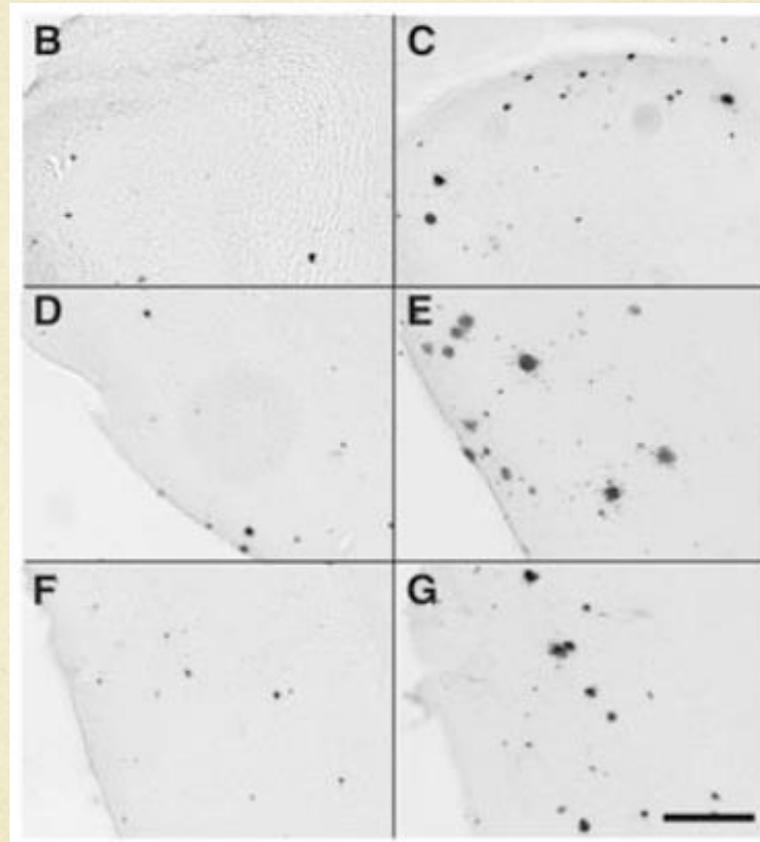
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# Sleep & Cognitive status

- As cognitive impairments advanced, sleep disturbances also increased (Yaffe et al., 2007)
- In individuals with Mild Cognitive Impairment (MCI): longer time to fall asleep in bed was associated with impaired memory (Westerberg et al., 2010)
- As sleep disturbance increased, risk of cognitive impairment increased (Blackwell et al., 2006; 2011)
- In an older adult population, a disrupted circadian cycle predicts
  - progression to mild cognitive impairment (Tranah et al., 2011)
  - impaired executive function (Walsh et al., 2014)
- Individuals carrying the APOe<sub>4</sub> gene who napped more than 60 mins a day progressed to Alzheimer's disease (Asada et al., 2000)
- Sleep disturbances **can** modulate MCI diagnosis (Gamaldo et al., 2012)

# Amyloid plaque deposits increase with reduced amounts of sleep



Olfactory Bulb

Piriform Cortex

Entorhinal Cortex

Sleep disruption increases amyloid, which  
increases sleep disruption....

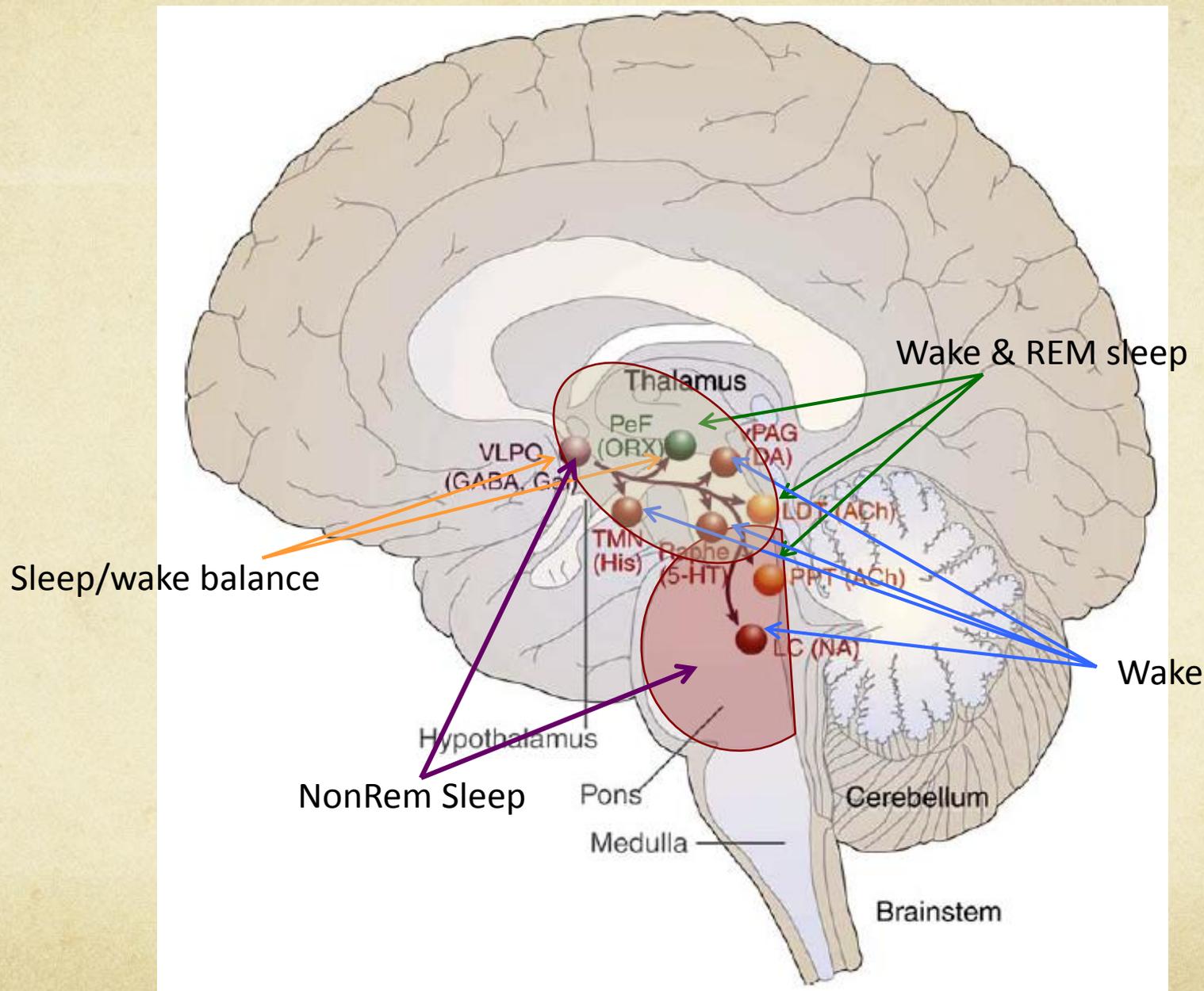
Increased likelihood of developing Alzheimer's  
disease

But Alzheimer's disease is both an amyloid and  
tau proteinopathy

Is there a relationship between tau and sleep?

# Progressive Supranuclear Palsy

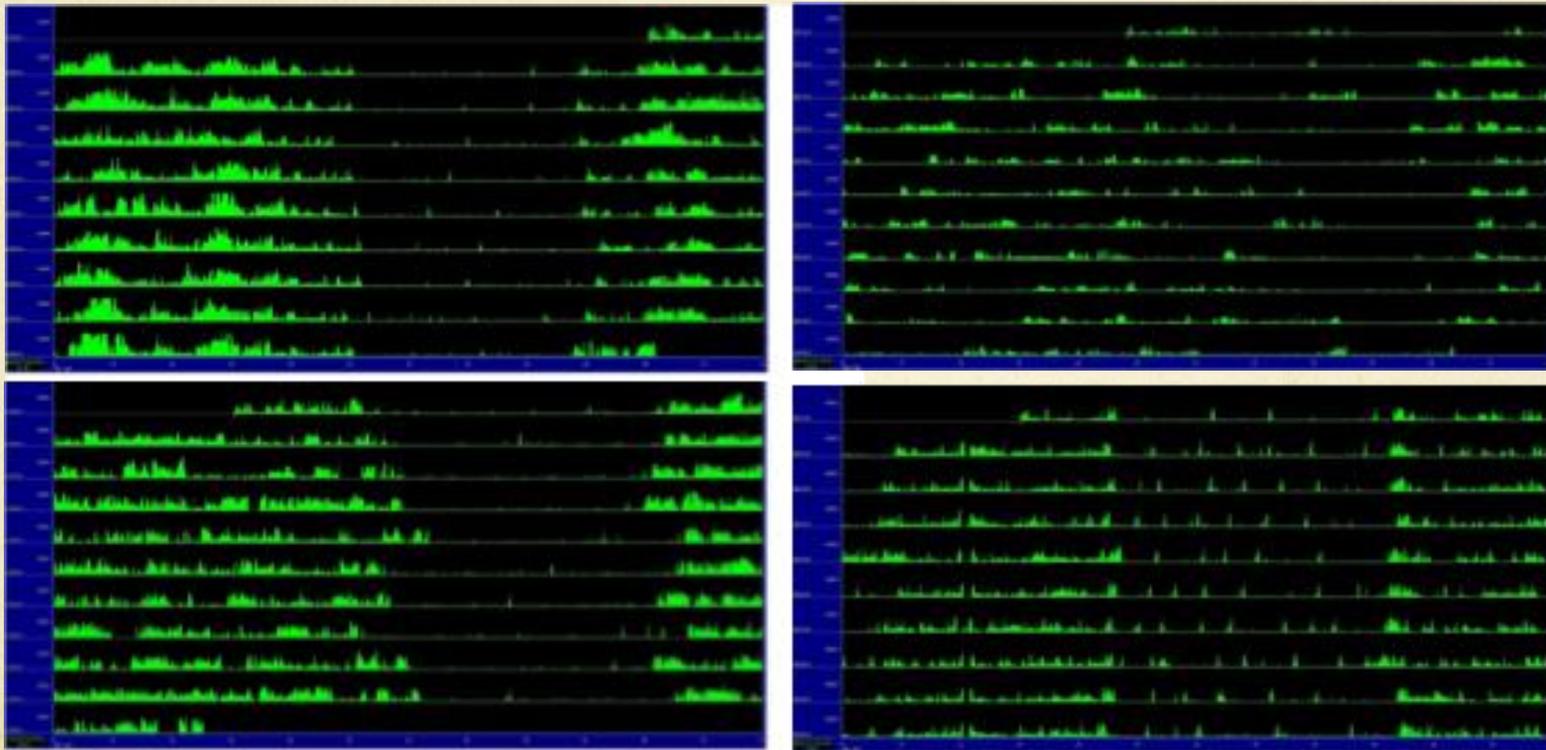


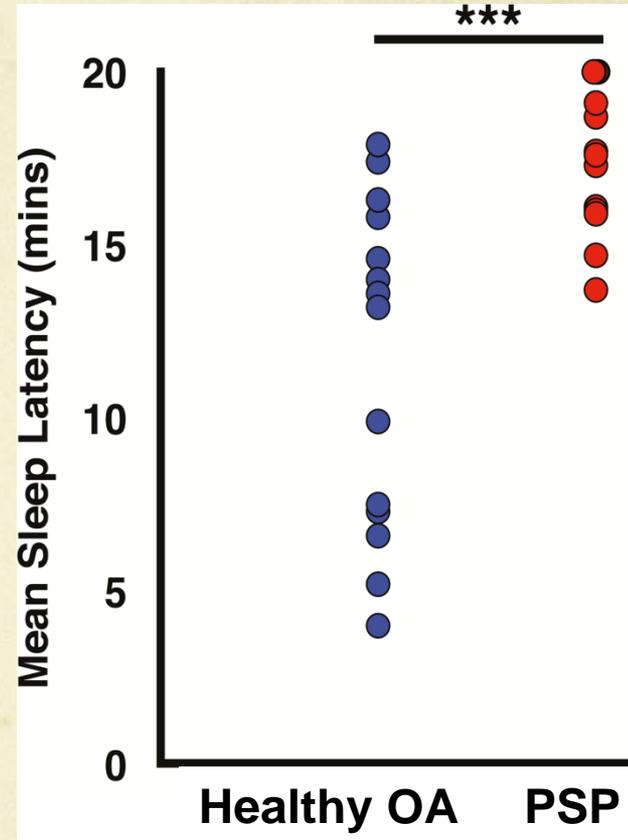
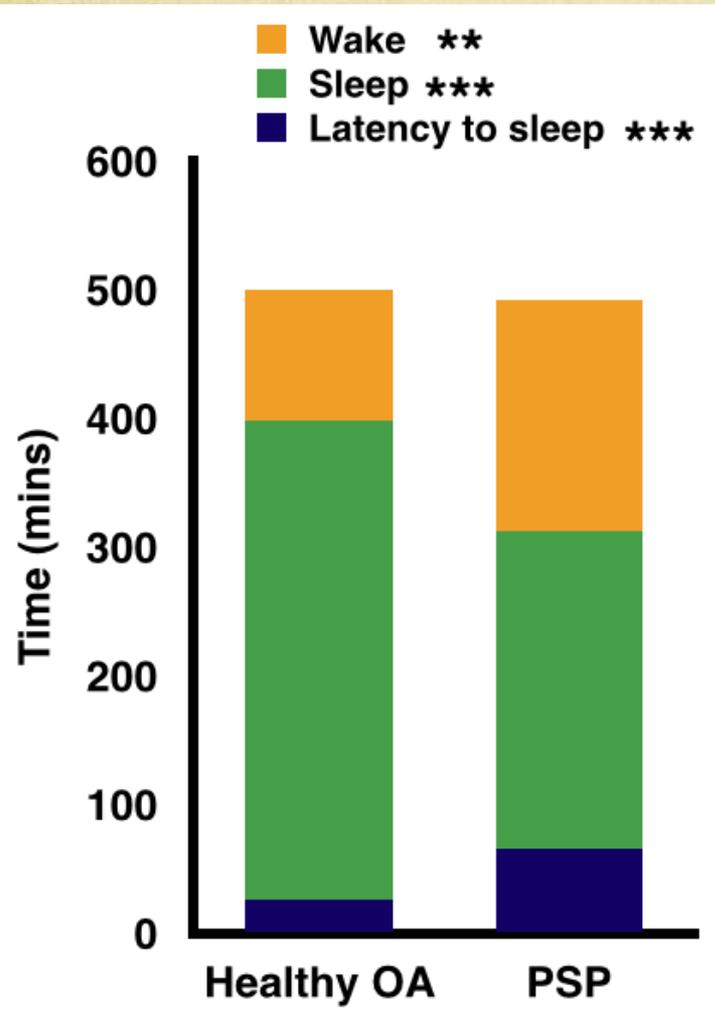


# Weakened rest-activity-rhythms in Progressive Supranuclear Palsy (PSP)

Healthy OA

PSP





- Disrupted night sleep with diminished propensity to sleep during the day
- Markedly decreased homeostatic sleep drive

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# Treatable factors that could improve sleep

- Hypertension increases sleep disruption (Eshkoor et al., 2013)
- Ischemic heart disease, diabetes, depression, arthritis and pulmonary disorders increase insomnia (Deschenes & McCurry, 2009)
- Ischemic heart disease, congestive heart failure and cardiomyopathy increase obstructive sleep apnea and restless leg syndrome (Deschenes & McCurry, 2009)
  - but diuretics increase sleep disruption
- Increased pain increases insomnia
  - but treatments can increase EDS
- Sleep disorders disrupt sleep

# Sleep Apnea



# Sleep Apnea

- Prevalence: 45 – 62 % (Ancoli-Israel et al., 2006)
- Some signs/symptoms include loud snoring, breathing interruptions while sleeping, excessive daytime sleepiness (fatigue, somnolence), dry mouth and morning headache
- Possible increased likelihood of hypertension, stroke, ischemic heart disease (Shamsuzzaman et al., 2003) increased atherosclerosis (Parish et al., 2004)
- Could contribute to reversible dementia in older adults (Janssens et al., 2000)

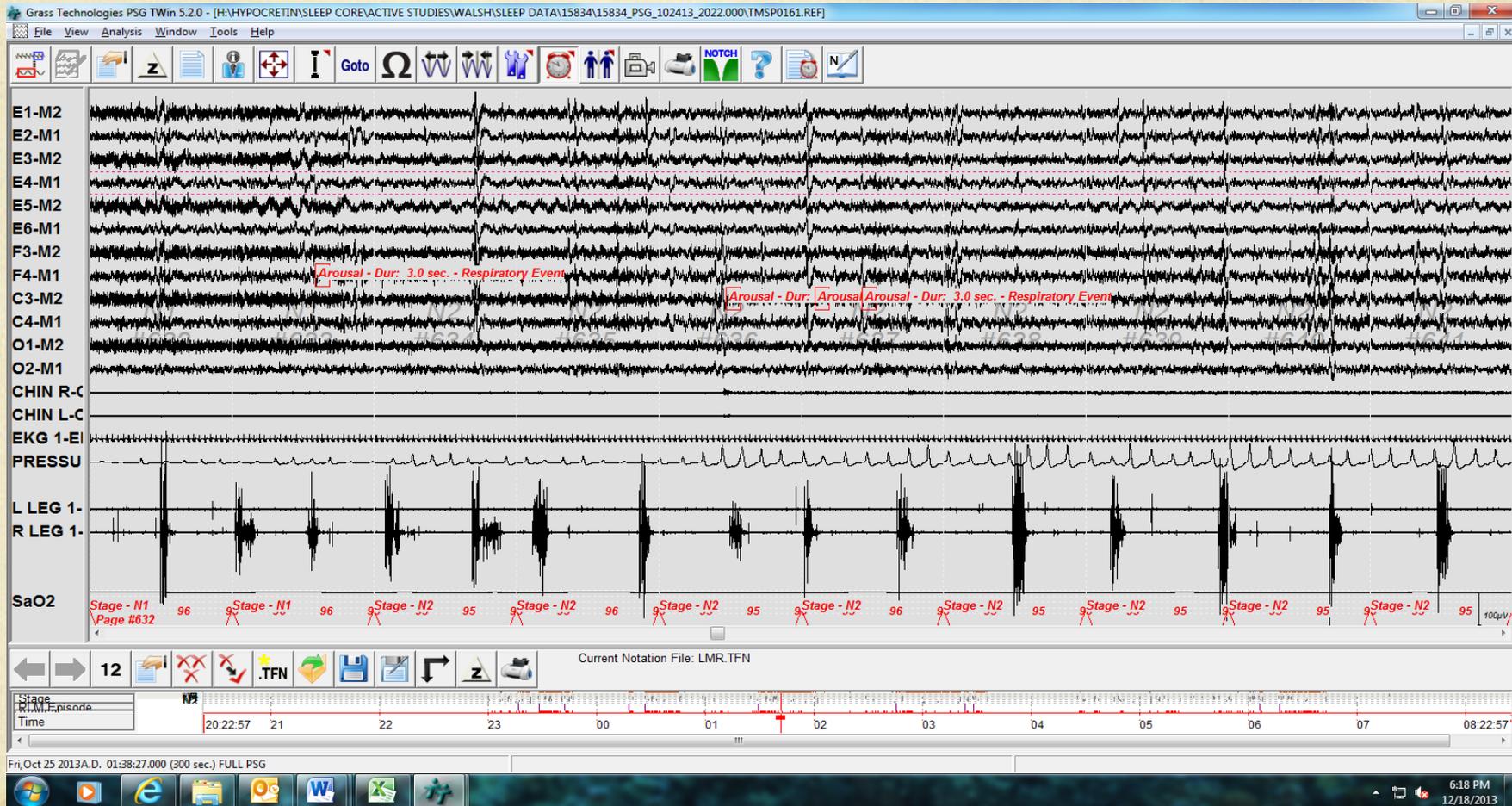
# REM sleep behavioral disorder



# REM sleep behavior disorder

- 9/10 RBD patients are men (Sforza et al., 1997; Olson et al., 2000)
- Ways to reduce or protect against RBD:
  - Medication review
  - Bed sensors

# Periodic Limb Movements (PLMs)



# PLMS & Restless leg syndrome (RLS)

- PLMS may be in 45% older adults (Hickey et al., 2000)
- RLS
  - Higher presentation in women (Rothdach et al., 2000)
  - In 10-35% older adults (Milligan et al., 2002)

# Good Sleep Hygiene

- Maintain regular bed time and rise time throughout the week
- Limit time in bed to sleeping
- Avoid or reduce napping
- Exercise before 2pm
- Spend time in natural light
- Avoid caffeine, nicotine and alcohol close to bed time
- Establish a comfortable sleep environment
- Establish a calming night time routine

# Treatments

- Antihistamines have negative side effects in older adults and should be avoided as a sleep aid
- Melatonin is thought not to have side effects and should improve sleep efficiency
  - BUT has not been shown to be successful in reducing insomnia in AD
    - Possibly due to circadian changes

# Suggestions for improving sleep through modified behaviors

- Sleep factors
  - Maintain regular bedtime schedule and routine
  - Maintain regular bed time and rise time
  - Limit time in bed to expected duration of sleep
  - Limit daytime napping to short period in early afternoon
  - Avoid naps in the evening



# Using Light Therapy as a Treatment



- Light helps to regulate the circadian rhythms
  
- Bright light treatment in the:
  - Morning – helps phase-delayed individuals
    - People who stay up too late and wake up too late
  - Evening – helps with sleep maintenance, in particular for phase-advanced individuals
    - People who go to bed too early and wake up too early

# Results from Light Therapy



- Actual benefit in using a light box is mixed
  - Increased total sleep time at night (Lyketsos et al., 1999)
  - Shifted circadian rhythms (Ancoli-Israel et al., 2002, 2003a,b; Dowling et al., 2005a,b)
  
- Benefit in using overhead bright light
  - Morning or all day lighting
    - increased total sleep time (Sloane et al., 2007)

# Combined light therapy and melatonin



&



- Morning bright light and melatonin
  - Improved nighttime sleep (Dowling et al., 2008; Riemersma-van der Lek et al., 2008)
  - Increased daytime activity (Dowling et al., 2008; Riemersma-van der Lek et al., 2008)
  - Decreased agitation (Riemersma-van der Lek et al., 2008)

# Suggestions for improving sleep through modified behaviors

- Environment
  - Bedroom
    - Quiet and consistently familiar
    - Keep the room as dark as possible
    - Reduce potential sleep interruptions (noise from a roommate, television, temperature)
  - Morning exposure to sunlight or bright light

# Environmental Factors

- Social isolation increased sleep disruption (Eshkoor et al., 2013)
- Participating in daytime activities
  - Decreased sleep fragmentation
  - Decreased the time to fall asleep
  - Decreased daytime sleepiness (Richards et al, 2005)



# Suggestions for improving sleep through modified behaviors

- Eating & Activities
  - Consistent meal times
  - Avoid alcohol, nicotine and caffeine
  - Void the bladder before bedtime
  - Limit fluid intake prior to bedtime
  - Routine daily activities
  - Avoid too many activities near bedtime

# Modifying:



- Decreased duration of nighttime awakenings (Alessi et al., 2005; McCurry et al., 2005)
- Increased total sleep time (Richards et al., 2011; McCurry et al., 2005; McCurry et al., 2011)
- Decreased daytime sleep (Alessi et al., 2005)
- Treatment effects maintained after 6 months (McCurry et al., 2005)

# Observing sleep disturbance

- Medications can exacerbate the presentation of sleep disorders
  - antidepressants
- Observe sleep disorders and alert medical practitioner

# Physical Activity



- In older adults:
  - Increases physiological and psychological well-being
  - Shifts circadian rhythms and promotes better sleep

# Modifying:



- Patients remained out of bed during the day, exposed to sunlight, 3/day physical activity, sleep hygiene intervention
  - Decreased duration of nighttime awakenings
  - Decreased daytime sleep (Alessi et al., 2005)
  
- Sleep hygiene education, walking, and light exposure
  - Improved total sleep time
  - Decreased night time awakenings
  - Treatment effects maintained after 6 months (McCurry et al., 2005)

# Further environmental interventions

- Daily light exposure, 30 mins walks and sleep hygiene education for caregivers
  - Increased total sleep time (McCurry et al., 2011)
- With resistance strength training 3/week, walking 2/week and social activity 5/week
  - Increased total sleep time
  - Increased sleep efficiency
  - Increased SWS sleep (Richards et al., 2011)

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# Resources

National Institutes of Health

[http://www.nhlbi.nih.gov/health/public/sleep/healthy\\_sleep.pdf](http://www.nhlbi.nih.gov/health/public/sleep/healthy_sleep.pdf)

NATIONAL SLEEP FOUNDATION

[www.sleepfoundation.org](http://www.sleepfoundation.org)

## Out of interest

Peter Tripp stayed awake for 200hrs

<http://www.73q.com/video.php?vid=113367>



# Acknowledgements

## **Mentors & Collaborators**

Michael Geschwind  
Lea Grinberg  
Elissaios Karageorgiou  
Joel Kramer  
Bruce Miller  
Thomas Neylan  
Kristine Yaffe  
Jennifer Yokoyama

## **Sleep team at the MAC & SFVA**

Samirah Javed  
Leslie Ruoff  
Jenny Zitser

## **MAC researchers & collaborators**

Marie Altendahl  
Emily Fox  
Danny Luong  
Nihar Patel  
Rowan Saloner  
Lisa Voltarelli  
Matt Wynn

## **Participants and their Families**

## **Funding:**

Hillblom Foundation Network Grant (Kramer & Miller)

Rainwater Foundation (Neylan)

NIA R01 AG032289 (Kramer)