National Sleep Foundation Presents

# Revisiting Senior Sleep

# Sleep is Essential to Health & Well-Being

- Key to our health, performance, safety and quality of life
- As essential a component as good nutrition and exercise to optimal health
- Essential to our ability to perform both cognitive and physical tasks, engage fully in life and function in an effective, safe and productive way

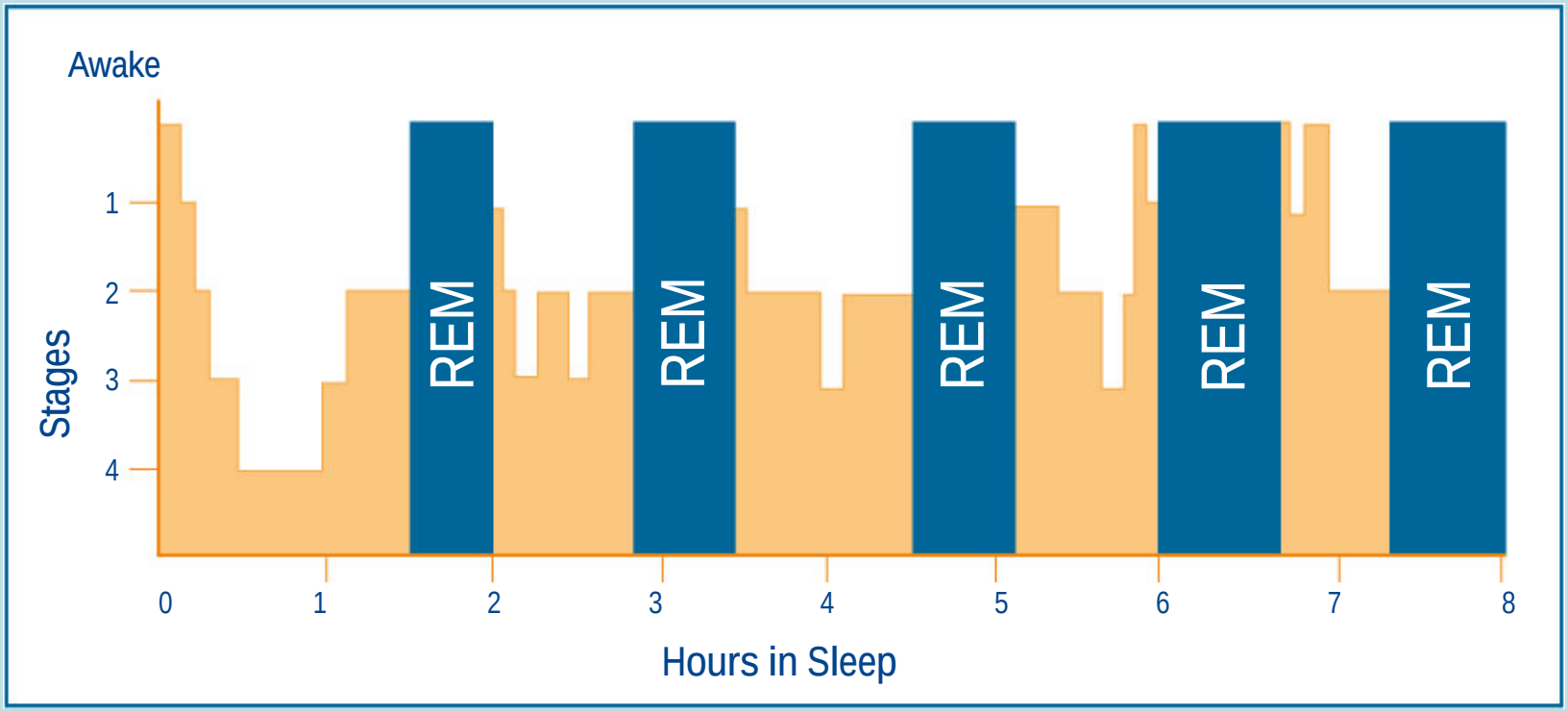
# Sleep and Aging

- How does sleep change as we age?
- Do we need less sleep as we get older?
- Can a person expect to experience more sleep problems or have a sleep disorder as they advance in age?
- As we age, how does sleep affect our overall health, medical conditions and general well being?
- What can we do to get good sleep?

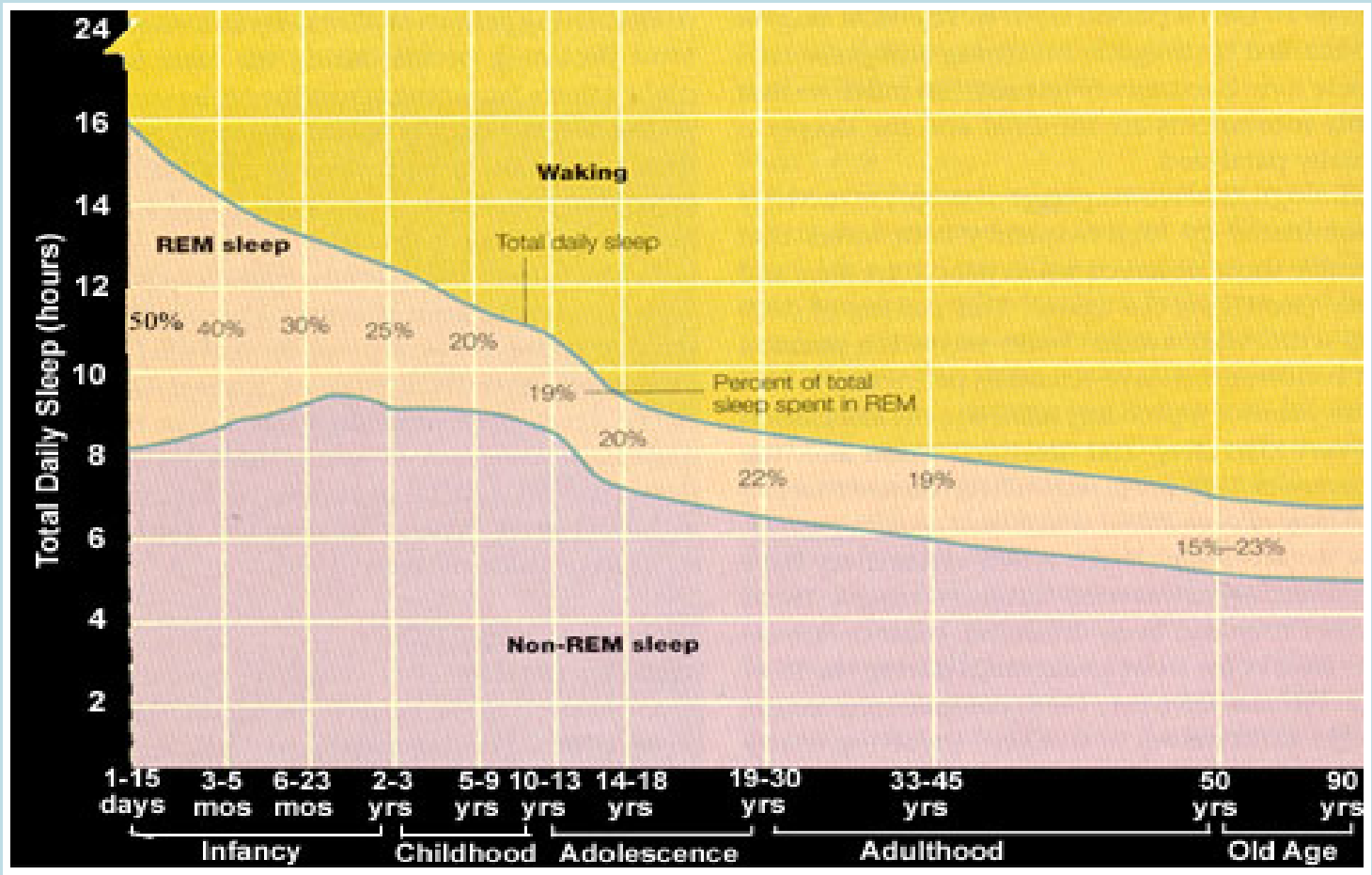
# *What about…* Total Sleep Time?

| How Much Sleep Do You Really Need? | |
|---|---|
| Age | Sleep Needs |
| Newborns (1-2 months) | 10.5-18 hours |
| Infants (3-11 months) | 9-12 hours during night and 30-minute to two-hour naps, one to four times a day |
| Toddlers (1-3 years) | 12-14 hours |
| Preschoolers (3-5 years) | 11-13 hours |
| School-aged Children (5-12 years) | 10-11 hours |
| Teens (11-17) | 8.5-9.25 hours |
| Adults | 7-9 hours |
| Older Adults | 7-9 hours |

# The Sleep Cycle in Adults



# *What about…* REM Sleep?




**By age 4-5, % REM decreases to adult level of 20-25%**

# *What about…* Slow Wave Sleep?

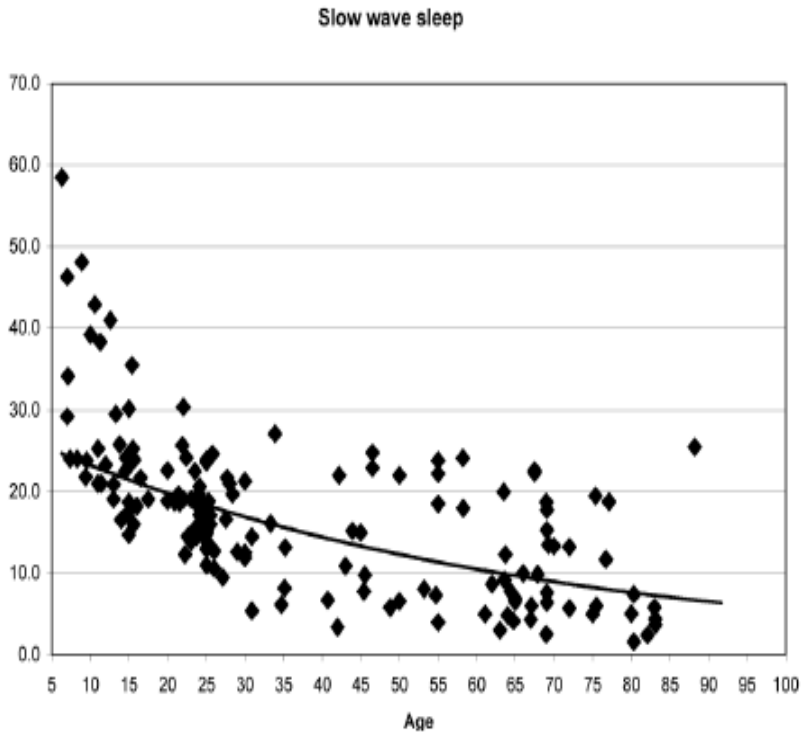



**Figure 1c**—Age-related trends for percentage of stage 2 sleep and percentage of slow wave sleep. Lines represent the exponential equations fitted for data from samples.

# *What about…* WASO?

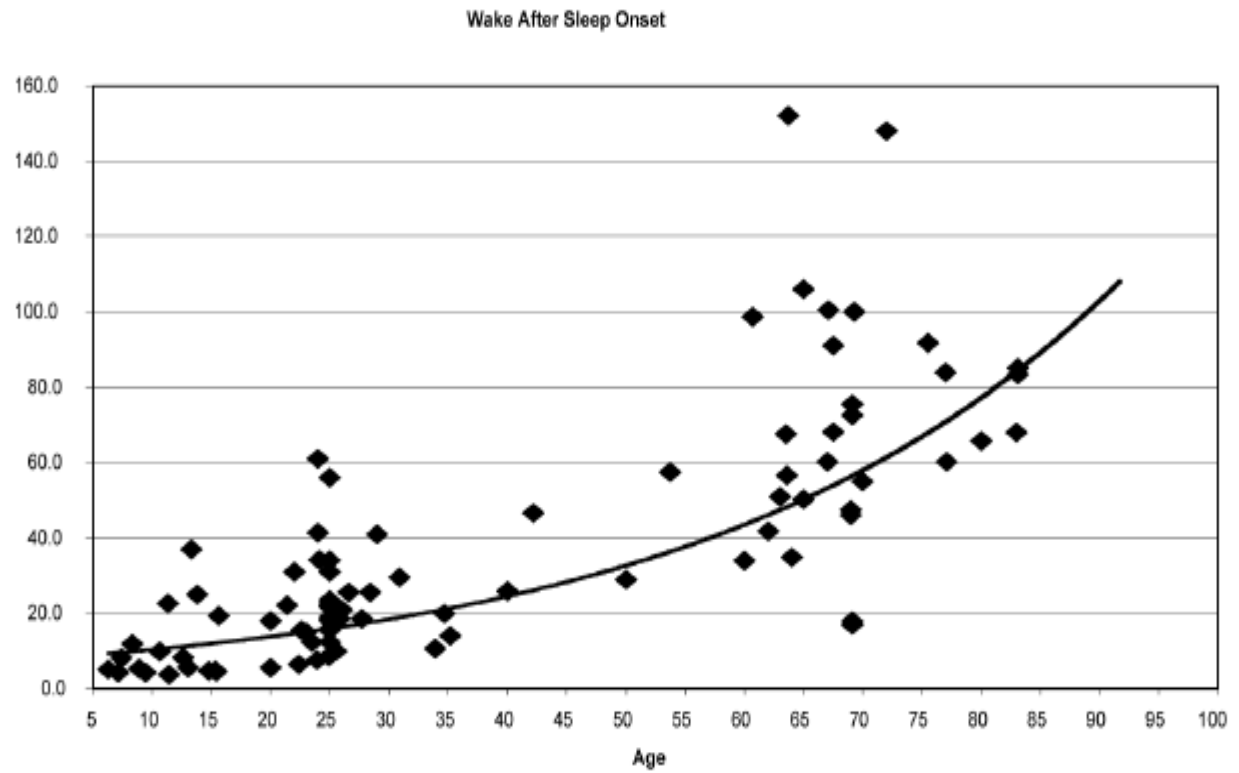
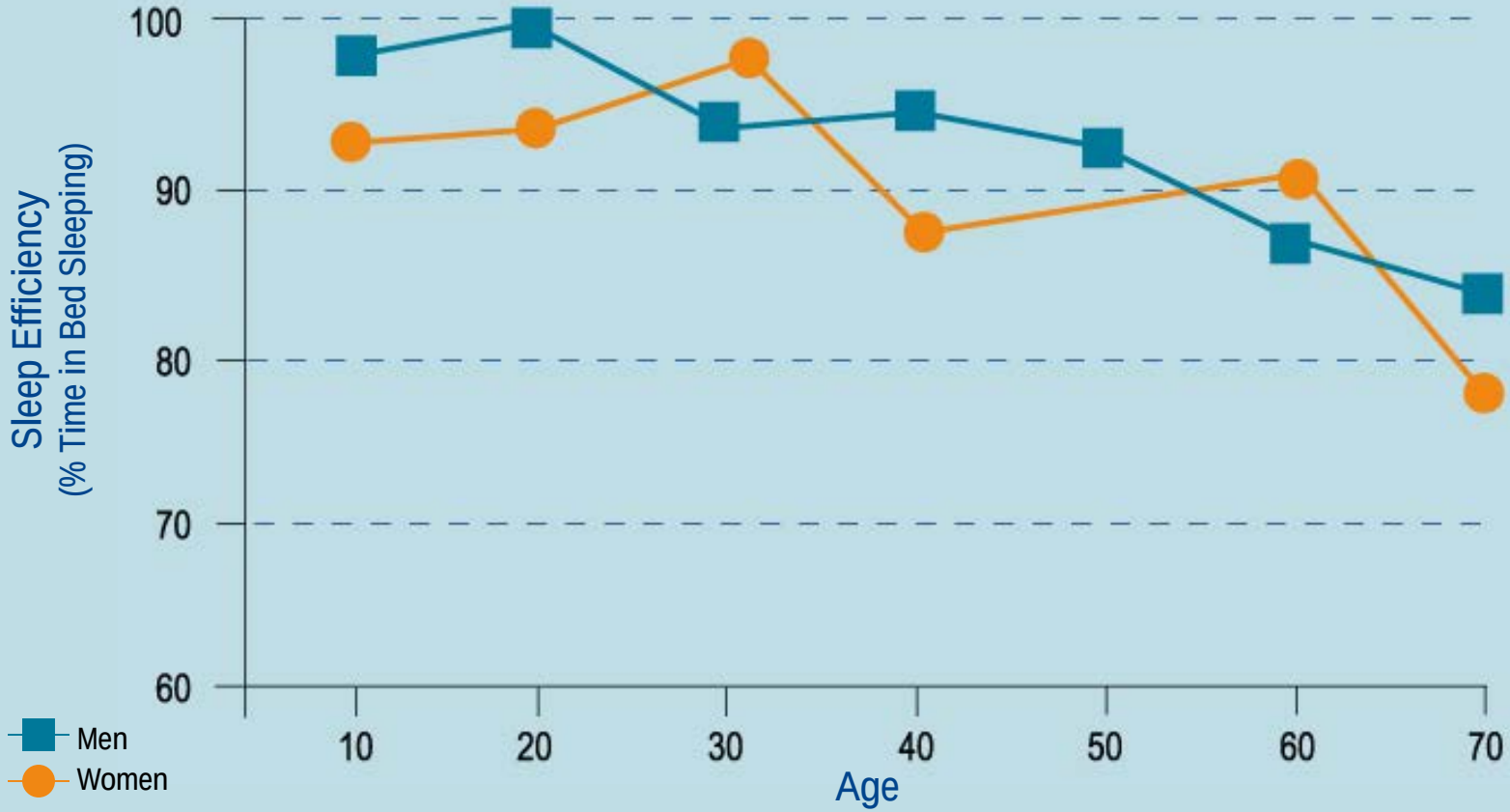


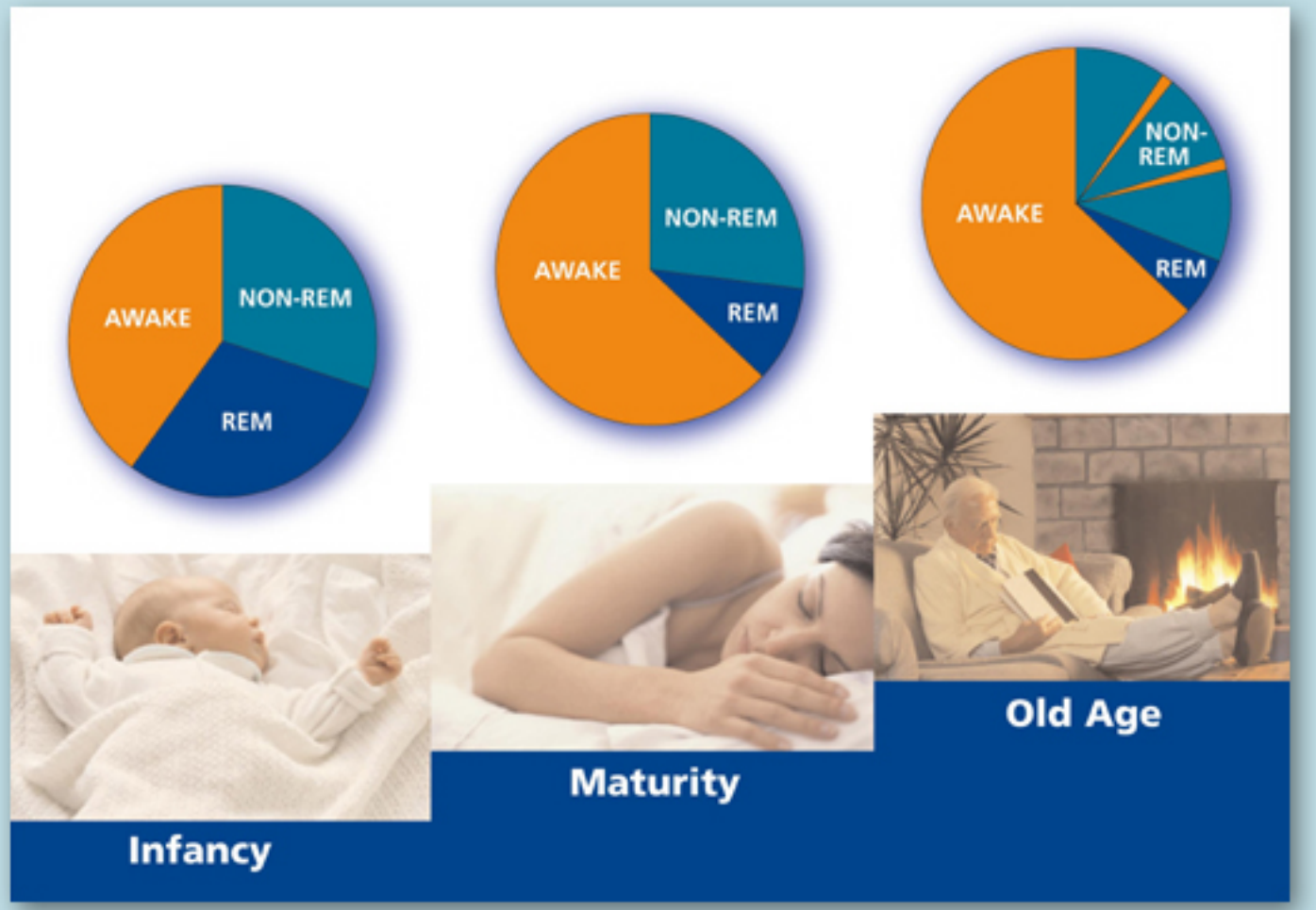

**Figure 1e**—Age-related trends for wake after sleep onset. Lines represent the exponential equations fitted for data from samples.

# Sleep Efficiency as function of aging

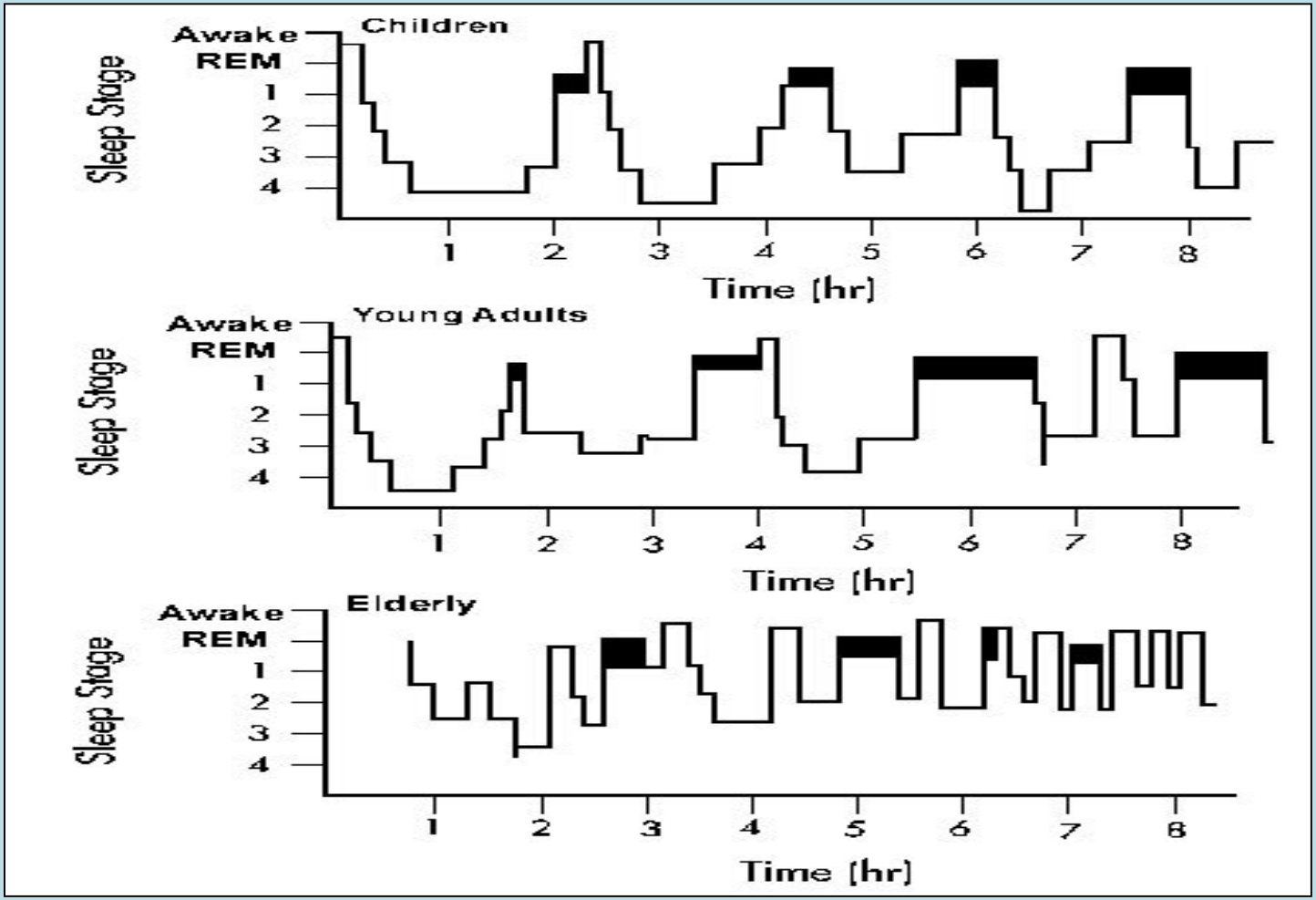
## Changes with age



# Normal Sleep and Normal Aging: Less Deep Sleep

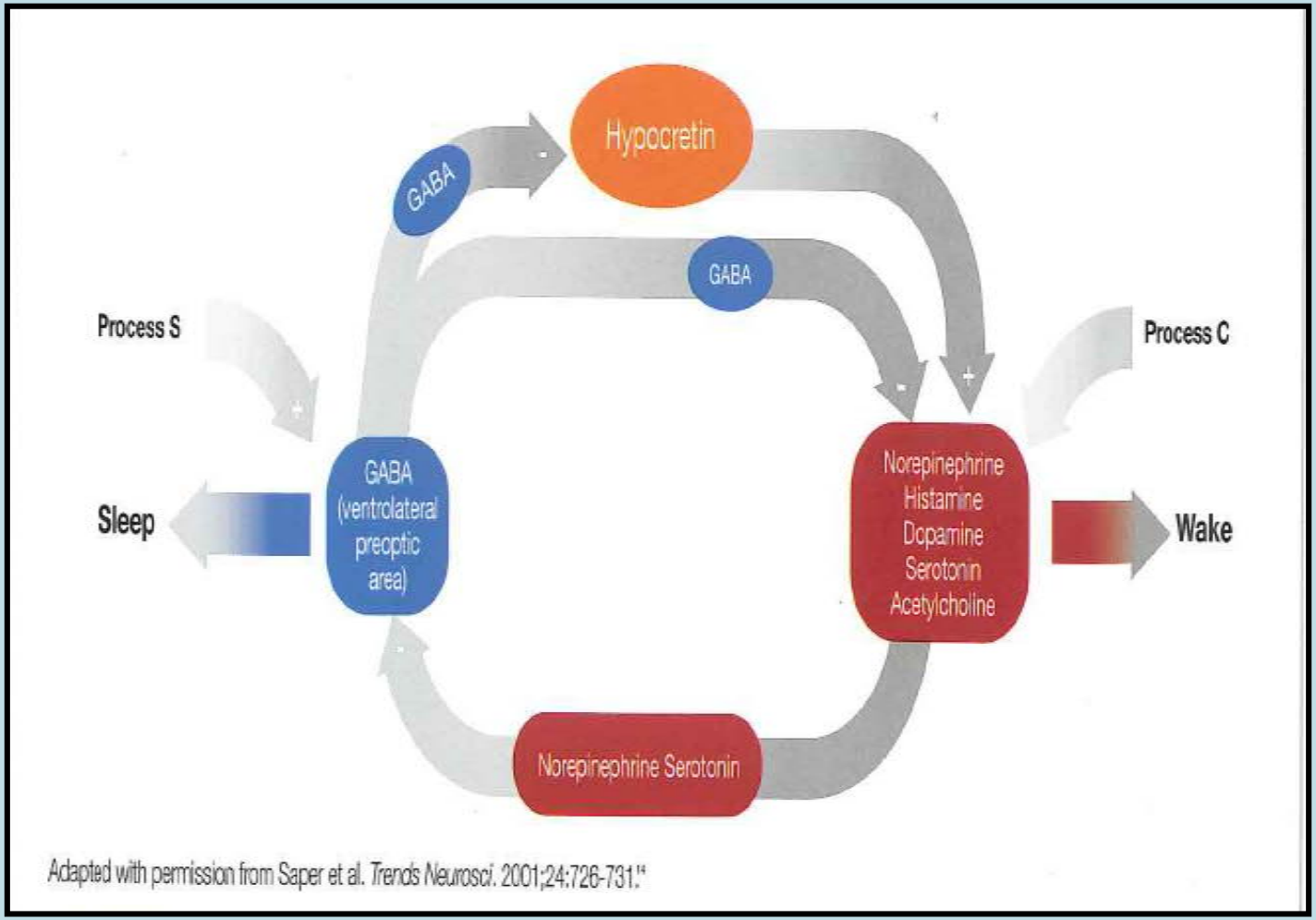


# Sleep Architecture



The ability to get continuous and consolidated sleep may become more difficult as we age

# The Chemical Complexity of Sleep



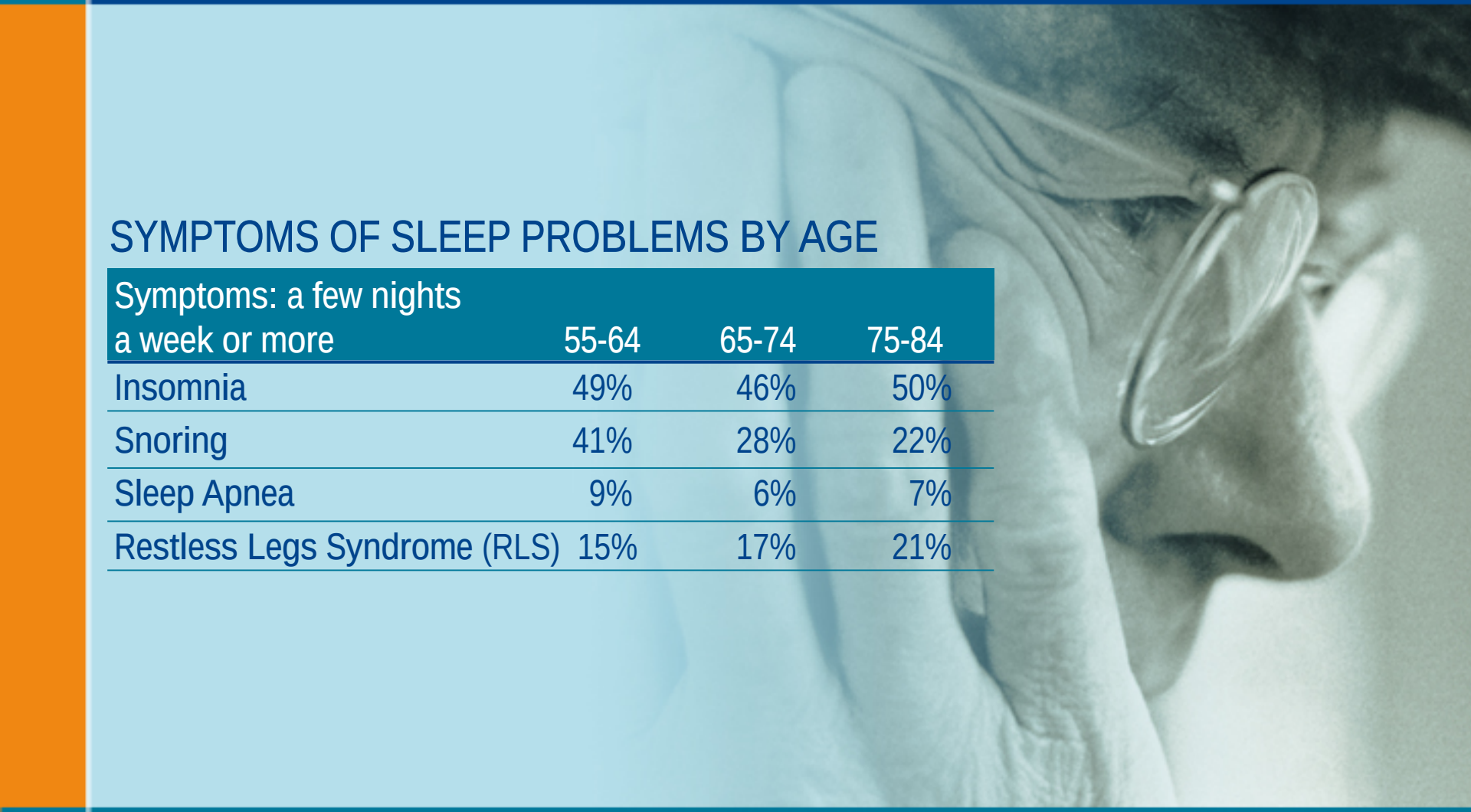

Adapted with permission from Saper et al. *Trends Neurosci.* 2001;24:726-731.[4]

# Health and Environment Affect Our Sleep

With age, we become more sensitive to:

- Hormonal Changes
- Physiological Conditions
- Environmental Conditions
  - Light
  - Noise
  - Temperature

# Sleep Problems/Disorders Prevalent Among Older Persons



## SYMPTOMS OF SLEEP PROBLEMS BY AGE

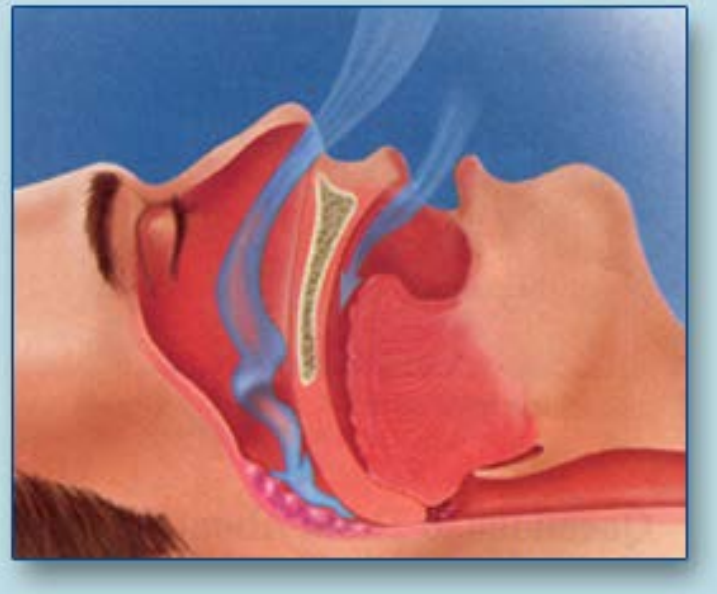
| Symptoms: a few nights a week or more | 55-64 | 65-74 | 75-84 |
|---|---|---|---|
| Insomnia | 49% | 46% | 50% |
| Snoring | 41% | 28% | 22% |
| Sleep Apnea | 9% | 6% | 7% |
| Restless Legs Syndrome (RLS) | 15% | 17% | 21% |

# Insomnia

- A perception or complaint of inadequate or poor sleep
  - Difficulty falling asleep
  - Frequent awakenings
  - Waking too early and having difficulty falling back to sleep
  - Waking unrefreshed
- A highly prevalent condition affecting as many as 48% of older persons
- Next day consequences

# Sleep Apnea

- Increases as we age: affecting 4% and 2% of middle-aged men and women and close to 27% and 19% of older men and women
- Characterized by pauses or gaps in breathing due to an obstruction of the airway



# Restless Legs Syndrome/ Periodic Limb Movement Disorder

- Neurological movement disorders
- Involuntary urge to move due to unpleasant feelings in the legs during sleep or rest
- Jerking of legs and arms during sleep
- Increases with age
- Treatment
  - Medications
  - Healthy lifestyle
  - Sleep hygiene

# Medical Conditions Increase with Age

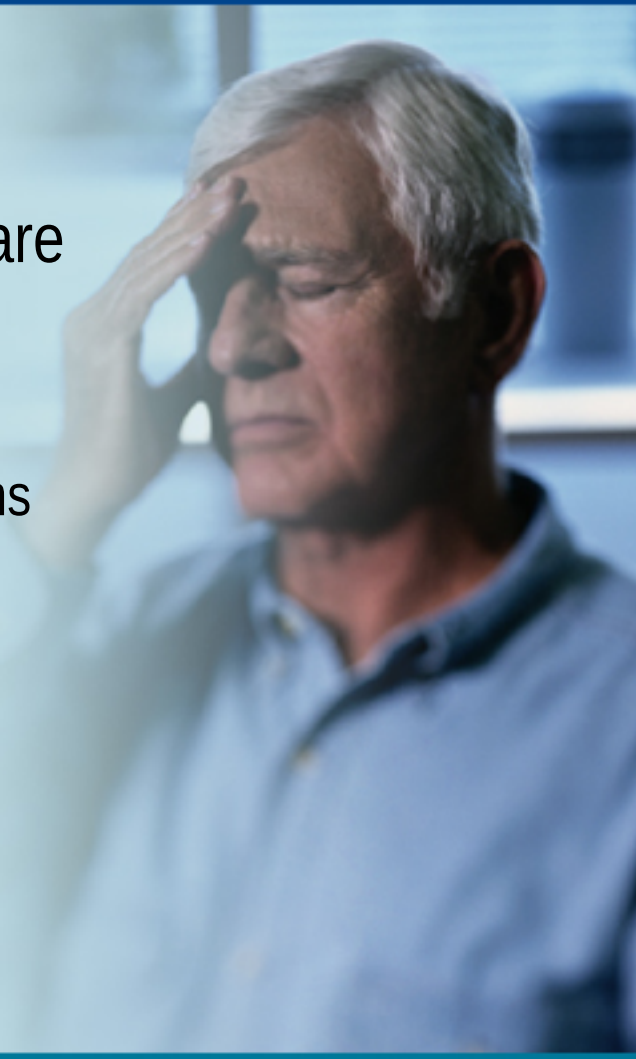
Medical Conditions increase with age and are often associated with sleep problems and disorders

- Hypertension and Heart Disease
- Heart Failure
- Stroke
- Menopause
- Cancer
- Gastrointestinal Disorders

# Medical Conditions Increase with Age (continued)

Medical Conditions increase with age and are often associated with sleep problems and disorders

- Alzheimer's, Parkinson's and cognitive problems
- Depression
- Arthritis
- Other conditions

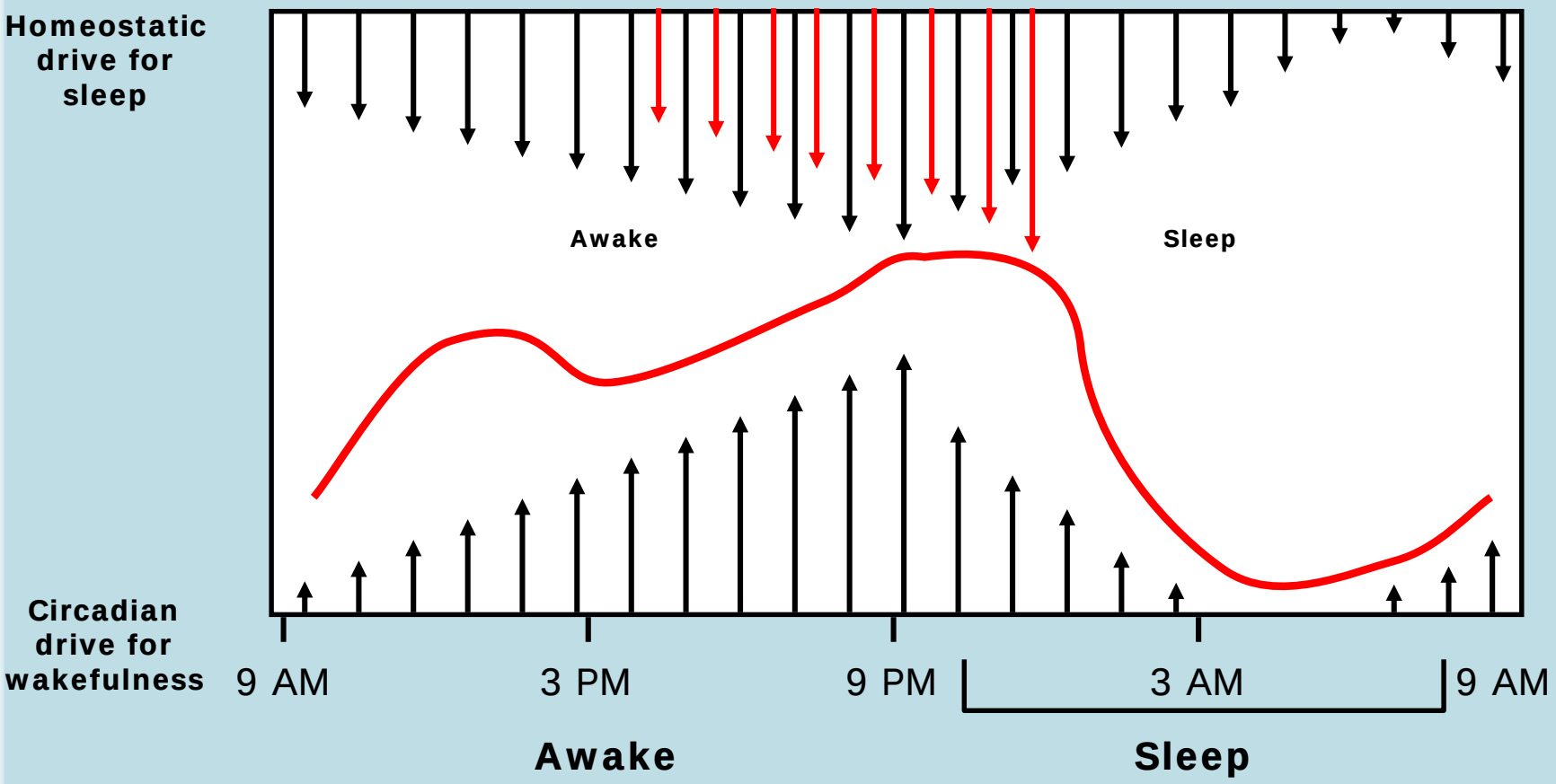


# Medications Can Also Cause Sleep Problems

# The Use of Alcohol, Caffeine and Nicotine Impacts on Sleep

National Sleep Foundation

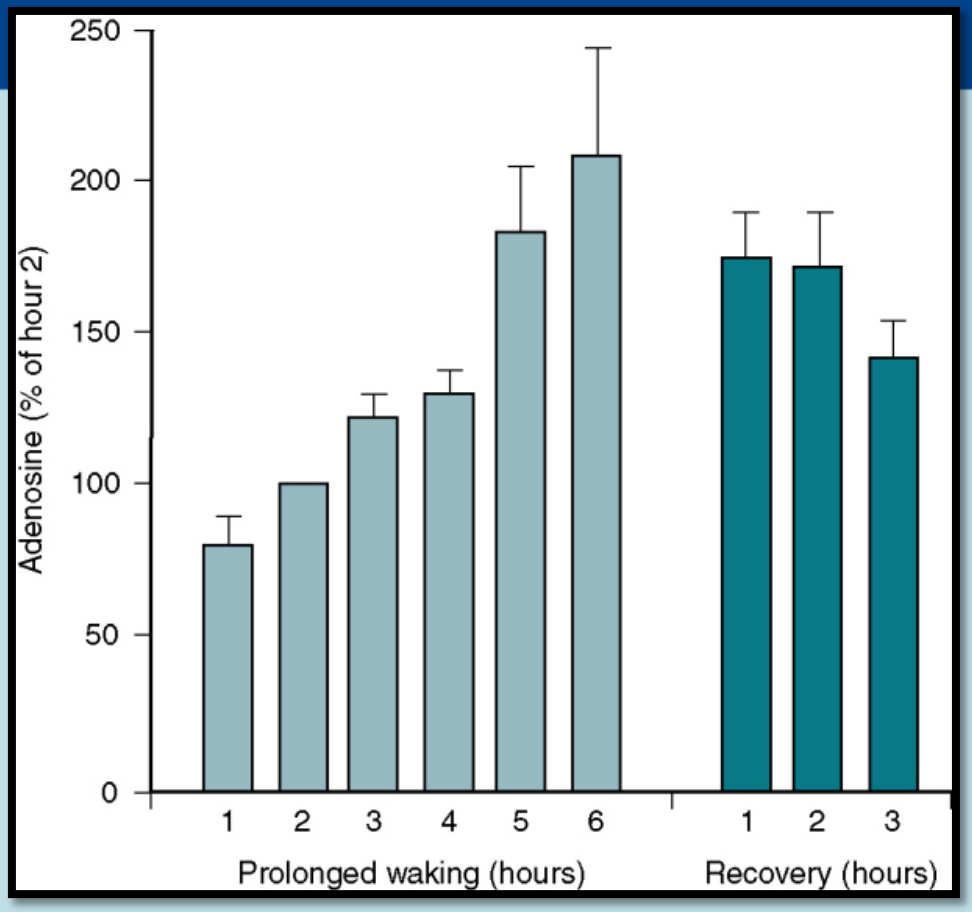
# The Opponent Process Model



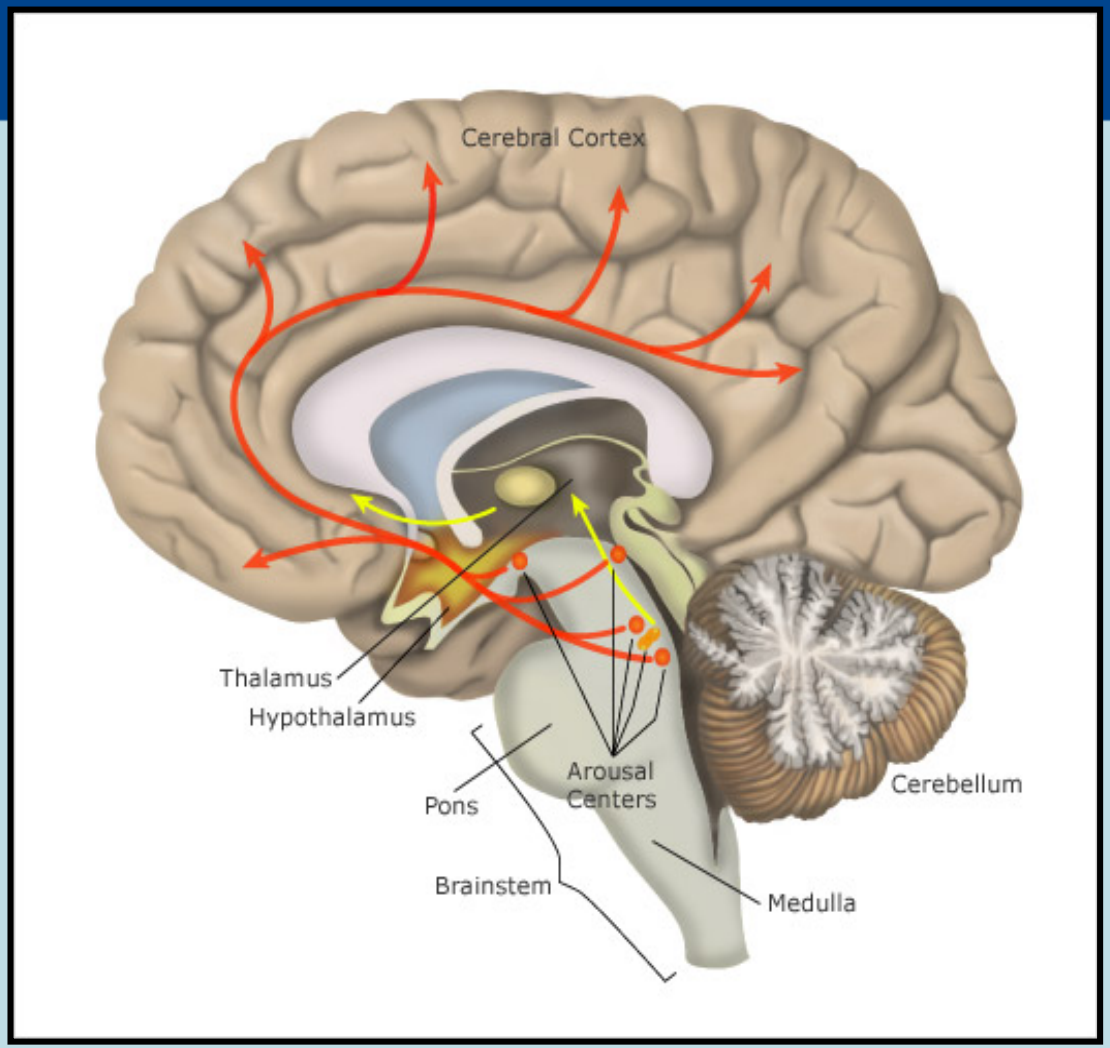

Adapted from Moore RY. Current Perspectives in Insomnia, Vol 3, 2004. http://www.medscape.com/viewprogram/3516_pnt.

# ADENOSINE

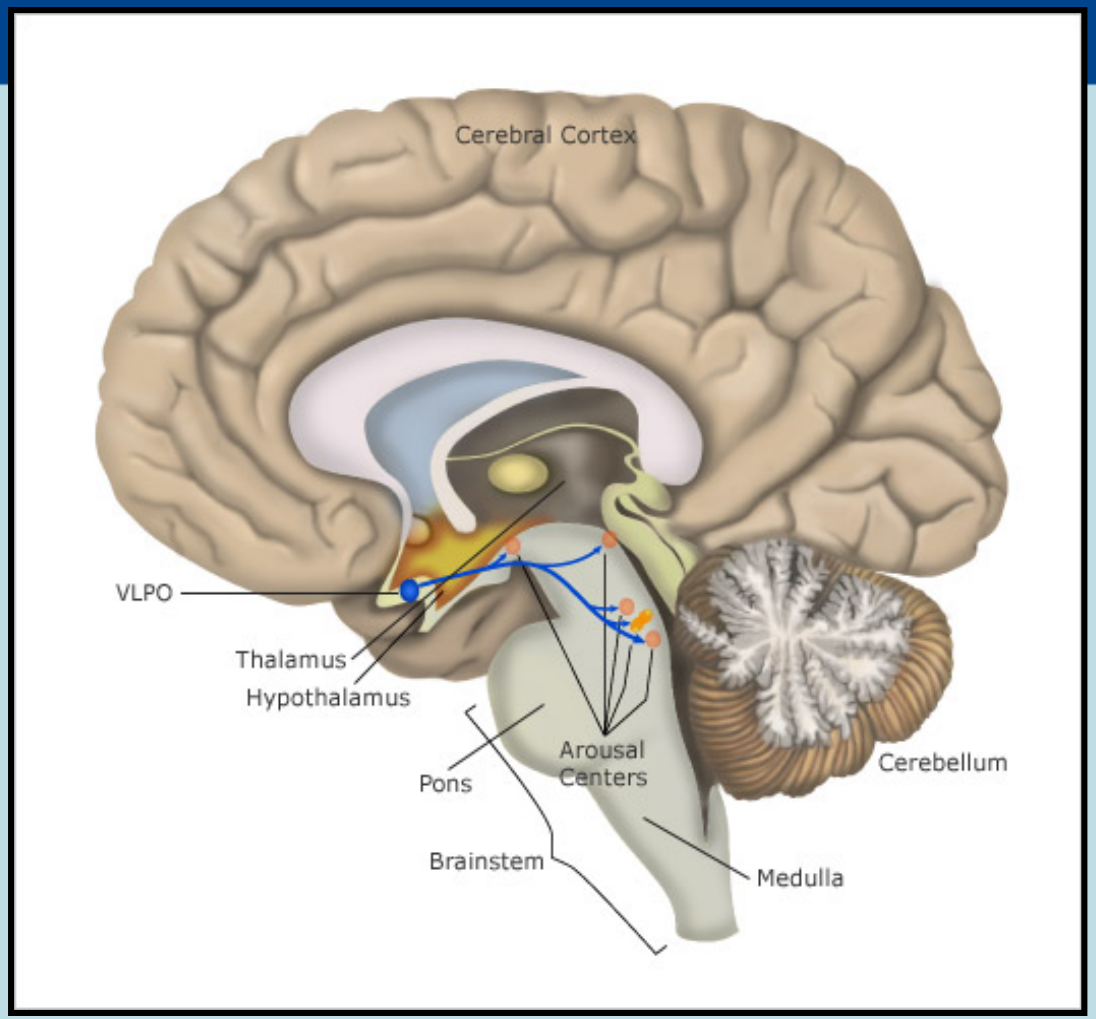
- Start with adenosine triphosphate (ATP)
- ATP molecules: capture the chemical energy obtained from food metabolism, and release it to fuel other cellular processes
- As we use more energy, Adenosine accumulates as a by-product
- Accumulation of Adenosine creates sleepiness




**Adenosine concentration changes in basal forebrain during prolonged wakefulness. Mean forebrain adenosine values by hour during 6 hours of prolonged wakefulness and in the subsequent 3 hours of spontaneous recovery sleep.**




During wakefulness, specific areas within the brainstem (particularly, the hypothalamus) send signals that stimulate the cerebral cortex. By keeping neurons in the cortex active, signals from these arousal centers maintain consciousness and allow for complex brain functions.

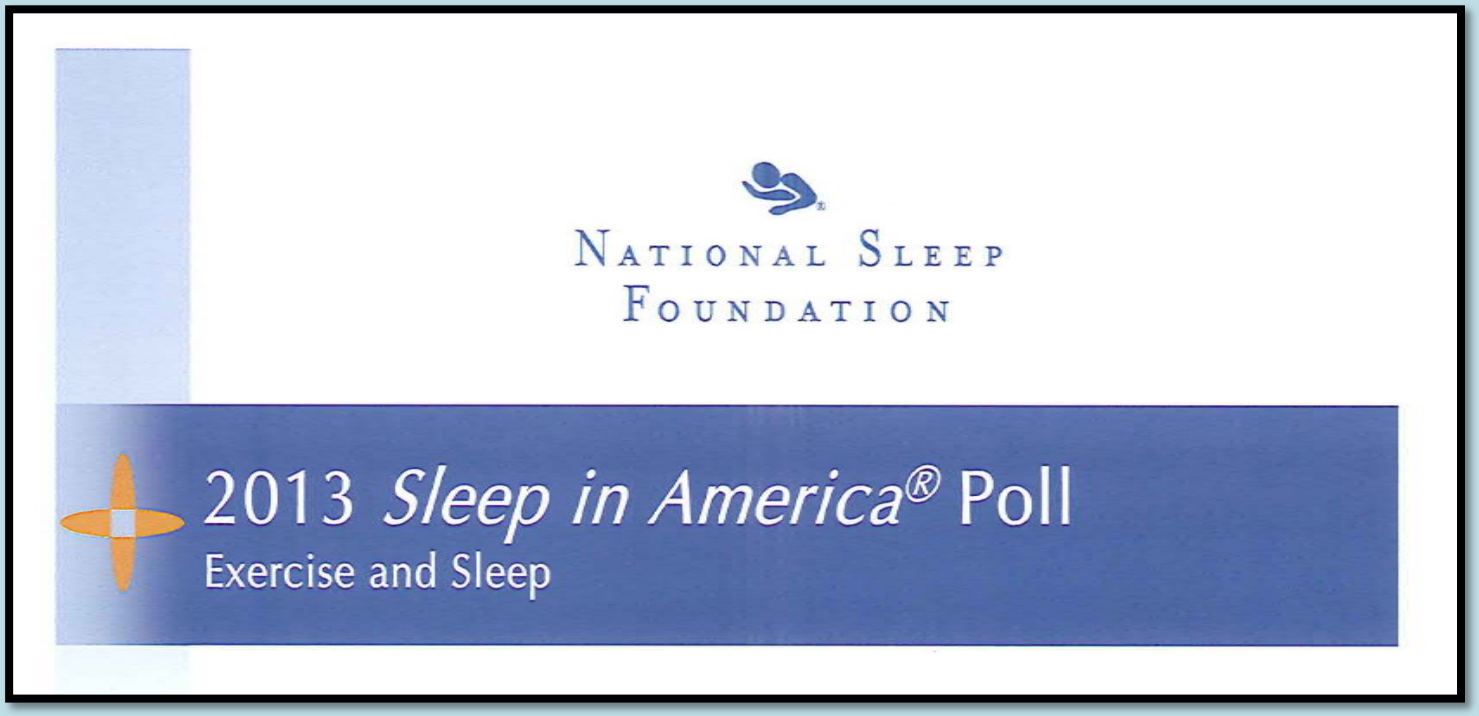


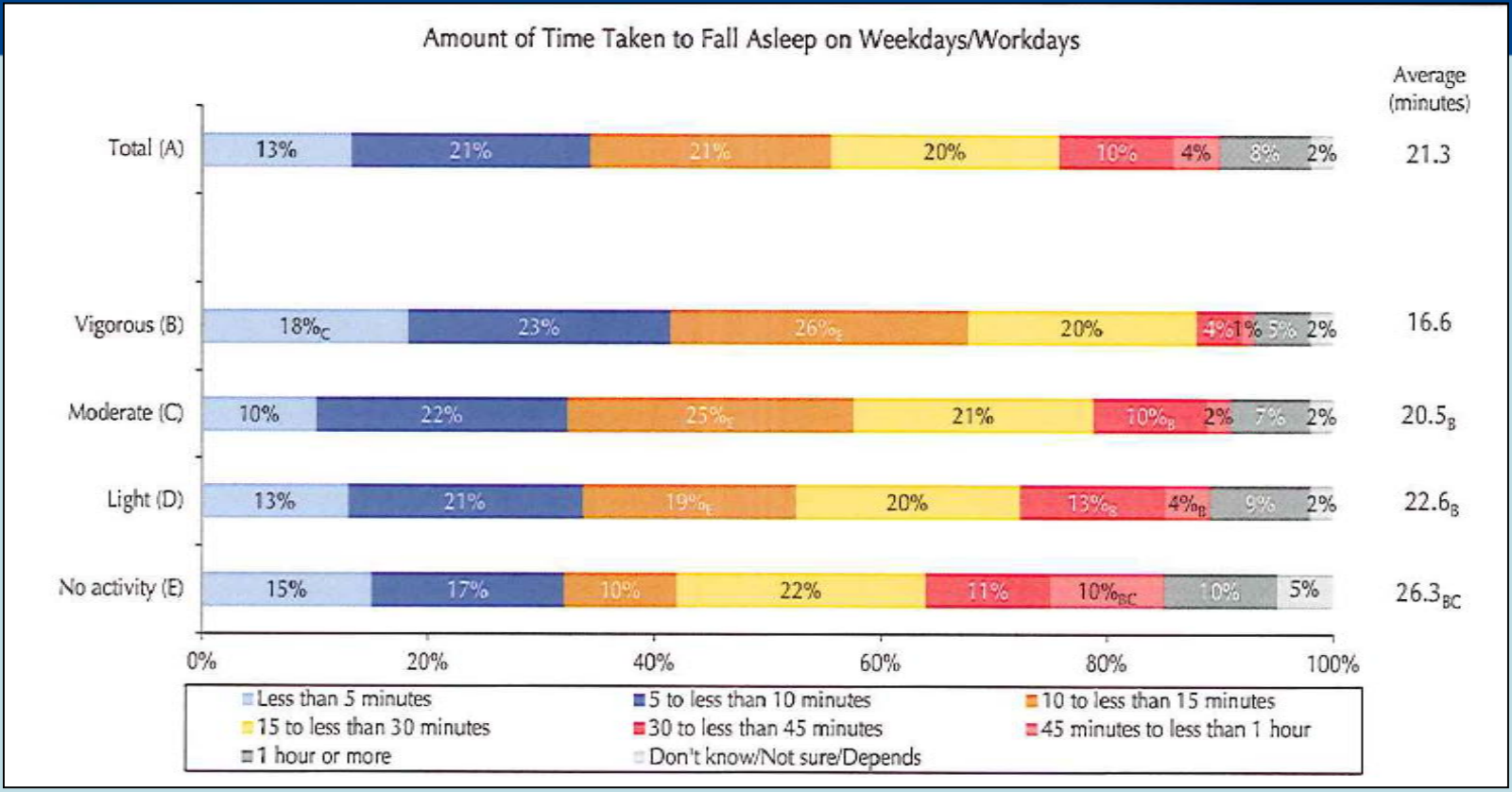

Neurons in the ventrolateral preoptic area (VLPO) promote sleep by inhibiting activity in these arousal centers that maintain wakefulness. Neurotransmitters released from VLPO neurons reduce activity in the arousal regions, causing us to pass quickly into the state of sleep.

# The problem with daytime napping

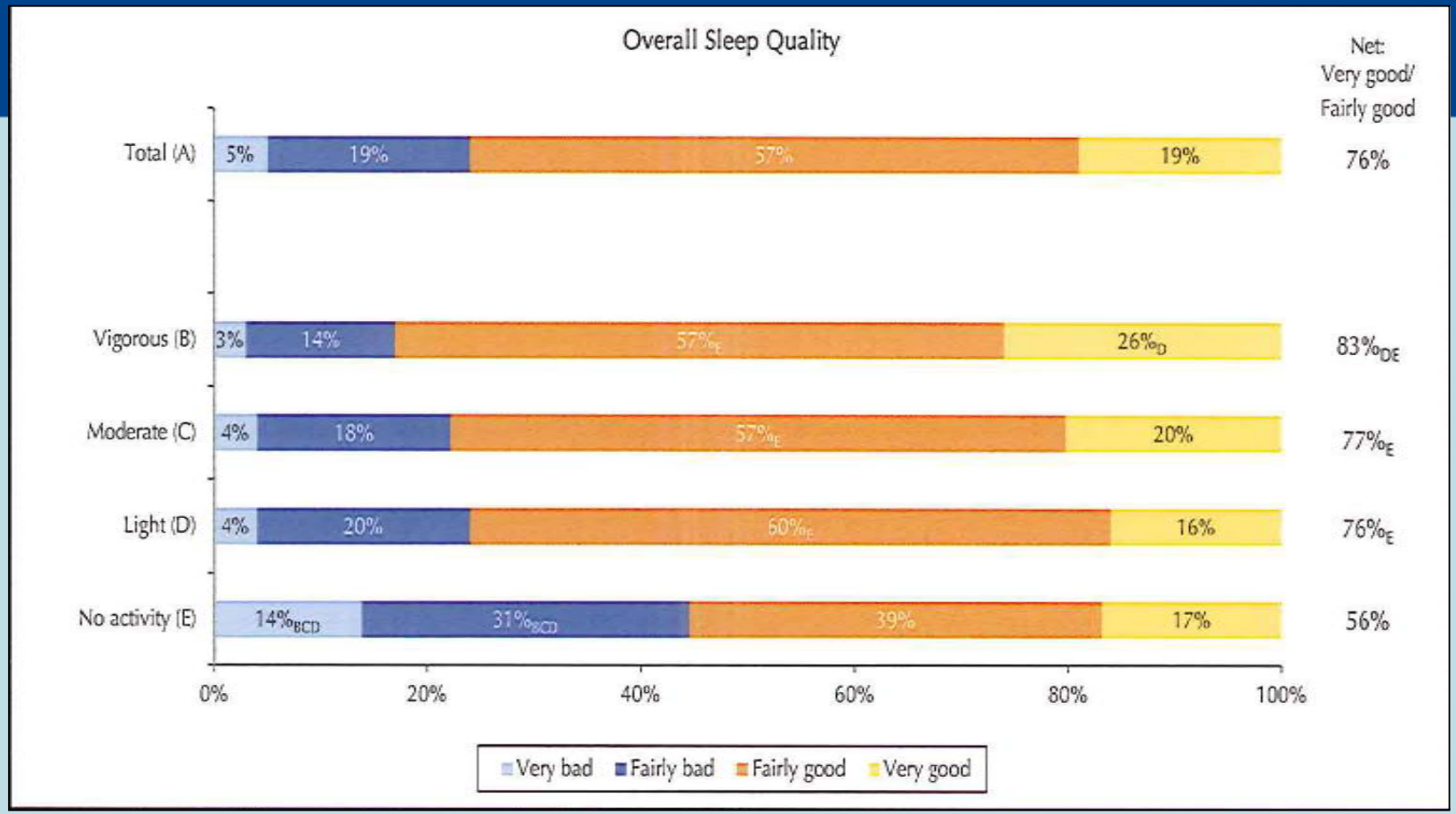
Homeostatic Drive for Sleep is reduced in intensity at normal bedtime

*How do we promote the accumulation of adenosine across the daytime hours?*





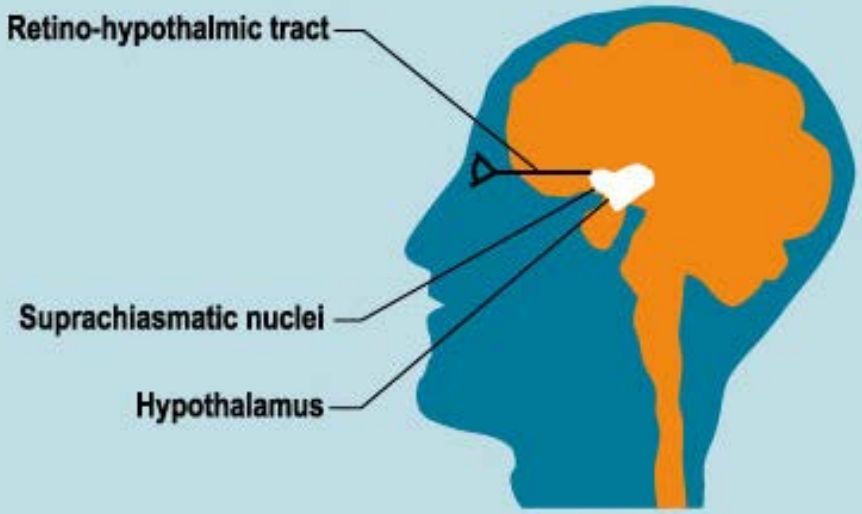

***Conclusion:*** Vigorous exercisers fall asleep faster, and significantly fewer of them report nights of delayed onset to sleep (i.e., insomnia)



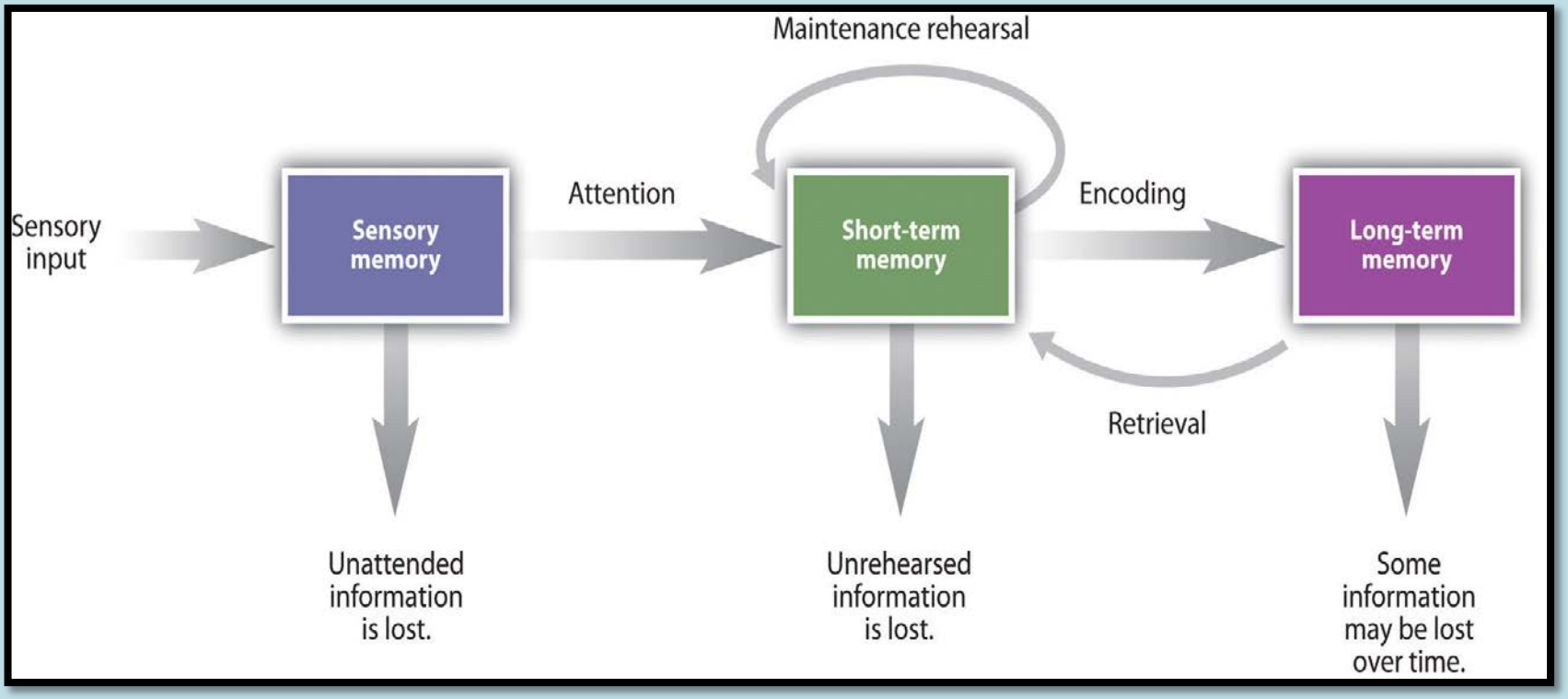

***Conclusion:*** The more exercise we get, the more likely we are to rate our sleep as "very good" or "fairly good" in quality

# Circadian Rhythms and our internal clock

- The biological clock resides in the brain
- It helps regulate when we feel sleepy and when we are alert
- It works in tandem with light and dark, and our body temperature and hormones



# Sleep, Memory & Cognitive Function


Maintenance rehearsal
Sensory input
Sensory memory
Attention
Short-term memory
Encoding
Long-term memory
Retrieval
Unattended information is lost.
Unrehearsed information is lost.
Some information may be lost over time.

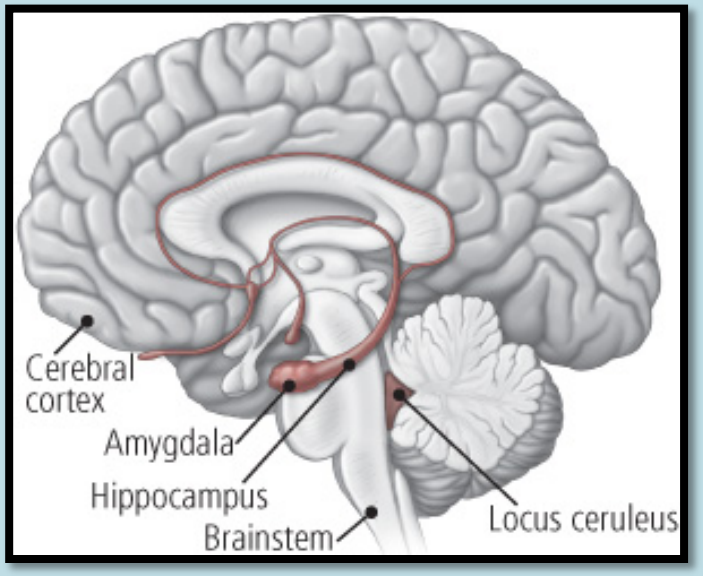
# Waking vs. Sleeping Rehearsal

- Waking Rehearsal is simply the purposeful repetition of the initial stimuli or piece of information

- What exactly then is Sleeping Rehearsal?

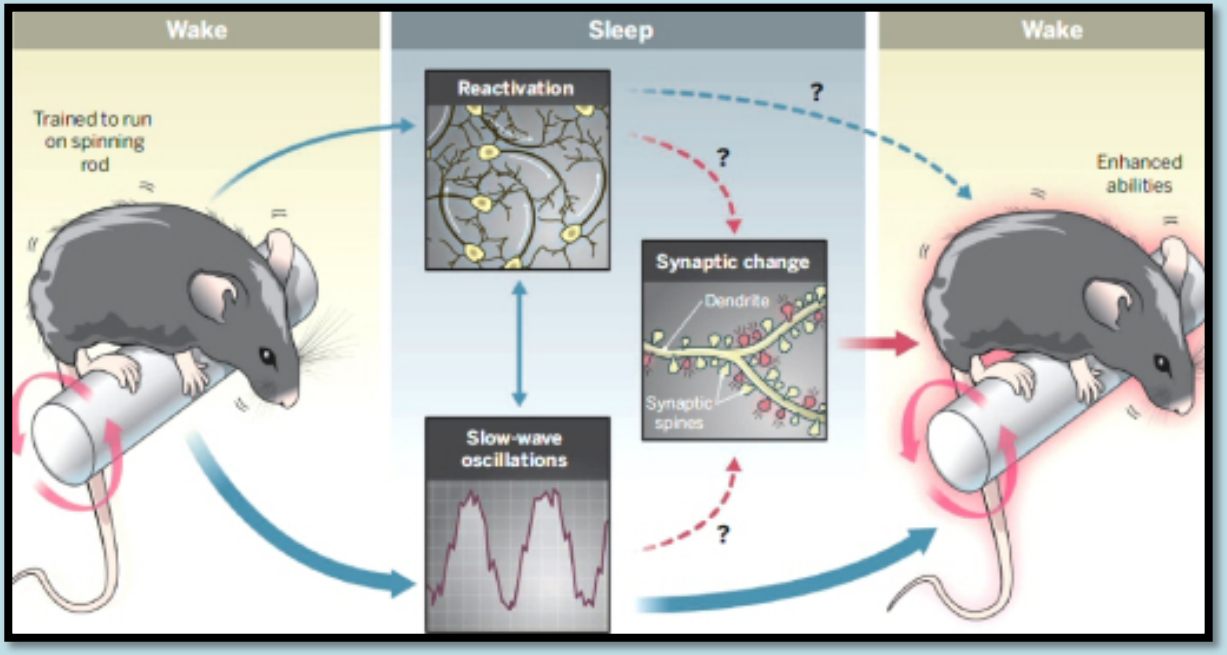
# Rehearsal during Sleep

- During sleep, there is continual activation between the hippocampus and the cerebral cortex (with a number of relay stations along the way).



# Rehearsal during Slow Wave Sleep

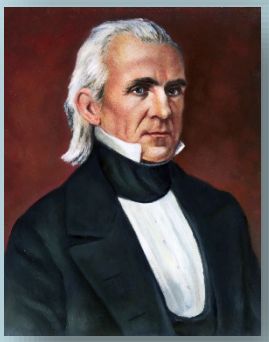
- Activation patterns in the sleeping brain mimic those recorded during the learning of the task during the previous day



# REM vs NREM Memory Consolidation

**SLOW WAVE SLEEP** plays more of a role in DECLARATIVE MEMORY:

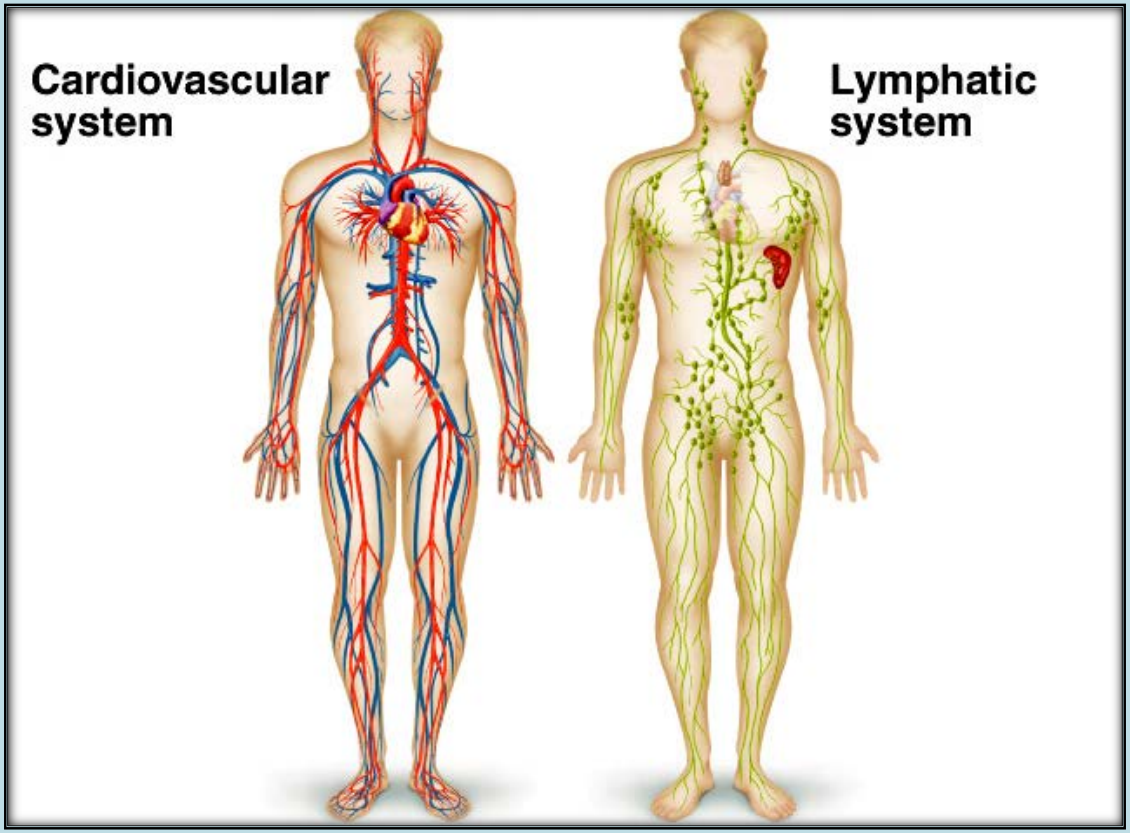
Remembering Basic Factual Information

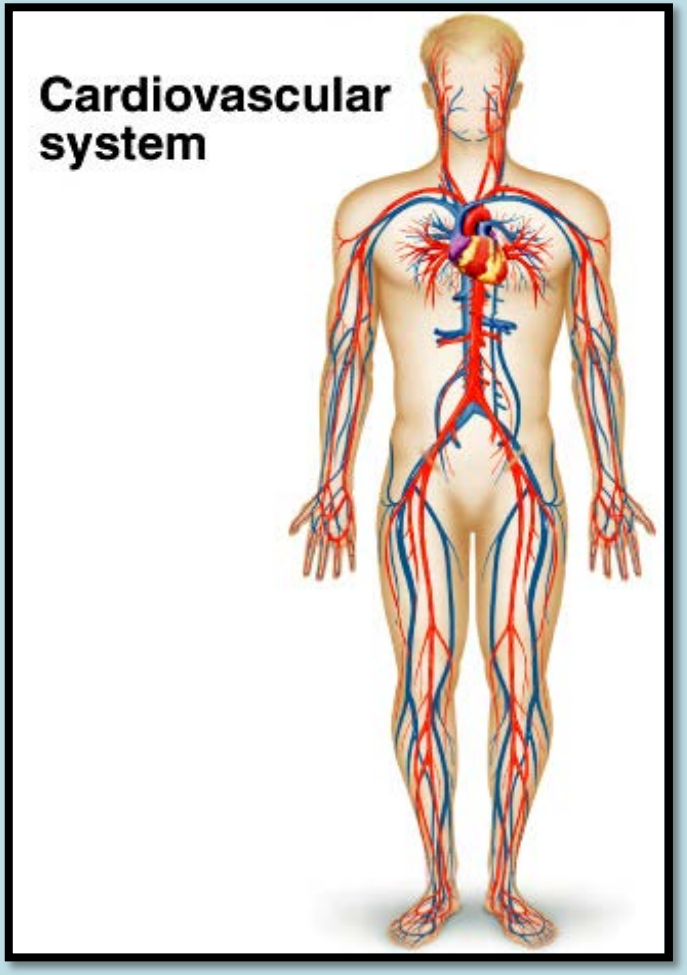
**REM SLEEP**
plays a stronger role in
PROCEDURAL MEMORY:

Remembering HOW to do something

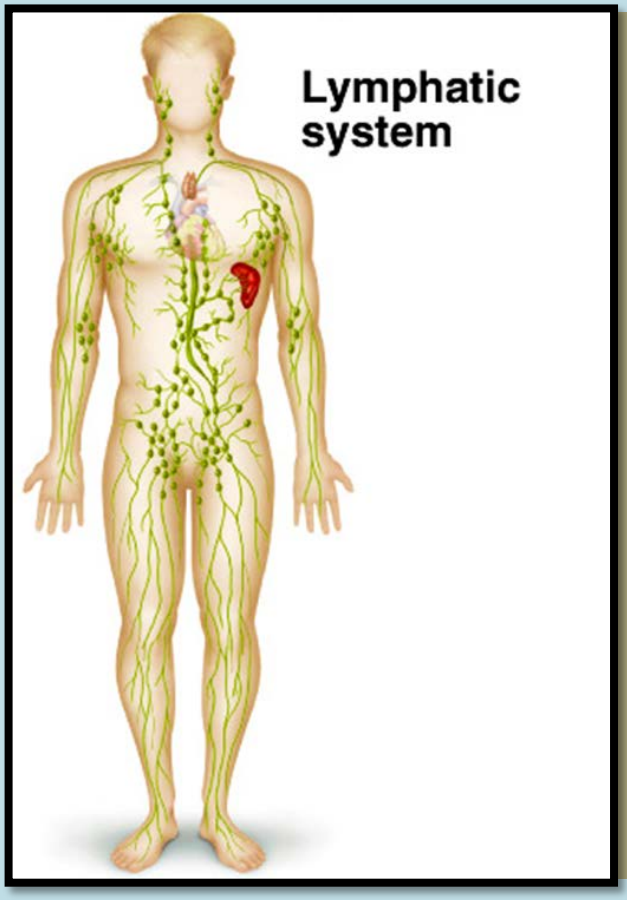
# Energy & Waste



- The brain uses about 25% of the body's energy supply, even though it occupies only 2% of body's mass



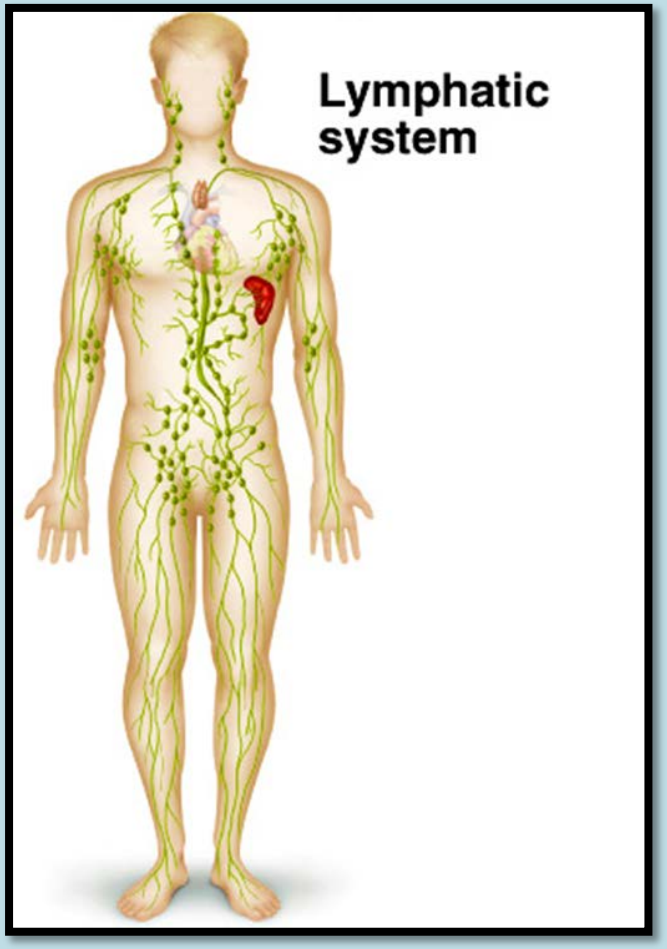

*How are nutrients supplied to the brain?*




# LYMPHATIC SYSTEM

A parallel collection of vessels that extends throughout the body…collects proteins and waste products…sends to circulatory system for removal.

# Given the supply of nutrients the brain needs to function, it creates a tremendous amount of waste.




- *…but the brain has very little lymphatic involvement.*

# Cerebrospinal Fluid (CSF)

- CSF  fills spaces that surround the brain.
- CSF doesn't stay on the outer surface of the brain, but rather is pumped into the inner regions of brain.
- It flows along the outsides of the blood vessels, and cleans away the waste from spaces between brain cells.
- Access to entire brain volume.

# *What impact does this cleaning have on cognitive function?*

- When the researchers injected beta-amyloid into the brains of mice, the CSF cleared away this “debris” twice as quickly during sleep as during wake
- When beta-amyloid collects and forms plaque inside brain cells, Alzheimer’s may develop
- Impaired quality & quantity of sleep is associated with a buildup of beta-amyloid.