

# Sleep in High School

- **biologic imperative**
- **sleep onset delayed**

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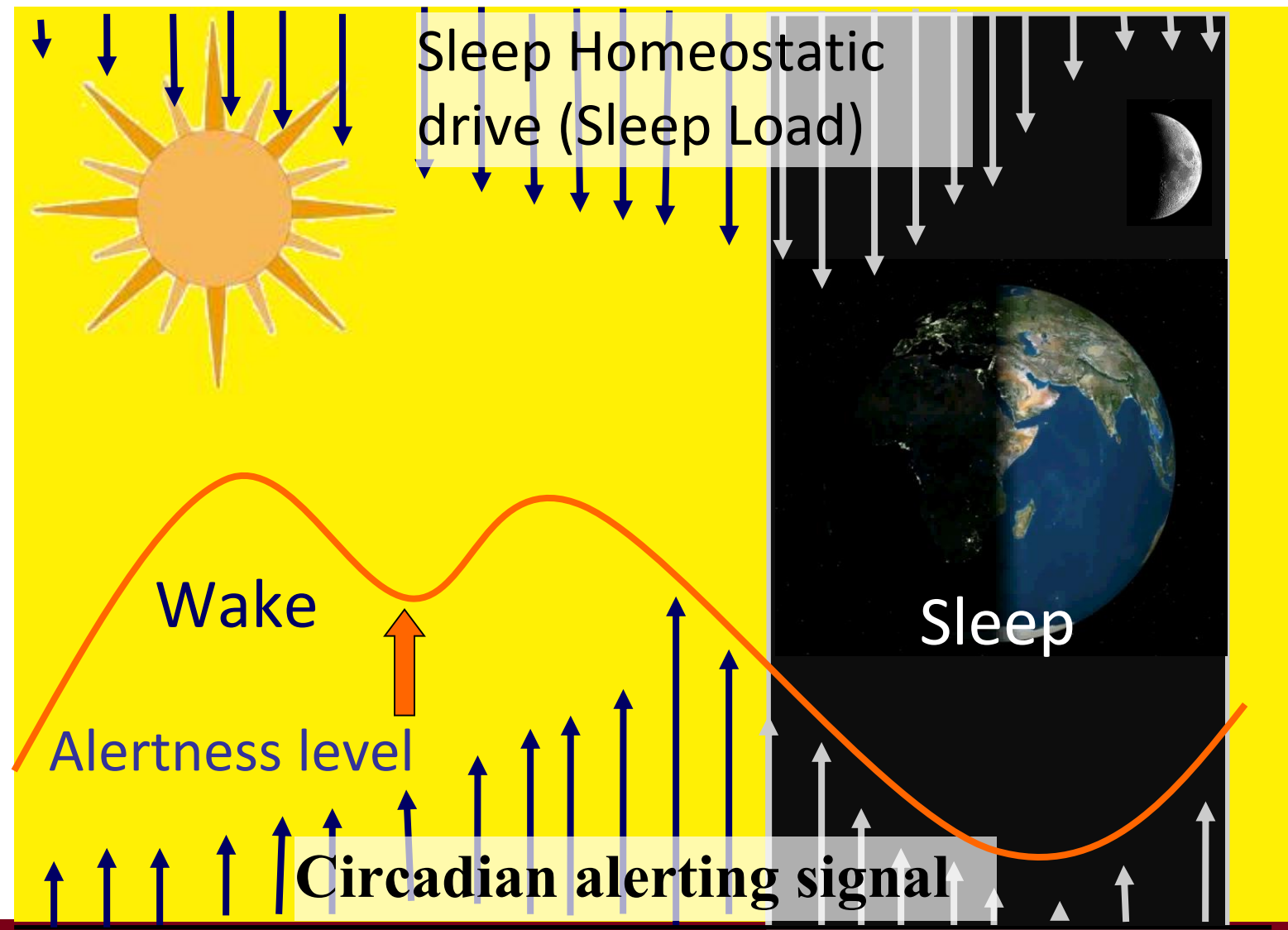
# Sleep.....

is a **biological imperative** that affects mortality, health and safety

- clock timing altered by light
- can be local and generalized
- enhances brain function
- balances mood



# Sleep Clock Start Time



9 AM

3 PM

9 PM

3 AM

9 AM

Time

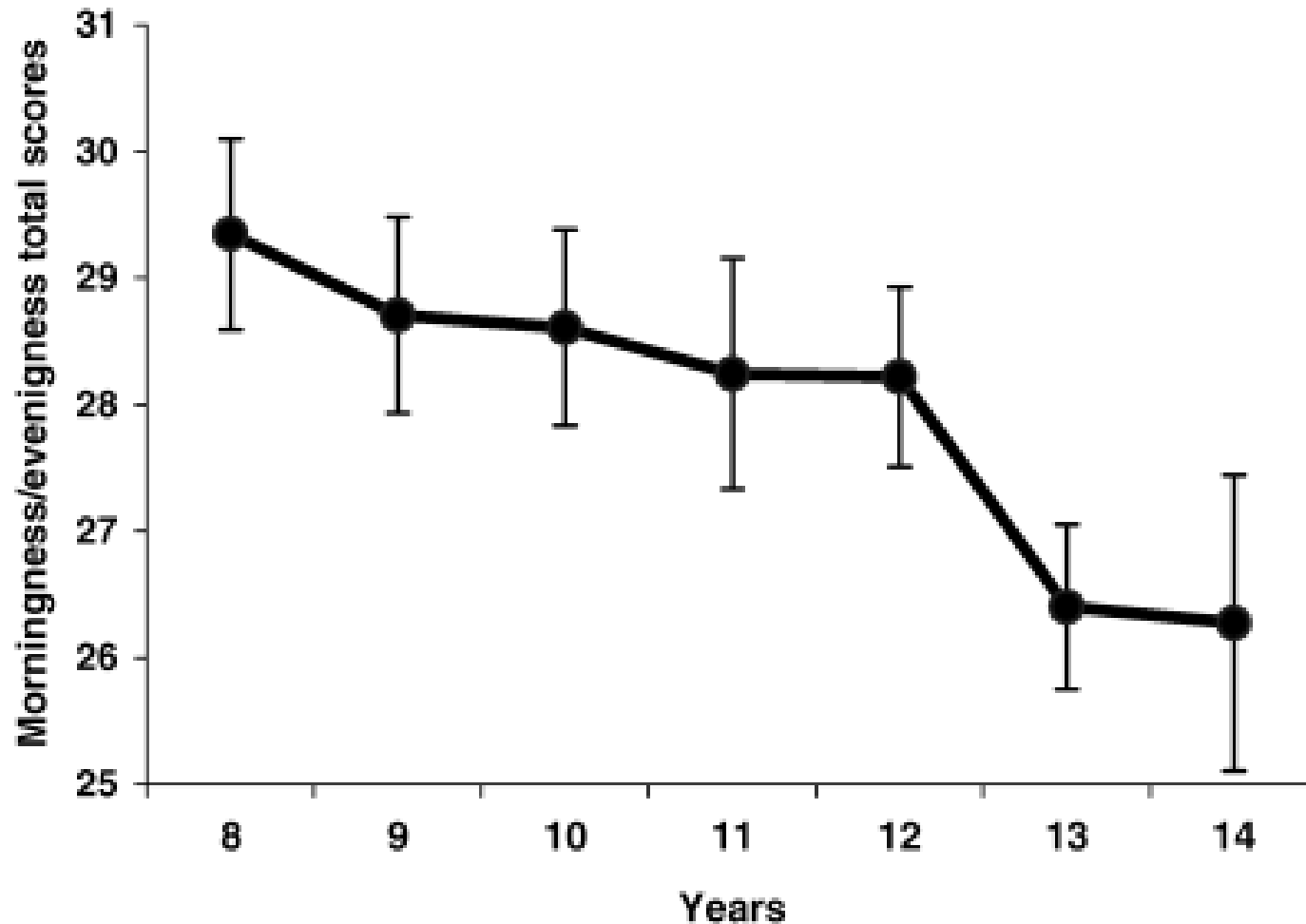


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# Sleep rhythm is delayed after age 12

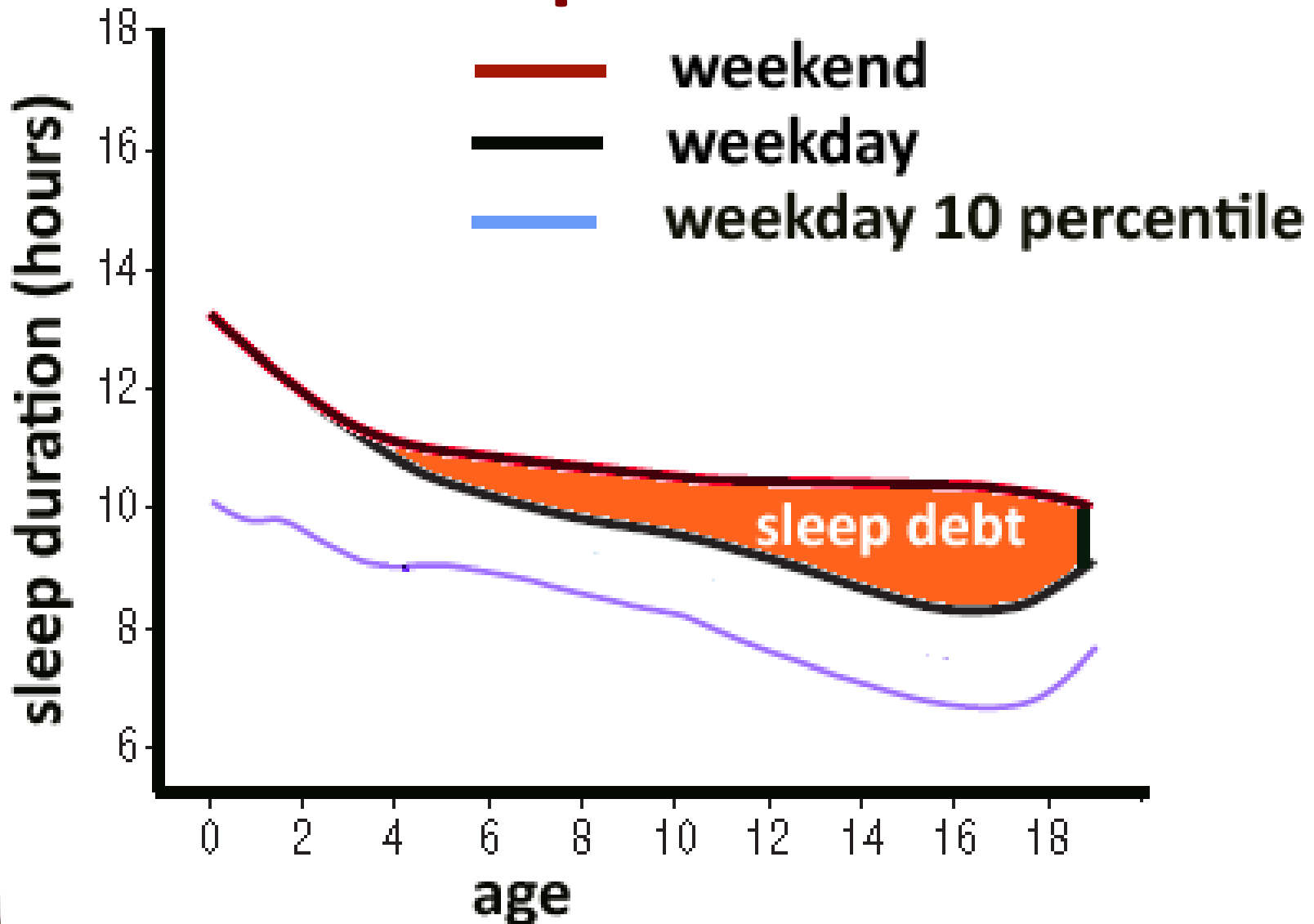
DOI: 10.1111/j.1365-2869.2007.00584.x



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# Sleep debt

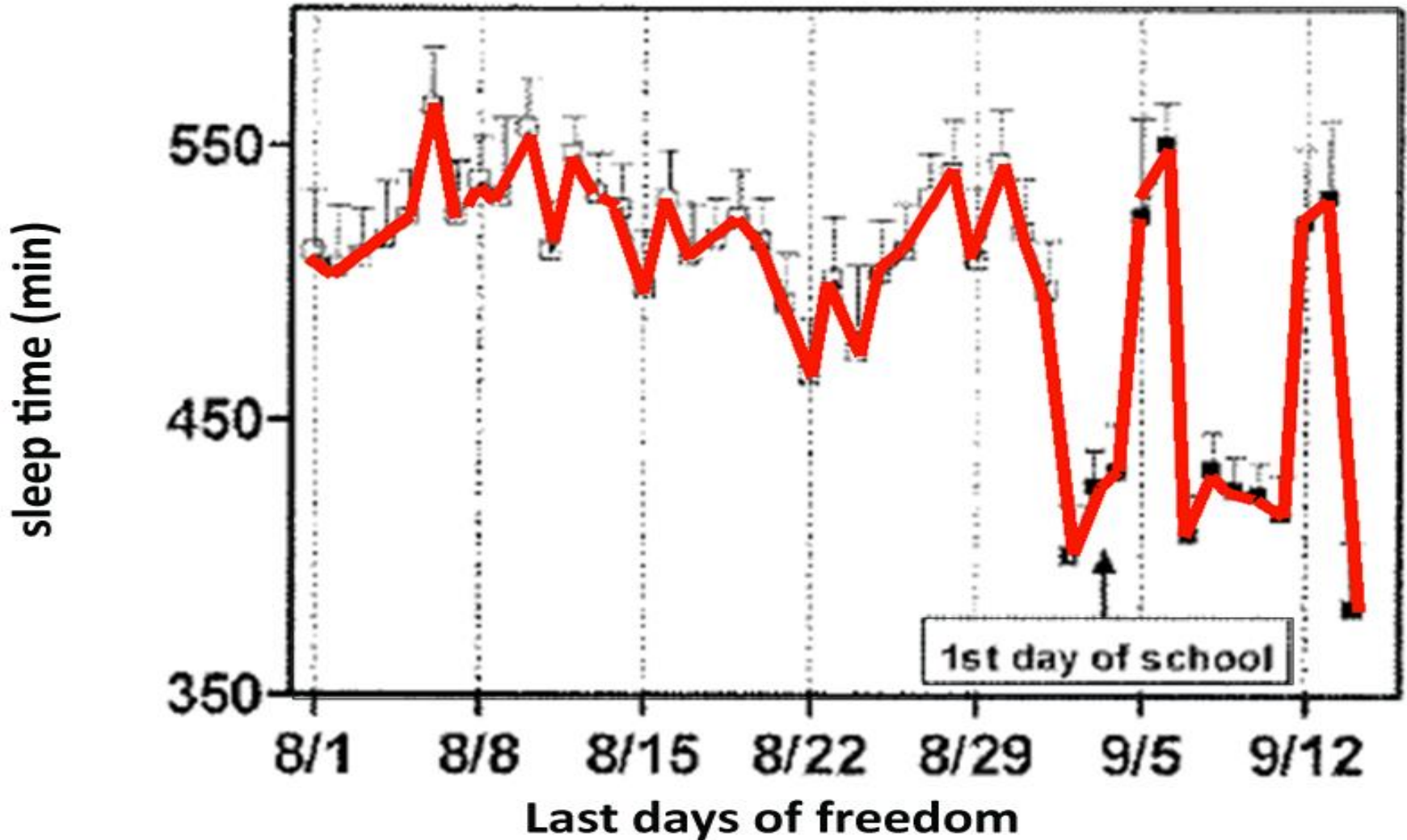


n=7374 adapted from  
doi: 10.1001/jamapediatrics.2013.423



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# Crashing into school



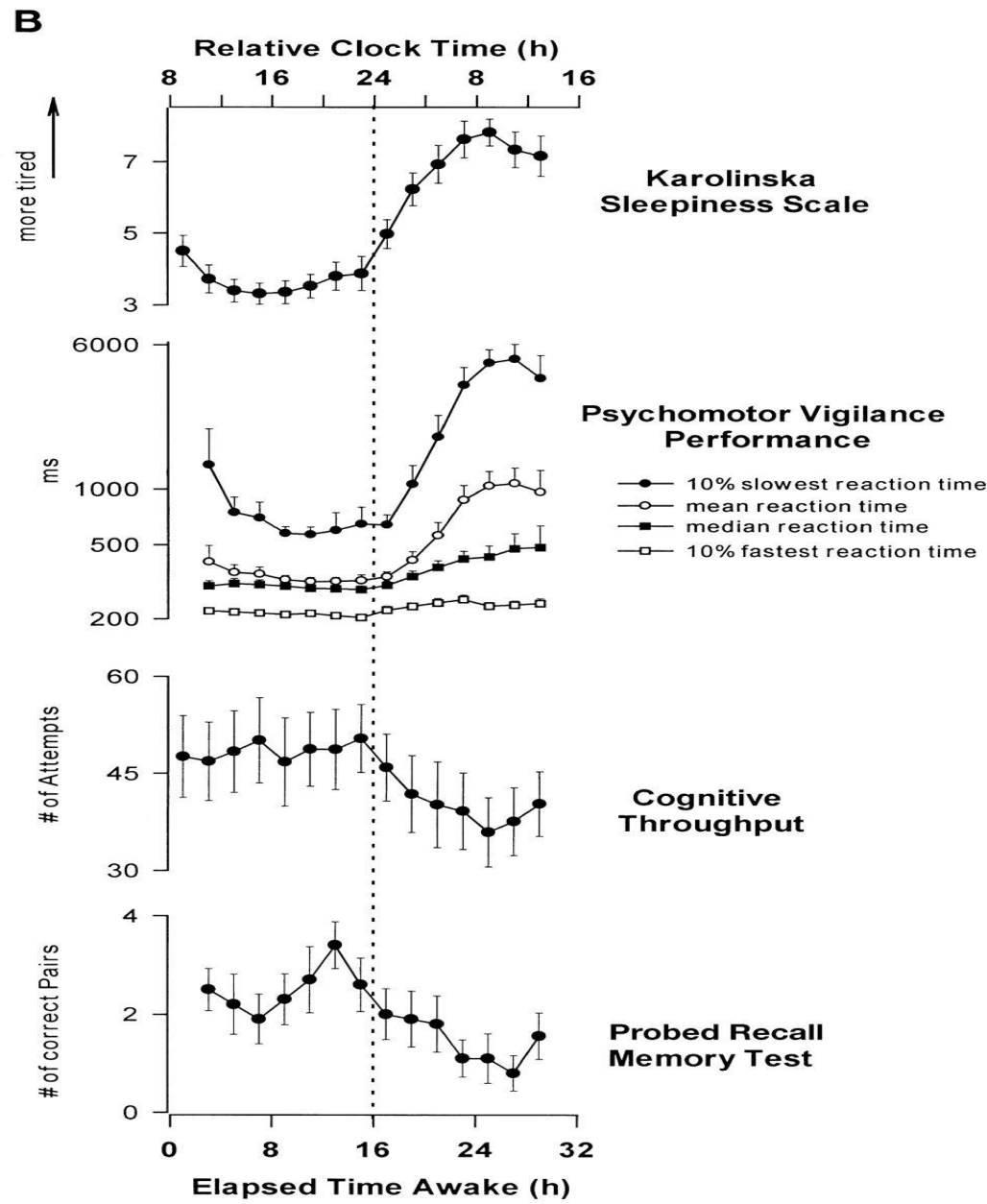
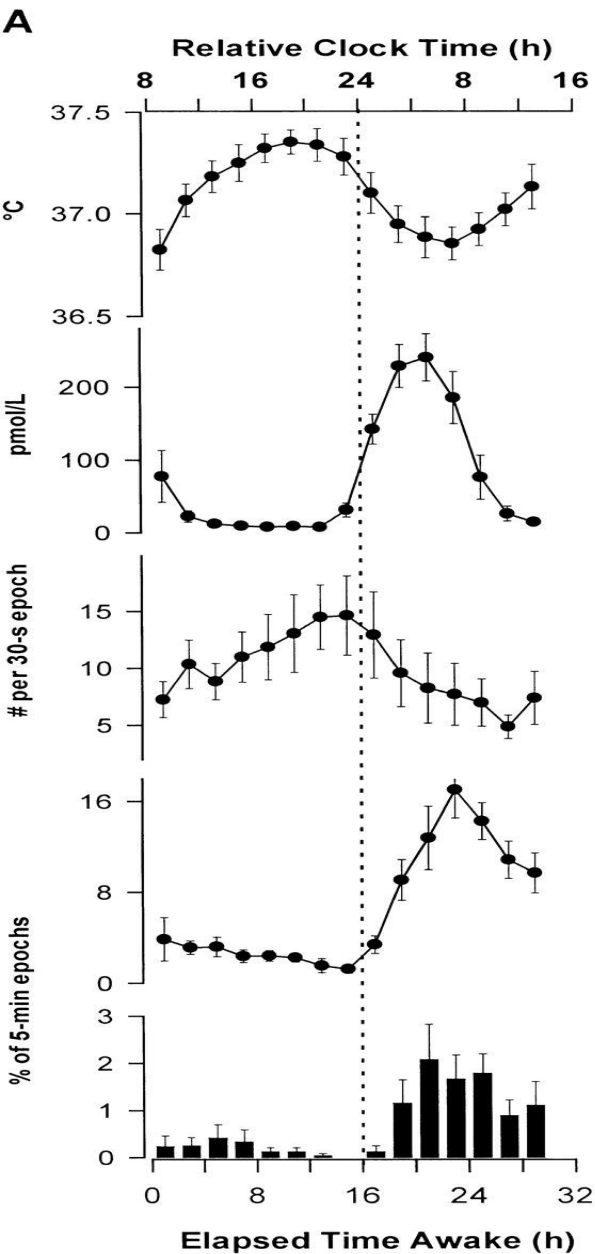
**What happens if you don't  
get sleep?**



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# No sleep = performance problem





# sleep and safety

.....why is he driving?



- Car accidents: highest cause of death in teens
- 2,700 teens killed (2010)

<https://youtu.be/QZZNxJS3mAI>



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# how are we doing?

CDC BRFSS n=74,571 in 12 states

- **35.3% < 7 hours sleep**
- **37.9% fell asleep unintentionally/1 month**
- **4.7% fell asleep driving/1 month**



# How much sleep is necessary?

## Evidence reviews 2015:

- **AASM  $\geq$  7 hours in adults and  $\geq$  9 hours in teens**
- **ATS 7-9 hours in adults**



# Ok, but WHY?

.....what's the science?



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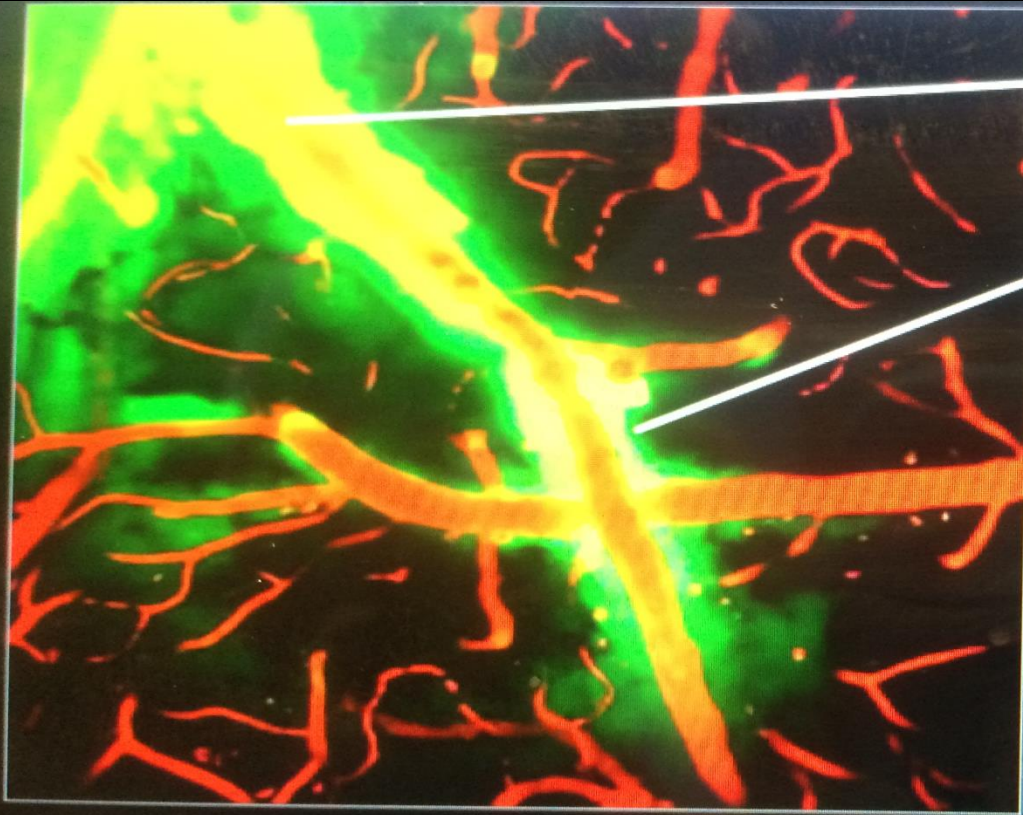
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# Why do humans need sleep?

- Clearance of neurotoxins
- Synaptic homeostasis and plasticity
- Learning, memory and abstraction



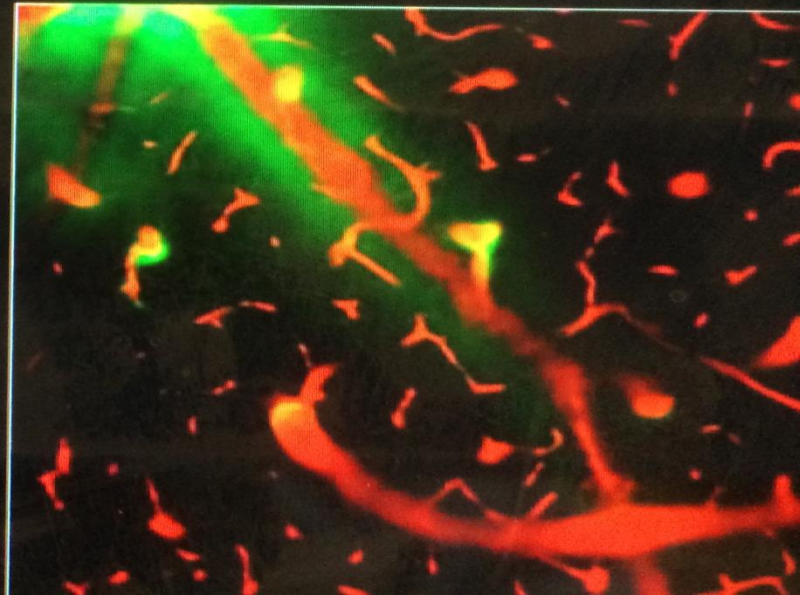
# Perivascular clearance



Blood Vessels

Cerebrospinal Fluid  
(CSF)

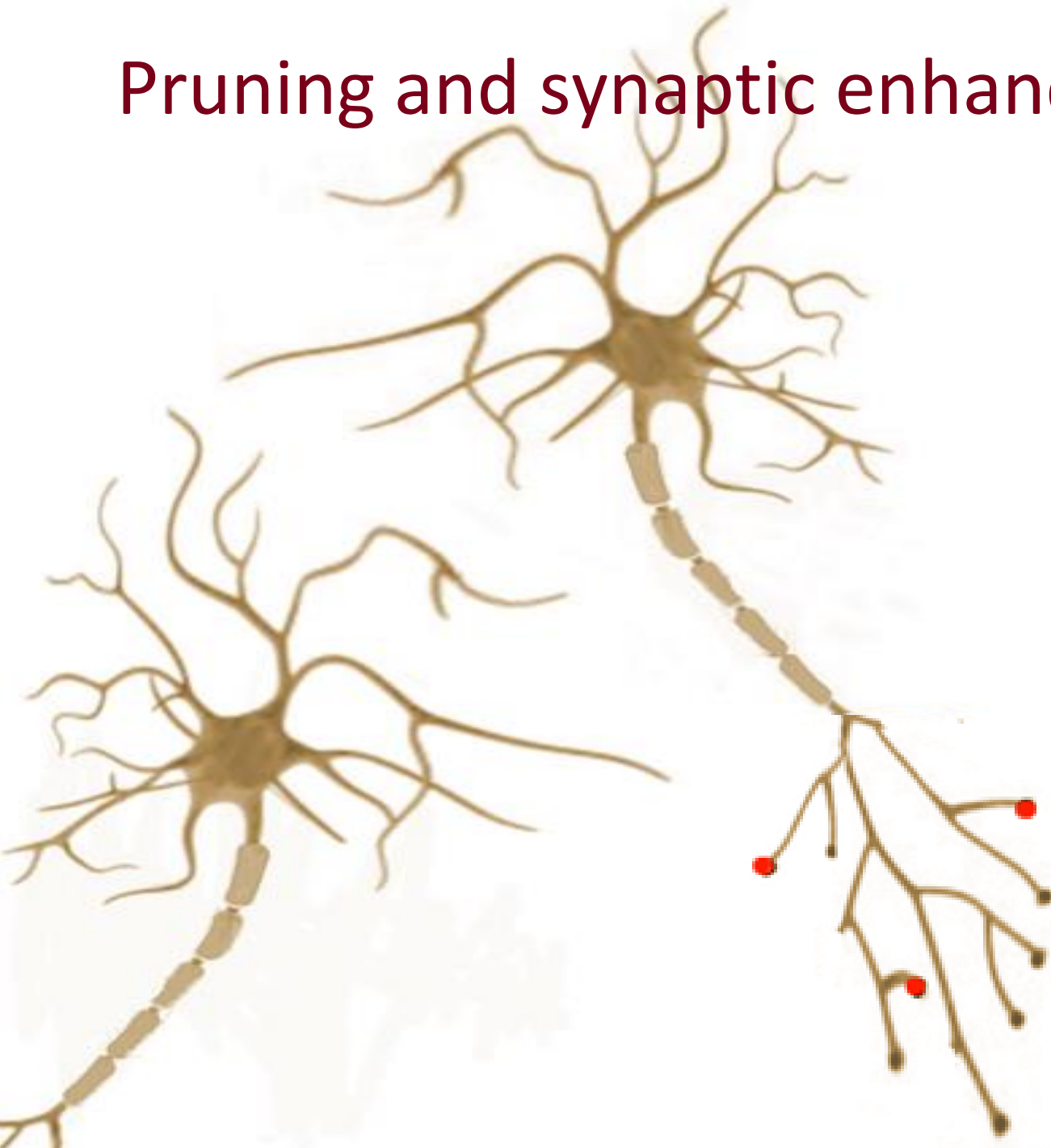
... and inside th



Imaging at the brain surface

doi: 10.1227/01.neu.0000442978.07078.e5

# Pruning and synaptic enhancement





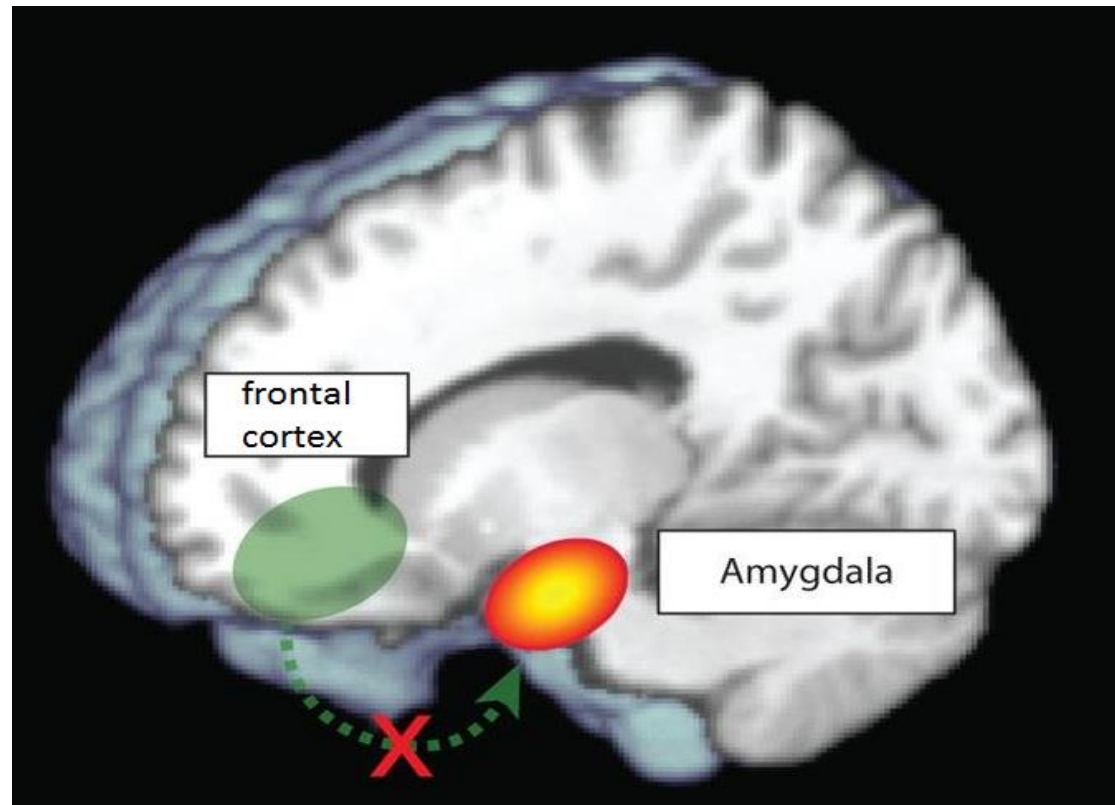
# Sleep and Brain Enhancement

- **Unitization** the ability to transform packets of memory into a unitary entities – from 539 75 214 to 53975214
- **Assimilation** placing new spoken words in a family of similar phonemically related words
- **Abstraction** the ability to recognize embedded rules in nonsense information



# REM sleep deprivation: impact on emotional reactivity

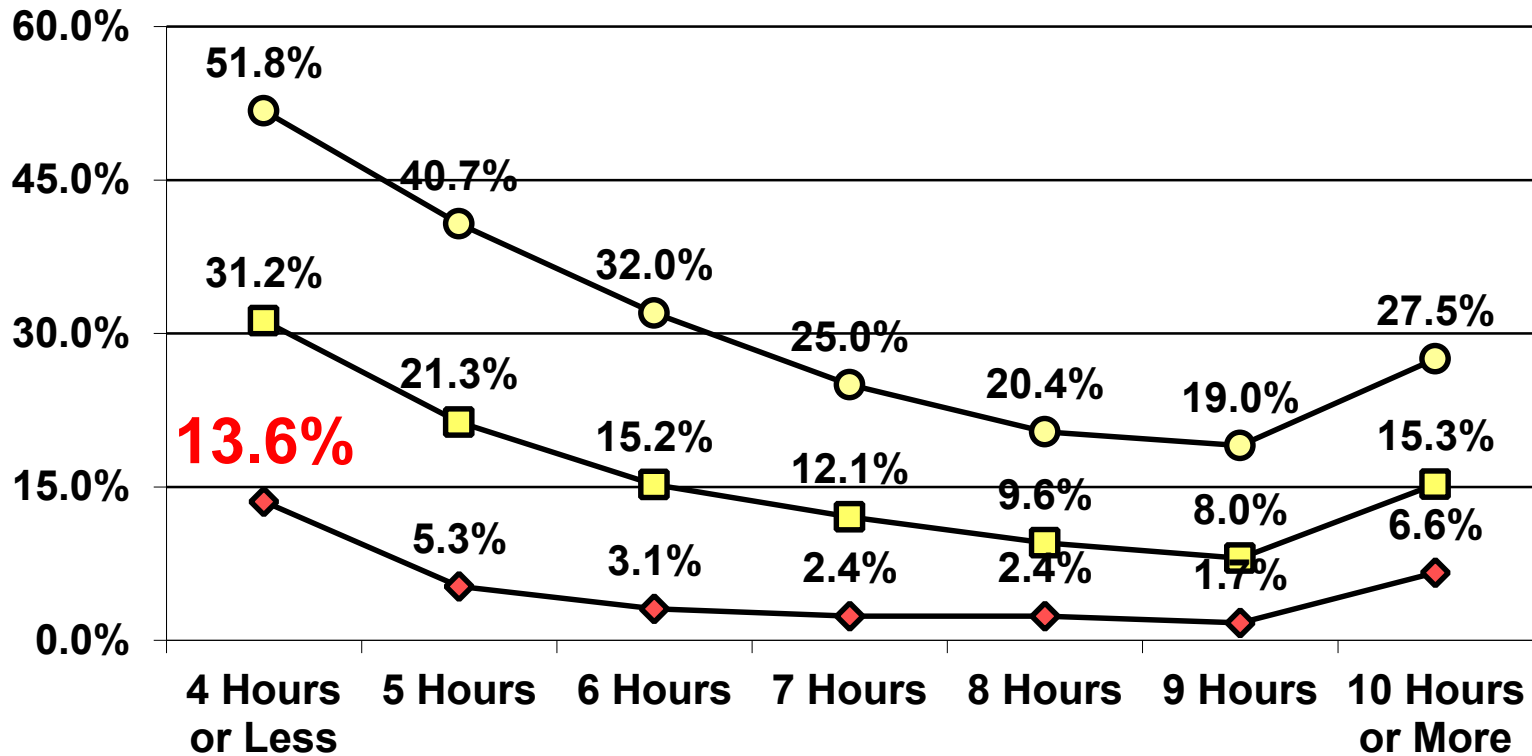
- Increased amygdala activity
- Decreased amygdala connectivity
- Increased emotional reactivity



# sleep and mood

N= 27,939 adolescents

doi: 10.1007/s10964-014-0170-3



○ Feeling Sad & Hopeless  
◇ Attempted Suicide

■ Considered Suicide



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**habits and schedules  
drive health, safety,  
and performance**



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# Translating sleep biology for high school students

- You will do better on tests
- You will look better
- Your mood will be better
- You will be less likely to have a car accident
- You will be less likely to gain weight
- You will live longer

