

## I'm Sooo Tired!



Presented by  
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## Quick Quiz

**Q:** According to the NHTSA what is responsible for at least 100,000 automobile crashes, 40,000 injuries, and 1,550 fatalities each year?

**Is it speeding, alcohol use, weather situations, or drowsiness?**

**A: Drowsiness**

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## Three Questions!

1. Can you commit suicide by not breathing?
2. Can refusing to eat be fatal?
3. Can sleep deprivation cause mortality?

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It all depends  
on what we  
are doing  
when we fall  
asleep--  
willing or  
unwillingly!



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## The tired brain simply goes to sleep ... zzzzzz

- If we go long enough without sleep, our brain will simply fall asleep, regardless of what we are doing--even while we are walking or talking.
- Can lack of sleep actually kill us?



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## But I Don't Feel Like I Need Much Sleep!

- Sleep deprivation decreases objective measures of performance
- Sleep deprived college students subjectively rated their alertness higher than did their well-rested colleagues.

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Pilcher, et al. Effects of sleep deprivation on performance: a meta-analysis. Sleep 1996 May;19(4):318-26.

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## Yo-Yo Ma Forgets Cello!

\$2.5 million, 266 yr. old instrument



**"I did something really stupid. I was in such a rush, I was so exhausted, I'd given a concert at Carnegie Hall last night. I just forgot!"**

New York (AP)  
October 16, 1999

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## Americans Are Tired!

2012 Gallup/Newsweek Survey

- 37% very tired more than 3 days per week!
- 25% tired all the time!



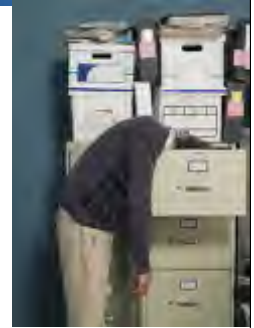
**Almost 2/3 of population are tired most of the time!**

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## Current Trends

- Adults sleep 1.5 hours less per day than our grandparents!
- Teens sleep 2.5 hours less per day since 1962!



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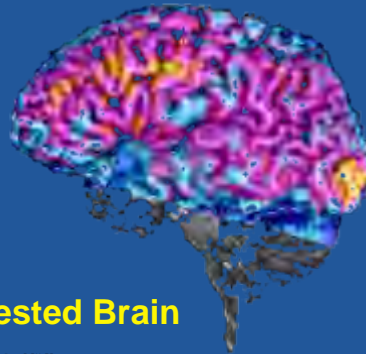
## Proud to Be Pooped!



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## Rested Brain



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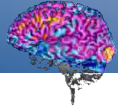
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## Tired Brain



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"Fatigue selectively targets the highest order of cognitive mental functions. Critical thinking becomes *impossible*."

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## High Order Mental Functions

- Discernment
- Judgment
- Initiative
- Creativity
- Forethought

Decision-making

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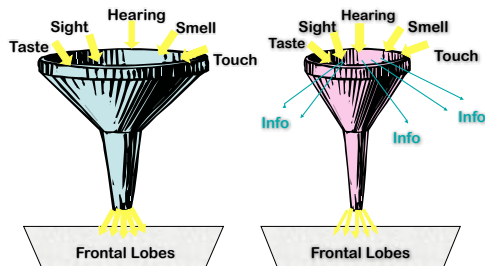
## Fatigue Primarily Affects Two Areas of the Brain

- **Thalamus:** gates (passes) sensory information to the higher centers of brain
- **Frontal lobes:** processes info to make decisions
  - ❖ current information from senses
  - ❖ previously learned information
  - ❖ experience

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## Fatigue "Chokes" the Thalamus



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## Fatigue Lowers Cognitive Efficiency

- Lessens awareness of our surroundings
- Decision-making falls to chance levels
- Reduces ability to process new information efficiently
- Impairs learning new information
- Decreases long-term memory

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A tired person is *inefficient*,  
*slower*, *less safe* and  
makes more *mistakes*!



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## Three Basic Causes of Fatigue

1. Long hours of physical work or activity
2. Long hours of mental work
  - Poor stress management skills (emotional stress)
3. The lack of sufficient sleep

or  
**Any Combination of the Above!**

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**“Today there is a ubiquitous intrusion of personal, social and cultural activity into the time traditionally reserved for sleep!”**

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George M. Beard (1839-1883)  
*American Nervousness, Its Causes and Consequences, 1881*

“The chief primary cause of . . . [the] very rapid increase of nervousness is modern civilization, which is distinguished from the ancient by these five characteristics:

- steam power
- the periodical press
- the telegraph,
- the sciences,
- and the mental activity of women.”

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## Technology Has Increased Fatigue

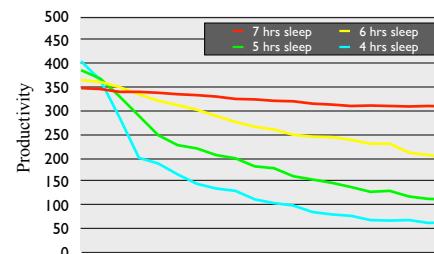


Interface:	Simple	→	Complex
Demands:	Physical	→	Mental
Options:	Few	→	Many
Training:	Once	→	Continuous
Span of Responsibility:	Narrow	→	Broad
Cost of Error:	Minimal	→	Large

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## The Impact of Sleep Debt On Productivity



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## Risks from Short Sleeping

- Sleep debt decreases the entire brain's ability to function, most significantly impairing areas of the brain responsible for
  - ❖ attention,
  - ❖ complex planning,
  - ❖ complex mental operations, and
  - ❖ judgement.

Belenky, et al. *J Sleep Res*. 2000;9(4):335-52. *J Sleep Res*. 1999;8(4):237-45. Review.

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## Risks from Sleep Deficit

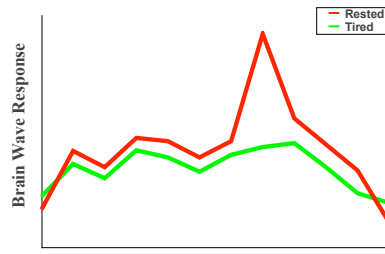
- After four 8-hour recovery nights of sleep,
- subjects were still making more errors than when they started.

Belenky, et al. / J Sleep Res. 2000;9(4):335-52. / Sleep Res. 1999;8(4):237-45. Review.

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Brain Wave Response



**Impact of Small Amounts of Sleep Loss**

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## Sleep deprivation not just in your head

- Sleep has traditionally been viewed from its effects on brain activity and function.
- New research shows its effects on other organs may be very significant to physical health.

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## Sleep deficit and obesity linked?

- Even moderate sleep debt causes altered metabolic state in healthy young males comparable to that of diabetics, with 30% impairment in glucose metabolism.
- The growing epidemic of sleep deprivation may be causally linked to the coincident epidemic of obesity.

Spiegel K, Leproult R, Van Cauter E. Impact of sleep debt on metabolic and endocrine function. Lancet 1999;354(9188):1435-9.

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## Health Risks from Sleep Deficit

- After 4 hours of sleep for 6 nights, healthy young men had blood tests that nearly matched those of diabetics
  - ❖ Ability to process blood sugar reduced by 30%
  - ❖ Huge drop in their insulin response (↑obesity)
  - ❖ Elevated levels of stress hormone cortisol, which can lead to hypertension and memory impairment.

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Spiegel K, Leproult R, Van Cauter E. Lancet 1999;354(9188):1435-9.

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## Fatigue Influences Obesity



Leptin

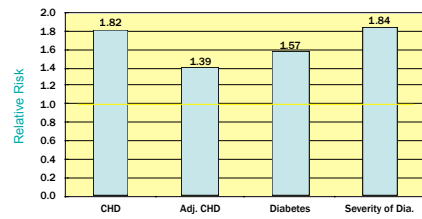


Ghrelin

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## Long-Term Sleep Restriction



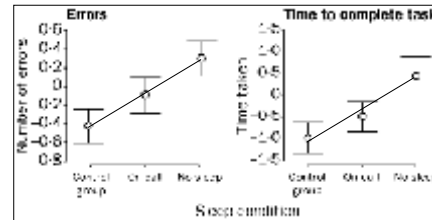
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## Surgeon's Performance Affected

- Performance on laproscopic training simulator decreases with less sleep



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Taffinder, et al. Effect of sleep deprivation on surgeons' dexterity on laparoscopy simulator. *Lancet* October 10, 1998;352:1191.

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## Reasons for Sleep Restriction

- Demands of a 24-hour society and rotating shift work
- Family needs superimposed on work responsibilities
- Increased time spent watching TV and surfing the Internet
- Insomnia, sleep apnea and other disorders

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## HOW MUCH SLEEP DEBT DO YOU HAVE?

0	2
1	3

- \_\_\_ 1. Sitting and reading
- \_\_\_ 2. Watching TV
- \_\_\_ 3. Sitting, inactive in a public place (i.e., church, a meeting)
- \_\_\_ 4. As a passenger in a car for an hour without a break

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## HOW MUCH SLEEP DEBT DO YOU HAVE?

0	2
1	3

- \_\_\_ 5. Lying down to rest in the afternoon when circumstances permit
- \_\_\_ 6. Sitting and talking to someone
- \_\_\_ 7. Sitting quietly after a lunch without alcohol
- \_\_\_ 8. In a car, while stopped for a few minutes in traffic

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## HOW MUCH SLEEP DEBT DO YOU HAVE?

Add up each response and total to calculate your total score:

0-5	Slight or no sleep debt
6-10	Moderate sleep debt
11-20	Heavy sleep debt
21-24	Extreme sleep debt

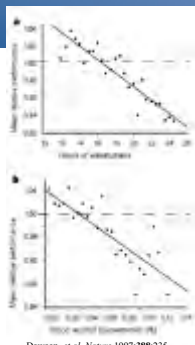
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## Comparing the Effect

- Looking for a scale to quantify the impairment of sleep deprivation, Australian researchers compared its effects to those of alcohol intoxication
- They found a close, direct correlation between the two sources of impairment



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Dawson, et al. *Nature* 1997;388:235

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## Which is Better? Tired or Drunk

### Wakefulness

17 hrs.

24 hrs.

=

=

### Equivalent BA

0.05

0.1

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Nature 1997 Jul 17; 388 (6639): 235

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## Sleep impairment and intoxication

- 16-18 hours of continuous wakefulness in healthy adults produced performance impairments comparable to legal intoxication with alcohol. (BAC >0.08%)

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Dawson, et al. *Nature* 1997;388:235  
Williamson AM, et al. *Occup Environ Med* 2000;57:649-655

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## Moderate Sleep Deprivation Equivalent to Legal Levels of Alcohol Intoxication

- 39 subjects, ages 30-49 years old
- Volunteer professional drivers
- Cross-over, randomized design



Occup Environ Med 2000; 57:649-655

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## Moderate Sleep Deprivation Equivalent to Legal Levels of Alcohol Intoxication

*"After 17 hours of wakefulness performance on most tests was equivalent or worse than that on a BAC of 0.05%. Response speeds were up to 50% slower for many tests and accuracy measures were significantly poorer than at this level of alcohol. After 22 hours without sleep, performance reached levels equivalent to the maximum alcohol dose given to subjects (BAC of 0.1%) Sleep is needed at the end of the day if adverse effects of performance are to be avoided."*

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## Sleep loss vs Ethanol ingestion

- sleep loss was more potent in its sedative effects
- comparable in effects on psychomotor performance.
- ethanol produced greater memory deficits
- all subjects were less aware of their overall performance impairment.

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Roches T, et al. Ethanol and sleep loss: a "dose" comparison of impairing effects. *Sleep* 2003 Dec 15;26(8):981-5.

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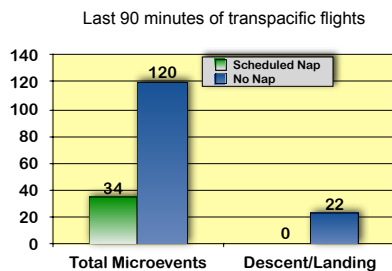
## How to know how much to sleep?

- Sleep needs vary between persons
- A simple empirical way to determine how much sleep is needed—performance is carefully measured in a systematic manner over time
- The subject incrementally sleeps more hours each night
- The point at which no further significant improvement occurs is the amount needed

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## Take a Nap! First Aid for Fatigue



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## Fatigue Affects Even the Best!



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## Fatigue Fighter Strategies

1. Learn to value sleep.
2. Get adequate sleep regularly -- 8-9 hours per night.
3. Exercise 30-60 min. every day.
4. Learn to manage your stress.
5. Eat properly & drink plenty of water.
6. Avoid caffeinated beverages, tobacco, and alcohol.
7. Rest a day each week & take an annual vacation.
8. If you suspect a sleep disorder, see your doctor.

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## Sleep more important than diet!

- Sleep is more essential to health than food or even water.
- It depends on what we are doing when we fall asleep--willing or unwillingly!

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