



Cornell University

Sleep for Success!

*Everything you must
know about sleep
but are too tired to ask...*

Dr. James Maas © 2011, All rights reserved

*How much sleep
do you get?*

The Sleep Deprivation Crisis

- Most people are moderately to severely sleep deprived. 71% do not meet the recommended 8 hrs/nt. (7.1? or less?)
- High school & college students are walking zombies

Even middle schoolers are exhausted and inattentive...

The Sleep Deprivation Crisis at Work

- 33% fell asleep at work last month
- For the vast majority, sleepiness diminishes:

Our concentration at work

The amount of work we can accomplish

The quality of our work

Sleep deprivation cost \$66 billion per year

The Sleep Deprivation Crisis

- 75% of people experience sleep problems each week.

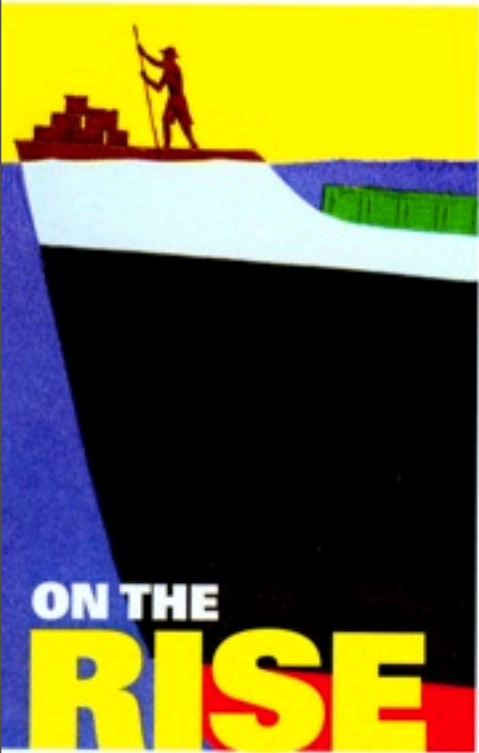
Difficulty falling asleep

Middle of the night awakenings

Waking up too early

Harvard Business Review

www.hbr.org



...page 60



- 60 **Emerging Giants: Building World-Class Companies in Developing Countries**
Tarun Khanna and Krishna G. Palepu
- 72 **The Tools of Cooperation and Change**
Clayton M. Christensen, Matt Marx, and Howard H. Stevenson
- 82 **THE HBR INTERVIEW**
Ideas as Art
James G. March
- 92 **Strategies for Two-Sided Markets**
Thomas Eisenmann, Geoffrey Parker, and Marshall W. Van Alstyne
- 102 **Meeting the Challenge of Corporate Entrepreneurship**
David A. Garvin and Lynne C. Levesque
-
- 20 **FORETHOUGHT**
- 37 **HBR CASE STUDY**
What Serves the Customer Best?
Paul F. Nunes and Woodruff W. Driggs
- 53 **DIFFERENT VOICE**
Sleep Deficit: The Performance Killer
A Conversation with Harvard Medical School Professor Charles A. Czeisler
- 114 **BIG PICTURE**
Can Science Be a Business?
Lessons from Biotech
Gary P. Pisano
- 126 **What Business Are You In?**
Classic Advice from Theodore Levitt
- 146 **EXECUTIVE SUMMARIES**
- 152 **PANEL DISCUSSION**

“Top executives have a critical responsibility to take sleep seriously. Educational programs about sleep should be mandatory. If you want to raise performance you need to pay attention to this fundamental biological process.

Encouraging a culture of sleepless machismo is worse than nonsensical; it is downright dangerous and the antithesis of intelligent management.”

Quality and quantity of sleep determines waking success!

Mood

Alertness

Energy

Thinking

Performance and productivity

General health

Longevity

Sleep deprivation...
makes you clumsy, stupid,
unhealthy and it
shortens your life.

Recent Research on Sleep

- **The sleeping brain is highly active:**
 - 1) Regulates immune, hormone & endocrine functions essential for general health

Univ. Chicago & Univ. Pittsburgh

Young Ss restricted to 6 hrs./ night for 6 nights
developed “senior citizen” profiles...

>cortisol, > blood sugar levels, < leptin molecules

Leads to: Hypertension (heart attacks & strokes),
Depression, Type II diabetes, Periodontal disease,
Skin Problems, Cancer, Obesity

Improper Sleep Increases Illness

Dr. Jan Born, Univ. of Luebeck, Germany

People who sleep less than 6 hours each night lower their resistance to viral infection by 50%

Improper Sleep Increases Illness

Sheldon Cohen of Carnegie Mellon University, *Archives Int. Med.*

Those who sleep less than seven hours a night are three times more likely to get a cold than longer sleepers.

Proper Sleep Clears Arteries

Diane Lauderdale, Univ. Chicago

One hour more sleep every night
decreases risk of artery calcification by 33%

17mm drop in systolic blood pressure

...

Blind women
have 50% less breast cancer
than sighted women.

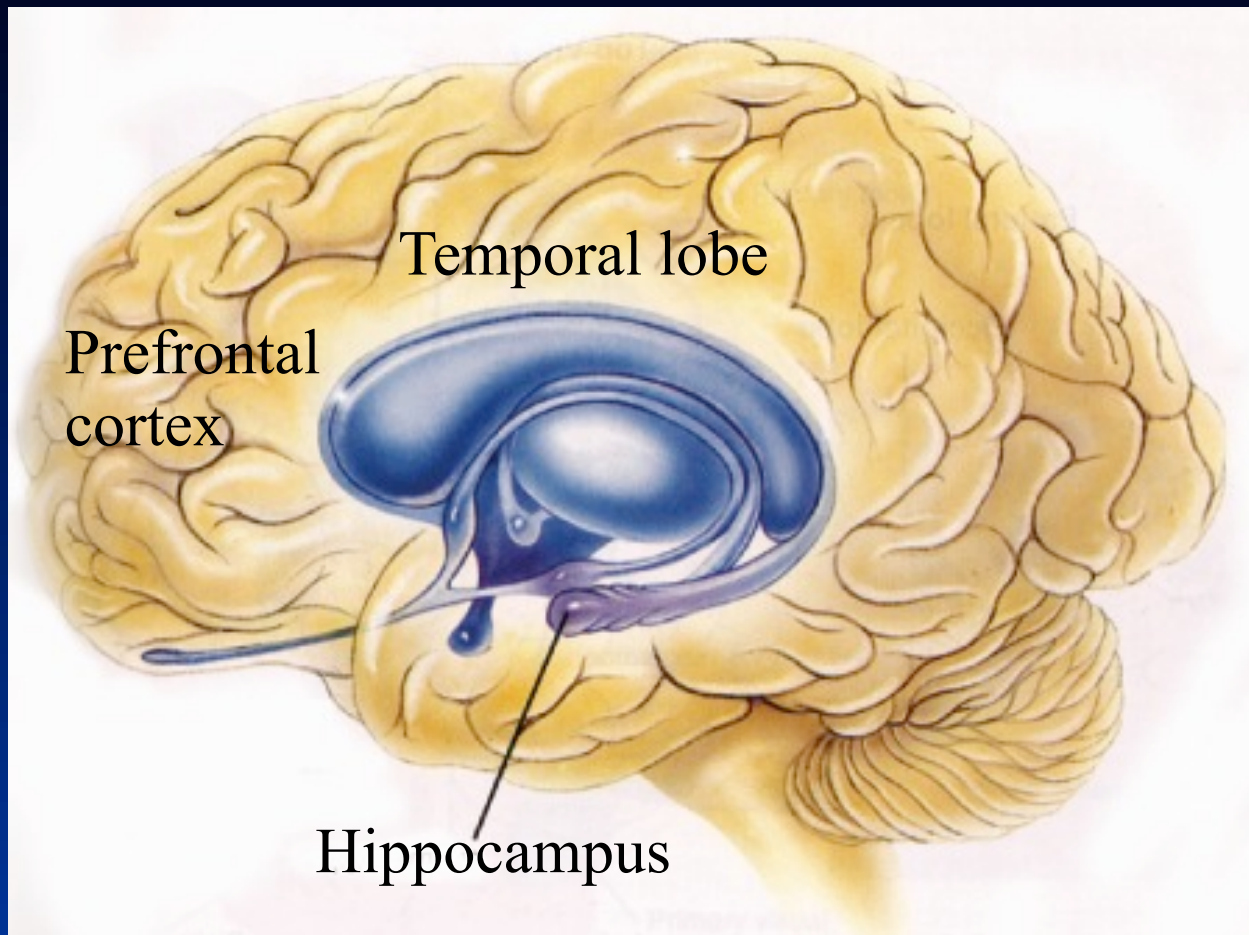
Recent Research on Sleep

The sleeping brain is highly active:

2) Puts new information into neural networks for long term storage...

essential for memory, learning, performance, problem-solving, creativity and athletic excellence.

POWER SLEEP for peak performance



All mental events enter hippocampus.

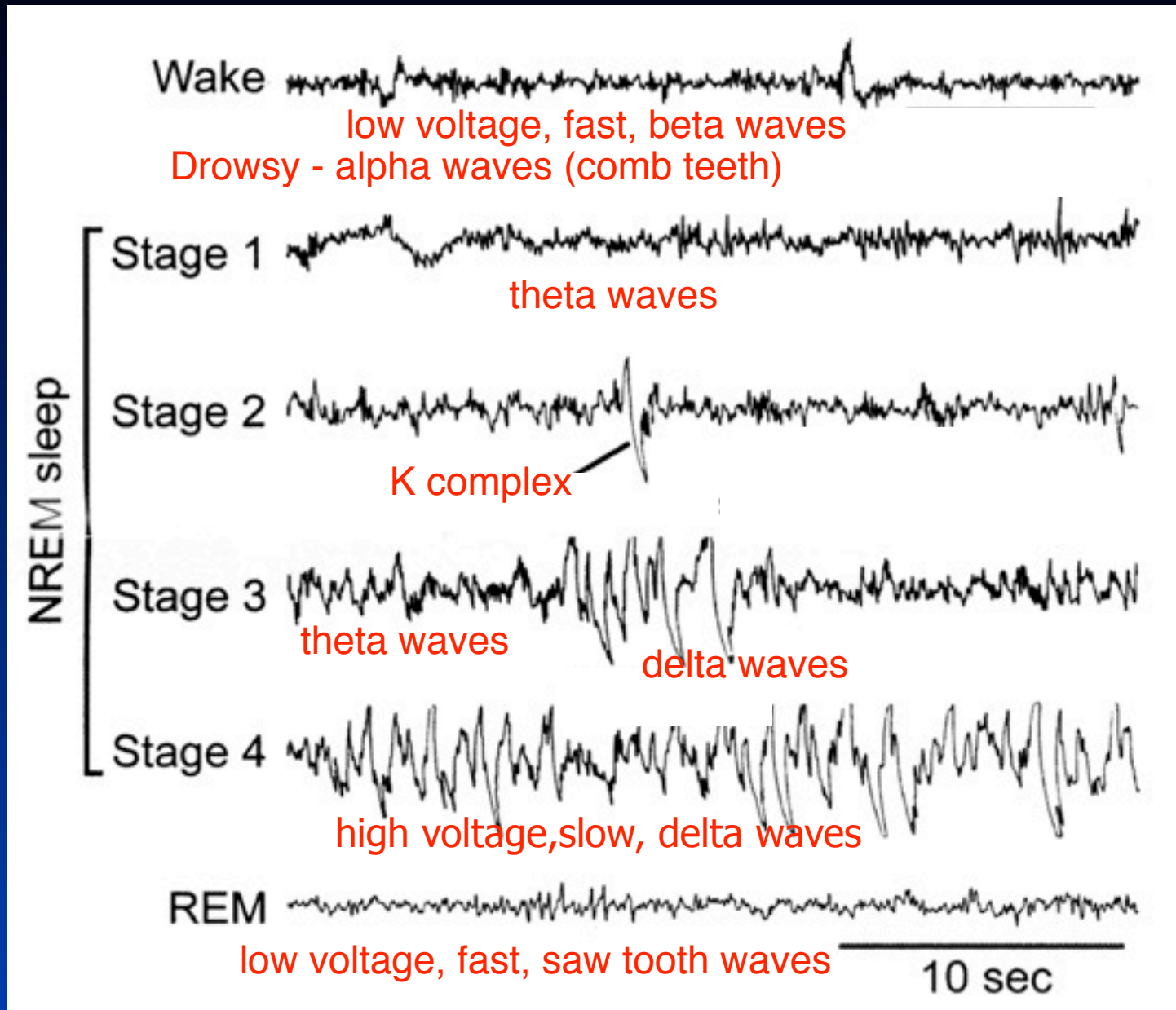
Sleep transfers information to the cerebral cortex and forms new connections of facts & concepts (memory traces).

Need 8 hrs. sleep for maximum transfer and retention.

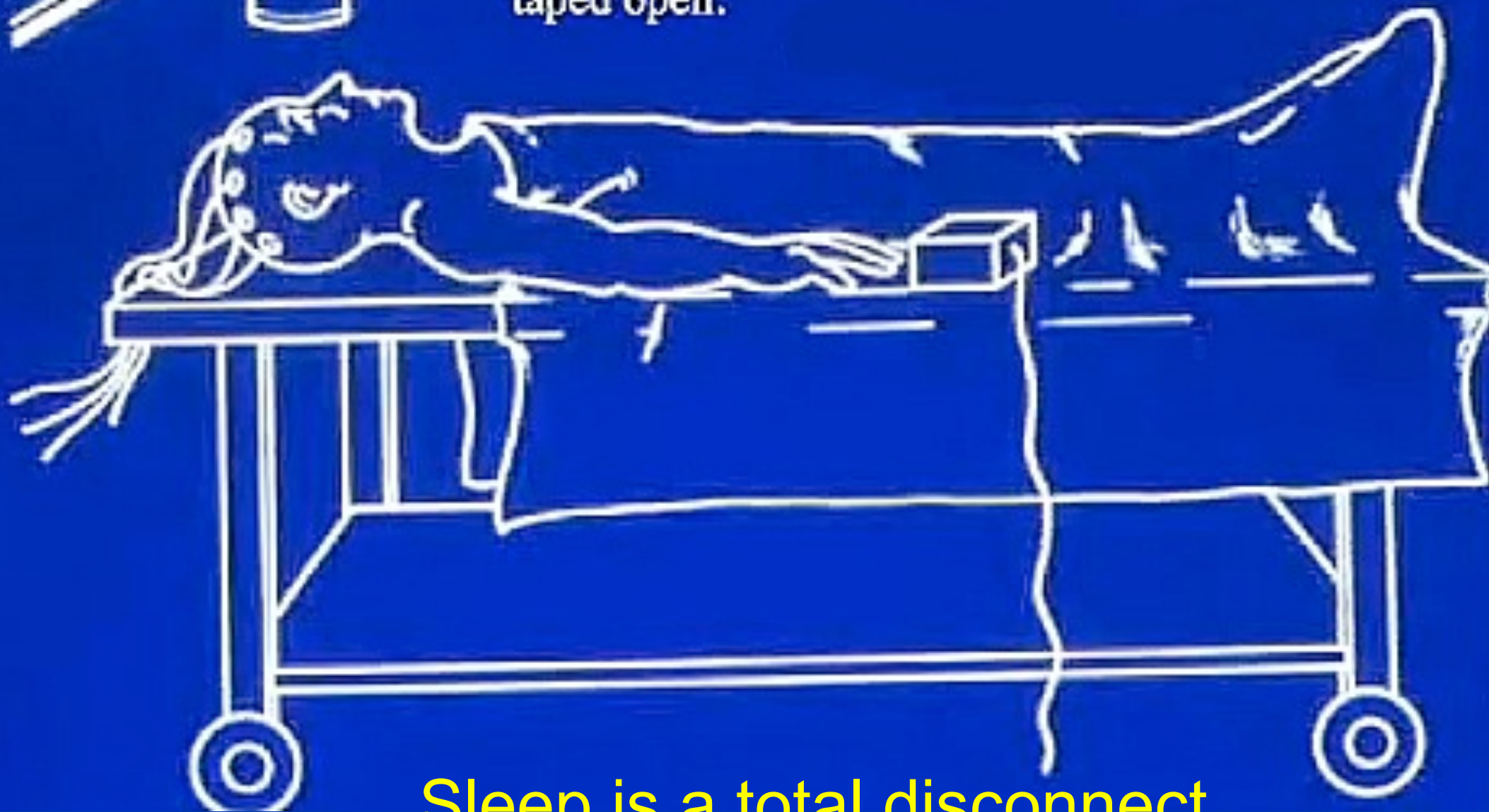
“Lack of sleep inhibits learning & memory”

Sleep deprivation
elevates stress hormone levels
causing the brain to
stop producing new brain cells
in the hippocampus

Brain Waves (EEG) and Sleep Stages

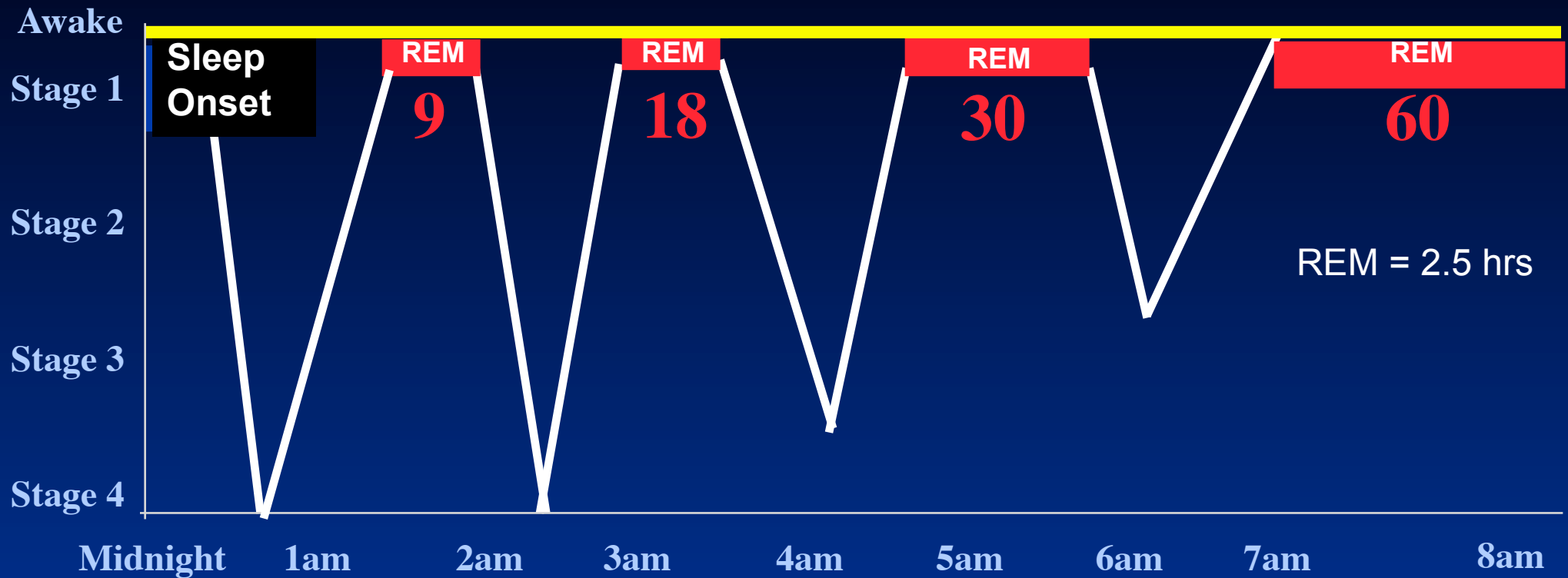


50,000 lux strobe light flash, when subject sees flash, press microswitch. Eyelids taped open.



Sleep is a total disconnect

Architecture of a Good Night's Sleep



The symphony of the night

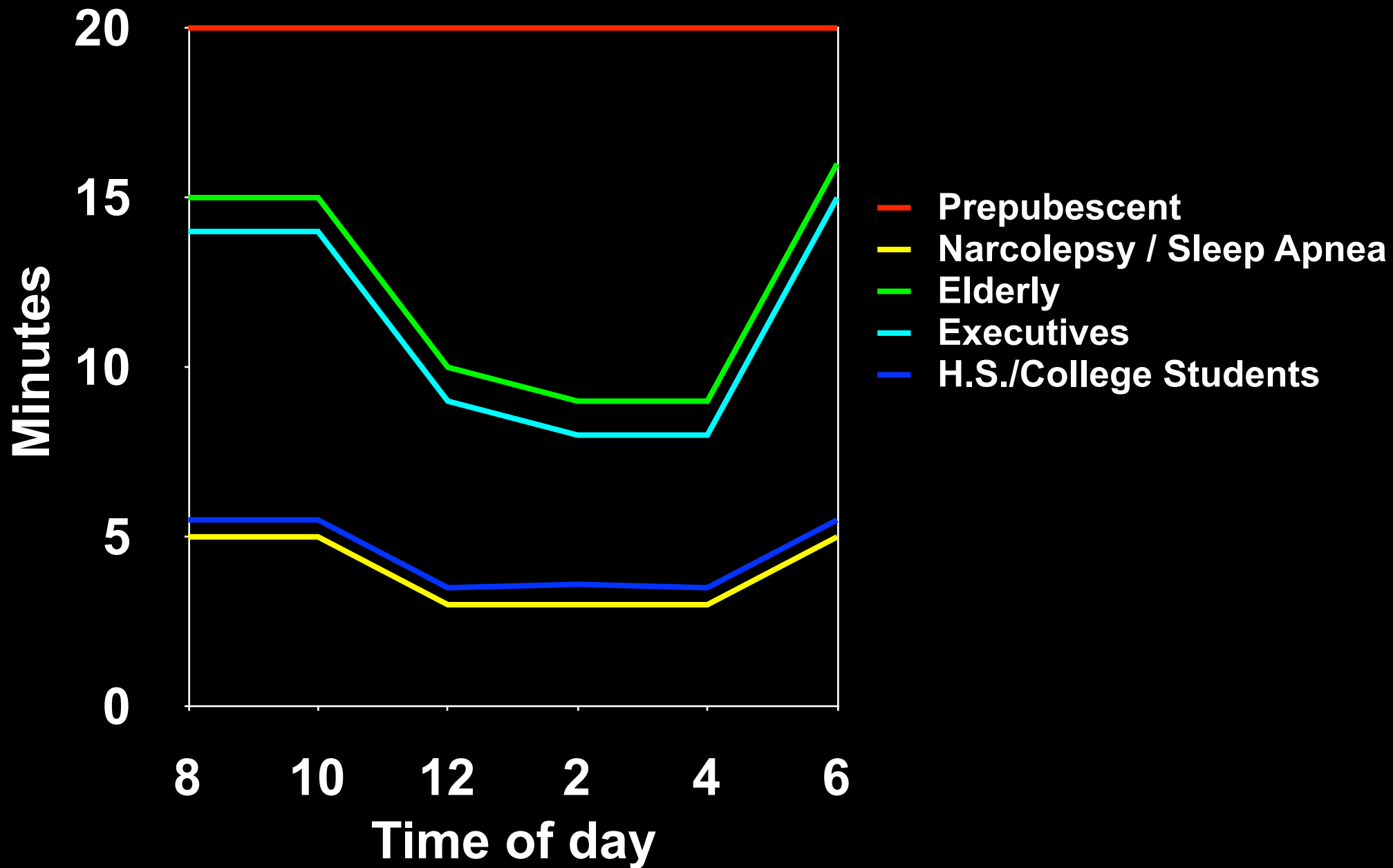
Sleep disorders are common

40 million people affected

by 1 or more of 89 sleep disorders

**MOST OF US
ARE
CHRONICALLY
SLEEP DEPRIVED**

Multiple Sleep Latency Test



Are You Sleep Deprived?

1. Does a heavy meal, low dose of alcohol, warm room, boring meeting or lecture ever make you drowsy?
2. Do you fall asleep instantly at night?
3. Do you need an alarm clock to wake up?
4. Do you repeatedly hit the snooze button?
5. Do you sleep extra hours on weekends?

Consequences of Sleep Deprivation

Do you want a colleague who is drunk at work?

- 2 weeks of 6 hr/nt sleep = .1% BAC
“Presenteeism” -- large economic toll
- Medical residents impairment >3 to 4 drinks
- Automatic driving behavior: “microsleeps”
- Interaction of alcohol & sleep deprivation
- 80,000 fall asleep at the wheel every day

Consequences of Sleep Deprivation

Drowsiness is Red Alert

Driving drowsy is the same as driving drunk

No loud radio, air conditioning, coffee, or food will prevent falling asleep at the wheel

The Drive Cam

Golden Rules for Peak Performance

- 1) Determine and meet your sleep requirement every night. It's hard-wired, not adaptable!

Adolescents need 9.25 hours sleep

20% fall asleep in school

Internal clock bedtime 3am, wake time 11am

I'm tired. Why can't I fall asleep?

40 volunteers (aged 18-22)
tried to sleep at 10 pm

37 (92.5%) had insomnia

Golden Rules for Peak Performance

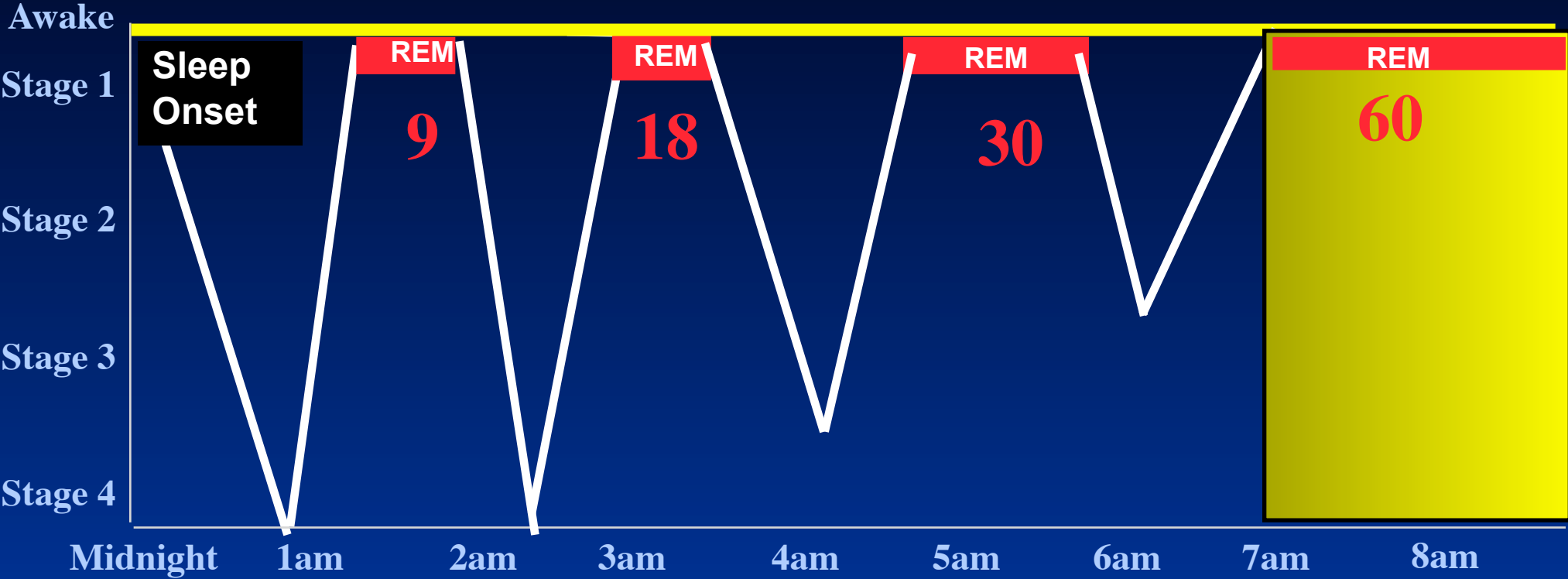
- 1) Determine and meet your sleep requirement every night. It's hard-wired, not adaptable!

Most adults need 7.5 to 8.5 hours sleep

Individual differences, genetically determined

What % can get by on 5 hrs. or less?

Shortened Sleep

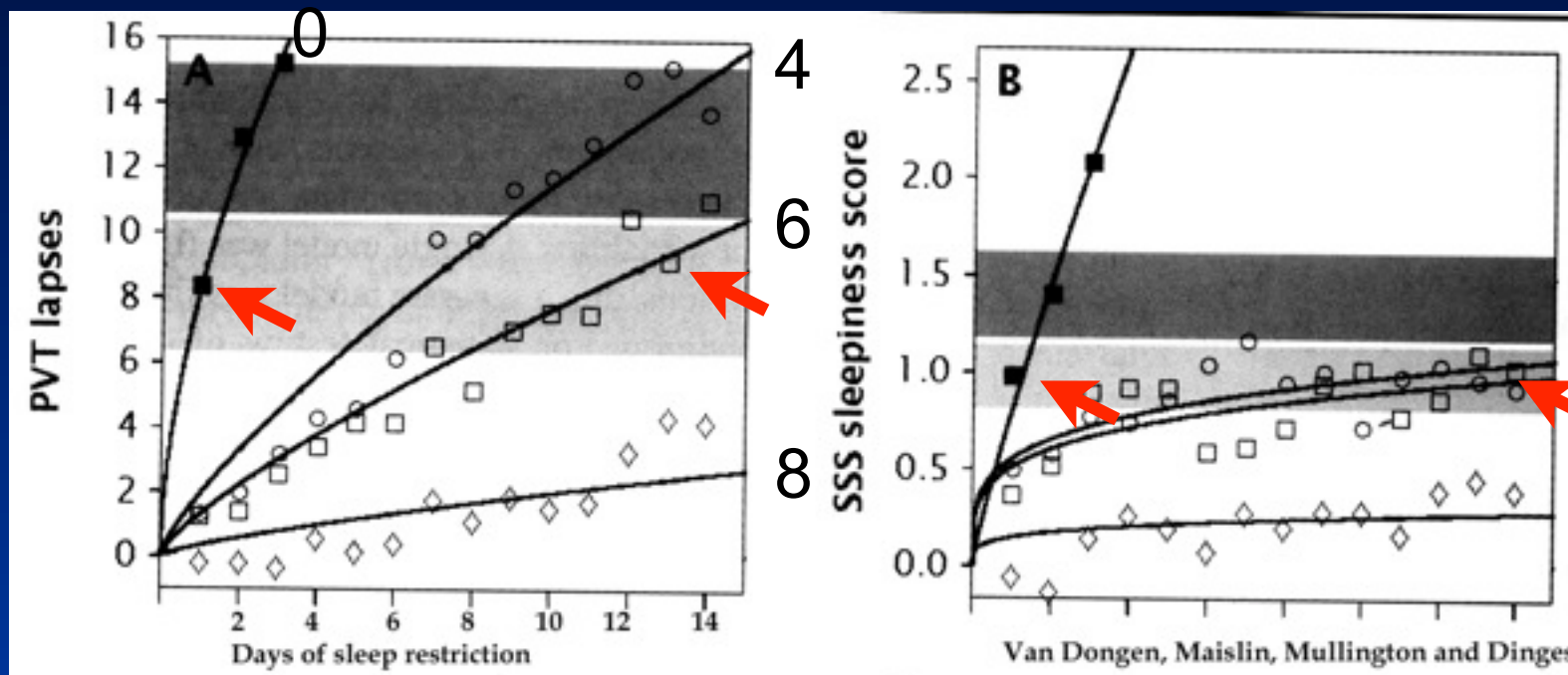


Consequences of Shortened Sleep

- Increased heart disease, diabetes, obesity, cancer
- Drowsiness/microsleeps/unintended sleep seizures
- Increased irritability, anxiety, depression, weight
- Decreased socialization skills & sense of humor
- Decreased motor skills
- Decreased cognitive performance:
 - Reduced ability to process, concentrate & remember
 - Reduced ability to communicate
 - Reduced ability for complex/multi tasking & creativity
 - Poor decision skills and increased risk-taking
- In sum: Reduced health and performance

Chronically limited sleep produces progressive neurological dysfunction in attention and memory.

Two weeks at 6hrs/nt. = One all-nighter.



Perceptual vigilance task

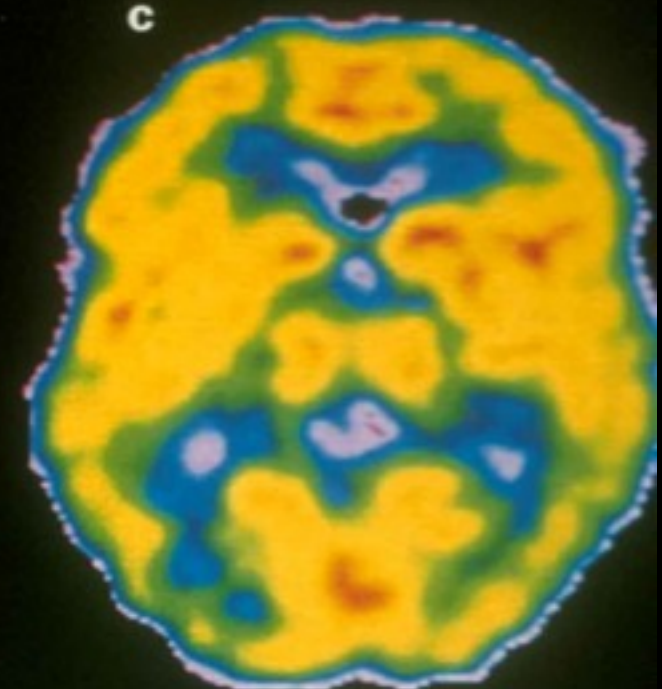
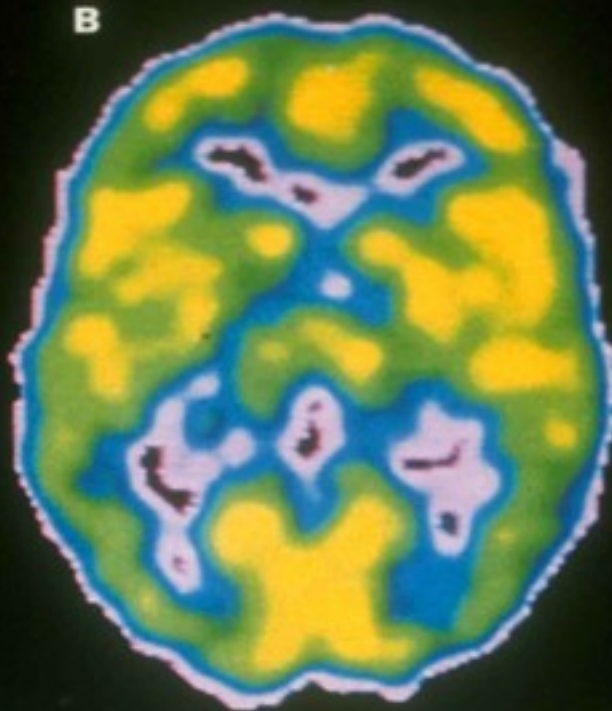
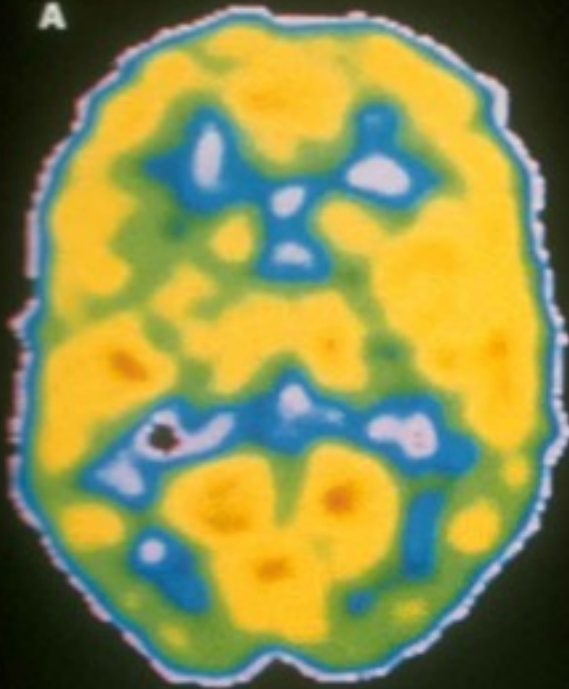
Stanford Sleepiness Scale

PET scans:

Awake

SWS

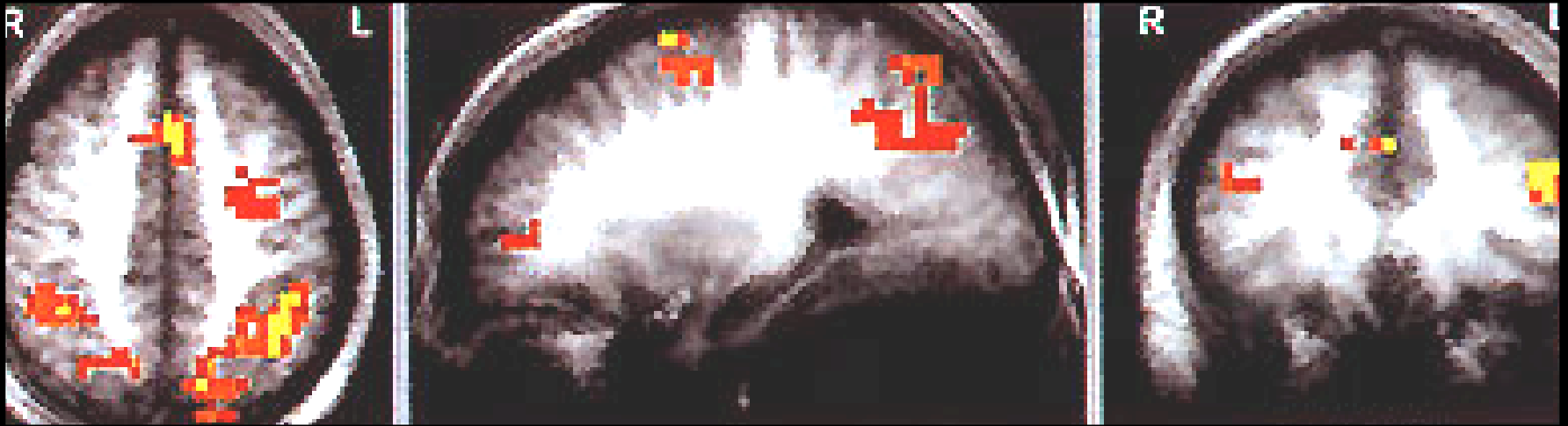
REM



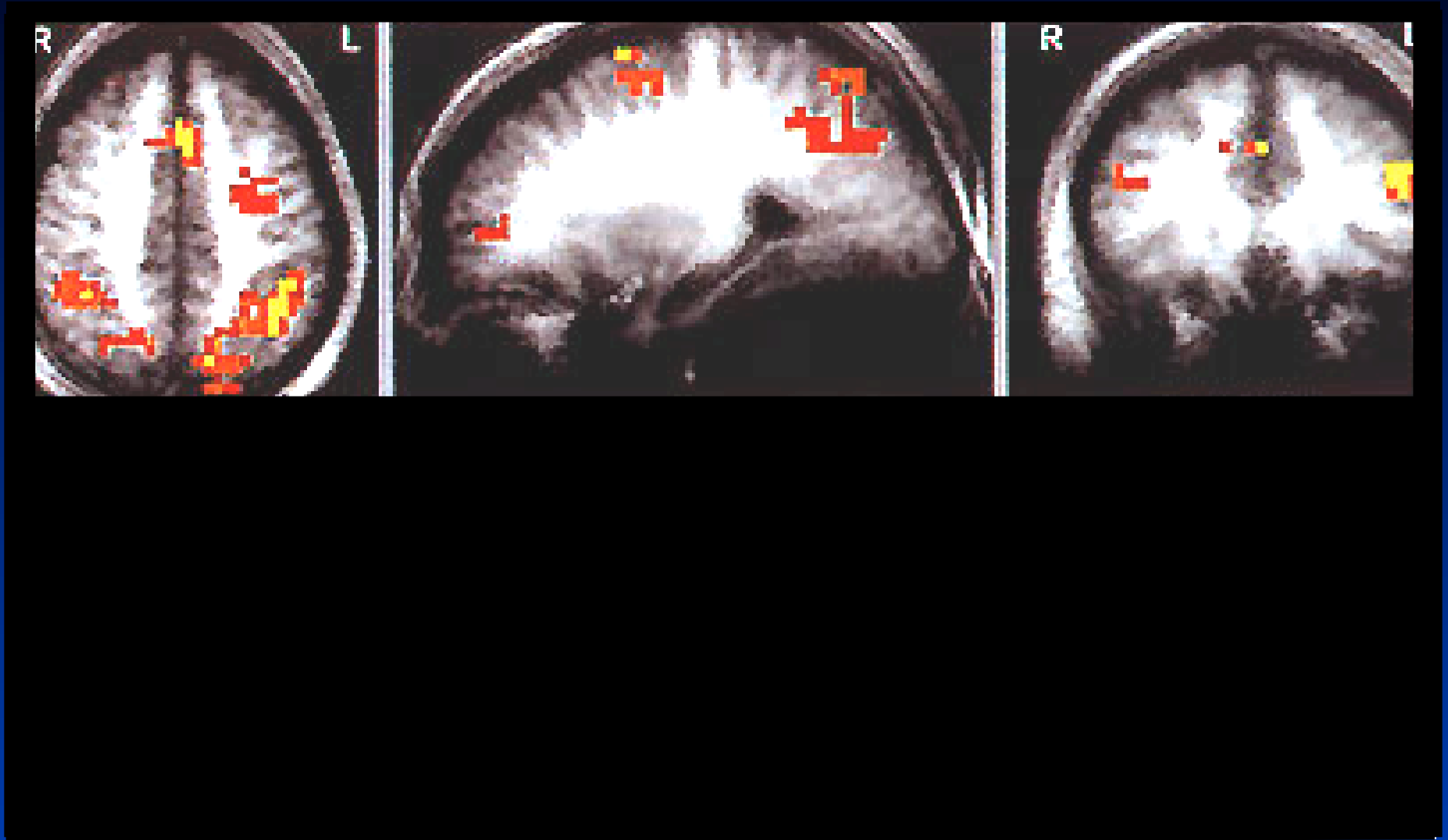
Above are PET scans of the brain (a) awake, (b) during NREM sleep and (c) during REM sleep. Each color corresponds to a different level of metabolism, with red and purple representing the highest and lowest levels of activity, respectively. NREM sleep shows the least amount of red and greatest amount of purple coloring, which corresponds to the low level of metabolic activity during this period. PET scans courtesy of: Buchsbaum MS, Gillin JC, Wu J, et al. Regional cerebral glucose metabolic rate in human sleep assessed by positron emission tomography. *Life Sciences*. 1989;45:1349-1356.

Effect of sleep deprivation on brain activation (math)

8 hrs
sleep



6 hrs
sleep



**Brain may
go off-line
with lack
of sleep**

Tired brains may enter sleep mode while awake

Study of rats shows critical cells switch off

By Elizabeth Weise
USA TODAY

Researchers know that sleep deprivation impairs the ability of people and animals to function. Now a team of researchers in Wisconsin and Italy has found that the brains of rats kept awake past their bedtimes begin to turn themselves off even though the rat is still awake.

Not only that, but certain brain cells — neurons — that get used the most during the day are the ones that appear most likely to go off-line. The researchers say it's likely that sleep-deprived human brains respond the same way.

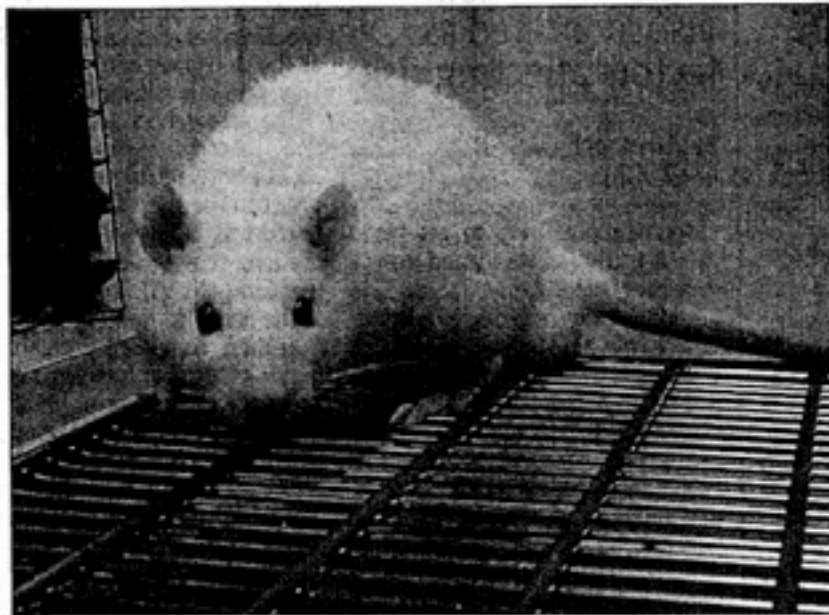
"It's very worrisome," says Chiara Cirelli, a professor of psychiatry at the University of Wisconsin-Madison and one of the researchers whose study is published in this week's edition of the journal *Nature*. Long before signs of sleepiness become overt, such as yawns and trouble keeping focused, it's probably already happening on a localized scale in the brain and this can

"have consequences on performance," Cirelli adds.

"It's the first time anyone has thought about sleep at the single-cell level," says Christopher Colwell, a professor in the Laboratory of Sleep and Circadian Medicine at the University of California-Los Angeles School of Medicine. "This study was really clever in suggesting a whole new way of thinking about sleep."

Sleep is crucial to mental and physical health in all animals, and it's clearly visible in the brain. Neurons are brain cells that process and transmit information via electrical signals. When we sleep, slow-wave activity appears in our brains as the neurons in the cortex, the portion of the brain involved in consciousness and attention, switch themselves off and go electrically silent. Wakefulness is when our neurons are on and generating spikes of electrical activity.

The researchers, at the University of Wisconsin-Madison and the Perceptual Robotics Laboratory in Pisa, Italy, kept rats up four hours past the time they'd normally be asleep and measured their brain waves using an EEG, or electroencephalogram. They found that although the rats were awake, individual neurons in their brains turned themselves off in a random pattern. The shutdown



Let sleepy rats lie down: The new U.S.-Italian study tracked the ability of sleep-deprived rats to find sugar pellets. Their neurons shut off in a random pattern.

of those neurons, the researchers believe, is why the rats did progressively less well on a task: finding a sugar pellet.

There's no reason to think this doesn't also happen in the human brain, Cirelli says. Her group is beginning to do similar studies in people

getting ready for brain surgery and having their neural pathways mapped.

She thinks it's also likely that in humans, as in rats, the most-used neurons are the ones turning off. "We have done several studies showing that the neurons that you use the most during the waking day are the ones that need to go

to sleep the most when you're tired. At a certain point, and we don't know exactly why, they start saying 'I've had enough. I'm going off-line.'"

Although much research has been done on how the brain functions when asleep and awake, looking at how a sleep-deprived brain functions at this level is new, says Colwell, who wrote a viewpoint piece about the paper that is also in *Nature* this week.

"What they're suggesting is that in the morning, maybe 90% of your cells are in the wake state and you perform very well," Colwell says. "But as you stay awake longer, your cells start to drift off into sleep and your performance starts to go down, which could provide an explanation as to why we function less well the longer we've been awake."

The research could mean that the 35% of Americans who told the Centers for Disease Control and Prevention that they routinely sleep less than seven hours a night are also losing portions of their brain functions even though they're still awake.

"The message is you need to take sleep very seriously," Cirelli says. "When you're starting to nod off, it's too late. Even before that, there may be impairment. Respect your need for sleep."

A Wake Up Call...



- ▶ Earlier check in times in PM
- ▶ Later start times in AM

Immediate Results

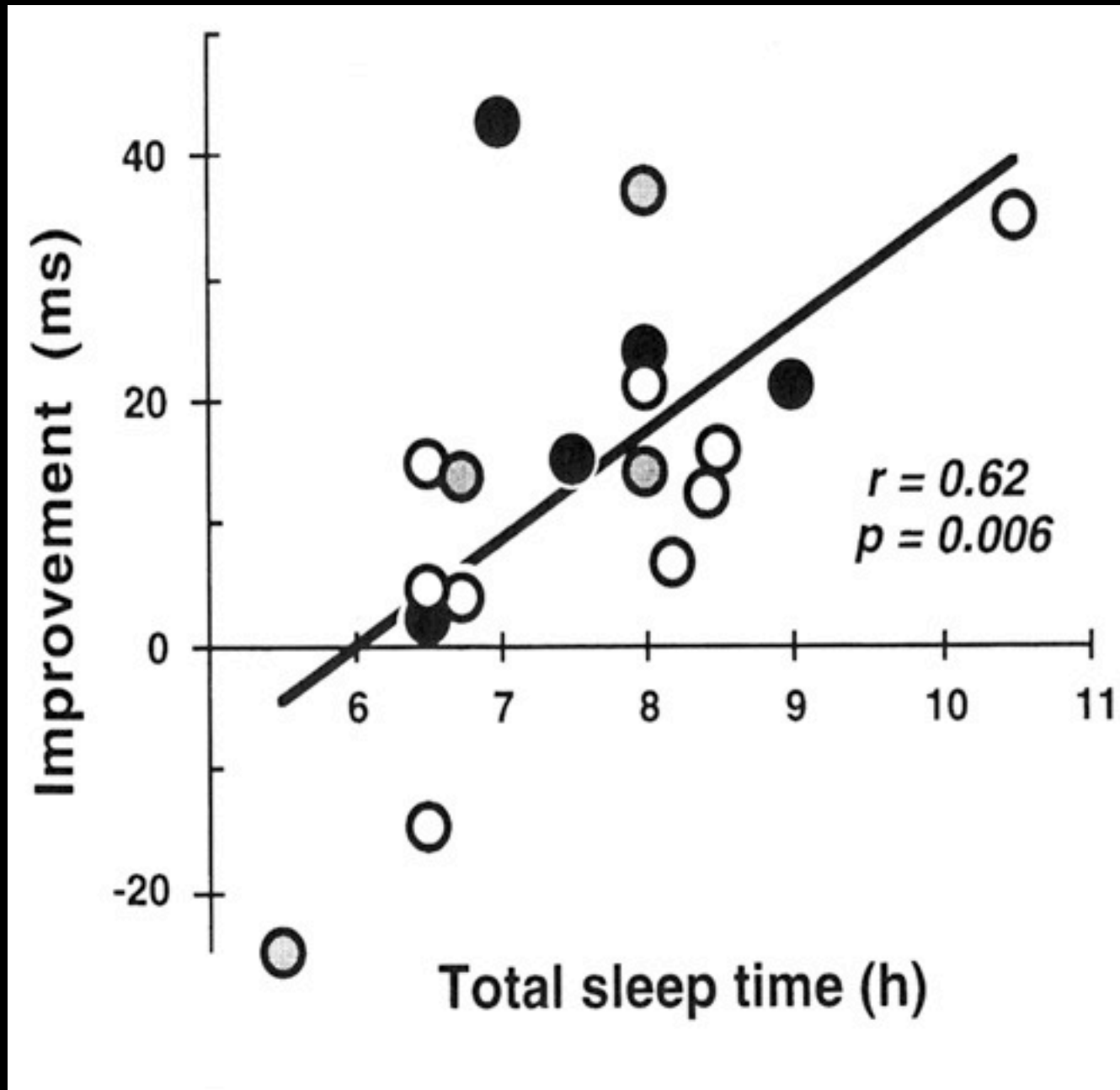
- ▶ GPA increase
- ▶ 20% fewer visits to infirmary
- ▶ Improved athletic records
- ▶ General mood, happiness, morning alertness
- ▶ 17% more hot breakfasts consumed
- ▶ Replications in schools from New England to Hawaii & Hong Kong





Friday, May 13, 2011





Students who sleep 9 hours per night
have significantly better grades
than those who sleep 6 or less.

Athletic Performance

Stanford & Cornell varsity athletes:

Basketball, football, swimming, wrestling,
track & field, golf, baseball, tennis, hockey

Major goal: reduce sleep debt to zero

Measured: reaction time, energy, fatigue,
and athletic performance.

Results: Athletic Improvement

Improved conditioning and weight training

Increased focus and concentration

Faster recovery from exhaustion

Decrease in injuries

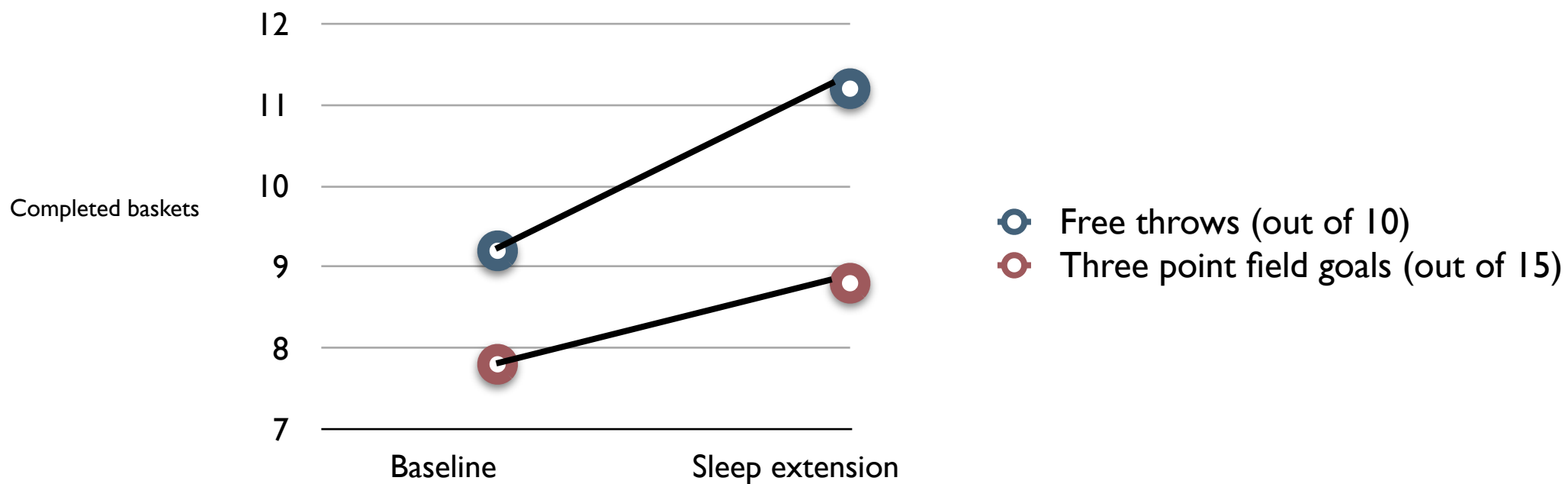
Faster reaction time

Decrease in fatigue and increase in energy

Basketball: Group Free Throws and Three Pointers

Free Throws: 79.1% → 88.5%

Three Pointers: 61.3% → 73.3%



Celtics, Knicks seize the day, drop morning shoot-arounds

By Chris Colston and Jeff Zillgitt
USA TODAY

To improve energy and overall health, the Atlantic Division's Boston Celtics and New York Knicks are planning to eliminate most morning shoot-arounds for home games.

Boston coach **Doc Rivers** has deemed the early-morning hours until 11 "Celtics time" and off limits at their training center in Waltham, Mass.

Rivers, who examined his eating and work habits after general manager **Danny Ainge's** heart attack in April, brought in Harvard Medical School professor Charles Czeisler to deal with sleep deprivation. That led to the blackout period.

"You get to the practice facility by

NBA Insider

9 a.m., so you're tired and probably grouchy," Rivers said. "That's what we're changing. We've moved practices to 1 p.m."

Knicks coach **Mike D'Antoni's** decision keeps players from commuting to the team's Westchester, N.Y., training facility by 10 a.m. and then to midtown Manhattan for the game. Players will report by 3:30 instead of 6 p.m.

"I like it because I live in New Jersey. ... It saves me two hours a day," forward **Al Harrington** said.



By Mike Groll, AP

Knicks of later time: Guard Nate Robinson and coach Mike D'Antoni.

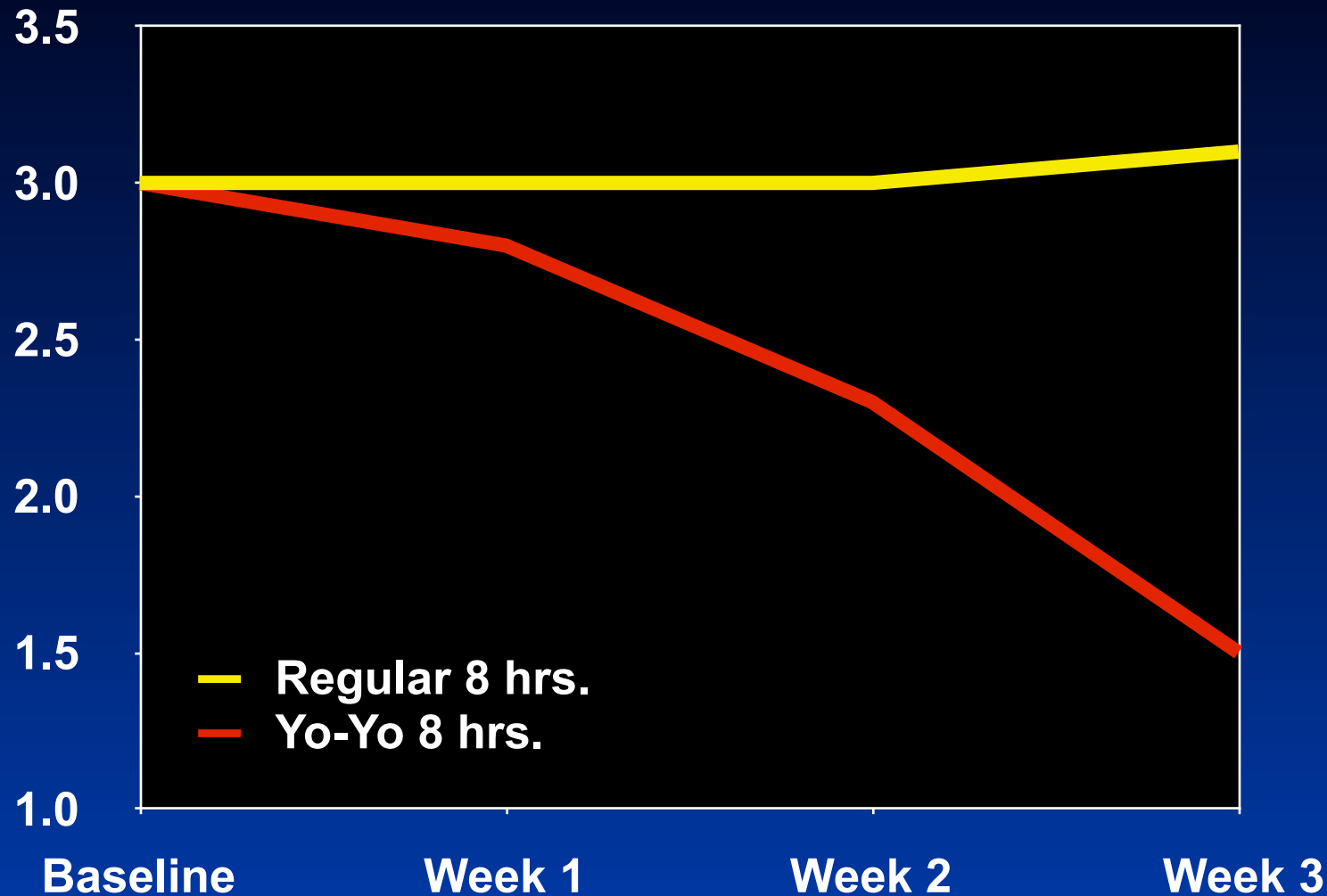
Sunday's preseason win against the Toronto Raptors: "I was like, 'This is a dress rehearsal, but you've got to get it right.' We want to get it right, and we want to

Golden Rules for Peak Performance

2) Establish a regular sleep/wake schedule

Go to bed and get up
at the same time
every night and morning

Sleep-Wake Schedules & Daytime Alertness



Manber, Bootzin, Acebo, Carskadon

Golden Rules for Peak Performance

3) Get continuous sleep

Normal to awaken several times

Disruptive to remain awake for longer than 20 minutes...

Disrupted Sleep

Caused by:

- Caffeine (after 2 p.m.)

Hint: to stay awake drink 2 oz./hr.

Decaffeinated = 3 milligrams caffeine per 8 oz.

Dunkin' Donuts: 26.9 mg (9 times the average)

Starbucks House Blend: 7.4 mg (2X the average)

McDonalds: 3.4 mg

7-Eleven: 2.6 mg (within the average)

Fragmented Sleep

Caused by:

- Caffeine (after 2 p.m.)
- Nicotine
- Liquor (within 3 hrs. of bedtime)

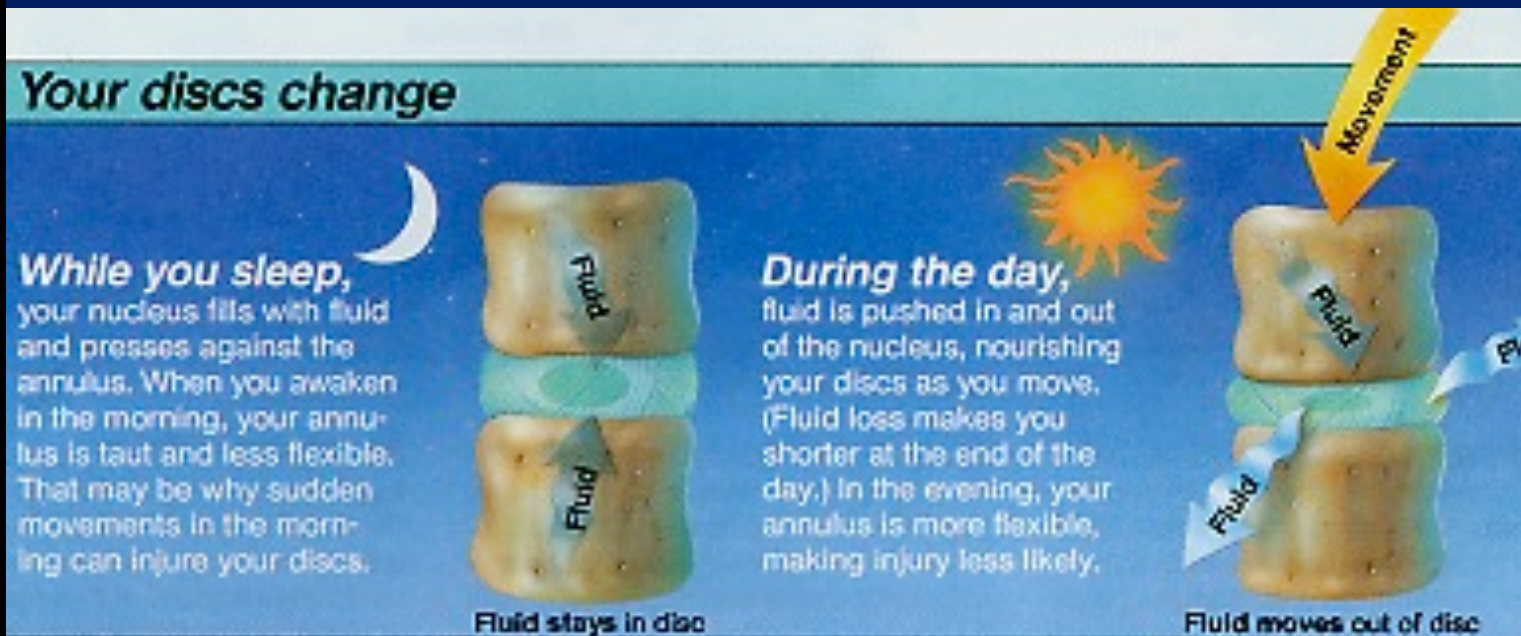
Fitness Improves Sleep

- **Exercise:**

Endorphins

(mood elevators reduce stress)

Best time to exercise ? **5-7pm or noon**



The Sleep Debt Bank Account

It takes 1 hour of sleep
to replace
every 2 hours of
having been awake

If sleep deprived: Go to bed earlier or ...

Restorative Nap

The biphasic sleep pattern
No modern day siesta

The “Power Nap”

Duration of naps
Good for positive emotions
Good for stress reduction

Proven Strategies for POWER SLEEP

1. Setting the bedroom stage:
Quiet, dark, cool, uncluttered

Quality Pillow for Better Sleep



The pillow test

Head, neck and spinal cord in alignment



Back

Stomach

Side

Strategies for POWER SLEEP

1. Setting the bedroom stage: dark, quiet, cool
2. A relaxing atmosphere; clocks; limit TV, computers, video games... 95% use within 1 hr of bedtime!

Reading on iPad before bed can affect sleep habits

April 24, 2010 | 7:00 am



Strategies for POWER SLEEP

1. Setting the bedroom stage: dark, quiet, cool
2. A relaxing atmosphere; limit TV; computers; clocks
3. A hot bath, easy stretching, “Worry Time”
4. Reading as a bedtime ritual
5. Relaxation; mental imagery; meditation; music (35%)
6. If you toss & turn...
7. Melatonin; Sleeping pills; Cognitive Behavior Therapy

Introducing...

LITEBOOK *Elite*™



Drug-free Performance Enhancement

Use Litebook for 15-20 minutes,
60cm. away at 45 degrees; don't stare at it

- * To jump start your morning

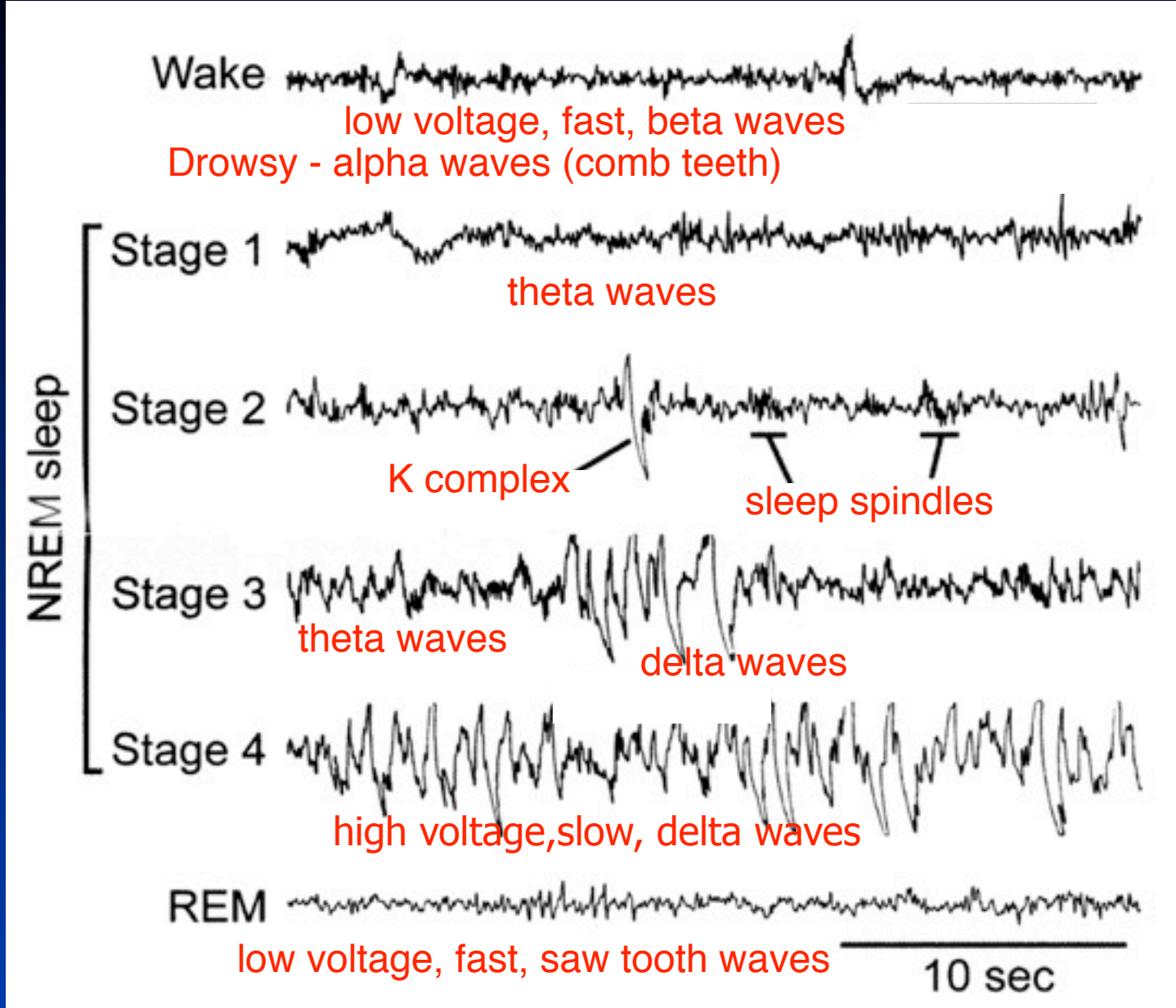
- * After long naps,

 - or to extend your evening

- * For jet lag

 - ... like 1-2 shots of caffeine
without the side effects!

Brain Waves (EEG) and Sleep Stages



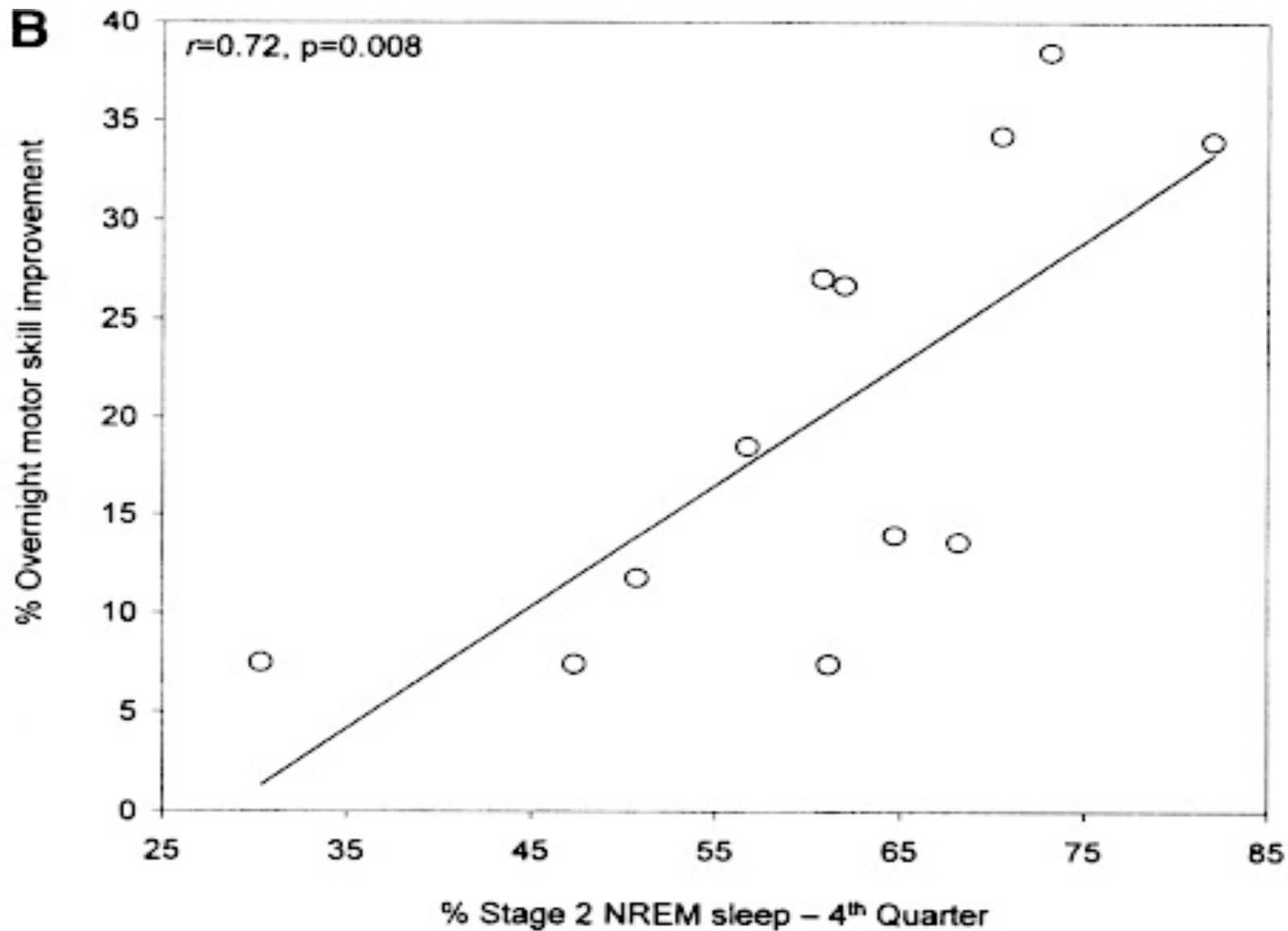


Figure 3. Relationship between Overnight Improvement and Stage 2 NREM Sleep Measures

Case History *“The Frustrated Athlete”*

- What’s your daily routine?
- How much sleep do you get?
- Do you have a regular sleep/wake schedule?
- How do you stay awake in school?
- Read “Power Sleep”
- No early morning exercise
- Get 9.25 hrs. sleep nightly
- Establish a regular sleep/wake schedule
- Cut out caffeine



Cornell University

***Good Night
and
Sweet Rems!***