Timothy Roach FRCP

NO FINANCIAL CONFLICTS OF INTEREST TO DECLARE

SLEEP

- Physiology of Sleep
  - Quantity and Quality
  - Circadian rhythms
  - Why we sleep
- Physical Health
  - Sleep Disorders
  - Sleep and Disease
- Mental and Emotional Well Being
  - Mental Health
- Performance and Safety
  - Sleep Deprivation and Fatigue
  - Accidents
  - Drowsy Driving
- Public Health Approach
  - Advocacy
- Conclusion






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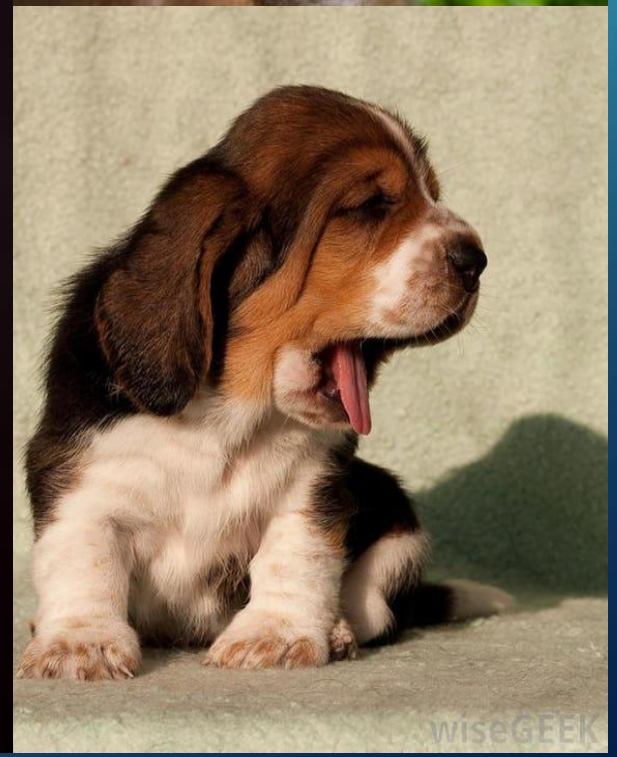
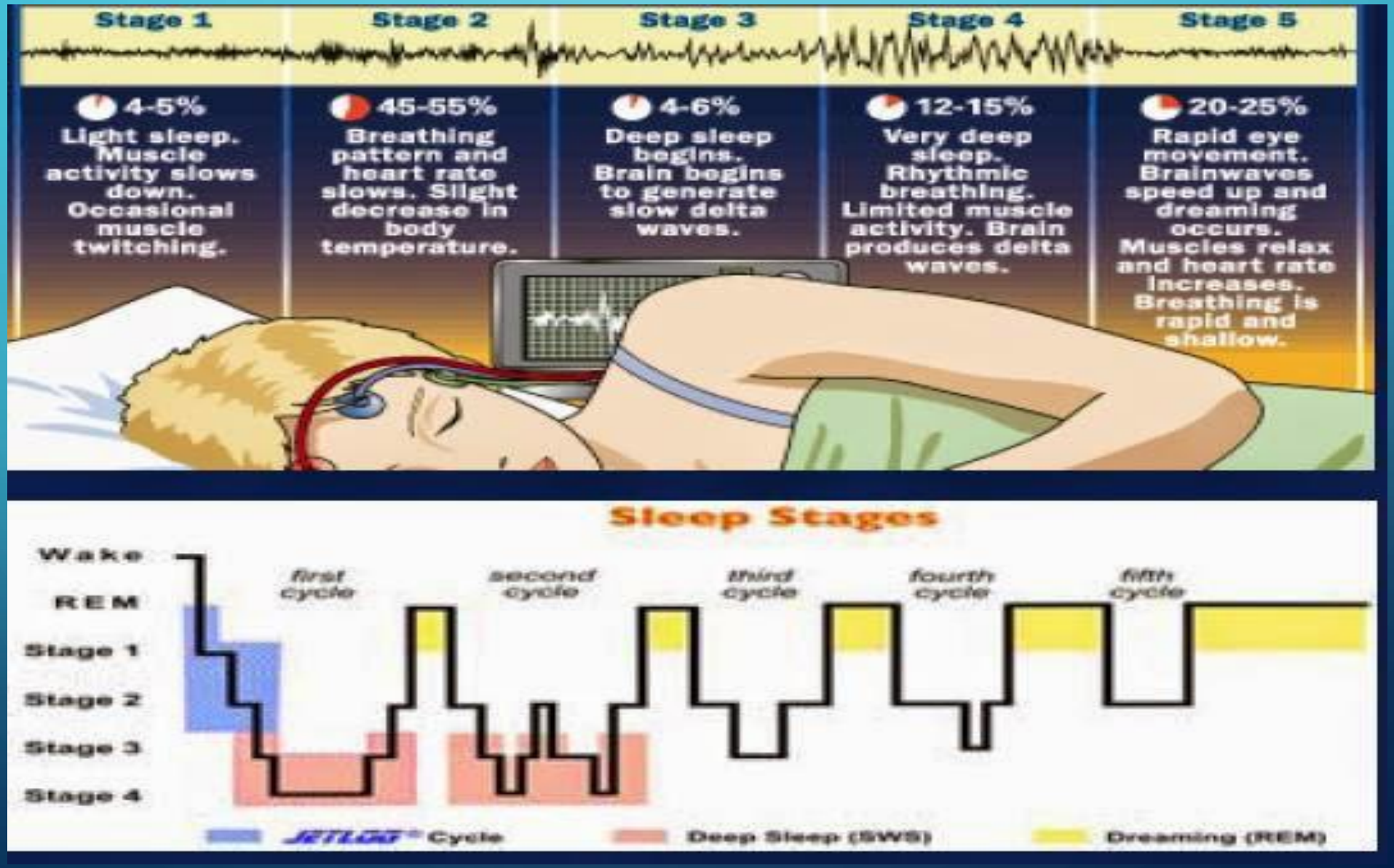
photography

wiseGEEK

THE SLEEP CYCLE

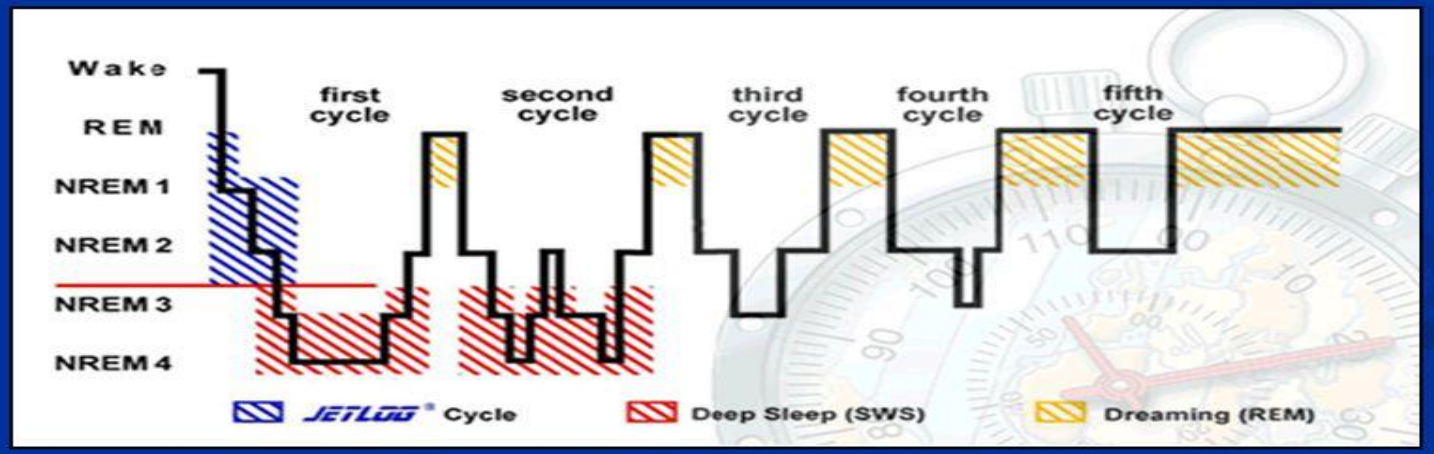


SLEEP HYPNOGRAM

Stages of Sleep, Hypnogram

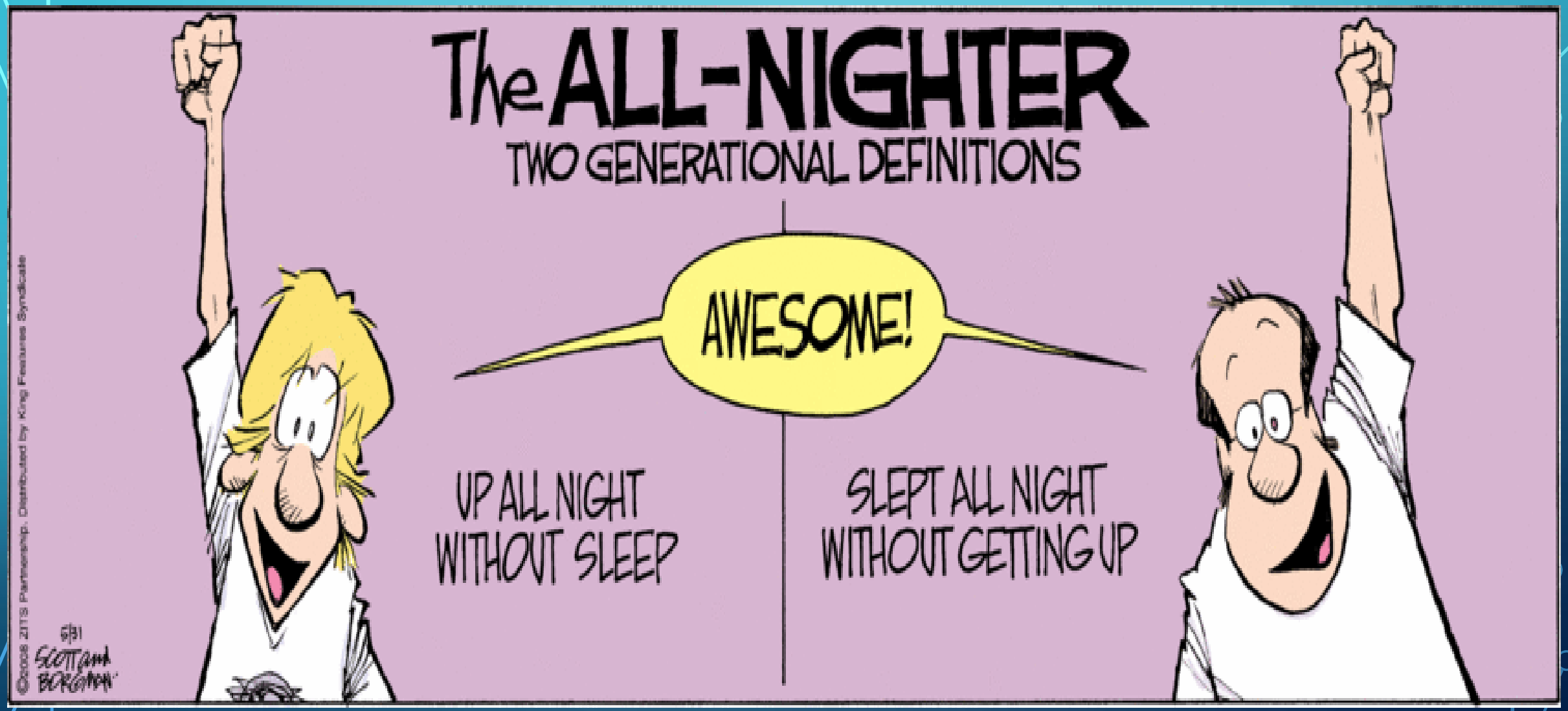
1. Wake (wakefulness, waking stage)
2. REM (Rapid Eye Movements) // dreams
3. NREM 1 (shallow/drowsy sleep)
4. NREM 2 (light sleep)
5. NREM 3 (deepening sleep)
6. NREM 4 (deepest sleep)

Hypnogram:



HOW MUCH SLEEP DO YOU REALLY NEED?

AGE	Newborn to 2 months old	3 months to 1 year old	1 to 3 years old	3 to 5 years old	5 to 12 years old	12 to 18 years old	Adult (18+)
							
SLEEP NEED	12hrs to 18hrs	14hrs to 15hrs	12hrs to 14hrs	11hrs to 13hrs	10hrs to 11hrs	8.5hrs to 9.25hrs	7hrs to 9hrs
							


The ALL-NIGHTER
TWO GENERATIONAL DEFINITIONS
AWESOME!
UP ALL NIGHT WITHOUT SLEEP
SLEPT ALL NIGHT WITHOUT GETTING UP
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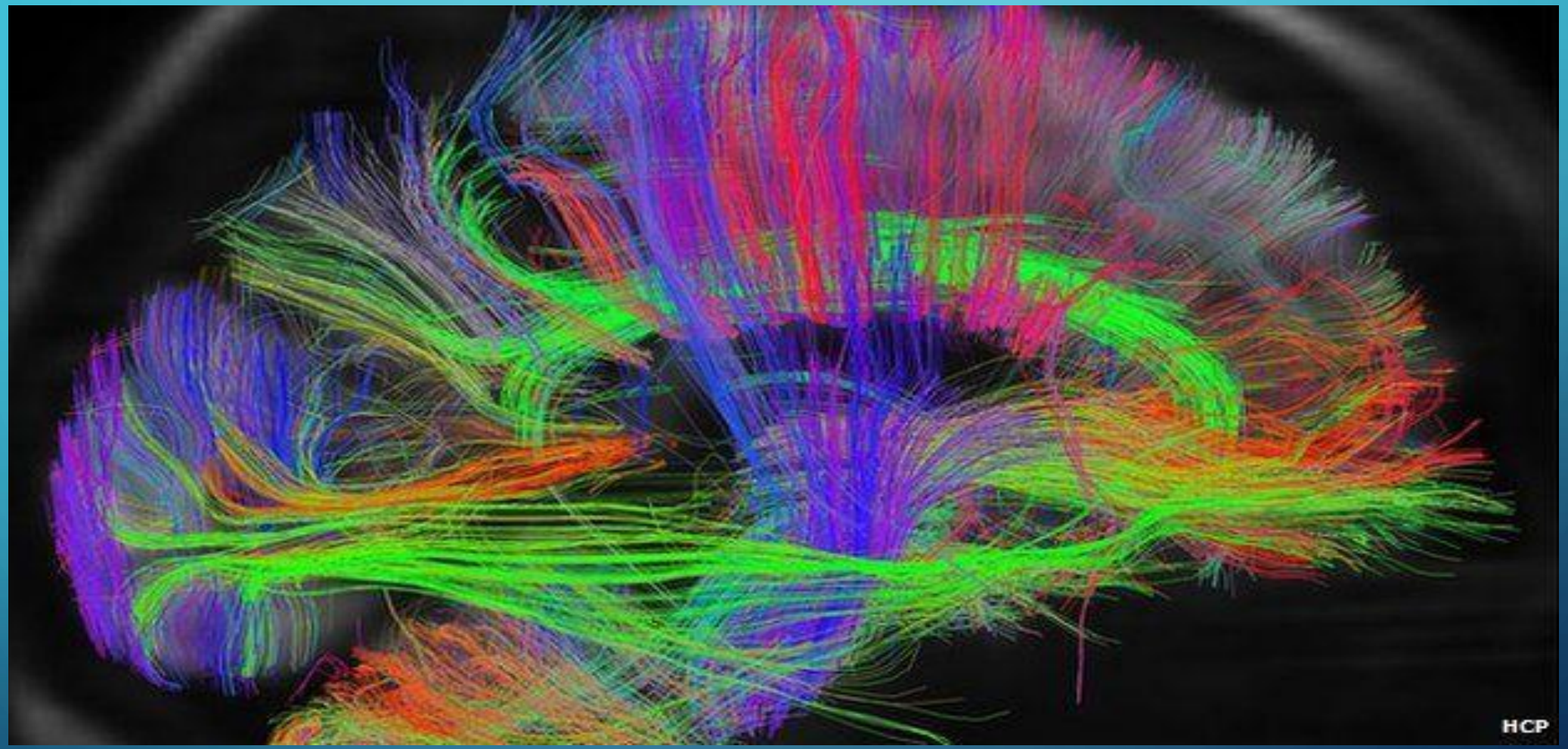
SCOTT and BORGMAN

WHY DO WE SLEEP?



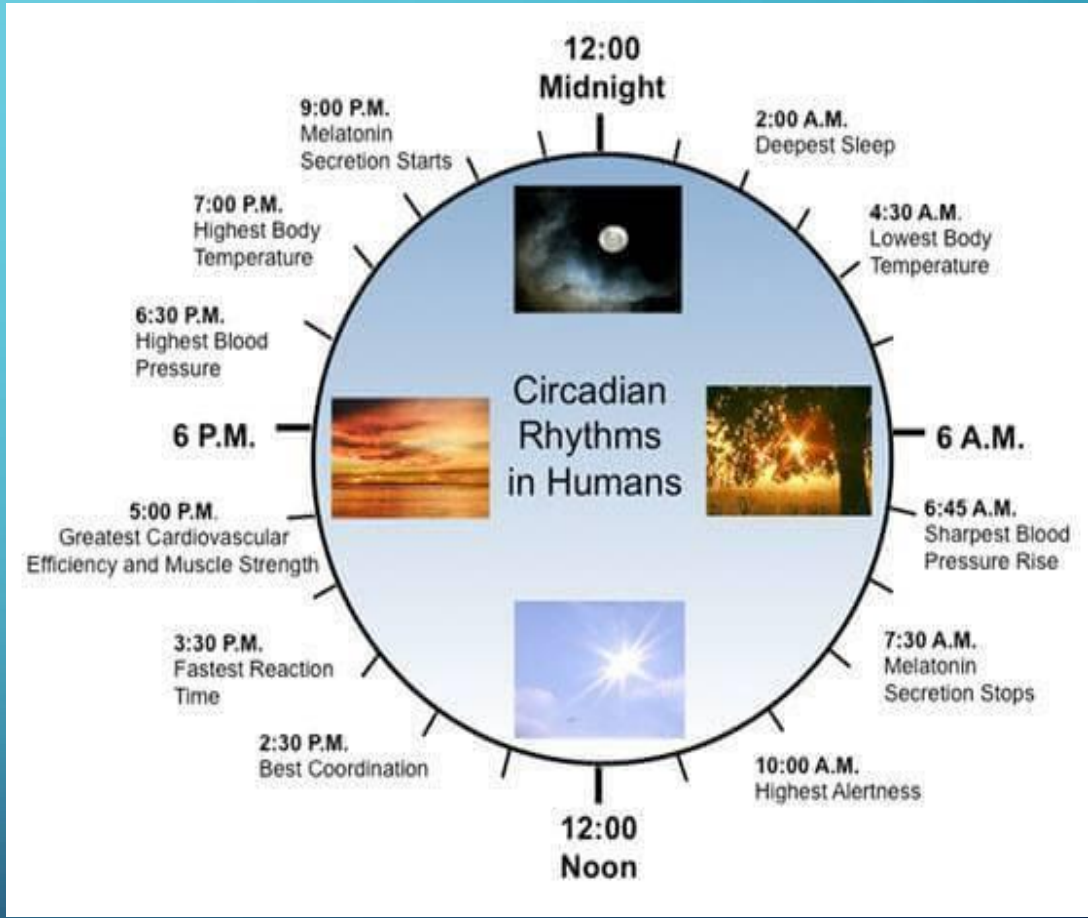
Sleep enables the brain's intricate wiring system to form and to clear out waste products
Sleep allows consolidation and organization of memory

PURPOSE OF SLEEP

- Restorative functions
- Energy conservation
- Memory & Learning consolidation
- Immune Function regulation
- Mood regulation/Depression

CIRCADIAN RHYTHM

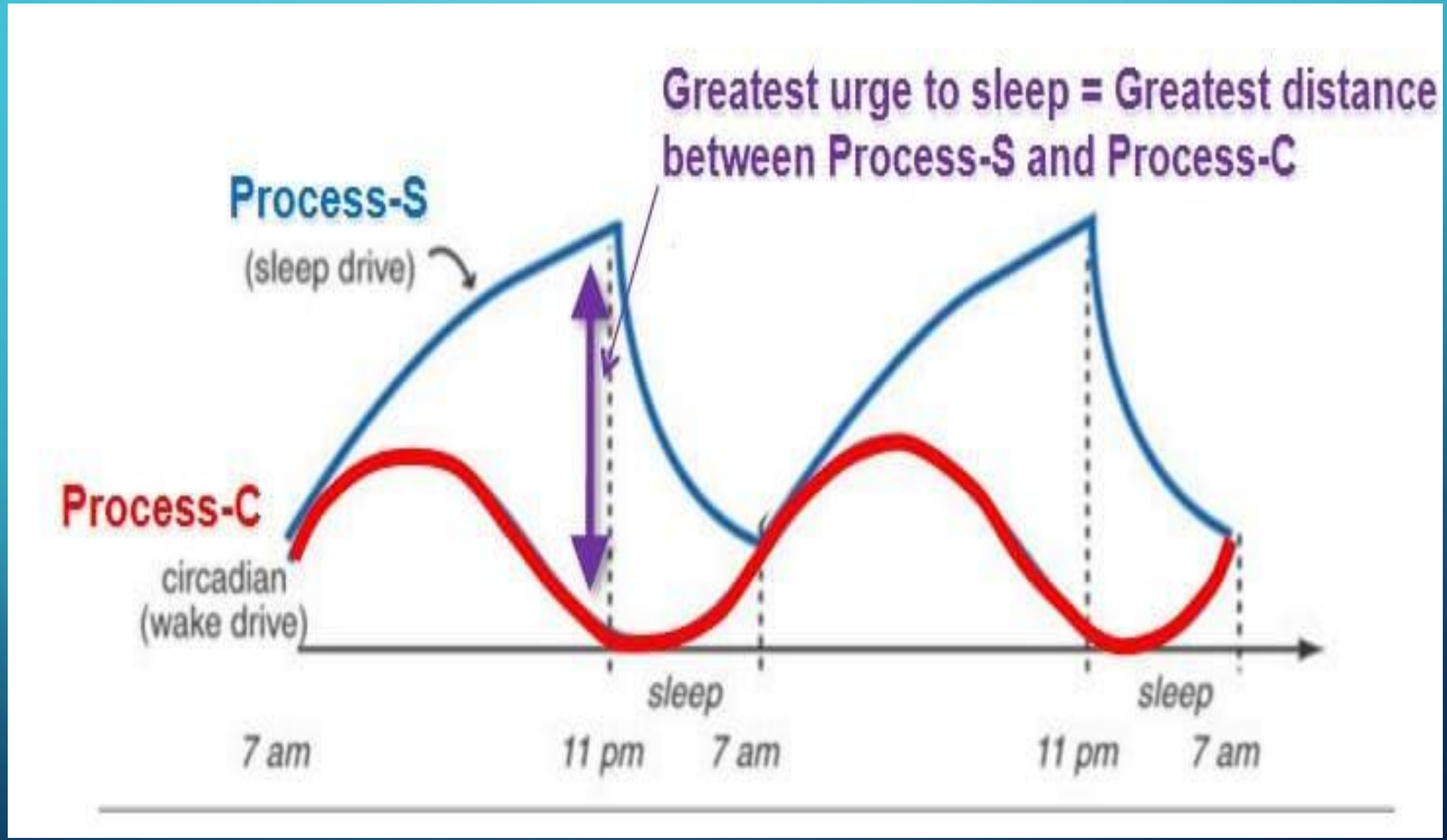
- A **circadian rhythm** is a biological process that displays an endogenous, entrainable oscillation of about 24 hours. These 24-hour rhythms are driven by a Circadian Clock, and they have been widely observed in plants, animals, fungi and cyanobacteria



SLEEP-WAKE CYCLE

- **Sleep-wake Homeostasis**, or Process S, is the accumulation of sleep-inducing substances in the brain. It's an internal biochemical system that operates like a timer, generating homeostatic sleep drive or the need to sleep after a certain amount of time awake. It effectively reminds the body that it needs to sleep - so the longer you've been awake, the stronger your desire for sleep becomes.

- **The circadian process**, also known as Process C, is the regulation of the body's internal biological processes and alertness levels. This is what controls the timing of sleep and it coordinates the light-dark cycle of day and night. Your circadian rhythm is what regulates your body's sleep patterns, feeding patterns, core body temperature, brain wave activity, and hormone production over a 24-hour period


Greatest urge to sleep = Greatest distance between Process-S and Process-C
Process-S
(sleep drive)
Process-C
circadian
(wake drive)
sleep
sleep
7 am
11 pm
7 am
11 pm
7 am

QUALITY SLEEP

SLEEP DEPRIVATION

- Accidents
- Impairs thinking and memory.
- Illness.
- Impaired libido
- Depression
- Increases aging
- Memory loss
- Increases weight
- Increases risk of death
- Impairs judgement

CAUSES OF SLEEP DEPRIVATION

- Voluntary Behavior
  - Behavior induced insufficient sleep syndrome (aka partying)
  - Stimulants – caffeine, drugs.
- Work or Study Commitments
  - Shift work
  - Jet lag
  - Adolescents
- Environment or Sleeping Habits
  - New parents
  - Snoring partner
  - Blue light – screen time
- Insomnia
  - Anxiety
  - Neurotransmitter imbalances (Parkinsons)
  - Psychiatric issues
- Sleep Apnoea
- Short Term Illness
  - Influenza, head colds.

ILL HEALTH AND IMPAIRED SLEEP.

High Blood Pressure	Diabetes mellitus	Stroke
Heart Failure	Obesity	Asthma & COPD
Heart Attacks	Kidney Disease	Fibromyalgia
Pulmonary Hypertension	Cancer	Pregnancy disorders
Angina (IHD)	Arthritis	Decreased libido
Palpitations (AF)	Cognitive impairment	Decreased Immunity
Alzheimer's Disease	Depression	Decreased fertility
Pulmonary embolism	Suicide	Restless leg syndrome
Increased risk of Death	Anxiety	Glaucoma
Post-surgical complications	Memory Loss	Intracranial Hypertension

SLEEP AND DISEASE

- Cardiac disease, Hypertension
- Obesity
- Dementia & neurological disorders
- Diabetes
- Cancer
- Glaucoma, Fibromyalgia,

SLEEP AND CARDIOVASCULAR DISEASE

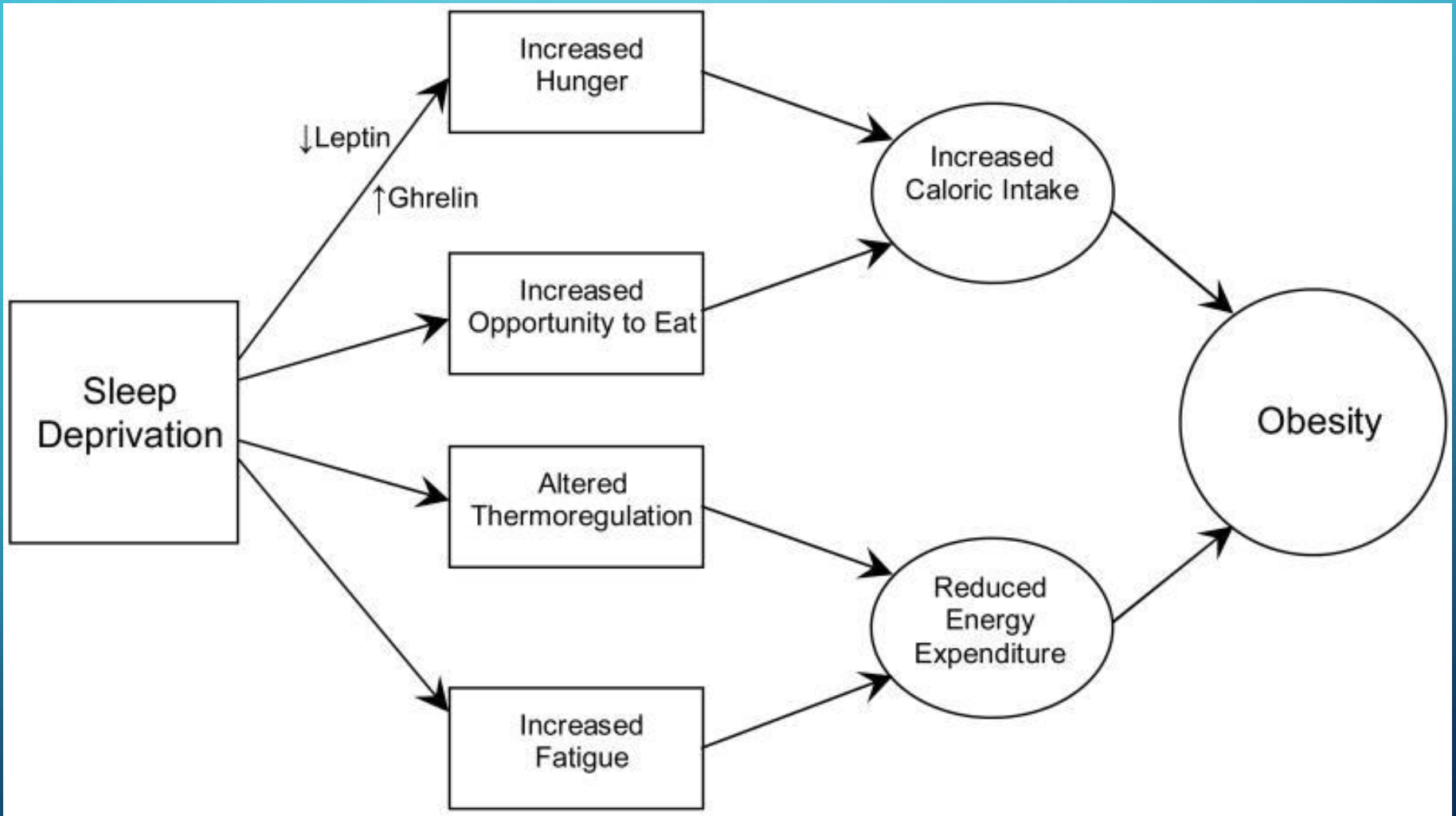
If you sleep less than six hours per night or have disturbed sleep you stand a 48% greater chance of developing or dying from heart disease and a 15% greater chance of developing or dying from a stroke.

Sleep duration predicts cardiovascular outcomes: a systematic review and meta-analysis of prospective studies

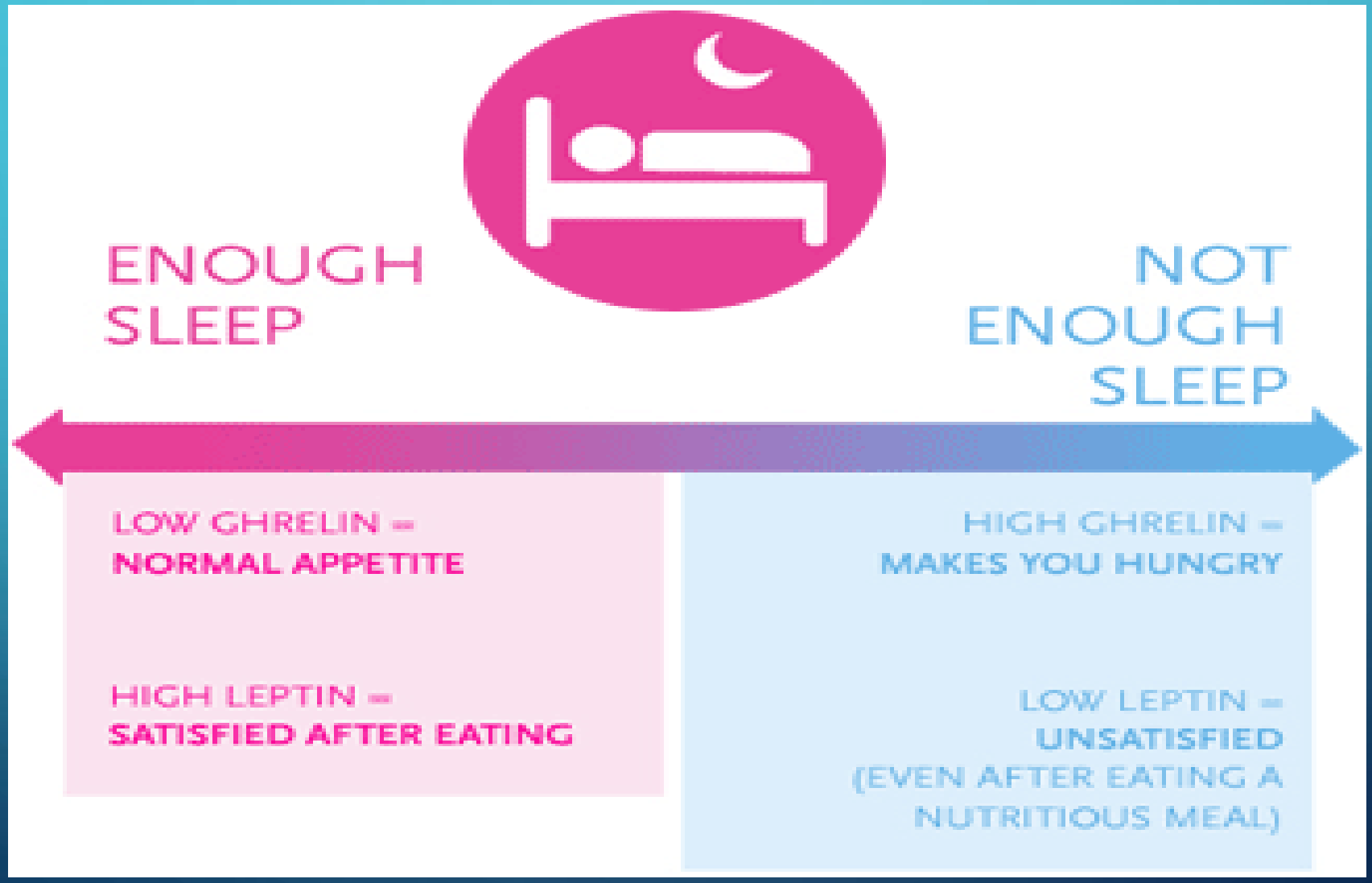
Francesco P. Cappuccio Daniel Cooper Lanfranco D'Elia Pasquale StrazzulloMichelle A. Miller

European Heart Journal, Volume 32, Issue 12, 1 June 2011, Pages 1484–1492

SLEEP DEPRIVATION AND OBESITY



LEPTIN AND GREHLIN



SLEEP DEPRIVATION AND OBESITY

- Cappucio, University of Warwick, UK.

Meta-analysis of short Sleep Duration and Obesity in Children and Adults

36 population studies, 634,511 participants, Age ranger 2 – 102 years.

- 60-80% increase in the odds of being a short sleeper amongst obese children and adults.

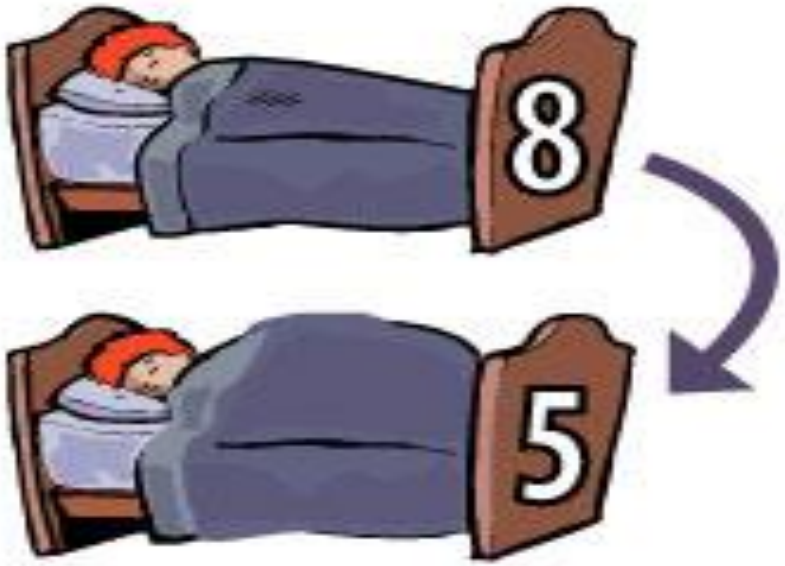
- In adults the reduction of I hours sleep/day is associated with 1.4 kg increase in body weight.

Cappucio, FP; Taggart FM; Kandala NB; Currie A; Peile E; Stranges S; Miller MA. Meta-analysis of short sleep duration and obesity in children and adults. *SLEEP* 2008: 31(5):619-626.

OBESITY AND WEIGHT CONTROL

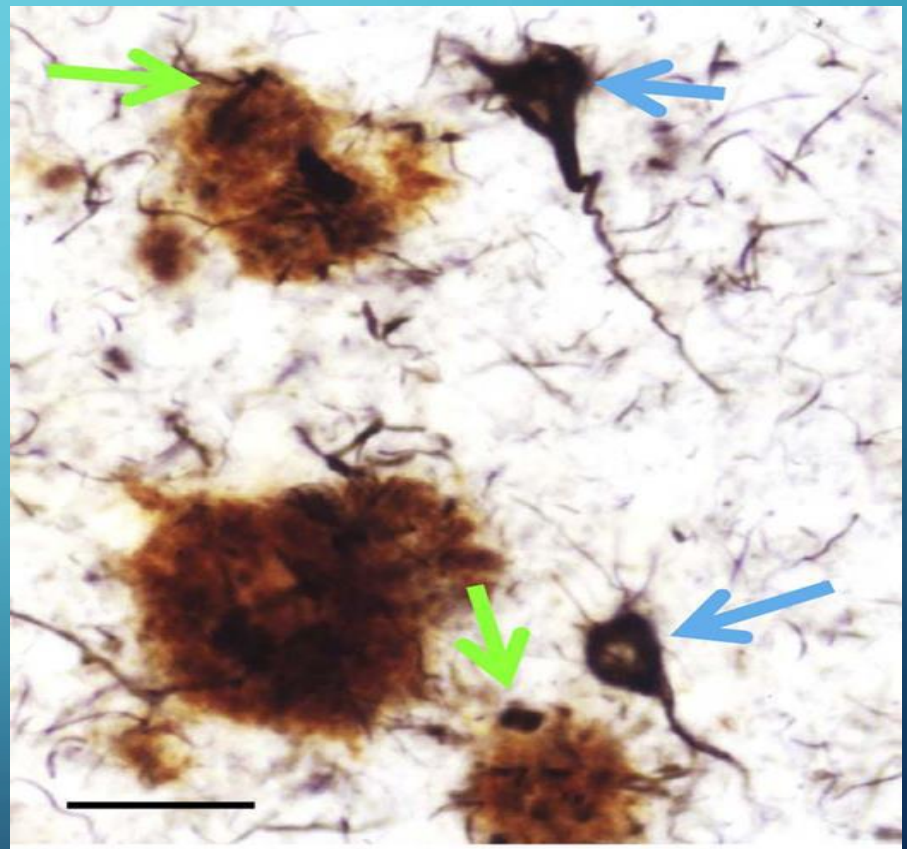
You snooze, you lose

After crunching the numbers on more than 1,000 participants in a study, researchers found that roughly eight hours of sleep correlates with a lower body mass index, lower levels of ghrelin (a hormone that triggers appetite) and higher levels of leptin (a hormone that signals that the body is full).

HOURS OF SLEEP	BODY MASS INDEX	LEPTIN	GHRELIN
	increases 3.6 %	decreases 15.5 %	increases 14.9 %

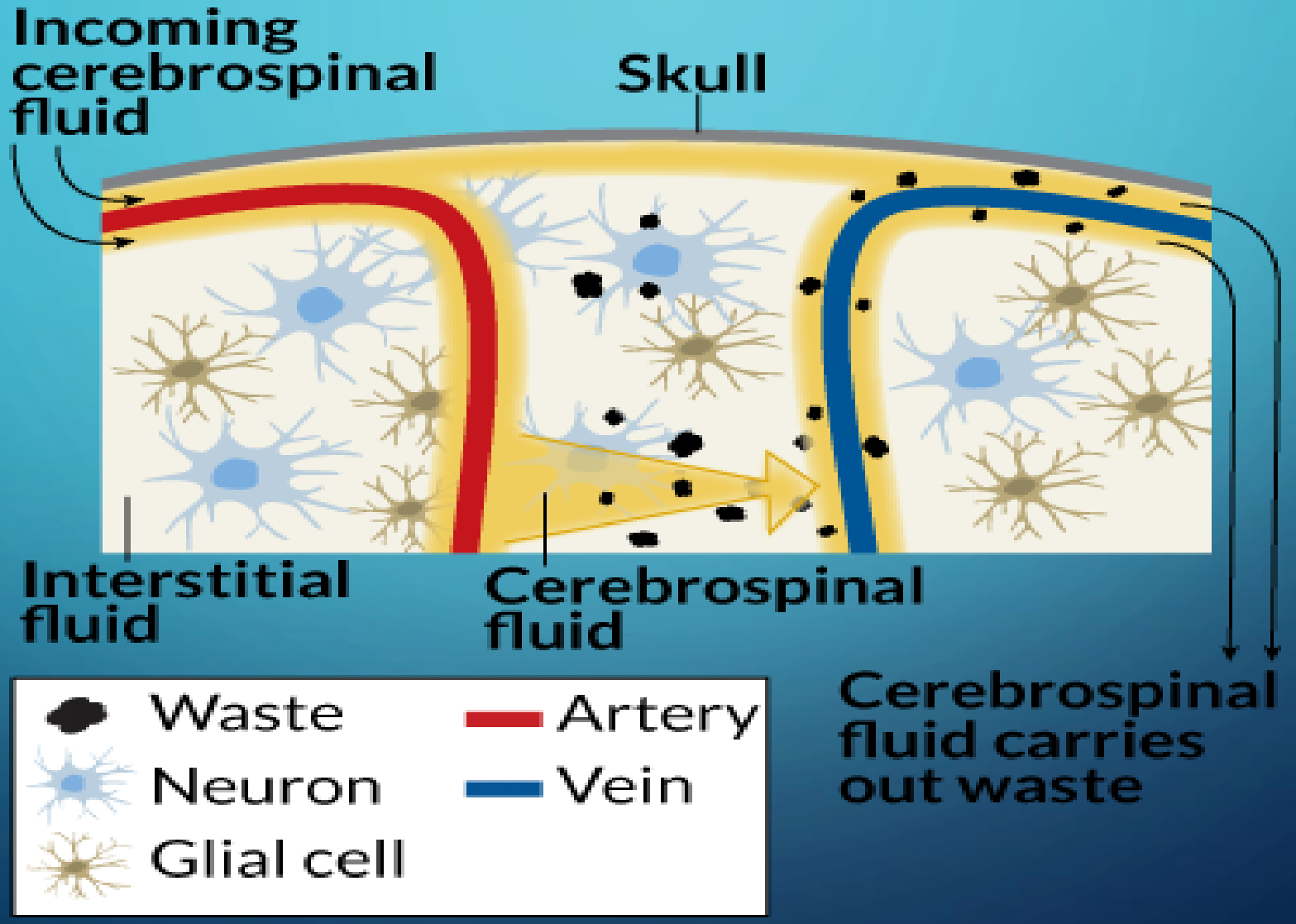
ALZHEIMERS DISEASE - NEUROPATHOLOGY

- AD is characterized diagnostically by 2 histologic findings:
  - (1) extracellular amorphous eosinophilic deposits of amyloid consisting of Aβ peptides, which are referred to as amyloid plaques
  - (2) intraneuronal aggregates of abnormally modified microtubule-associated protein tau (neurofibrillary tangles).



Immunohistochemistry:
Aβ (brown)andTau(black)

SLEEP AND DEMENTIA – GLYMPHATIC SYSTEM



SLEEP DEPRIVATION AND AMYLOID BUILD UP IN THE BRAIN.

- The study involved 20 volunteers between 22 and 72 years old, who received PET brain scans that measure amyloid build-up in the brain. Researchers compared levels of brain amyloid after a night of restful sleep and after a night of sleep deprivation. Sleep deprivation was associated with increased amyloid accumulation in areas of the brain associated with the early stages of Alzheimer's disease

β-Amyloid accumulation in the human brain after one night of sleep deprivation

Ehsan Shokri-Kojori, Gene-Jack Wang, Corinde E. Wiers, Sukru B. Demiral, Min Guo, Sung Won Kim, Elsa Lindgren, Veronica Ramirez, Amna Zehra, Clara Freeman, Gregg Miller, Peter Manza, Tansha Srivastava, Susan De Santi, Dardo Tomasi, Helene Benveniste, Nora D. Volkow

Proceedings of the National Academy of Sciences Apr 2018, 201721694; DOI:10.1073/pnas.1721694115

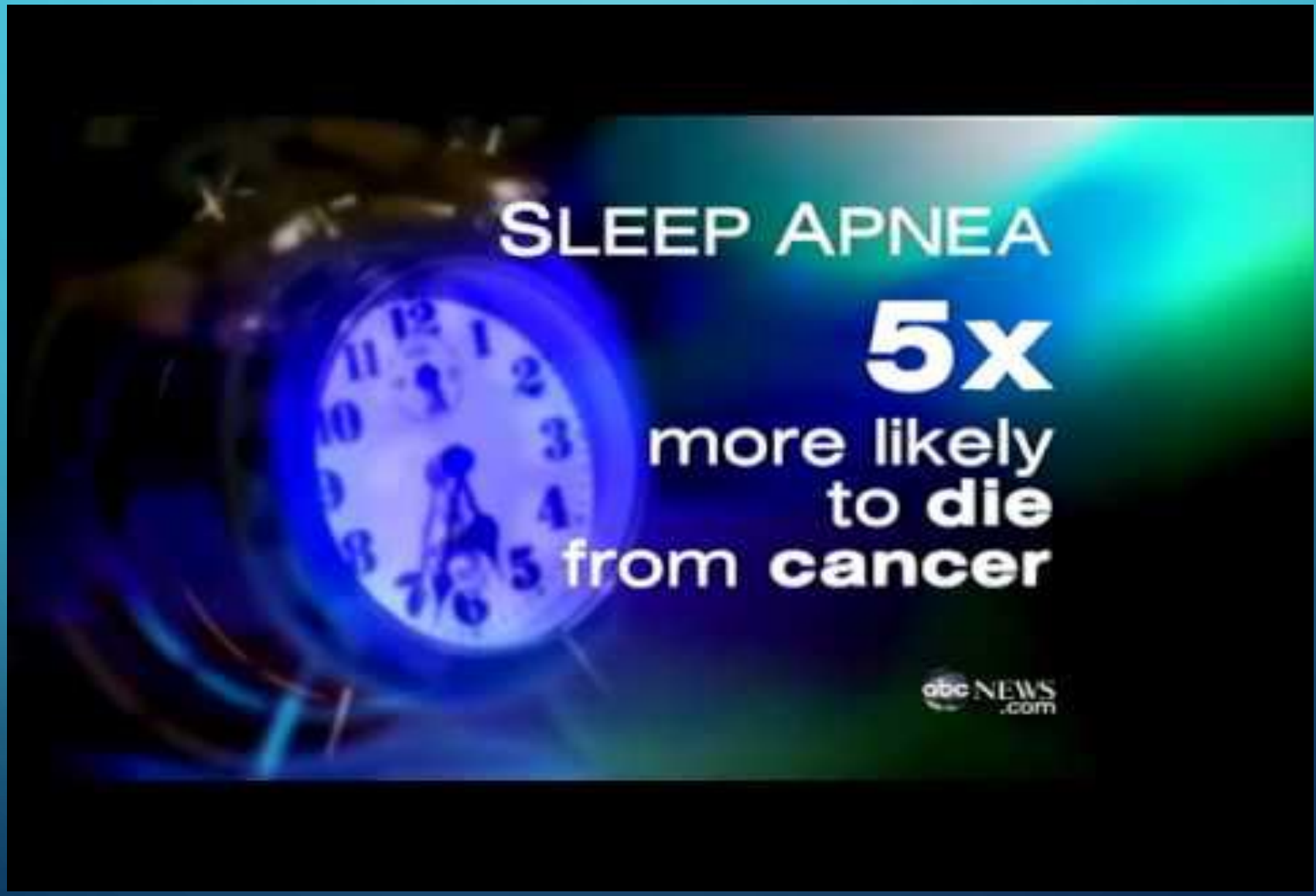
SLEEP AND CANCER

Cancer

"Exposure to light-at-night [is] associated with an increased risk of breast cancer" (Davis & Mirick 2006)[19].

A WHO agency recently concluded that shift work is carcinogenic due to circadian disruptions and their link to cancer[21].

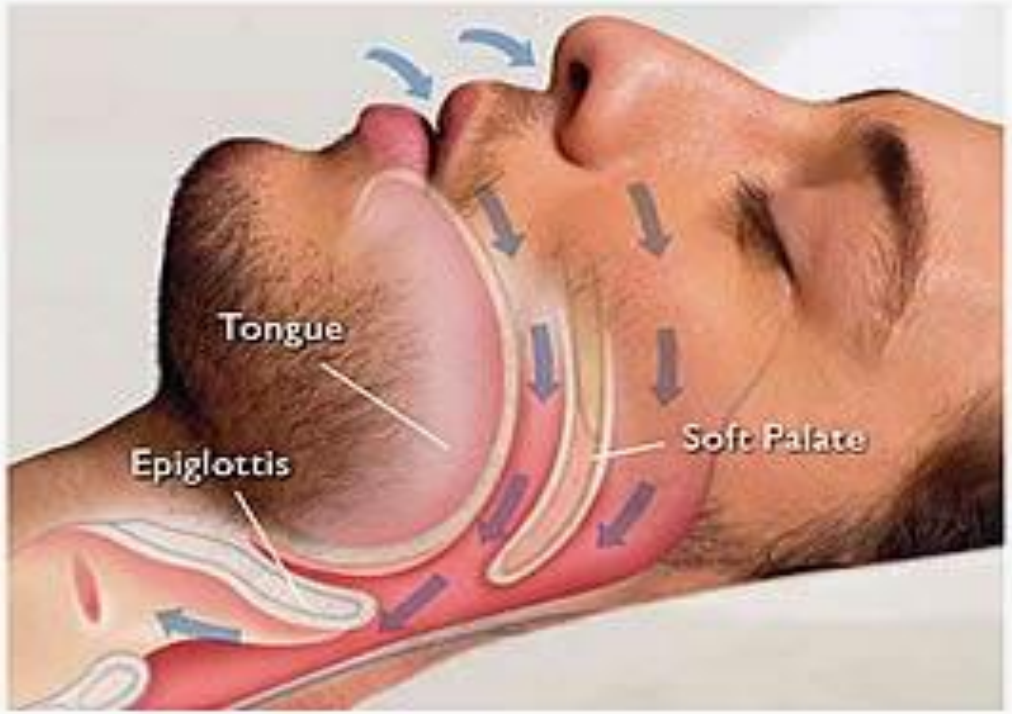
SLEEP AND CANCER



SLEEP DISORDERS - THERE ARE OVER 100 SLEEP DISORDERS

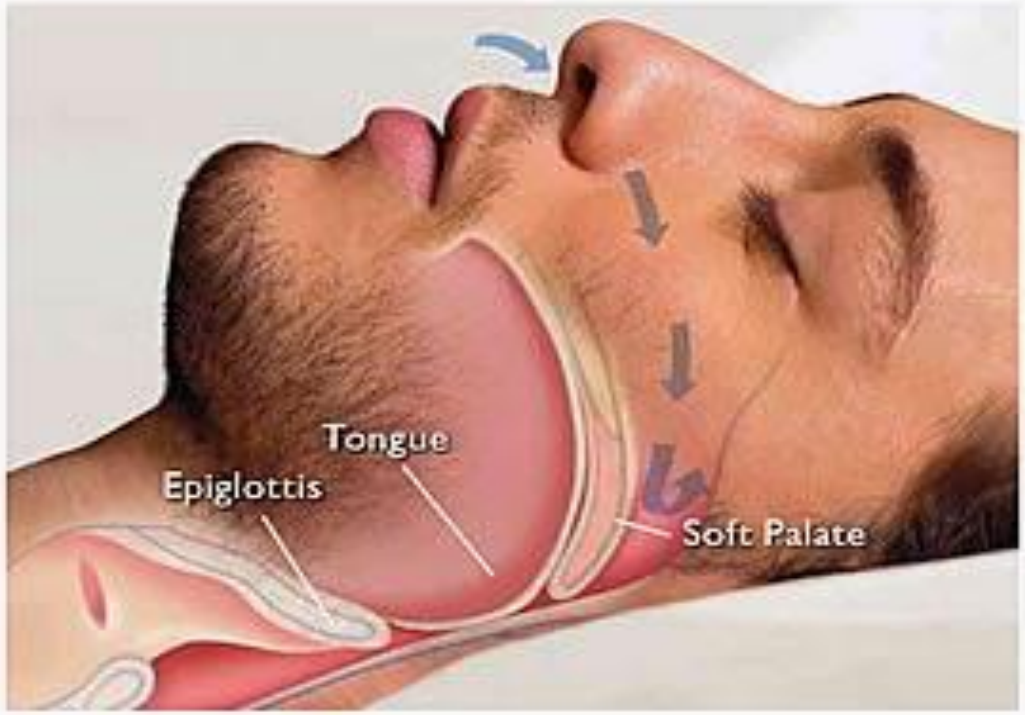
- Insomnia
  - Acute & Chronic
- Hypersomnia
  - Narcolepsy
- Circadian Rhythm Sleep Disorder
  - Jet Lag
  - Shift work sleep disorder
- Parasomnias
  - Sleep walking
  - REM related behavior disorders (Nightmares)
  - Night Terrors & Bed wetting
- Sleep related breathing disorders
  - Central Sleep Apnoea
  - Obstructive Sleep Apnoea
- Sleep related hypoventilation
  - Congenital & Acquired
- Sleep related movement disorder
  - Restless leg syndrome
  - Bruxism (teeth grinding)
- Physiological variants
  - Hypnic jerks.

OBSTRUCTIVE SLEEP APNOEA



Normal breathing

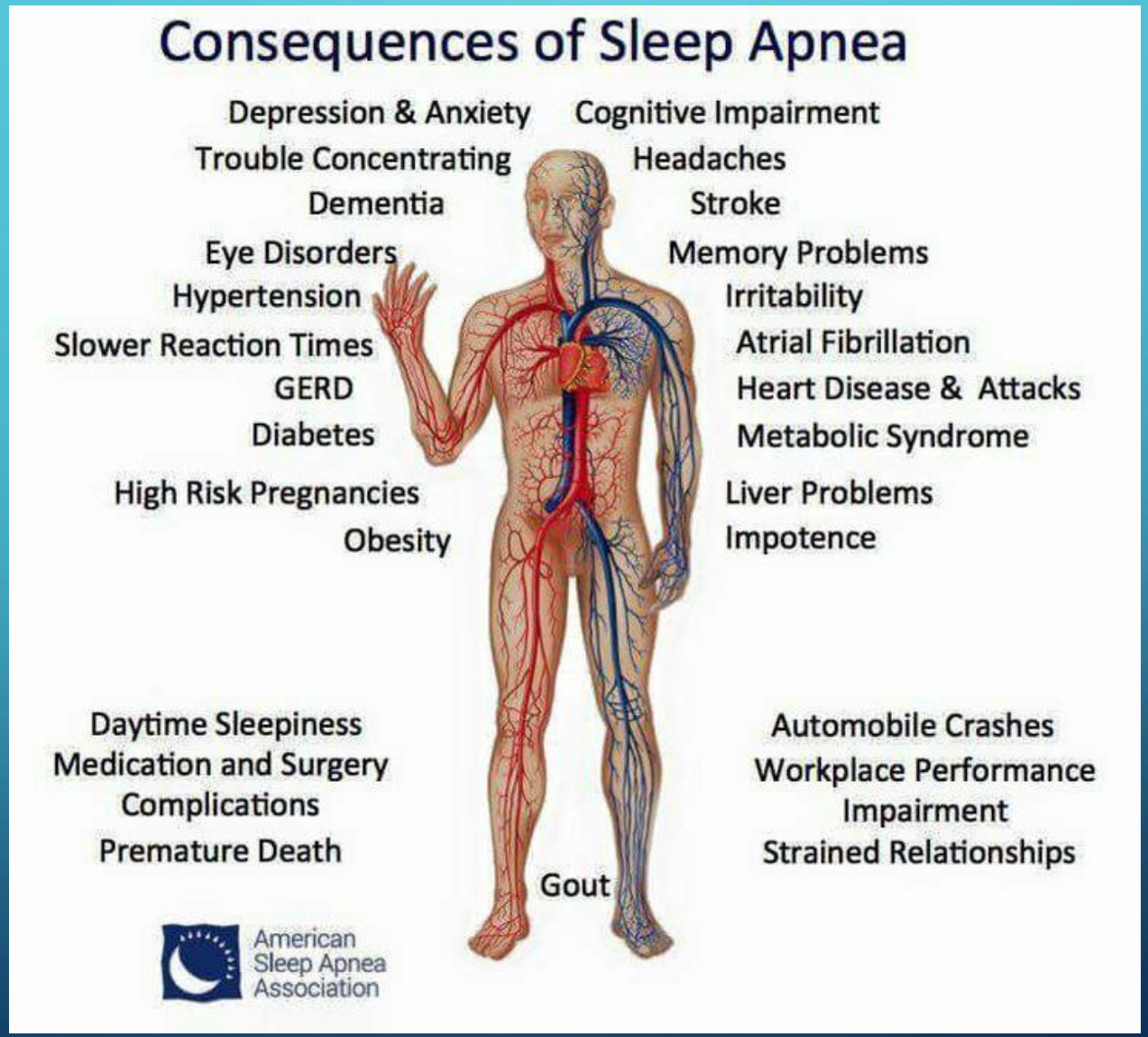
During sleep, air can travel freely to and from your lungs through your airways.



Obstructive Sleep Apnoea

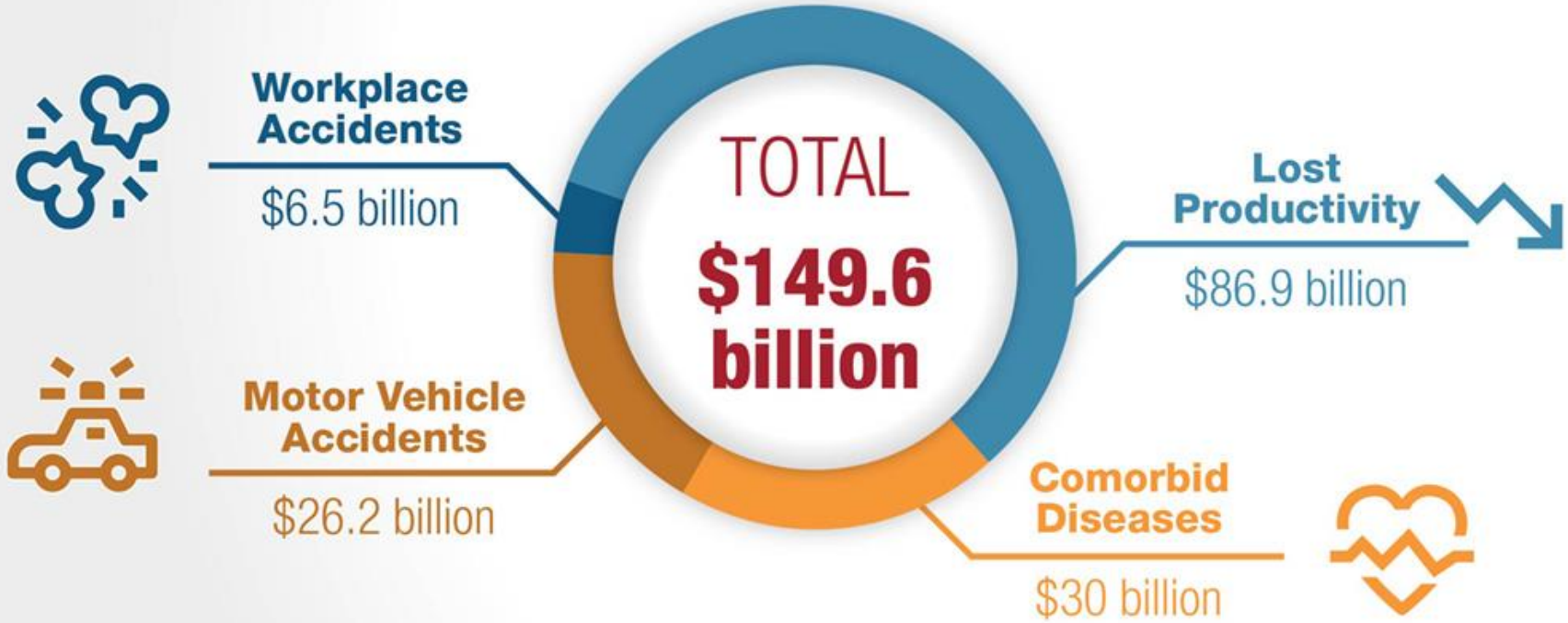
Your airway collapses, stopping air from traveling freely to and from your lungs and disturbing your sleep.

OBSTRUCTIVE SLEEP APNOEA



Undiagnosed Sleep Apnea: *A Hidden Health Crisis*

In the U.S. the estimated economic cost of undiagnosed obstructive sleep apnea was nearly $150 billion in 2015.



Source: American Academy of Sleep Medicine, 2016 | www.sleepeducation.org

MENTAL AND EMOTIONAL WELL BEING

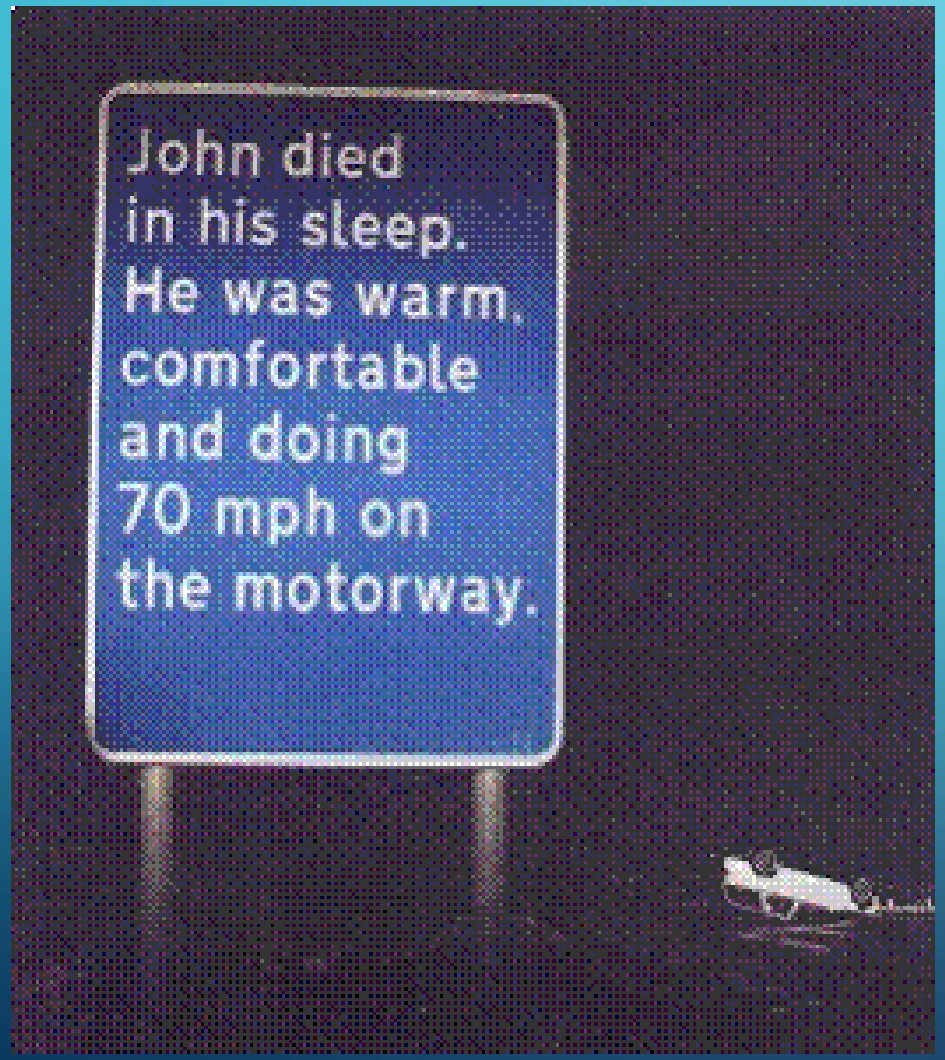
- Mental Health:
  - Depression
    - Persons with Insomnia are 4 times more likely to develop major depressive symptoms.
  - Bipolar disorder
    - 60 – 90% of persons with bipolar disorder have insomnia
  - Anxiety disorders
    - 50% of patients with generalized anxiety disorder, PTSD and Panic attacks report sleep difficulties.
  - ADHD
    - 25-50& of children with ADHD have a sleep problem.

EMOTIONAL WELLBEING

- Less sleep might mean less relationship happiness, decreased sense of humour and impairs good decision making.
- Lack of sleep increases emotional reactivity and makes individuals testy, irritable and short-tempered.

PERFORMANCE AND SAFETY

DROWSY DRIVING



DROWSY DRIVING CAUSED ABOUT **72,000** CRASHES, **800** FATALITIES AND **44,000** INJURIES IN ONE RECENT YEAR

DROWSY DRIVING

Factors of Accidents due to Sleepiness

Occupational Factors

- People with more than one job are 2x more likely to have a crash related to sleep.
- Working night shift increase risk by 6x
- Working more than 60hrs. Per week increases risk 40%

Amount of Sleep

- One fourth of drivers in sleep-related crashes & 1.3 of drivers fatigue-related crashes got less than 6 hours of sleep.

Sleep Quality & Sleep Disorders

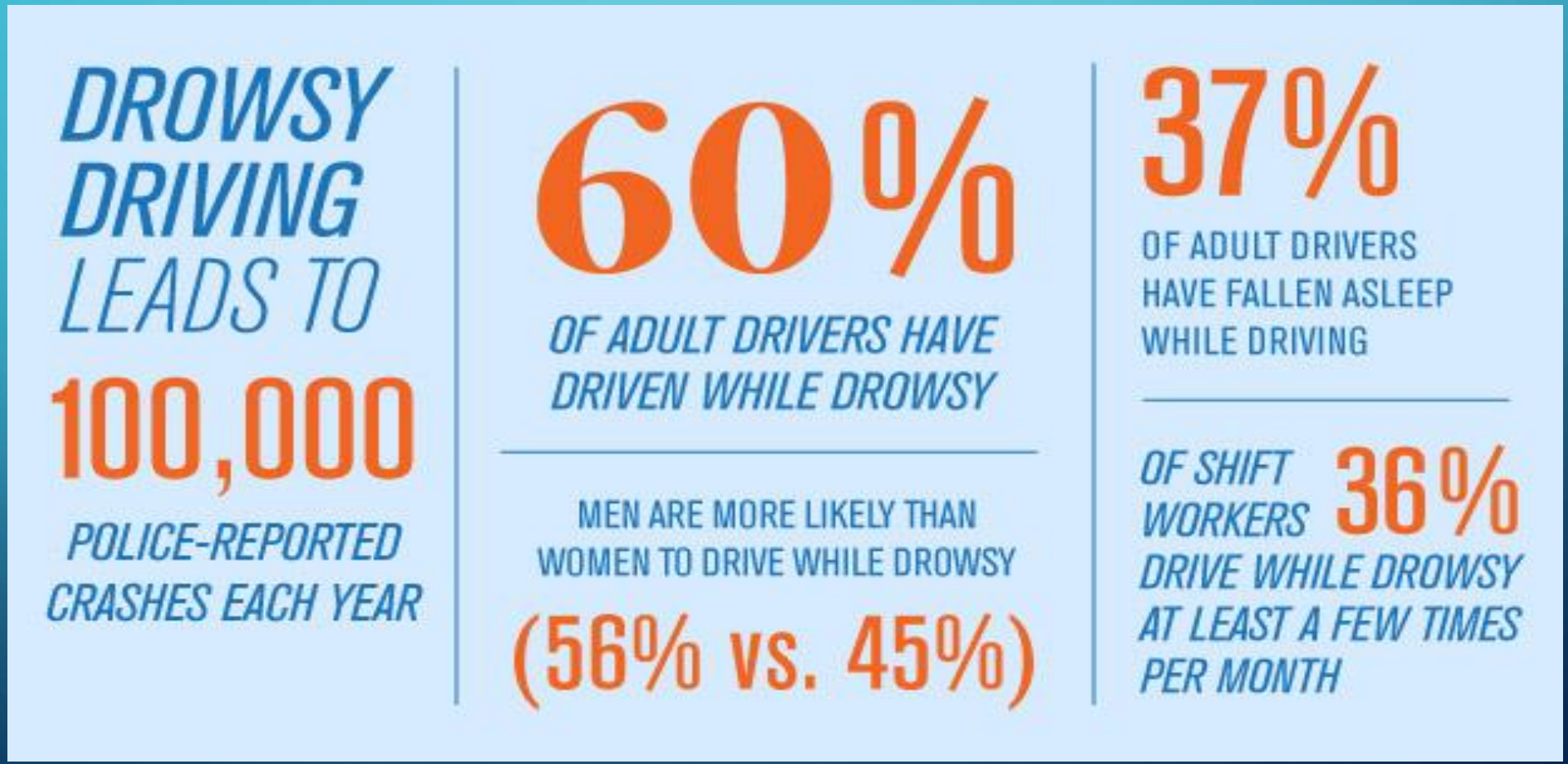
- Drivers in crashes were 2x more likely to mention that they got inadequate sleep.
- Few drivers reported having a diagnosed sleep disorder –problem with public education?

DROWSY DRIVING

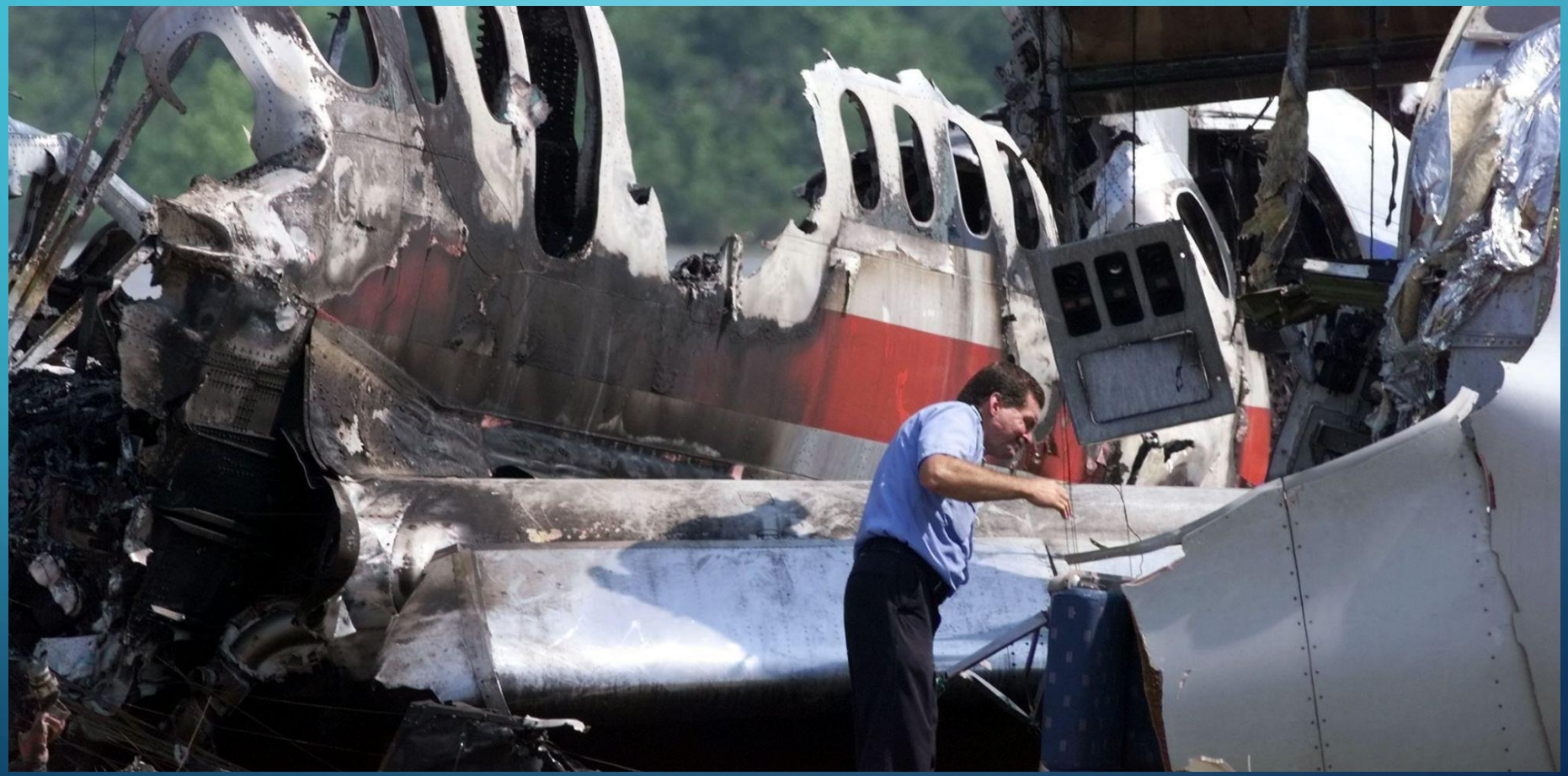
Sleepiness and Driving

- 15-20% of all MVA's felt to be sleep related.
- DOT estimates 100,000 MVA's per year direct result of driver sleepiness/drowsiness.
- 1500 fatalities / 71,000 injuries per year.
- Excessive sleepiness 2nd leading cause of car accidents, and a major cause of truck accidents in the US.
- The peak age for fall-asleep driving accidents is 20.
- Drivers under 30 account for 2/3 of all drowsy-driving crashes.

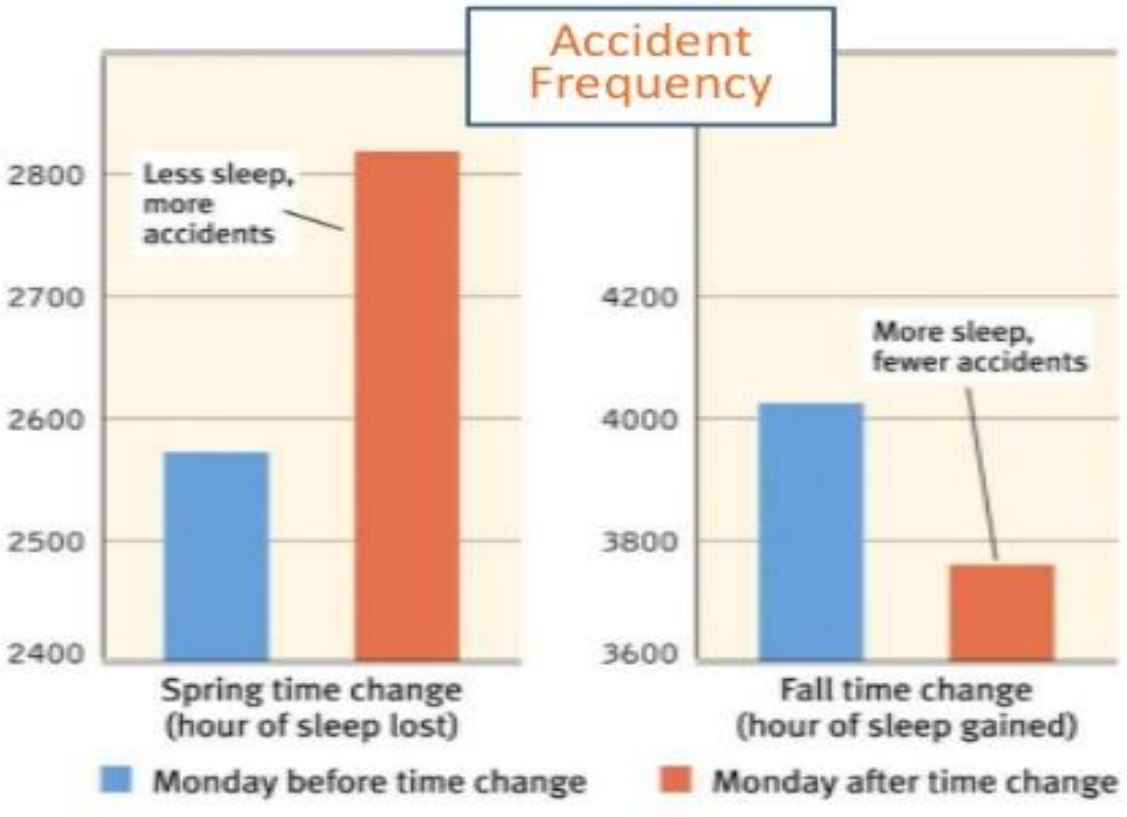
DROWSY DRIVING



AIRLINE ACCIDENTS AND DROWSINESS

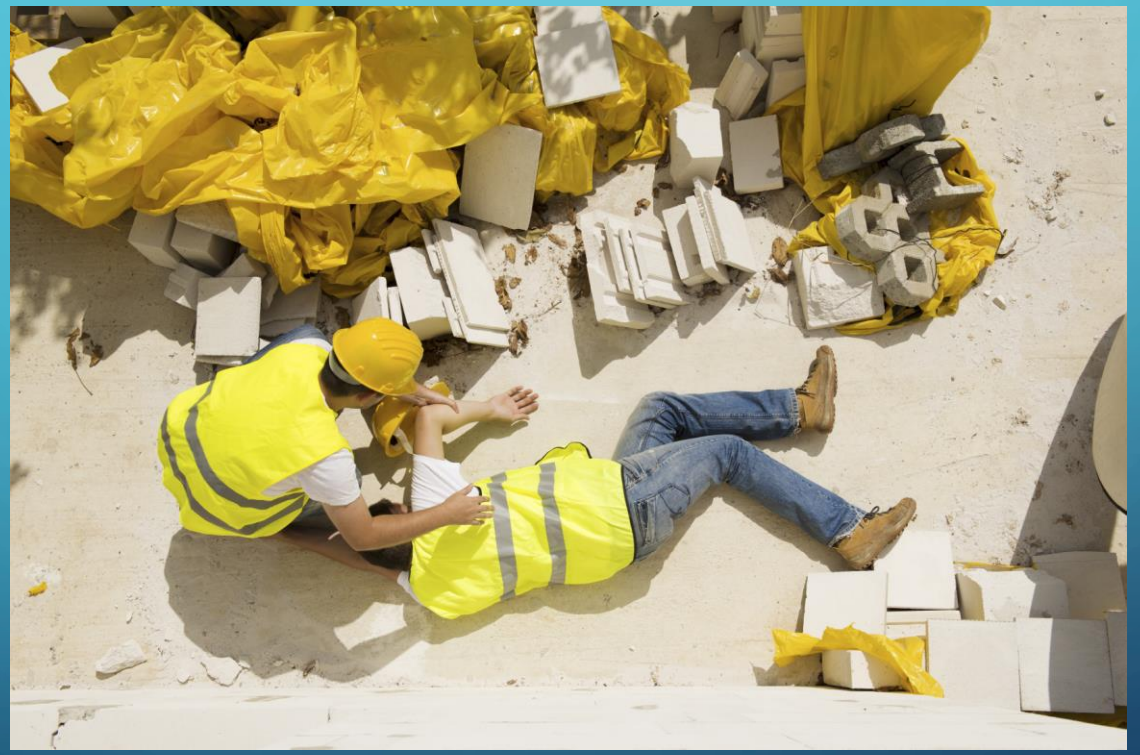


DAYLIGHT SAVING TIME AND ACCIDENTS



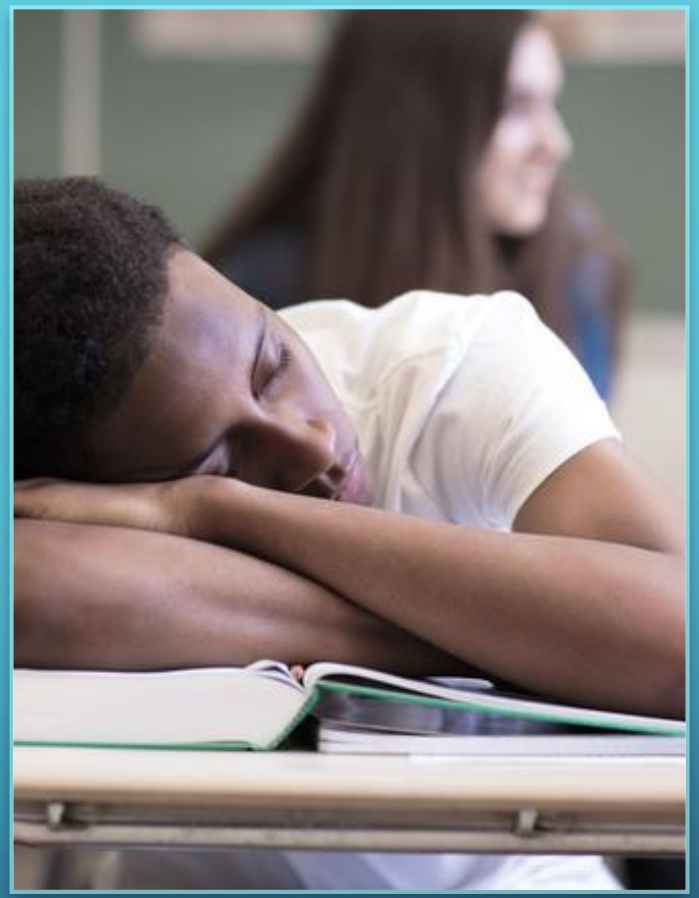
Sleep loss results in more accidents, probably caused by *impaired attention* and *slower reaction time.*

WORKPLACE ACCIDENTS DUE TO DROWSINESS

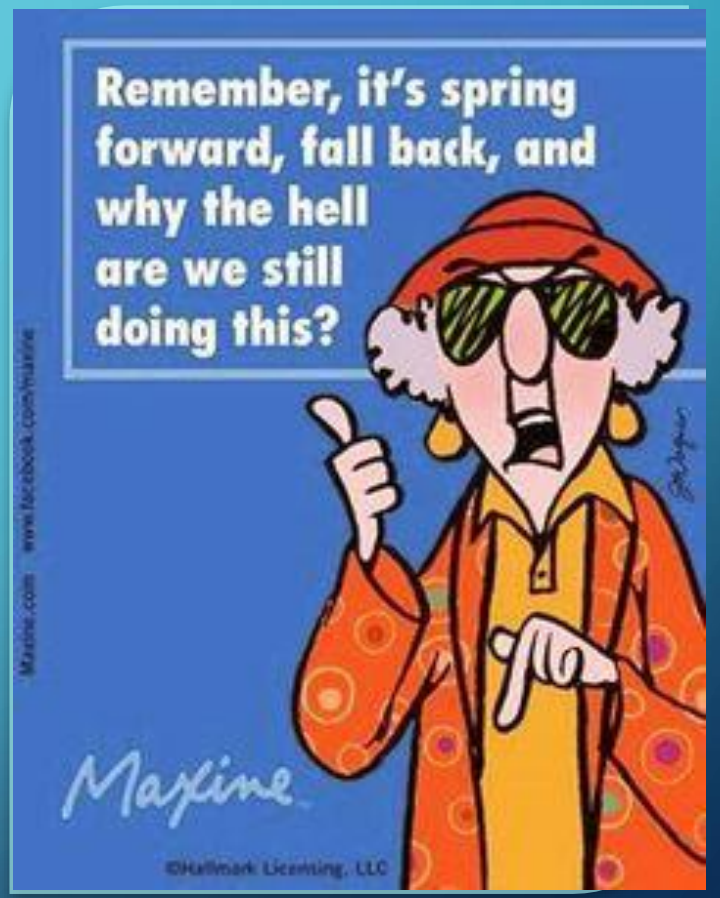


PUBLIC HEALTH CONCERNS

OBESITY IN CHILDREN



SCHOOLCHILDREN



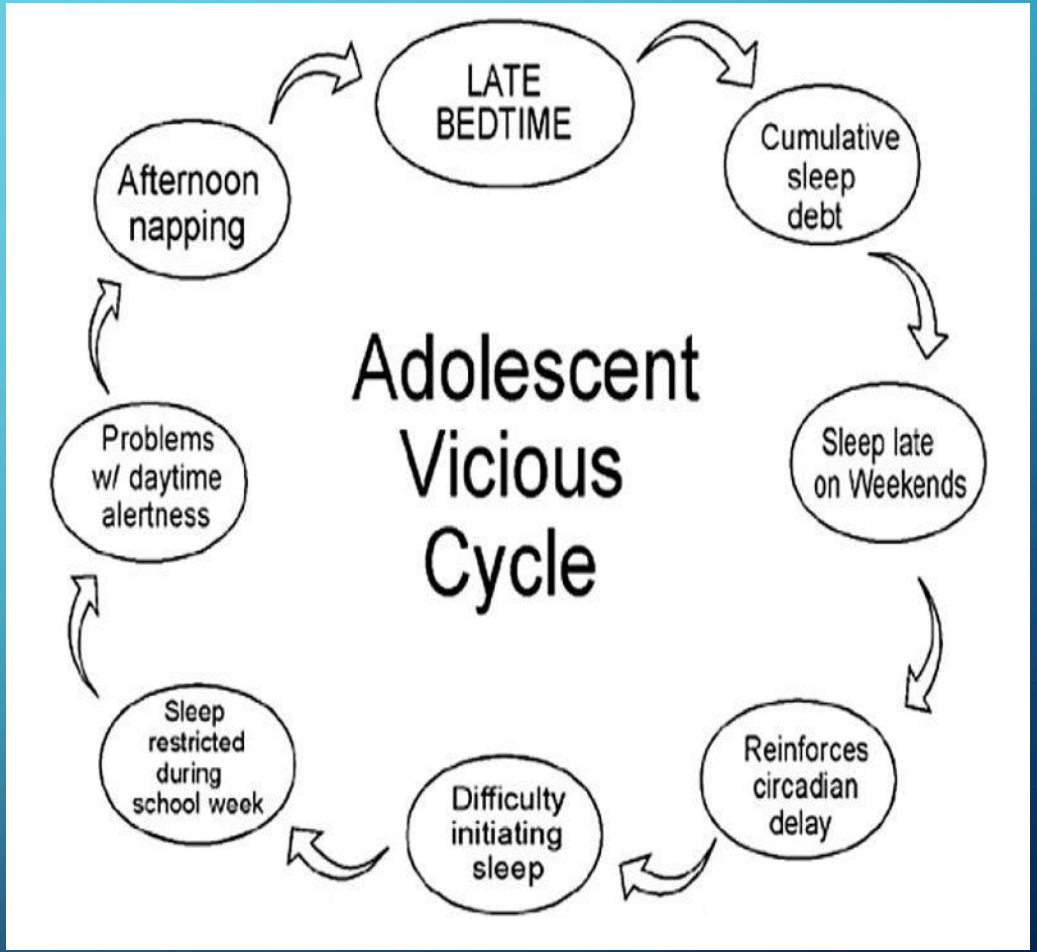
DAYLIGHT SAVING TIME

TEENAGERS AND SLEEP

- Most US teens are sleep deprived. The Youth Risk Behavior Surveillance Studies of 2007 – 2013 consistently showed that less than 10%of teenagers were getting the 9-10 hours of sleep recommended by the CDC & WHO.

DEFICIENT SLEEP IN ADOLESCENTS

- Mood and affect changes
- Behavior problems
  - Non-compliance
  - Aggression
  - Hyperactivity
  - Poor impulse control.
- Risk taking behaviors and increased accidents.
- Neurocognitive defects
  - Attention
  - Memory
  - Executive functioning
- Weight gain
  - Increased caloric intake
  - Increased consumption fats and carbs.



LATER SCHOOL START TIME OUTCOMES

- Multiple studies have demonstrated the benefit of later start school time… Students getting > 8 hours sleep/night:
  - Better academic outcomes
  - Better attendance rates
  - Higher graduation rates
  - Reduced tardiness
  - Less depression
  - Less caffeine use
  - Fewer car crashes.

LATER SCHOOL START TIME OUTCOMES

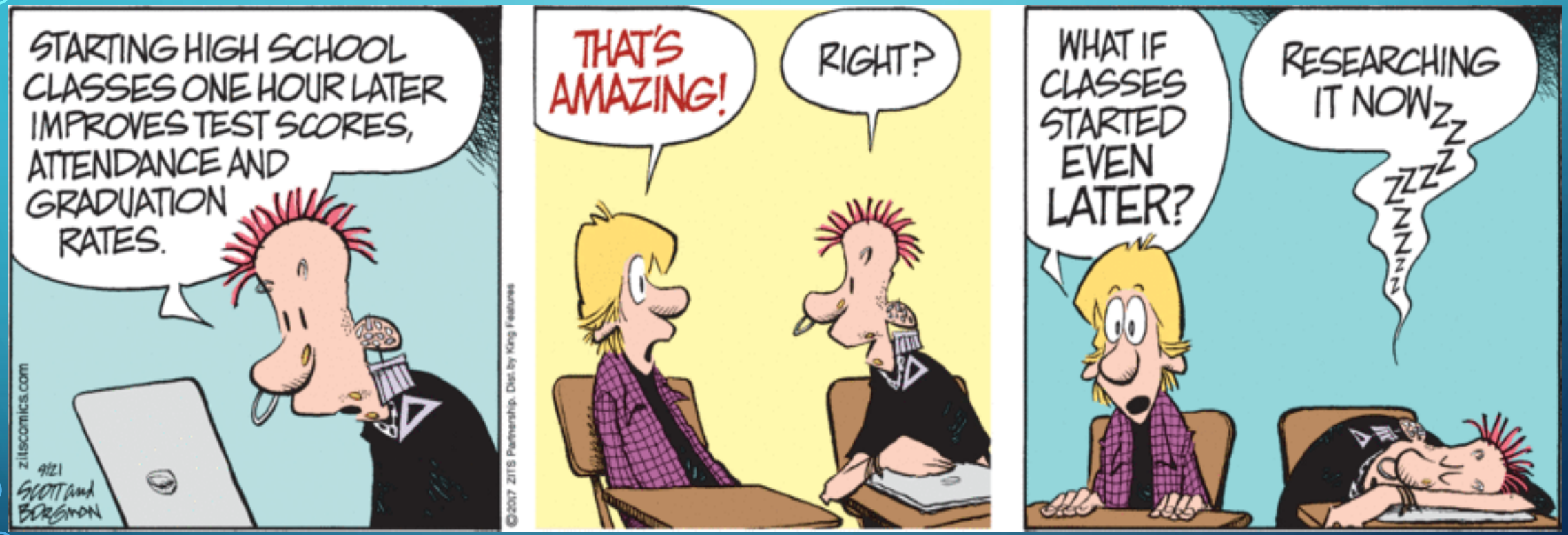
- Fairview High School, Colorado.
  - Went from 7.30 am to 8.00 am start.
  - Students getting > 8 hours of sleep increased from 33.6% to 42.5%.
  - Tardiness went down from 2.44% to 2.15%.
  - Overall GPA increased:
    - 1st period class most noticeable change increasing between 0.2 and 0.3 for 11th and 12th graders.
  - Another school (Kentucky) started 1 hour later and recorded a 16.5% decrease in motor vehicle accidents.

WHAT ABOUT SPORTS?

- Stanford freshmen athletes increased time in bed to 10 hours/night:
  - Basketball – Faster sprint (0.7 seconds), more accurate free throws (9%), improved mood, decreased fatigue.
  - Football – 20 yard and 40 yard dash improved by 0.10 secs.
  - Swimming – faster 15m sprints (.51 secs), faster reaction time off blocks (0.15 secs), faster turns (0.10 secs).

RECOMMENDATIONS TO START MIDDLE/HIGH SCHOOLS NO EARLIER THAN 8.30 A. M.

- American Academy of Paediatrics
- Centers for Disease Control and Prevention
- American Medical Association
- American Academy of Child and Adult Psychiatrists
- American Psychological Association
- American Thoracic Society
- Americam Academy of Sleep Medicine
- National Education Association
- National Parent Teacher Association
- National Association of School Nurses


STARTING HIGH SCHOOL CLASSES ONE HOUR LATER IMPROVES TEST SCORES, ATTENDANCE AND GRADUATION RATES.
zitscomics.com
9/21
SCOTT and BORGMAN
THAT'S AMAZING!
RIGHT?
©2017 ZITS Partnership, Dist. by King Features
WHAT IF CLASSES STARTED EVEN LATER?
RESEARCHING IT NOW
ZZZZZZZZZZZZ

TAKE HOME MESSAGES

- Sleep is essential for learning, growth and development.
- Adolescents are significantly sleep deprived, with school start times as one of the strongest contributing factors
- Changing start times is not coddling students, but setting them up for success in life

CDC DECLARES SLEEP DISORDERS A PUBLIC HEALTH EPIDEMIC

- Behavioral Risk Factor Surveillance System
- Those age 65 and older were most likely to report unintentionally falling asleep during the day (44.6%), and Black Americans (52.4%) were more likely to experience this problem than either Hispanics (41.9%) or Whites (33.4%)
- Those age 25 to 34 were more likely to fall asleep while driving (7.2%) than those age 65 or older (2.0%), and men were more likely to experience this problem (5.8%) than women (3.5%)

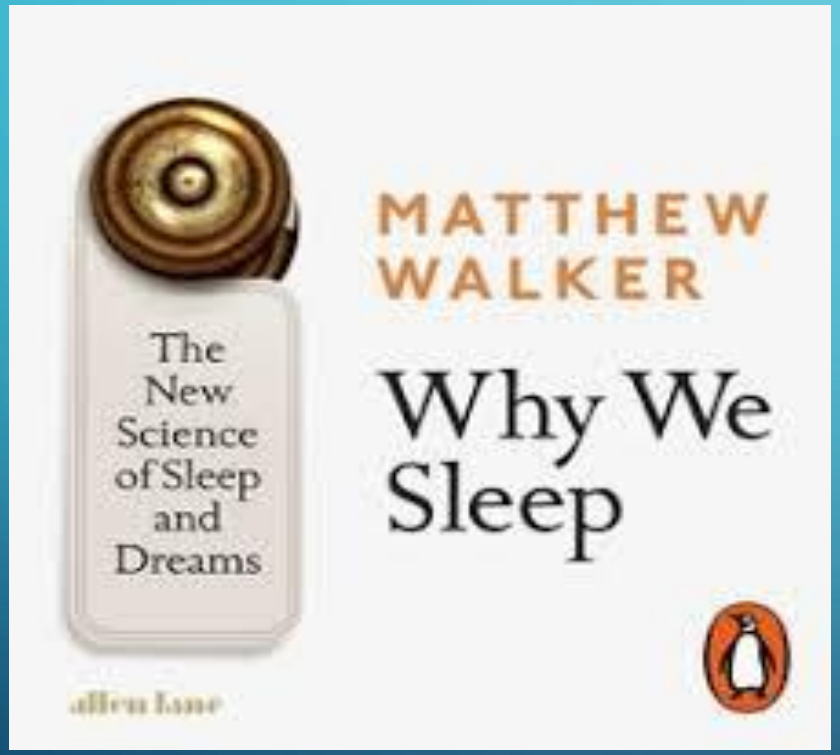
ADVOCATING FOR BETTER SLEEP HEALTH.

- Research on the effectiveness of screening and counseling efforts
- Education of employers on the health effects of long shifts and insufficient sleep
- Delaying school start time for high school students
- Educating the public on the risks of drowsy driving
- Improving surveillance of sleep health, especially among young children

THE CRITICAL PUBLIC HEALTH MESSAGE

Sleep is essential for good health; it is a necessity, not a luxury.

CONCLUSION



- "This silent sleep loss epidemic is the greatest public health challenge we face in the 21st century in developed nations. If we wish to avoid the suffocating noose of sleep neglect, the premature death it inflicts, and the sickening health it invites, a radical shift in our personal, cultural, professional and societal appreciation of sleep must occur."