SLEEP

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If you don’t sleep, you don’t learn or heal or grow
Circadian Rhythms

Information from the “body clock” (see p.184) is passed to the brainstem so that basic body processes follow a 24-hour rhythm.
We spend 1/3 of our lives asleep
Why do we sleep?

Two theories:

- **Restorative**: Helps the body recover from work it did when awake. REM sleep important for memory and learning.

- **Adaptive**: Developed because animals need, to protect themselves i.e., avoid falling off a cliff or getting eaten. Animals that serve as food sleep the least.
Why Sleep Matters

- Sleep loss affects:
  - Memory, attention, complex thought
  - Motor response
  - Emotional control
  - Immune system
  - Endocrine system
“Participants viewed pictures in which neutral (e.g. car intact, non-threatening animal) and negative emotionally arousing objects (e.g. totaled car, threatening animal) and backgrounds were mixed and matched. Participants remembered emotional components better than neutral components after a night’s sleep, suggesting that slumber specific brain processes help us sort out what is important.”

Sleep and Memory
Motor Control

- People who were awake for 19 hours scored worse on performance and alertness tests than those who were legally intoxicated.

- People with sleep apnea did as badly on tests of reaction time as those legally intoxicated.
Sleep Affects Mood

- University of Pennsylvania study found that subjects who slept 4.5 hours/night for one week reported feeling more stressed, angry, sad and mentally exhausted.

- When normal sleep resumed mood scores improved dramatically.
Mental Illness

- Sleep deprivation affects mood disorders
- Bi-polar shift usually preceded by insomnia
- Depression either begins or is worsened by sleep deprivation
Sleep deprivation can have significant and important effects on the secretion of hormones from endocrine glands, especially those that follow a circadian pattern. A classic example includes the effect of sleep loss or disruption in children and the impact on growth. Growth hormone is secreted during slow-wave sleep, which is more common in the early part of the night in children.
SLEEP DEPRIVATION INCREASES SENSITIVITY TO PAIN
Sleep Architecture

• The predictable pattern where REM and NREM sleep alternate throughout the night in 90-110 minute cycles, repeated 4-6 times a night

• The “waves” of sleep
Sleep Architecture
Rapid Eye Movement (Rem) and Non-rapid Eye Movement (NREM) Sleep
What happens during sleep?

- Some parts of the brain are more active in sleep than while awake
- Describes the sleep cycle
- Two types of sleep (REM + NREM)
- 4-6 cycles per night
- Cycles last approx. 75-110 min.
- Restorative sleep depends on the time spent in deep sleep (NREM 2-4)

Rapid Eye Movement (REM)
- Vivid, storied, emotional dreams
- Characterized by fast, desynchronized brainwaves
- Memory consolidation – theta waves – enable long term potentiation of glutamate neurotransmitters in the hippocampus
- Limbs temporarily paralyzed
REM SLEEP
This fMRI scan shows activity (yellow most active, then red) during REM sleep, spanning areas involved with generating sensations.
AWAKE
This PET scan shows the areas that are active when a person is awake (shown in red and yellow). The green and blue areas are less active.

DEEP SLEEP
This PET scan shows that activity quiets down in many areas of the brain during deep sleep. The purple areas are the least active.

DRUGGED SLEEP
Most sleeping drugs induce deeper sleep than normal. The purple areas on this PET show that much of the brain is inactive.
Everything We Know About Dreams
We Don’t Get Enough Sleep

- 1/3 of all adults report sleeping < 7 hours

- Not getting enough sleep (even by one hour/night)
  - Cognitive and motor control impairments
  - Increased irritability and emotional reactivity
  - Loss of physical stamina
  - Paradoxically – insomnia
  - Long term linked to obesity, diabetes, hypertension and depression
Melatonin: The Hormone Connection

Melatonin—hormone secreted by pineal gland in response to darkness. Promotes sleep.

Cortisol stimulates alertness, production begins just before waking.

Release of hormones (growth hormone, FSH, luteinizing hormone, TSH)
What Interferes with Sleep?

- Primary Insomnia due to physical causes
- Video games
- Cell phones
- Missing the opportunity
- Caffeine
Sleep Hygiene

- Decrease caffeine
- No alcohol after 7:00 p.m.—rebound insomnia
- No evening exercise
- Nicotine is a stimulant
- Adequate exposure to daylight
- Sleep in a dark, cool, noise-free room
- No computer or video games before bed
- Wind down for 1-3 hours
- Generally decrease activity in arousal systems
MayoClinic.com
Seven Tips to Better Sleep

Work by decreasing arousal systems in the brain

1. Stick to a sleep schedule, same time every day. **If no sleep in 15 minutes, get up and do something relaxing, then try again when sleepy**

2. Pay attention to what you eat and drink
   Don’t go to bed hungry or stuffed
   Caffeine, nicotine and alcohol all disrupt sleep
Tips for better sleep

3. Create a bedtime ritual. Promote better sleep by easing the transition between sleep and wakefulness

4. Get comfortable. Good pillow, good bed, quiet, dark, cool

5. Limit daytime naps. Keep naps to 10-30 minutes in mid-afternoon

6. Include physical activity in daily routine, but not too close to bedtime

7. Manage stress—pen and paper next to bed