Sleep and Dreaming

Sleep Deprivation Trivia

Peter Tripp stayed awake for 201 hours in 1959. Guinness Book of Records record is 18 days, 21 hours, 40 minutes. Sleep deprivation implicated in Three Mile Island, Exxon Valdez, Challenger and Bhopal disasters.

Copyright © Houghton Mifflin Company. All rights reserved.
Examples of Biological Rhythms

• Seasonal migrations
• Mating seasons
• Menstruation
• Circadian rhythms:
  • Daily rhythms
  • “Circa” means around, “dia” means day
• Ultradian rhythms:
  • Cycles that occur several times per day

Zeitgebers: External Cues Help Set Circadian Rhythms

• “Zeit” means time in German.
• “Gebers” means givers.
• Internal clocks interact with zeitgebers.
• Light is an important human zeitgeber.
• Human “free-running” cycle is about 25 hours.
• Blind individuals and sailors serving on submarines may experience sleep problems.
Individual Variations

- “Larks” are morning people.
- “Owls” are night people.
- Many people are in between these extremes.
- Most adolescents are temporarily owls.

Shift Work and Jet Lag

- More errors occur on evening and night shifts.
- Shift workers average 1.5 hours less sleep, and are more prone to sleep-related illnesses and psychological disorders.
- Adjustment to jet lag requires about 1 day per time zone crossed.
- Airline crews traveling across time zones are subject to cognitive defects.
Adjustments to Phase Delays Are Easier than Phase Advances

Daylight Savings Requires Adjustment, Too

April shift is a phase advance.
- analogous to eastward travel
- 7% increase in traffic accidents

October shift is a phase delay.
- analogous to westward travel
- 7% decrease in traffic accidents
The Suprachiasmatic Nucleus is the Body's Master Internal Clock

- The retinohypothalamic pathway provides information about light to the SCN.
- Isolated SCN tissue maintains its circadian rhythms.
- Transplants of SCN establish donor rhythms in recipient animals.
- The SCN may control other “internal clocks.”

Discovery of the Retinohypothalamic Tracts

1. Transsection eliminated the ability of light-dark cycles to entrain circadian rhythms.
2. Transsection did not eliminate the ability of light-dark cycles to entrain circadian rhythms.
3. This suggested that the sensory tracts that regulate the entrainment of circadian rhythms by light-dark cycles, branch off from the optic chiasm and project to the suprachiasmatic nucleus of the hypothalamus.
The SCN is active during the day in both diurnal and nocturnal animals. The SCN tells the animal whether it's day or night, but not how to behave.

How do We Study Sleep and Wakefulness?

- Electroencephalogram (EEG)
- Evaluation of muscle tone
- Evaluation of eye movement
Stages of Waking and Sleeping

- Wakefulness is characterized by relatively desynchronized alpha and beta waves (rapid & low amplitude).
- Slow-wave sleep (SWS) consists of progressively deeper stages of sleep, characterized by relatively synchronized theta and delta waves (slower with bigger amplitude).
- Rapid-eye-movement sleep (REM) is characterized by an EEG resembling wakefulness.
- 90–120 minute cycles characterize both sleep and wakefulness.

EEG During Wakefulness and Sleep

- Slow-wave sleep (stages 3 and 4) show larger percentages of delta waves, slow or absent eye movements, no sexual activation, and normal muscle tone.
- REM sleep combines an active EEG, rapid eye movements, sexual activation sometimes, and muscular paralysis.
Sleep Patterns in a Typical Night

- The first 4 hours contain more SWS, especially Stages 3 and 4.
- The second 4 hours contain more REM.
- REM episodes occur approximately every 90–120 minutes.
Sleep Patterns Across the Lifespan

REM sleep is more prevalent in infancy.
Aging is associated with drops in overall sleep and proportion of SWS.

Dreaming

- Dreams occur during both Slow-wave sleep and REM.
- REM dreaming is more vivid, less logical, story-like and longer.
- Sleep researchers have found that we usually dream about familiar places and routine activities, but unfamiliar people.
### Nightmares vs. Night Terrors

<table>
<thead>
<tr>
<th></th>
<th>Night Terrors</th>
<th>Nightmares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of night</td>
<td>Within four hours of bedtime</td>
<td>Late in sleep cycle</td>
</tr>
<tr>
<td>State on waking</td>
<td>Disoriented, confused</td>
<td>Upset, scared</td>
</tr>
<tr>
<td>Response to caregivers</td>
<td>Unaware of presence, not consolable</td>
<td>Comforted</td>
</tr>
<tr>
<td>Memory of events</td>
<td>None, unless fully awakened</td>
<td>Vivid recall of dream</td>
</tr>
<tr>
<td>Return to sleep</td>
<td>Usually rapid, unless fully awakened</td>
<td>Often delayed by fear</td>
</tr>
<tr>
<td>Sleep stage during which event occurs</td>
<td>Partial arousal from deep NREM (SWS) sleep</td>
<td>REM sleep</td>
</tr>
</tbody>
</table>

### Some Theories About Why We Dream:

- Dreams incorporate ongoing functions (e.g. vestibular activity) and/or environmental events (e.g. your alarm clock).
- Dreaming is a way to forget irrelevant information.
- Animals integrate memories and experience while dreaming.
Why Do We Sleep?

- Sleep keeps us safe.
- Sleep preserves energy.
- Sleep restores our bodies.

Functions of SWS

- Rest, repair body.
- Human growth hormone (HGH) is released during Stages 3 and 4 SWS.
- Deprivation produces joint and muscle pain.
Functions of REM

Birds and mammals (except the echidna) show REM.
REM increases after learning has occurred.
REM rebound.
People can live and learn without REM.
  - brain injury
  - SSRIs suppress REM
REM deprivation sometimes improves mood in depressed patients.

What Parts of the Brain Manage Sleep Phenomena?

© Staffan Widstrand/CORBIS

Copyright © Houghton Mifflin Company
Sleep Disorders

*Dyssomnias* involve difficulties with the initiation, maintenance, timing and quality of sleep.

*Parasomnias* involve unusual behaviors that intrude on normal sleep.

Dyssomnias

**Insomnia**
- Onset insomnia = trouble falling asleep
- Maintenance insomnia = trouble staying asleep

**Sleep apnea** – breathing stops while sleeping, often many times a night

**Narcolepsy**
Dyssomnias

Common Characteristics of Narcolepsy:

- Daytime sleepiness and sleep attacks (fall asleep in totally inappropriate situations)
- Cataplexy = loss of muscle tone while awake
- Hallucinations = dreamlike experiences while awake
- Sleep paralysis = inability to move while falling asleep

Harriet Tubman may have had narcolepsy.

Narcoleptic Dogs Show Cataplexy

Copyright © Thomson and Wadsworth
So Do People

Parasomnias (unusual behaviors that intrude on normal sleep)

• Sleep talking
• Sleep walking
• Bedwetting
• Restless leg syndrome