Biological Rhythms and Sleep

Circadian Rhythms occur on a 24-hour cycle and include sleep and wakefulness. Termed our “biological clock,” it can be altered by artificial light.

Light triggers the suprachiasmatic nucleus to decrease (morning) melatonin from the pineal gland and increase (evening) it at nightfall.

Awake but Relaxed

When an individual closes his eyes but remains awake, his brain activity slows down to a large amplitude and slow, regular alpha waves (9-14 cps). A meditating person exhibits an alpha brain activity.

Sleep Stages

Measuring sleep: About every 90 minutes, we pass through a cycle of five distinct sleep stages.

Sleep Stages 1-2

During early, light sleep (stages 1-2) the brain enters a high-amplitude, slow, regular wave form called theta waves (5-8 cps). A person who is daydreaming shows theta activity.
Sleep Stages 3-4

During deepest sleep (stages 3-4), brain activity slows down. There are large-amplitude, slow delta waves (1.5-4 cps).

REM: rapid eye movement

- Eyes dart & heartbeat more rapid/irregular
- “Paradoxical sleep”
  - EEG resembles beta waves
  - Muscle system mostly inactive
- If awoken during REM
  - Seem instantly alert (unlike stage 4)
  - Likely to report dreaming
- REM: 20% of total sleep
  - Every 90min, increasing in length during night
  - REM occurs 4-6 times/night (depend on time)

Stage 5: REM Sleep

After reaching the deepest sleep stage (4), the sleep cycle starts moving backward towards stage 1. Although still asleep, the brain engages in low-amplitude, fast and regular beta waves (15-40 cps) much like awake-aroused state.

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% REM over lifespan

A person during this sleep exhibits Rapid Eye Movements (REM) and reports vivid dreams.
EEG record: Awake v. 5 Stages of Sleep

Note:
- Height
- Frequency
- Regularity

Stage 3: <50% delta
Stage 4: >50% delta

90-Minute Cycles During Sleep
With each 90-minute cycle, stage 4 sleep decreases and the duration of REM sleep increases.

Sleep Cycle: Stages of sleep

Why do we sleep?
We spend one-third of our lives sleeping.

If an individual remains awake for several days, immune function and concentration deteriorates and the risk of accidents increases.
Sleep Deprivation

Results in:
1. Fatigue and subsequent death.
2. Impaired concentration.
3. Emotional irritability.
4. Depressed immune system.
5. Greater vulnerability.

Why do we sleep?

1. Sleep Protects: Sleeping in the darkness when predators loomed about kept our ancestors out of harm’s way.
2. Sleep Helps us Recover: Sleep helps restore and repair brain tissue.
3. Sleep Helps us Remember: Memory consolidation occurs during sleep.
4. Sleep may play a role in the growth process: During sleep, the pituitary gland releases growth hormone. Older people release less of this hormone and sleep less.

Sleep disorders

- Insomnia
  - Persistent problem falling or staying asleep
  - 20-65yrs: most likely due to stress
- Narcolepsy
  - Overwhelming sleepiness (directly into REM)
  - Genetic w/ no cure
- Sleep apnea and SIDS
  - Cessation of respiration
- Night terrors/sleepwalking
  - 20% of 3 to 12yr olds experience 1+ episode
- Sleep paralysis
  - Muscle paralysis of REM persists past awakening

Dreams

The link between REM sleep and dreaming has opened up a new era of dream research.
What We Dream

**Manifest Content:** A Freudian term meaning the story line of dreams.

1. **Negative Emotional Content:** 8 out of 10 dreams have negative emotional content.
2. **Failure Dreams:** People commonly dream about failure, being pursued, rejected, stressful situations (naked), or struck with misfortune.
3. **Sexual Dreams:** Contrary to our thinking, sexual dreams are sparse. Sexual dreams in men are 1 in 10; and in women 1 in 30.
4. **Lucid Dreaming:** With practice we can also learn to control the direction of our dreams.

Why We Dream

3. **Physiological Function:** Dreams provide the sleeping brain with periodic stimulation to develop and preserve neural pathways. Neural networks of newborns are quickly developing; therefore, they need more sleep.

Why We Dream

1. **Wish Fulfillment:** Sigmund Freud suggested that dreams provide a psychic safety valve to discharge unacceptable feelings. The dream’s manifest (apparent) content may also have symbolic meanings (latent content) that signify our unacceptable feelings. However, there is no empirical support after years of study.
2. **Information Processing:** Dreams may help sift, sort, and fix a day’s experiences in our memories.

Why We Dream

4. **Activation-Synthesis Theory:** Suggests that the brain engages in a lot of random neural activity. Dreams make sense of this activity.
5. **Cognitive Development:** Some researchers argue that we dream as a part of brain maturation and cognitive development.

All dream researchers believe we need REM sleep. When deprived of REM sleep and then allowed to sleep, we show increased REM sleep called **REM Rebound**.
### Dream Theories

#### Summary

<table>
<thead>
<tr>
<th>Theory</th>
<th>Explication</th>
<th>Critical Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freud's wish-fulfilment</td>
<td>Dreams provide a “psychic safety valve”—expressing otherwise unacceptable feelings, conflict manifestation, content and a deeper layer of latent content—a hidden meaning.</td>
<td>Lacks any scientific support; dreams may be interpreted in many different ways.</td>
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<tr>
<td>Information processing</td>
<td>Dreams help us sort out the day’s events and consolidate our memories.</td>
<td>Why do we sometimes dream about things we have not experienced?</td>
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<tr>
<td>Physiological function</td>
<td>Regular brain wave patterns from REM sleep may help develop and preserve neural pathways.</td>
<td>This may be true, but it does not explain why we experience meaningful dreams.</td>
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<tr>
<td>Activation-synthesis</td>
<td>REM sleep triggers neural activity that awakens dormant visual memories, which our dreaming brain weaves into stories.</td>
<td>The individual's brain is weaving the stories, which still tells us something about life dreams.</td>
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<tr>
<td>Cognitive development</td>
<td>Dream content reflects dreamers’ cognitive development—prior knowledge and understanding.</td>
<td>Does not address the neuroscience of dreams.</td>
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