Mystery of Sleep

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Neal Dach

Salvador Dali - 1937
http://surrealists.co.uk
Rebecca
• Why do we sleep?
• What happens when we don’t get enough?

Nina
• How does the brain regulate sleep?

Neal
• What happens in the brain during sleep?
“If sleep does not serve an absolutely vital function, it is the greatest mistake that evolution ever made”

- Allan Rechtschaffen

My kitten Dina, Tom Twigg photography, Wikipedia commons, Nature publishing
How do we know an animal is asleep?
What is sleep?

A behavior:
- Little or no movement
- Reduced responsiveness
- Temporary and reversible
- Usually confined to certain times/settings

A brain state:
- Electrical signals inside the brain change
- Can be affected by certain drugs
Why do we sleep

1. Protection
2. Energy Regulation
3. Recovery
4. Process Memories
Protection and Predator Avoidance
Energy Regulation

During wake your body uses energy

Movement

Thinking

Temperature regulation
Energy Regulation

During wake your body uses energy
- Movement
- Thinking
- Temperature regulation
Energy Regulation

During sleep your body conserves energy.
- Reduction in metabolic rate
- Reduction in temperature
Energy Regulation

During sleep loss
Changes in hormones which regulate metabolism
Increase in appetite

Wikipedia commons
Restoration and Recovery

Cellular housekeeping

• Increased cellular growth
• Removal of cellular waste

Immune Cell
Restoration and Recovery

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Memory Consolidation and Learning

Memory enhancement:
  Recollection is improved

Protection from interference:
  Memory is not confused with new, similar information
Memory Consolidation and Learning
Memory Consolidation and Learning

Information → Short term memory → Hippocampus → Long term memory storage
Sleep Deprivation Health Consequences

* Cognitive and performance impairment
* Reduced ability to judge own impairment

* Adverse effects on emotional state
* Decreased ability for social interactions
* Increased pain sensitivity

Long term:
Increased risk of obesity (energy regulation)
Increased risk of diabetes (energy regulation)
Increased risk of heart disease (immune response)

Drowsy Driving

http://healthysleep.med.harvard.edu/
Medical Residents

80 hours a week
30 hour maximum straight shift

Air Traffic Controllers

Inconsistent shifts
Short breaks between shifts
## Summary

<table>
<thead>
<tr>
<th>Sleep</th>
<th>Sleep Loss</th>
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<tbody>
<tr>
<td><strong>Predator avoidance</strong></td>
<td>- Being eaten by a lion</td>
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<tr>
<td><strong>Energy regulation</strong></td>
<td>- Increased appetite</td>
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<tr>
<td></td>
<td>- Hormonal changes</td>
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<tr>
<td></td>
<td>- Risk of obesity and diabetes</td>
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<tr>
<td><strong>Recovery from stress</strong></td>
<td>- Increased pain sensitivity</td>
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<tr>
<td></td>
<td>- Risk of heart disease</td>
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<tr>
<td><strong>Consolidates memories and enhances learning</strong></td>
<td>- Impaired cognition and performance</td>
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