Chapter 10: Sleep

Outline

A. Starting Out: Caught Between Sleeping and Waking

Consciousness and control while sleepwalking

B. Sleep and the Brain

How lack of sleep affects human cognition

Conclusions can we draw from the fact that all animals sleep

1. The Brain is Active During Sleep

Sleep cycles in humans

The two main categories of sleep

Non-REM sleep

Slow-wave sleep

Physical changes that happen to the body during REM

What happens in the brain during REM

Other animals that experience REM

Emergent stage 1 sleep

2. The Neural Networks of Sleep

Ventrolateral preoptic nucleus (VLPO)

The role of the VLPO in sleep

Damage to the VLPO

Insomnia

The arousal network

The sleeping/waking system is bistable

The sleeping/waking system is mutually inhibitive

3. The Brain During REM Sleep

Atonia

Acetylcholinergic neurons

How pontogeniculo-occipital waves are associated with sleep?

C. Research Methods: Electroencephalography (EEG)

What an electroencephalography monitors

Field potential and its relations to the use of EEG

The various types of brain waves

The frequencies of each brain wave

Electrooculography

Electromyography

D. The Circadian Rhythm

The definition of a circadian rhythm

What effects how long a person sleeps at night

Circadian rhythms are endogenously generated

Circadian rhythms in the absence of external cues

The mammalian internal clock

1. Entrainment of the Circadian Rhythm by Light Cues

Entrainment

Factors that can entrain the circadian rhythm

Zeitgebers

Melanopsin

The role of the pineal glad

2. The Circadian Rhythm is Not Fixed

Variation in sleep phases

Jet lag

3. The Circadian Rhythm and Napping

Monophasic sleep

Polyphasic sleep

E. Case Study: The Shifted Circadian Rhythm

Delayed sleep phase syndrome

Advanced sleep phase syndrome

Non-24-hour sleep-wake syndrome

F. The Bigger Picture: Schools and Circadian Rhythms

Circadian rhythm in teenagers

G. Why Do Brains Sleep?

Indicators that sleep is vital to life

1. Four Theories of Sleeping: Restoration, Survival, Simulation, Learning

How exercise effects sleep

Neurotransmitter levels during sleep

Indications that sleep is not purely restorative

Evidence against the theory of sleep as a survival advantage

Study on threatening dreams (South Africa v. Wales)

Sleep as a way to process information

2. Rehearsal

What happens to memories when they are reactivated during sleep

What happens during sleep when humans are learning a new task

What increased levels of SWS activity in specific regions on the brain indicate

Differences in performance levels after a nap involving only REM sleep,only SWS sleep, both types of sleep

3. Forgetting

The importance of forgetting during REM sleep

4. Insight and the Restructuring of Information

How sleeping might play into gaining insight and solving problems

H. Dreaming

REM sleep as humans age

Dreaming during non-REM sleep

Dream loss or impairment

1. Dream Content

Sigmund Freud

The activation-synthesis model

Content of dreams across cultures and time

Differences in the dreams of adults and children

Dreaming a learned “skill”

Dream development

2. Can Dreams Shed Light on Consciousness?

Activation during REM sleep

Difficulties of using the dreaming state to study consciousness

3. Dreams of the Future and How to Study Them

What can influence dreams

Drug use that results in more vivid and frightening dreams

How antidepressants effect sleep

How anti-seizure medication effects sleep

I. Neuroscience of Everyday Life: Lucid Dreaming

Lucid dreams

Training yourself to have more lucid dreams

The passage of time in lucid dreams

Higher levels of alpha waves present during lucid dreams than during regular dreams

J. Sleep Deprivation and Disorders

1. Sleep Deprivation

Microsleeps

Occupations that are more likely to correlate with sleep deprivation

The cognitive effects of sleep deprivation

The physical effects of sleep deprivation

2. Insomnia

A continuous state of hyperarousal

Hypnotics

-Benzodiazepines and nonbenzodiazepines

-GABA

Fatal familial insomnia

Restless leg syndrome (RLS)

3. Hypersomnia

Hypersomnia

External factors that may influence hypersomnia

Narcolepsy

Cataplexy

Sleep paralysis

Hypnagogic hallucinations

Automatic behaviors

Orexin/hypocretin

Narcolepsy: a genetic condition? An autoimmune disorder?

4. Parasomnia

The definition of a parasomnia

Somnambulism (sleepwalking)

Night terrors

REM sleep behavior disorder

K. Case Study: Staying Awake

Randy Gardner and extreme sleep deprivation (264 hours)

Mood swings

Inability to concentrate

Paranoia and hallucinations

L. Case Study: The Family Who Couldn’t Sleep

Fatal familial insomnia

Prion disorder