

SLEEP

Thursday, October 6, 2016

12:30 PM

Sleep: absence of overt behavior, absence of consciousness.

-> Measures are indirect.

Methods to measure sleep characteristics.

- ElectroMyoGram(EMG): muscle activity(face/legs)
- ElectroEncephaloGram(EEG):Brain activity
- ElectroOculoGram(EOG): Eye movements
- Air flow measurements: breathing
- Heart Rate..

Sleep has different stages characterized by different EEG waveforms (Frequency content)

Delta: 0- 4hz

Theta: 4-8hz

Alpha: 8-12hz

Spindles 12-13hz

Beta: 13hz-30hz

Gamma: 30+hz

Sleep Stages & Rhythms

1. Awake
2. Stage 1 sleep: theta activity-> drowsiness, heavy eyes.. Lasts ~10 minutes)
3. Stage 2: sleep spindles, k complex-> sensory disconnection lasts ~15 minutes

Stages 3 & 4 are combined and known as Slow Wave Sleep

- During this process neurons undergo up and down states: periods of activity/silence (1 period/second)
 - Down state: rest
 - Up state: neuron is firing. Memory consolidation.
- 4. Stage 3: delta activity (low to increasing slowly)
- 5. Stage 4: Delta activity (high) lasts ~60 minutes
- 6. R.E.M: Dreaming, loss of muscle tonus, rapid eye movements, activity in sexual organs. Theta & Beta desynchronize. ~Lasts 25 minutes. Also called Paradoxical sleep.

Sleep is a cycle. Free running sleep/wake cycle.

- experiment: room/cave without windows, free food, entertainment, no clocks.
- measure: the amount of time awake/sleeping
- result: sleep/wake cycle is not the same as day/night cycle

Free running awake/sleep cycle lasts ~25 hours.

REM/NON-REM cycles every 90 minutes and is controlled by an internal clock.

REM sleep has a refractory period of ~ 1 hours. Increase of metabolic activity in CNS, decrease of activity in the PNS. Sexual organs activity. Dynamic dreams.

Why do we sleep?

- Sleep is a behavior (adaptive response).
- All animals have slow wave sleep, but only mammals and birds experience REM sleep. Sleep is a "protective behavior". It is dangerous to move at night..

[OR]

- Sleep as a restorative process. Resting of the brain(but not related to the body's activity).

Evidence:

- Cortex: Metabolic activity and blood flow decrease by 25% (during slow wave sleep)
- Highest activity (when awake)
 - >Highest delta and lowest activity during slow wave sleep
- Sleep needs vary with development.

Sleep is a need (genetic basis)

Different species have very different sleep needs.. (see diagram)

Brown bat sleeps 82.9% whereas the giraffe sleeps about 8%

Sleep duration in humans

- Sleep need vary among humans (4-10 hours)
- Sleep starts in utero (in the womb)
- Sleep needs vary along the life span. Need less and less sleep as we age.

Slow Wave Sleep

- Deprivation studies
 - No significant physical consequences (human)
 - Loss of weight and death (rats)
 - Not proportional function of recuperation.
- Slow Wave Sleep need is not related to physical exercise,
- Brain metabolic activity decreases *by 25%, delta occurs in the region that were the most active in the awake state.
- Related to mental activity and declarative memory consolidation
 - Nap after learning
- Related to body temperature.
 - Aspirin/ ibuprofen had a lower temperature which prevents slow wave sleep
 - Citokines (immune response) increased temperature slow wave sleep.
- Dreams: Static Images.

REM Sleep

- deprivation studies possessed a significant consequence on cognitive performance
- REM sleep shows rebound phenomenon after deprivation
- Brain metabolic activity increases.
 - In infants: REM= 70% of sleep, developmental role?
 - In adults: REM=15% of sleep, learning & memory, consolidation, forgetfulness.

Sleep Disorders

Insomnia:

- Sleep needs are variable (4-8 hours) Depends on genetic and environmental factors. (Health, day activity, mood) Insomnia depends on the individual.
- Insomnia is the overall problem of falling asleep. It may be due to stress, psychological factors or drug rebounds (after benzodiazepines (valium) or barbiturates (Anxiolytics))
- Quantity of sleep vs quality of sleep. (sleep apnea)

REM Sleep Disorders

- Sleep attacks (low arousal, few minutes. Sleep)
- Cataplexy(high arousal, no loss of consciousness)
- Sleep paralysis (awake atonia): just before or after sleep
- Hypnagogic hallucinations (awake, dreaming, usually nightmares)
- REM without atonia (aka REM sleep behavior disorder) acts out dreams.
- Narcolepsy: genetic and hormonal (Orexin) bases

Slow Wave Sleep Disorders

- Sleep walking (15% of children 5-12 do it at least once)
 - Eyes are open, no arms stretched outward, state of half consciousness, usually no walking, sleep related disorder.
- Sleep talking (Hypnosis, truth serums)
- Night Terror (fear of losing consciousness? No memory of the event)
- Fatal Familial Insomnia: Damage to thalamus. Insomnia, paranoia, hallucinations, dementia, death. Related to ' mad cow disease' No cure, genetic.
- Bed-wetting: Primarily in children, partially genetic and partially environmental.

If you had a quiz

T/F our natural sleep/wake cycle is always exactly hours

-false

t/f The brain is much less active in REM sleep than in SWS

-False, the opposite as stated.

You dream full dynamic stories during _____ sleep. Sleep attacks may occur during _____ sleep.

REM & REM

Research shows that REM Sleep is involved in:

Patients suffering from cataplexy