Reticular III Unit 16
By Kunal Shah

2 stages of sleep can be distinguished by EEG, behavior, and pharmacologically:

1) Slow wave sleep has 4 progressively deeper stages, each stage with deeper and slower EEG waves. Heart rate, BP, and respiration are stable, and decreased from waking.
2) REM sleep (aka paradoxical sleep, active sleep, and desynchronized sleep) shows brain activity similar to that of an awake, alert, and active state, however the body is paralyzed

It is not yet known which brain areas control sleep, however many sites contribute.

Slow wave sleep-

-Characterized by **high voltage, low frequency**, synchronized brain waves.
-Individuals can move (ie shift position about every 20 mins).
-**Parasympathetic** activity dominates: decreased HR, BP, and respiration
-Slow wave sleep can be divided further into 4 stages (1, 2, 3, and 4) with progressively lower frequency and higher voltage waves.

Stage 1 = people have hypnic myoclonia (big muscle contractions)
Stage 2 = "spindle sleep" due to intermittent bursts of activity on EEG.
Stage 3 and 4 = "delta sleep." Night terrors and sleepwalking in these stages.
Stage 4 sleep most difficult to interrupt. Sleep deprivation increases time spent in type 4 sleep.

***Benzodiazepines** can suppress stage 4 sleep

REM sleep-

-Characterized by **low voltage, fast activity** pattern in brain waves
-Rise in brain temperature, and **sympathetic** activation leading to increased HR, BP, GI movements, and respiration (also erection….=morning wood?).
-Muscle **atonia**. Only muscles of eye and middle ear are not paralyzed. Paralysis stems from the locus coeruleus (in pons). *A lesion here=no muscle atonia during REM.*
-REM sleep is both the hardest to awaken someone (deep), and the one most likely to be spontaneously awaken (light).
-REM is suppressed by alcohol and barbiturates
-Bursts of electrical activity found in pons, thalamus, and visual and auditory cortex (PGO spikes)
-**REM sleep deprivation = decreased performance on learned mental skills**.

Sleep cycle

-Non- REM and REM sleep cycle with 4-6 periods, at 90 minute intervals
-Later in the night, mostly in stage 2 or REM stage
-REM=20-25% of total sleep
-Stage 1=5%

-Stage 2=50%
-Stage 3=5%
-Stage 4=15%

-Total sleep decreases with age.

-Sleep may be viewed as the active inhibition of the ascending reticular (ARAS) and hypothalamic activating systems.

-Parts of the more rostral reticular formation are required to maintain wakefulness, while parts of the more caudal reticular formations are necessary to permit sleep.

-Destruction of the raphe produces complete insomnia, while administration of drugs that increase serotonin levels increases the amount of non-REM sleep.

-**The reticular thalamic nucleus** is actively inhibited during waking, but are released from inhibition during slow wave sleep.

-Since information from the periphery to the cortex is processed through the thalamus, **inhibiting thalamic relay neurons means the higher brain is cut off from outside interruptions.**

Sleep Disorders

Caused by:
-Brain related [Circadian rhythms, neurological, psychiatric (ie depression)].
-Other medical causes (Obstructive sleep apnea, Asthma, COPD, Pain)
-Behavior (poor sleep hygiene, drugs)

Insomnia:

-Either inability to achieve sufficient sleep, sense of insufficient sleep, difficulty in falling asleep

-Effects: memory, concentration, link with CV, depression (x4), impaired performance

Sleep Apnea:

-Brief periods of interrupted breathing during sleep

-Obstructive Sleep Apnea- the major cause of daytime sleepiness

-Accompanied with snoring, overweight, neck/throat abnormalities.

-Treatments to reduce the above

Narcolepsy:

-Sudden irresistible sleep attacks

-2nd leading cause of excessive daytime sleepiness

-Symptoms:

-Cataplexy-a sudden loss of muscle tone ranging from slight weakness to total collapse, triggered by intense emotion.

-Sleep onset paralysis/sleep offset paralysis

-Hypnagogic hallucinations-vivid, often scary dreams and sounds reported when falling asleep

-Sleep onset REM

-Caused by mutation in receptors for the hypothalamic neuropeptide transmitter, hypocretin.

-Diagnose with history and nocturnal polysomnogram

-Treatments- modafinil, stimulants (Dexedrine, Ritalin), ant depressants, lifestyle adjustments.

Other sleep disorders include: Restless Leg Syndrome, Periodic Limb Movements in sleep, and Nocturnal Sleep-Related Eating Disorder