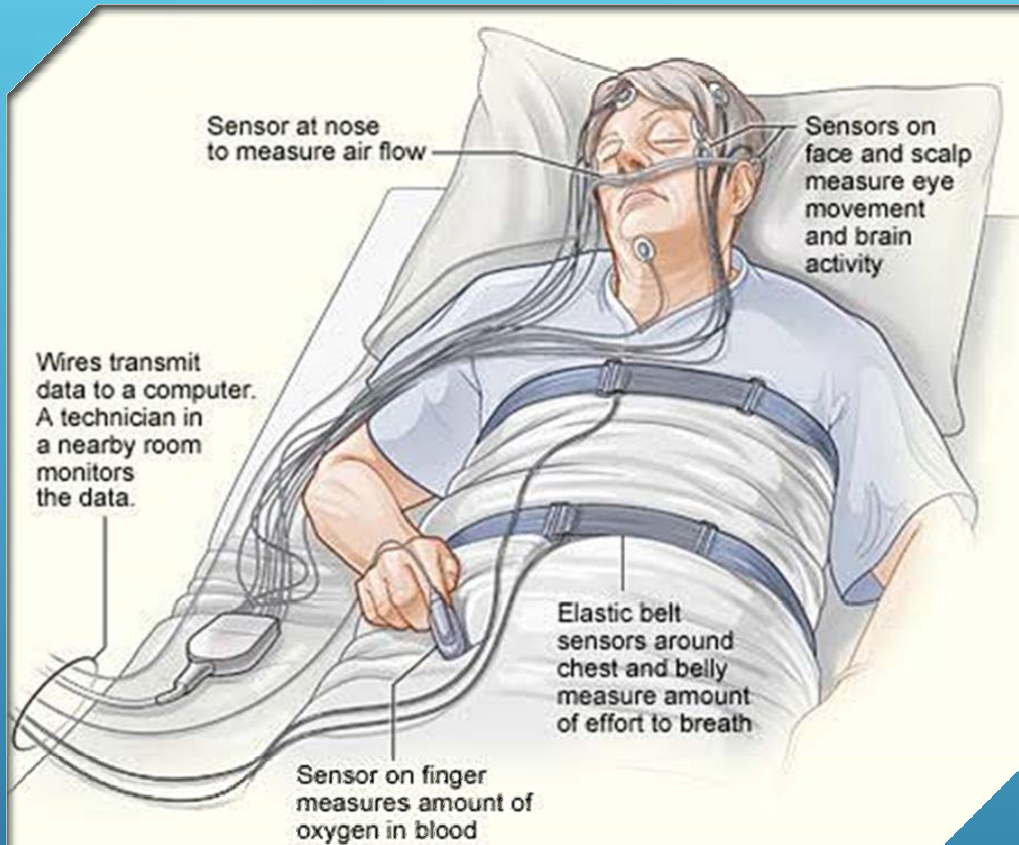


SLEEP AS A SCIENTIFIC PHENOMENON

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POLYSOMNOGRAPHY

Polysomnography (PSG) is a multimodal technique to measure physiological processes during sleep.

PSG includes electroencephalogram (EEG – measures of electrical impulses in the brain), electromyogram (EMG – measures of skeletal muscle movements), electrooculogram (EOG – measures of eye movement), and other physiological indicators of sleep.



STAGE 1 SLEEP

During this stage, the EEG is dominated by theta waves: waves of low to moderate intensity and intermediate frequency (3-7 Hz;).

Further, EOG measures slow rolling eye movements and EMG measures moderate activity.

The person becomes less responsive to stimuli and has fleeting thoughts.



STAGE 2 SLEEP

Two patterns: K-complexes and sleep spindles

A K-complex typically has a duration of a half second and is large and slow. These each occur as a single wave amongst the theta waves.

Sleep spindles are bursts of waves. They have a frequency of 12-14 Hz and are moderately intense. Like K-complexes, these spindles do not last long: only a half to one and a half seconds.

During stage 2, there is no eye movement and EMG measures moderate activity. This stage brings increased relaxation in the body that is characteristic of sleep, such as decreased heart rate, respiration, and temperature.



STAGE 3 & 4 SLEEP

During Stage 3 and Stage 4 sleep, a person transitions into slow wave sleep (SWS). Stage 3 and Stage 4 are characterized by delta waves, which are high amplitude, low frequency waves (0.5-3 Hz) and signify the deepest level of sleep. Initially, delta waves are mixed with higher-frequency waves, but as Stage 3 progresses to Stage 4, delta waves come to dominate. During SWS, a person continues to show no eye movement and moderate muscle movement. The heart rate and digestion slow, and growth hormones are secreted.



STAGE 5 SLEEP

REM sleep, which is characterized by bursts of quick eye movements. Also unique to REM sleep, the EEG measures waves that most resemble the beta waves seen in individuals when awake. However, the waves in REM sleep are sawtooth waves with low intensity and variable frequency. These waves are more jagged in appearance than beta waves, which are also low intensity, but high frequency (16-25 Hz).

Unlike the conscious state, REM sleep is characterized by low (almost no) skeletal muscle movement: hence the name “paradoxical sleep.”

Although the person physiologically appears to be awake, their muscle movement does not corroborate, as the individual is nearly paralyzed except for sudden bursts or twitches. REM sleep is generally when dreams occur.



SLEEP AND CIRCADIAN RHYTHMS

Circadian rhythm refers to the biological waxing and waning of alertness over the 24-hour day, sometimes known as the biological clock.

Body temperature rises as the morning approaches, is at a high during the day, dips in early afternoon, and then begins to drop again before sleep at night. Light, both natural and artificial, also influences the biological clock by activating light-sensitive proteins in the retina. These proteins send signals to the brain's pineal gland, which is the region responsible for the production of melatonin, a hormone that induces sleep.

SLEEP DISORDERS

DYSSOMNIAS

Insomnia is the most common sleep disorder and is characterized by difficulty falling or staying asleep.

Those with **narcolepsy** experience periodic, overwhelming sleepiness during waking periods that usually last less than 5 minutes.

Sleep apnea is a disorder that causes people to intermittently stop breathing during sleep, which results in awakening after a minute or so without air.

SLEEP DISORDERS

PARASOMNIAS

Somnambulism (or sleepwalking) tends to occur during slow wave sleep (Stage 3), usually during the first third of the night. There may be genetic predispositions for sleepwalking and sleeptalking.

Night terrors also usually occur during Stage 3 (unlike nightmares, which occur during REM sleep toward morning). A person experiencing a night terror may sit up or walk around, babble, and appear terrified, although none of this is recalled the next morning.