

## Sleep Stages Classification

The most common frequency bands of EEG used to characterize the sleep cycle are:

- **Alpha** - the approximately 10 Hz EEG rhythm characteristic of relaxed wakefulness, but also seen, generally at a somewhat slower frequency, during REM sleep.
- **Beta** - An EEG frequency of between 15 and 30 Hz.
- **Delta** - A slow EEG rhythm, with a frequency of 3Hz or less with high voltage. Characteristic of Quiet Sleep or, as seen in humans and primates, sleep stages 3 and 4. Most common in the mid-brain area, or just anterior of Lambda.
- **Theta** - EEG wave forms of 4-6 Hz, most common in the parieto-temporal (frontal – or anterior of Bregma) areas and sometimes associated with emotional activity.

Common transient EEG patterns used for sleep stage identification (primarily in humans and primates):

- **K-complexes** - Sharp negative high voltage EEG waves that are followed by a slower positive component. In some species, K-complexes occur spontaneously during NREM sleep. They are also seen during SWS as evoked responses to external stimuli.
- **Spindles** - A rhythmical, repetitive waveform of 12-14 Hz seen against a background of mixed EEG frequencies. Associated with stage 2 sleep (or SWS) in some species.

Wake EEG is dominated by the alpha rhythm, while the remainder of the EEG is characterized by lower voltage, irregular waveforms with a mixture of frequencies.

Human sleep comprises two physiological states:

- **NREM** (non rapid eye movement) sleep and
- **REM** (rapid eye movement) sleep, also known as paradoxical sleep (PS)

NREM sleep consists of four stages, each of which is characterized by progressively slower brain wave patterns, with slower patterns indicating deeper sleep (sleep spindles/delta oscillations). NREM makes up about 75% of total sleep time and gives way to the first REM episode of the night, which makes up approximately 25% of total sleep time.