

## Biorhythms, Sleep and Dreaming - Dreaming

The nature of sleep was unknown until the 1930s when the EEG was invented. The EEG measures brain activity. By the 1950s, the nature of sleep had been researched and identified culminating in the work of Dement and Kleitman who linked rapid eye movement (REM) sleep with dreaming.

There are two kinds of sleep – non-REM (now known as Slow Wave Sleep), and REM. Each sleep cycle last approximately 90 minutes. The stages of the cycle are as follows:

1. Before the onset of sleep, brain activity changes from low amplitude and high frequency Beta waves to Alpha waves of higher amplitude but slower frequency. This is now a relaxed state.
2. Stage 1 of slow wave sleep then begins. Breathing and heart rate slow down, temperature drops and muscles relax. Irregular and slower Theta waves appear as we enter stage one sleep.
3. After about one minute in stage one, the EEG shows another change which marks the beginning of stage 2 sleep. The waves are medium amplitude and quite slow but there are also bursts of high frequency waves known as sleep spindles. In addition, if a familiar sound such as calling the person's name occurs, this will register on the EEG as a K-Complex. This shows that we are still capable of perceiving our environment even though we are in stage 2 sleep. We spend approximately 20 minutes in this stage while brain activity gets gradually slower with higher amplitude turning into Delta waves.
4. As stage 3 sleep approaches, up to half of brain waves have become Delta waves, even slower in frequency but begin to grow in amplitude. Gradually the percentage of Delta waves increases and when they reach well over half of the brain waves, we have entered stage 4 sleep. This transition into stage 4 from stage 2 takes approximately five minutes. Stages 3 and 4 are the deepest stages of sleep. We do not respond to the environment and it is extremely difficult to be woken up during these stages. Muscles are extremely relaxed and heart rate, blood pressure and temperature are at their lowest. The first period of stage 4 sleep lasts about 40 minutes.
5. We start to climb the sleep staircase going through stage 3, into stage 2 where we spend approximately ten minutes.
6. Instead of returning to stage 1, brainwaves become desynchronised, lower amplitude and high frequency as if you were awake and alert. At the same time, eye muscles begin to twitch and eyes begin to move around sockets. Muscles become paralysed; we have now entered the first period of REM sleep. This lasts for approximately ten minutes. End of first sleep cycle.
7. Following the first bout of REM sleep, we return to stage 2 and stay there for about 25 minutes.
8. We then descend rapidly through stage 3 into stage 4 where we spend the next 30 minutes in deep sleep.
9. Travel back through 3 into 2 and this time quickly into REM sleep, lasting about ten minutes.
10. We then descend into stage 2 for about an hour. Instead of further movement within slow wave sleep, we then enter REM sleep for as long as 40 minutes. In the third cycle, you do not enter stages 3 or 4. This pattern is repeated in the fourth cycle.
11. The fourth cycle begins with around 70 minutes of stage 2 sleep immediately followed by the fourth bout of REM sleep.
12. First four cycles take about seven hours. Fifth cycle will end with us waking up – fifth cycle known as emergent sleep. You can wake straight from REM or from stage 2 sleep.