

Why Do We Sleep and Dream?

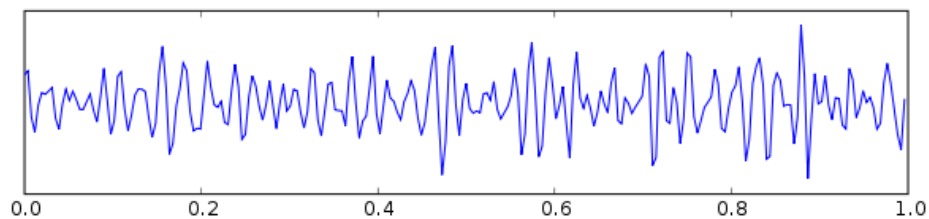
Dr. Govind Bhattacharjee¹

“To sleep, perchance to dream-ay, there’s the rub.” Hamlet

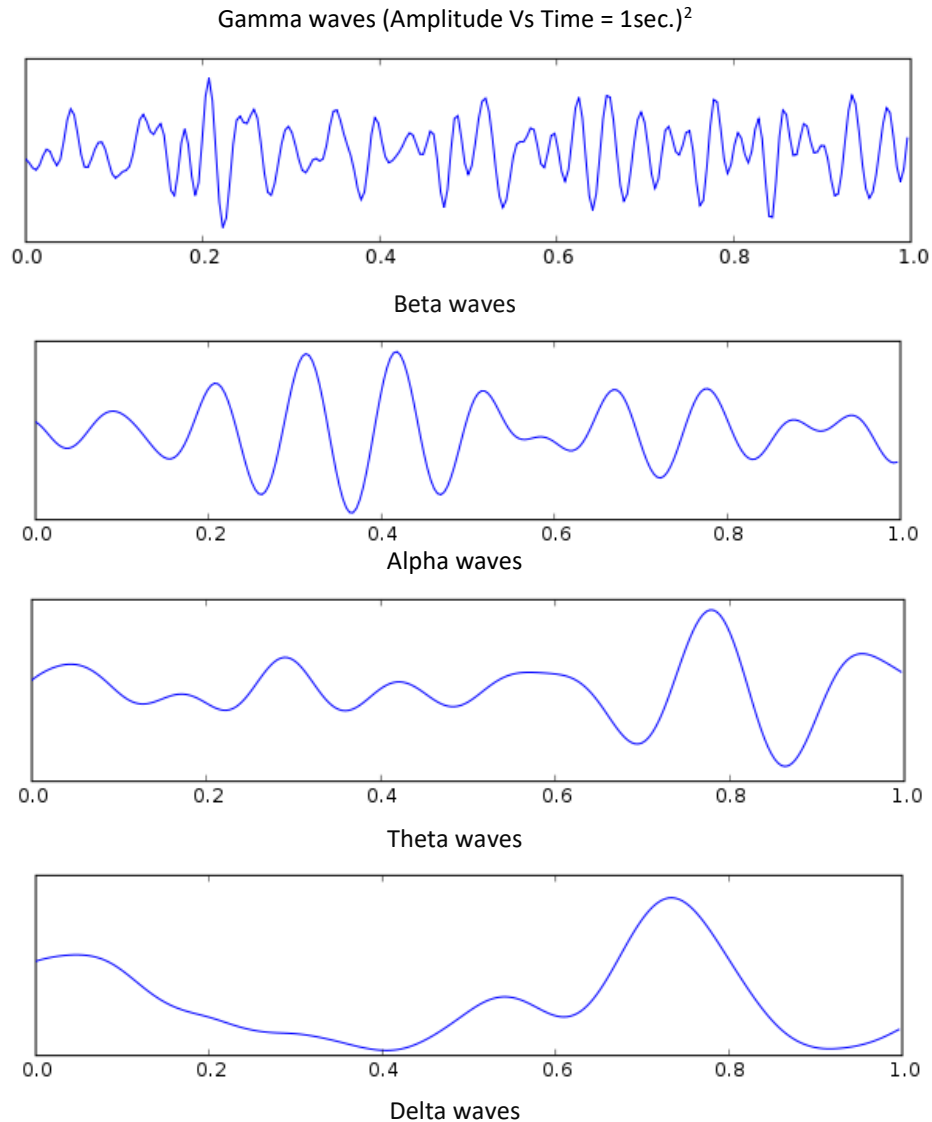
Why do we sleep? There are various theories - and none explains it fully. We know that deprivation of sleep causes various problems including irritability, lack of focus and concentration, and interferes in our ability to learn complex tasks and also in recalling from our memories. Evidence suggests that during the deepest sleep, the body secretes useful enzymes and growth hormones in higher amounts – this may partly explain why children during their growing periods sleep most of the time.

EEG studies allow us to monitor the activities of the brain during sleep. From these studies we know that there are basically two types of sleep: REM (Rapid Eye Movement) and Non-REM (NREM) sleep. REM sleep is relatively active in which the eyes move rapidly under our eyelids, and most of our dreams occur during REM sleep only. Non-REM is a much deeper and restful sleep during which there are no eye movements; even if we dream during this type of sleep, we usually do not remember them upon waking. It has also been proved that we dream in real time and that the body is usually paralysed during dreaming to protect it from injuries arising from the movement of limbs that may be triggered by the dreams.

Scientists have identified five types of waves in the brain: (1) the high frequency gamma waves (40-100 cycles per second), which are important for learning, memory and information processing, and are associated with higher cognitive tasks. (2) The active mental state corresponds to what is known as beta waves, vibrating at frequency of 12-40 cycles per second, which are commonly observed when we are awake and active, and engaged in logical thinking and problem solving. (3) The alpha waves with a frequency range 8-12 cycles per second help promote deep relaxation; these waves are also triggered by psychedelic drugs like marijuana or alcohol. There are believed to be the gateway to our subconscious mind lying at the base of our conscious awareness. (4) Theta waves predominate during what is known as REM sleep; these trigger experiences of intuition, relaxation and creative surges. These are present during light meditation and sleep, including the all-important REM dream state. (5) Finally, the deep sleep patterns correspond to delta waves in the brain vibrating at frequencies of 0.1 to 4 cycles per second; these are associated with the deepest levels of relaxation. The Delta frequency is the slowest of the frequencies and is experienced in deep, dreamless non-REM sleep and in very deep, transcendental meditation. It is believed to be in the realm of the unconscious.



¹ The author is a senior civil servant and also a writer of popular science as also a commentator on socio-economic issues.

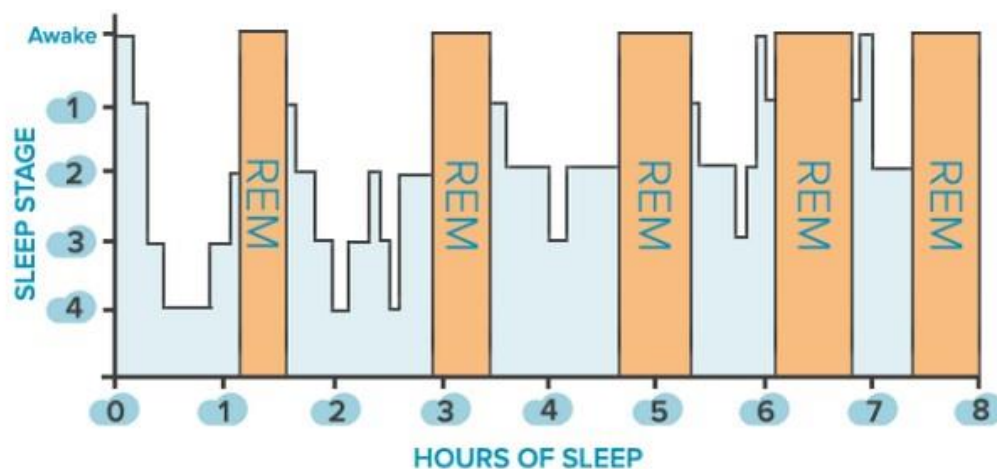


These wave patterns are observed during our sleep also. Being conscious means being aware of our surroundings as well as being aware of feelings, emotions, sensations, thoughts and feelings which we experience when we are awake. In waking consciousness, we remain alert and can organise and control our thoughts and feelings to a large extent. Sleep is an altered state of consciousness in which our mental activities undergo a shift from the waking consciousness. The sleep-wake cycle is a circadian rhythm, a bodily cycle that occurs and completes over a period of 24 hours. It is controlled by an internal clock in a part of the brain called the hypothalamus that guides us to fall asleep and to wake up at particular times. As night approaches, it makes the pineal gland in our head to secrete the hormone melatonin that makes us sleepy and as daylight approaches, it tells the pineal gland to stop secreting melatonin to wake us up. The circadian rhythm is a by-product of our evolution. The hypothalamus also controls the body temperature which falls when we are asleep.

² All graphs from https://commons.wikimedia.org/wiki/File:Eeg_gamma.svg, delta.svg etc.

Each night, our brain transitions through several sleep cycles, each cycle comprising five stages of sleep – four NREM sleep followed by one REM sleep - with their distinctive patterns of brain waves. Each cycle takes about 90-110 minutes to complete. During an 8-hourly sleep pattern, one may pass through 5 such cycles. The first of these five stages is a light sleep into which people fall when alpha waves fade away, and theta waves start dominating the brain. Most sensory movements come to a stop followed by the loss of self-awareness.

As we drift further into sleep, during the second stage, as the body temperature drops, the heart rate slows down, and breathing becomes shallow. Half our sleep is spent in this stage of a light dreamless sleep, with theta waves still predominating while our physical bodies undergo sleep paralysis with the loss of almost all muscle tones. The slowest and longest delta waves start appearing during the third and fourth stages of NREM sleep. Once these waves make up more than half the total brain activity during stage four, we fall into a deep, peaceful and restful sleep. While the body is at the lowest level of activity, the release of growth hormones from the pituitary gland peaks during stage four. It is during stage four that sleep disorders like sleep-walking or *somnambulism* may occur during which the walker apparently has no memory. Some people also suffer from night terror – characterised by extreme fear or screams during this stage.

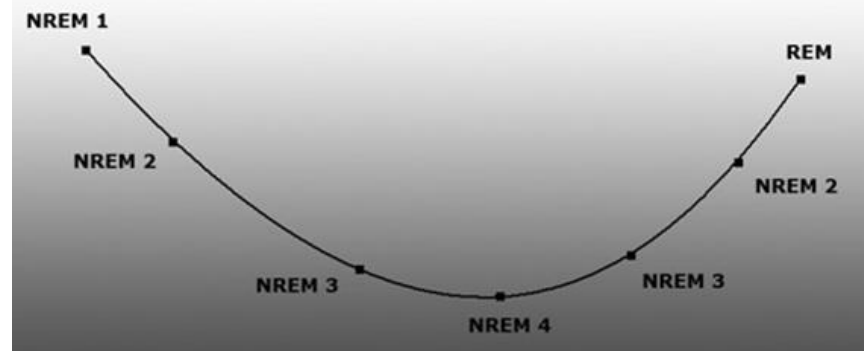


Five Stages of Sleep³

After stage four, a person will go through stages three and two again and then he falls into a pattern of sleep characterised by rapid movement of the eye under the eyelids. This is the fifth and the last stage of REM sleep in the cycle; this also marks the onset of dreaming. Brain is now dominated by beta waves similar to those resembling a state of wakefulness – this stage is hence known as *paradoxical sleep* because the person is still asleep. Awakened from the REM sleep, a person is able to recollect the dream. Ninety percent of our dreams occur during REM sleep, which are very vivid. Nightmares may also occur during the REM sleep, and in a fairly serious disorder known as the 'REM behaviour disorder', a person may even act out the nightmares as the muscles cease to be paralysed. While NREM sleep restores

³ Source: <http://www.world-of-lucid-dreaming.com/>

the physical body, REM sleep deals with the stresses and emotions of the day. A person deprived of sufficient REM sleep during a night will usually experience a 'REM rebound' the next night, with highly increased REM sleep.



Transition through Various Sleep Stages⁴

It is also during the REM stage that people may experience lucid dreaming, when they are aware that they are indeed dreaming. Lucid dreaming is conjectured to be a unique state of consciousness, characterised by high frequency gamma waves and heightened activity in the frontal and front-lateral areas of the brain connected with linguistic and other higher mental functions linked to self-awareness.

Why do we dream? Since times immemorial, people have pondered over the meaning of dreams. Towards the end of the nineteenth century Sigmund Freud and Carl Jung attempted to address the problem through the psychological method called psycho-analysis. Freud believed that dreams arose from our repressed desires, although in symbolic form. The actual dream he called the 'manifest' content as opposed to its 'latent' or hidden content, which is the symbolic meaning of the manifest content, which, when interpreted correctly, would bring out some unconscious conflict in the mind of the dreamer. For interpreting the dreams of patients, Freud used the technique of 'free association' in which patients were encouraged to say whatever came into their minds without the fear of being negatively judged, thereby revealing their unconscious concerns. Freud believed that the repressed impulses would then break free into their consciousness. Dreams, as he famously said, were "the royal road to the unconscious."

Jung, while believing in their psychological importance, differed with Freud in their interpretation. Though both believed that the dreams arose from the unconscious mind, Jung held that there was a collective unconscious, besides the personal unconscious. The collective unconscious constructs the archetypes, the collective, universal memories and ancient fears that surface in our dreams through symbols. Some of the archetypes he identified included the *anima* and the *animus* – the feminine side of a man and the masculine side of a woman respectively, and the *shadow* and *persona* – the dark, hidden side of personality and the side known to the world.

Modern psychoanalysis has of course progressed far ahead of the Freudian times. Freud's obsession with sexuality as the root problem of all psychological disorders probably arose from the fact that most of his

⁴ *Ibid.*

patients were wealthy Austrian women who lived in the era of sexual repression. His theory of free association was also ambiguous and lacked the support of concrete scientific evidence.

In 1953, sleep researchers Eugene Aserinsky and Nathaniel Kleitman discovered that dreaming was associated with REM sleep and that sleepers could recall dreams most frequently if they were awakened when their eyes appeared to be moving rapidly beneath their eyelids. This discovery gave researchers a useful tool to monitor dreams. Scientists today reject the Freudian theory of dream interpretation. A landmark 1977 scientific paper by John Allan Hobson and his Harvard colleague Robert W. McCarley boldly called for "important revisions" in psychoanalytic dream theory, proposing instead the so-called "activation-synthesis model of dream production", which argued that the primary motivating force for dreaming is not psychological but physiological. The "activation-synthesis hypothesis" states that dreams actually do not mean anything - they are merely electrical impulses in the brain that pull random thoughts and imagery from our memories. In order to make sense of it all, humans, according to this theory, make up their dreams after waking up. However, it is now known that other mammals such as cats also dream. From this and other available evidence, evolutionary psychologists have formulated the "threat simulation theory" which suggests that dreaming is an ancient biological defence mechanism that provided an evolutionary advantage to the mammals by simulating potential threatening events – preparing them for efficient threat perception and avoidance".

New research also points to the strong relationship between dreams and memories, and between emotions and dreams. It was found that vivid and emotionally intense dreams – the ones that people generally remember - are linked to increased activity in brain areas like amygdala and hippocampus, which are important for our memory processing. Interestingly, scientists have identified where dreaming occurs in the brain, ever since a patient had reported to have lost her ability to dream, having suffered a lesion in a part of the brain known as the right inferior lingual gyrus, located in the visual cortex. Thus, we know that dreams are generated in, or transmitted through this particular area which is associated with visual processing, emotion and visual memories.

All these discoveries reflect on the possible purpose of dreaming which is to guard ourselves against emotions, especially the negative ones. Even if the dreams are unreal, the emotions attached to them are real. Dreams, by creating a memory of a certain experience, try to take the emotion out of it, especially when the emotion is negative which can increase our worries and anxieties. This is supported by the increased correlation found between severe REM sleep-deprivation and mental disorders. Nobel laureate Francis Crick and his colleague Graeme Mitchison argued that dreams are nothing more than a mechanism for the nervous system to clear the brain of unnecessary cognitive debris that it accumulates every day.

All over the world, people seem to have remarkable commonality between dreams. Psychologist Cavin Hall (1996) concluded in the basis of survey of about 10000 dreams that most dreams reflect events that happen in our daily life. In his book "Finding Meaning in Dreams" (1996) based on extensive survey, Dr William Domhoff concluded that across cultures, men dream more often of men, while women dream equally of men and other women. Dreams dreamt by men also have more sexual contents. Psychologist Ian Wallace has interpreted over 150,000 dreams during more than 30 years of his practice and listed the following dreams amongst the most common: Being chased by animals or snakes, teeth falling out, being

unable to find a toilet, being naked in public, being unprepared for an exam, fear of flying, fear of falling, being in an out-of-control vehicle, being late and finding an unused room. Some of these dreams may possibly reflect our evolutionary developments and fears, like the fear of falling from a tree dating back to the time when primates were living arboreal lives and were in mortal fear of falling from the trees on the ground that was dominated by mighty ground-dwelling predators or being chased by a reptile, again recollecting a period when mammals were struggling with reptiles for supremacy upon earth.

Happy sleeping and dreaming, surrounded by all these theories!