The Dream World

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"YOU HAVE TO DREAM BEFORE YOUR DREAMS CAN COME TRUE"

- Dr. APJ Abdul Kalam

HOW does one explain a dream house, a dream job, or a dream girl in a Bollywood movie? Mere fantasy? All they imply is – a coveted, hard to get, much longed for house, job and so on; your 'dream comes true' when you get what you desired.

Dreams can be aspirations, play the role of a mentor or guide at times, predict the future or remind you of past tidings, nightmares and so on. As for me, I always 'dream' of driving my own car in a fast lane, bungee-jumping, roller coaster rides, giant wheels–all of which I am otherwise petrified to do in real life–add wishful thinking to the list?

In short, dreams mean different things to different people. What are dreams made of anyway? And why do we dream? These are the two big questions that are baffling, fascinating and have captivated our imagination for a long time.

A few key points about dreams and dreaming: Though many people may not remember, everyone dreams from 3 to 6 times per night. Around 95% of dreams are forgotten by the time a person is out of bed. Usually, five minutes after a dream people forget 50% of its content – increasing to 90% in another five minutes.

It is thought that each dream lasts between 5 and 20 minutes. People that feature in a dream are often recognised by the dreaming person. The dreamer does not have much control over the content, visual images and activation of the memory. As for dreams predicting future – usually it can be due to coincidence, a false memory or the unconscious linking together of known information.

Experts still do not fully understand why we dream or what causes them. There are several hypotheses and concepts with likely explanations as to why we dream. From available evidence and methodologies, researchers also speculate that dreaming

- consolidates learning and memory tasks,
- simulates real-life experiences,
- represents highly meaningful functioning of unconscious mental processes, and
- consciously includes three temporal dimensions: experience of the present, processing of the past, and preparing for the future.

What goes on in our minds just before we fall asleep, probably affects the content of our dreams. For example, just before exams students may dream of the course material and so on. The content of dreams is inside your brain. If you are worried or excited about something, there's a good chance that you will dream about it.

But there are other factors – age and gender, for example – that influence dream content. Psychiatric conditions can impact dreams. Similarly, born blind participants report their dreams centering around smell, touch, sound and taste components compared with control groups. Such incidental observations suggest that during the switch from wakefulness to sleep, everyday happenings reemerge in dream-like images.

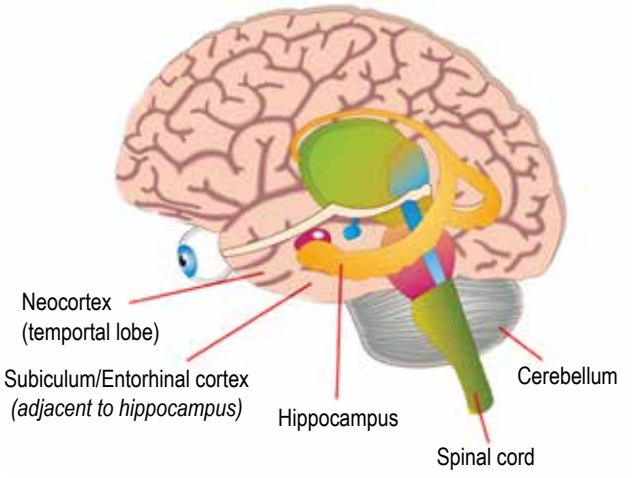
The first sleep cycles each night contain relatively short REM (Rapid Eye Movement) periods and long periods of deep, the non-REM sleep. As the night progresses, REM sleep periods increase in length while deep sleep decreases.

REM sleep is the sleep stage at which most dreaming occurs. Until REM sleep is completed, the body is essentially paralysed. This paralysis is caused by the release of glycine – an amino acid – from the brain stem onto the motor neurons (neurons that conduct impulses outward from the brain or spinal cord). And this paralysis could be nature's way of making sure that we do not act out our dreams. REM paralysis, therefore, is in some sense an evolutionary protection, put in place to keep us from acting out our dreams.

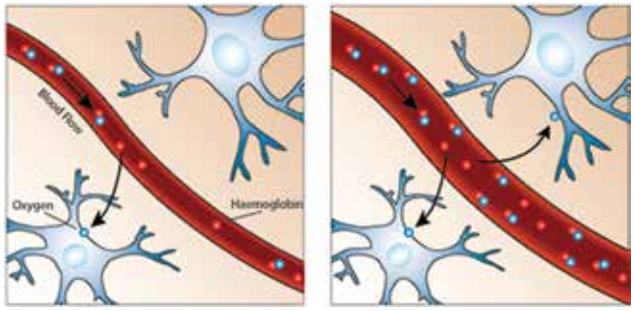
Although "dreaming" may occur during both REM and NREM periods, the dreams obtained from these periods differ significantly in both quality and quantity and are likely to be produced by different processes. In REM sleep dream content reflects only neocortical activation, which is assumed to account for the fragmented, weird, nature of these dreams. High levels of cortisol, the stress hormone, as are observed late at night and in the context of REM sleep, disrupt normal hippocampal to neocortical communication affecting the content of dreams.

In slow-wave deep sleep, however, dream content reflects the normal interaction between hippocampal and neocortical circuits, allowing typical periodic memories to emerge.

Dreams are a gripping area of research for scientists, partly because there's still so much to learn about how, and why, we dream. Technology opens up new ways to observe the dreaming brain.



Hippocampus and Neocortex in the human brain



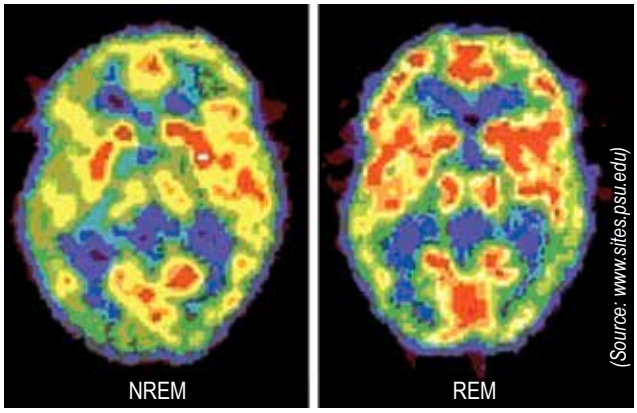
Resting Activated

BOLD fMRI for functional imaging

Functional MRI (fMRI) evaluates brain physiology, is highly sensitive so it can detect small changes. Almost all fMRI techniques use the contrast mechanism called *BOLD* (Blood Oxygenation Level Dependent) MRI. BOLD contrast reflects a complex interaction between the volume of blood, its flow, and its transport of oxygen by an iron-containing protein (hemoglobin) in red blood cells. Brain imaging helps scientists "see" what until now could only be reported by subjective, possibly inaccurately recalled, dream accounts. For example, in a study with rats trained to run through mazes to get rewards, researchers were able to record neuron activity in sleeping rats and determined that the rats were running the same mazes in their dreams.

Alone and in combination, these imaging techniques are transforming our understanding of how the brain functions. Imaging (detailed and timely snapshots of the brain at work) combined with big data (the information researchers amassed about dreams from experiments in sleep labs) may offer some stronger answers, peeling away the mystery of dreams in dealing with our emotions, and revealing their meaning in memory making.

Scientists monitored volunteers who slept inside an fMRI scanner while connected to EEG electrodes that measured brain wave activity. When the EEG indicated they were dreaming, the participants were awakened and asked what images they had seen in their dreams. They were later able to match certain



Most Active Least Active

REM is where most dreams occur

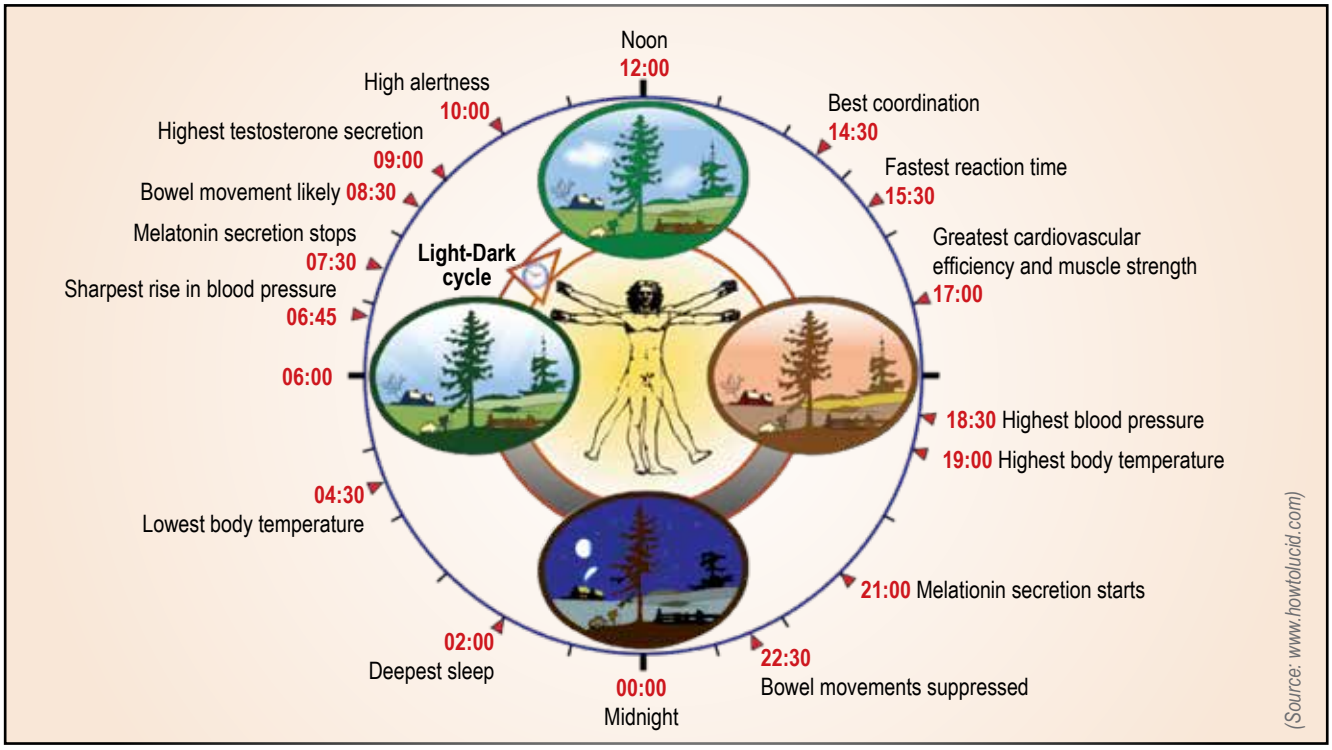
patterns of brain activity to certain images for each person. "There's a crude correspondence between the brain scan and the image; from the scan, you can guess it's an animal with four legs," says Deirdre Barrett, a psychologist and dream researcher at Harvard Medical School. Though a preliminary state of this dream decoding, the ability to actually gather content from a dream is getting closer.

Patrick McNamara, a neurologist at Boston University School of Medicine wants to study individuals' dreams over time to observe differences and changes in emotional tone, colours, words and other significant patterns and connect these with events in their lives that would bring him closer to understanding whether dreams are farsighted – it might be possible, for example, that certain kinds of dreams occur before you are struck with flu or tummy problems, or any other happier events.

Such studies could also reveal more about nightmares, and possibly lead to ways to control or avoid them. Barrett plans to extract the new database, Dreamboard.com which has accumulated 165,000 dreams, to study how often nightmares occur, and how they relate to an individual's trauma or a family history of anxiety disorder.

Speaking on a practical note, sleep and dreams are a big business. What's at stake is not just philosophy, but public health: disturbed sleep leads to attention problems, weight gain, productivity loss and so on. Books to relaxation videos to pills, the market has grown to a $ 32.4 billion industry, increasing 8% annually.

Bad dreams and nightmares trouble victims of abuse, grief, divorce, broken homes, etc. With this in mind many dream researchers have signed on to support *Shadow: Community of Dreamers* (founded by Hunter Lee Soik, 2013), using an alarm clock app on your smartphone, which will wake people, collect dream reports by typing/talking, anonymise them and beam into a searchable, analyzable online set of databases. Then look for statistical patterns, using machine learning algorithms: Which images occur the most often? Which locations? Which emotions? Then they would tie these dream traits to patterns



of brain activity in the people who slept in their lab. They speculate that for therapeutic purposes, dreaming serves as an emotional mirror and with enough dream samples, major emotional issues in relationships can be solved.

What's been discovered so far, however, suggests that such studies could reveal an enormous amount about what role dreams play in our lives, and how important they are for biological, psychological or social reasons. McNamara believes scientists can find out if what they have been saying for years is true — "that reflecting on our dreams is useful and can give us insight into ourselves". Psychologists say so, and many people think so. But research, he says, gives us the potential to know.

For example, for the first time, researchers have pin pointed two genes that they believe control REM, NREM sleep and dreaming, by analysing genes and brain activity of more than 8,000 mice. Using chemical mutagenesis to introduce random mutations they succeeded in isolating two mutations in these mice – *Sleepy* which showed exaggerated response to sleep deprivation, and *Dreamless* with shortened and unstable REM sleep periods. It is possible that proteins produced by these genes could be drug targets for sleep disorders. The corresponding genes were also known in Drosophila and nematodes. Such conserved roles in invertebrate genes show the importance of controlling sleep in all animals.

But is it really possible that we could learn to control dream content with some kind of gene therapy? It's not likely, considering that sleep is affected by not only numerous genes but also many other external factors. Dream content modification is nowhere in sight yet, because of the complex relationship between our genes and our dreams.

Then again, for a creative mind dreams are a boon. There are several incidents of creative greats having eureka moments when they dream; the night before his enlightenment, the Buddha experienced his 'five great dreams'. Following are a few examples of classic dreams:

- Mendeleev's periodic table.
- Mathematical ideas by Srinivasa Ramanujam.
- Albert Einstein's Theory of Relativity.
- Sewing machine by Elias Howe.
- The idea of Google by Larry Page.

However baffling, it is not likely that a simple answer or a single theory – ever – would explain the full role of dreaming in human life. Each of us knows from our own experience how our imagination weaves unrelated ideas together when we dream. Regular exercise, sleeping well, and vivid dreams go hand-in-hand allowing you to sleep deeper and dream better and to become more of a creative powerhouse. Van Gogh says it all "I *dream of a painting and then I paint my dream"*.

Dreaming can help you learn and develop long-term memories. Keep your heart open to dreams. For as long as there's a dream, there is hope, and as long as there is hope, there is joy in living. As for scientists, dreams are – at least for now – an endlessly exciting, appealing mystery.

So, until then 'Sweet Dreams'.

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