- Sleep Tips

Sleep Tips

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The Science of Sleep: Overview

The Brain in Sleep: Understanding Sleep Stages

One way to understand more about sleep is to look at it the way an EEG machine does—in other words, to study the pattern of our brainwaves as they change throughout the night. Sleep scientists did exactly this for the first time in the 1950s, and what they discovered then remains just as fascinating today.

The neurons in our brains talk to each other by discharging minute electric currents across tiny gaps between them. Via electrodes placed on a person's scalp, the collective discharge of all of these brain cells together can be fed into an electroencephalograph, or EEG, and displayed as an oscillating voltage—a wave.

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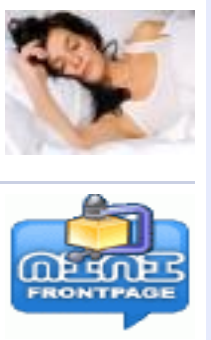

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As anyone familiar with the idea of biofeedback knows, brainwaves are categorized into different types based on how fast they oscillate. Each type of wave neatly corresponds to a different state of consciousness. Characteristic brainwaves when we're awake, for example, include anxious beta (12 to 30 cycles per second, or Hz) and calm alpha (8 to 12 Hz). But how about when we're asleep?

The first thing to know is that the sleeping brain alternates between two very different types of activities—so different, in fact, that many scientists consider them to be two different forms of sleep, with completely different purposes from the point of view of biology and evolution. The first of these two types is dreaming, and the second is—well, not dreaming. The easiest way to tell the difference is that when we dream, we move our eyes—which is why this type of sleep is called Rapid Eye Movement, or REM. And when we don't dream, we *don't* move our eyes—which is why the second type of sleep is called Non-Rapid Eye Movement, or NREM.

Brainwaves during REM don't appear much different from brainwaves when we're awake—which makes sense, given that while dreaming we're frantically engaging in imaginary conversations, missing imaginary appointments, having sex with imaginary strangers, and so on. But brainwaves during NREM differ quite a bit—so much so that we can distinguish four different stages of NREM sleep based on the type of brainwave. Rather unexcitingly, these stages are called Stages 1, 2, 3, and 4.

Sleep throughout the stages

Stage 1 is light sleep—the kind of sleep where you may experience brief, repetitious thoughts, along with fragmented images that don't add up to complete dreams. If someone wakes you up, you may swear that you weren't really asleep, just thinking of something. Stage 1 is also when you may suddenly start awake, as if you had felt yourself falling—an involuntary reflex known as a hypnic jerk. The type of brainwave for this stage is called theta (4 to 7 Hz).

Stage 2 is similar to stage 1, except strange artifacts now show up on the EEG—sudden bursts of fast brainwaves called sleep spindles, and brief high-voltage spikes called K-complexes. K-complexes are interesting because although they can occur on their own, they also occur in response to loud noises in your sleeping environment—such as if someone knocks on your bedroom door. We spend about half the night in Stage 2 sleep. It's a more relaxed, slightly deeper sleep than Stage 1.

Stage 3 and *Stage 4* sleep are the only forms of sleep, however, that truly deserve to be called "deep." Children and teens spend a lot of time here, because that's when the body grows fastest and heals best, while older adults spend less and less, with seniors getting hardly any. Stages 3 and 4 together are sometimes called delta sleep, after the characteristic brainwave shared by both (0.5 to 4 Hz).

Rolling through the night

These stages follow each other in sequence in what's known as the sleep cycle. In a good night's sleep of 7 to 8 hours, we roll our way through about 5 such complete cycles, each cycle taking about 90 minutes. Each cycle takes us through Stages 1 through 4, back up to 1, and finally into a stage of REM sleep before the cycle repeats.

The proportion of time spent in each stage changes as the night wears on: when we first fall asleep, we spent most of our time in NREM, but by the time morning rolls around, almost all of the cycle is taken up by REM. This explains why you're more likely to remember your dreams when you wake up at your regular time than if someone wakes you in the middle of your sleep: by the time you're ready to get up, you can't help but be in the middle of a dream. And the deeper your NREM sleep, the deeper and more vivid your dreams will be later on, with your most vivid dreams occurring around the time you normally wake up for the day. If you suffer from chronic insomnia, on the other hand, you won't feel well-rested, and your dreams will suffer along with your body.

Strange sleep facts

Here's some interesting facts about sleep stages you may not know:

- The vivid but brief visions we sometimes experience when falling asleep aren't dreams, but so-called hypnogogic imagery, after Hypnos, the Greek god of sleep.
- If you're forced to rise and shine when you're in the middle of NREM sleep, rather than when you're dreaming, you're more likely to feel groggy and stupid and have a hard time waking up. The technical name for this condition is sleep inertia. You can also get sleep inertia from napping too long - which is why short naps are usually better.

The body is safely paralyzed during REM sleep. This is a blessing—except if you wake up in this state and find yourself temporarily unable to move. Such attacks of sleep paralysis are believed to be the basis for the stories of nighttime demonic possession common to all cultures.

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