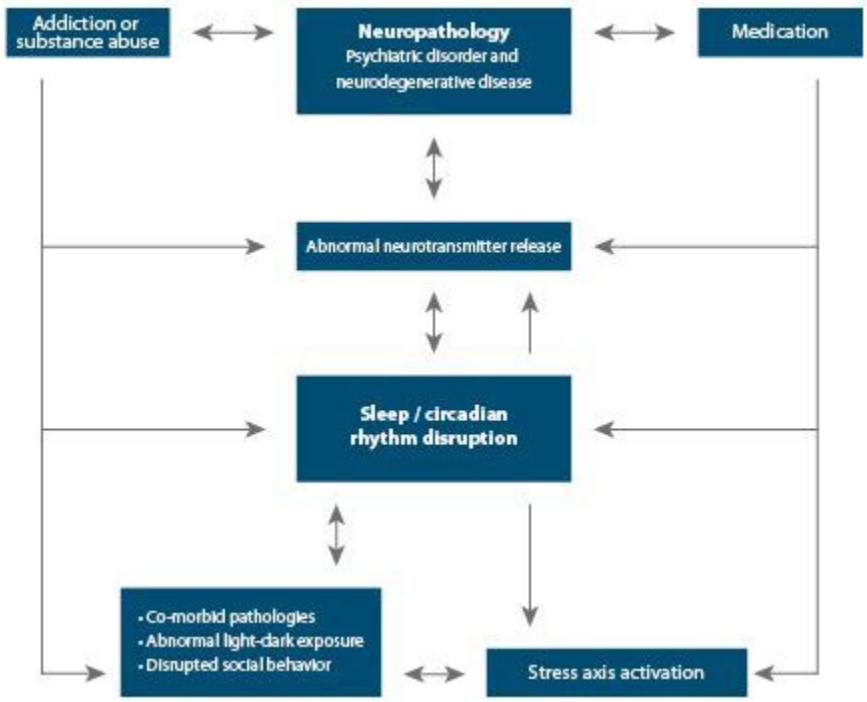
We all know good sleep is important, but what is sleep? There are some who believe sleep is nothing more than a random waste of otherwise productive time. “Sleep…Oh! How I loathe those little slices of death,” is a quote attributed to Edgar Allan Poe.

Increasingly, sleep is being recognized not as “little slices of death” but as essential fuel-up time for all brain and body functions. One study of rats demonstrated that sleep-deprived rats lived only three to five weeks, while their normal life span is two to three years. Whether for rats or humans, sleep is a core process. Poor sleep is not just a side-symptom of other primary disease processes. Lack of sleep may actually be the cause of a number of human pathologies [see fig. 1].



Because sleep is fundamental to our overall well-being, increasing our understanding of how sleep happens—or doesn't happen—may lead us to a place where more of us can benefit from its life-giving, healing and energy-building powers.

In our society, when a person can't sleep, there is a tendency to reach for a pill. Behind this habit is the idea that sleep is an issue of chemistry. Yet, a purely chemical model of sleep is highly limiting.

There is a model of sleep aligned with an appreciation for the brain's innate potential for healthy functioning and how healthy functioning corresponds to a state of the brainwaves, which we call balance and harmony. This model can help recover high-quality sleep.

Today, we have many new tools to help us understand the brain in the state of sleep. Modern research shows sleep has a dual nature: either as a function of electrical activation patterns, i.e., brainwaves, or as a function of changes in brain chemistry.

On the particle side of the debate, there is ample experiential evidence and scientific studies that demonstrate that chemical activity in the brain can profoundly alter sleep tendencies. Many foods, medicines and other substances are well known to have promotional or inhibitory influences on sleep. Furthermore, studies have demonstrated the existence of sleep-regulatory substances, which, after accumulating in the cerebrospinal fluid of an organism and then being injected into another one, can induce the state of sleepiness.

Wave approaches to sleep focus on its cyclical aspects. A focus on wave aspects has intrinsic appeal, since sleep itself comes and goes regularly in healthy individuals. On this side of the debate, researchers have shown, for example, that there is an extra dose of sleepiness that comes in the middle of the afternoon. Within and between sleep periods, there are predictable cycles of brainwave activity. The timing of the beginning and end of a sleep period is also intimately connected with the timing of our secretion of hormones, the level of arousal of our cardiovascular system, immune system and metabolic functioning and integration of our cognitive capacities. Without good quality sleep, these systems become poorly modulated and dysfunctional over time.

The reason sleep must be better understood as either waves or particles—but not both—is more than academic. Considering the 50 to 70 million Americans with sleep disorders or the $150 billion spent by US companies to address sleep-related issues, it's easy to see that having a truer handle on sleep is a serious issue with many consequences.

BETTER SLEEPING THROUGH CHEMISTRY?

Questions around the role of melatonin provide a perfect example of the wave-versus-particle sleep conundrum. There can be little doubt that brain activation regulates melatonin production and, reciprocally, melatonin influences the character of brain activation. But which side of this two-way street reflects a higher degree of self-regulation? Which direction allows finer tuning of brain functionality as a whole?

Melatonin is secreted by the pineal gland at night in response to increasing darkness. Melatonin has multiple effects on human physiology, including induction of sleep and regulation of mood, body temperature, cardiovascular functioning and inflammation.

A focus on the wave (or function) model might lead an individual to purposefully synchronize their sleep habits with the natural earthly cycles of dark and light, and so maximize the responsiveness of their body systems to the melatonin being released at nightfall. Those who adhere to the particle model might ingest a melatonin supplement as a means to enhance sleep.

THE BRAIN'S FUNDAMENTALS FOR SLEEP

We believe that the brain drives chemistry—and virtually everything else. By observing how human experience and behavior can shift when their brainwave patterns shift to a state of balance and harmony, we have come to appreciate the power of the brain as the most precious resource on our planet.

Good sleep correlates to brain activation patterns (as measured by EEG) that are reasonably balanced (left-to-right and front-to-back) and harmonized (low and high frequencies in a good proportion to one another throughout the brain). Balance and harmony are required especially in those brain areas that generally function for the purpose of internal processing and reception of external stimuli: the temporal, occipital, parietal and midline (or corpus callosum) areas.

As an example, shown here are brain activation patterns in the same regions of the left and right hemispheres, at the same time. We see that there is an optimal balance between the hemispheres, as well as between the low and high frequencies of each lobe.

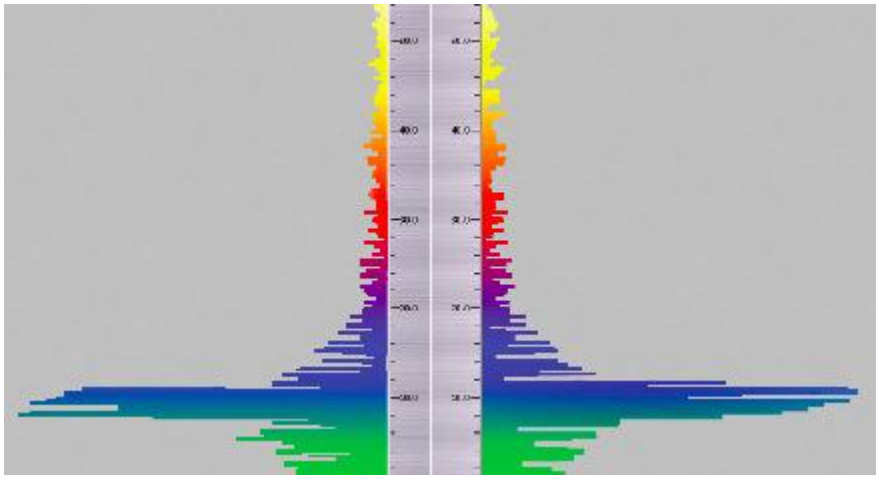


Figure 2: A spectrograph of brainwaves via a type of high-resolution EEG technology called Brainwave Optimization. In this graph, we are able to see the balanced brainwaves of a person at rest, with eyes closed. The Y-axis represents frequencies from 0 to 60 hertz, and the X-axis represents amplitude of each frequency from 0 to 17 micro-volts. Based on this pattern, there is a strong likelihood that this person feels balanced and has the ability to attain restful sleep.

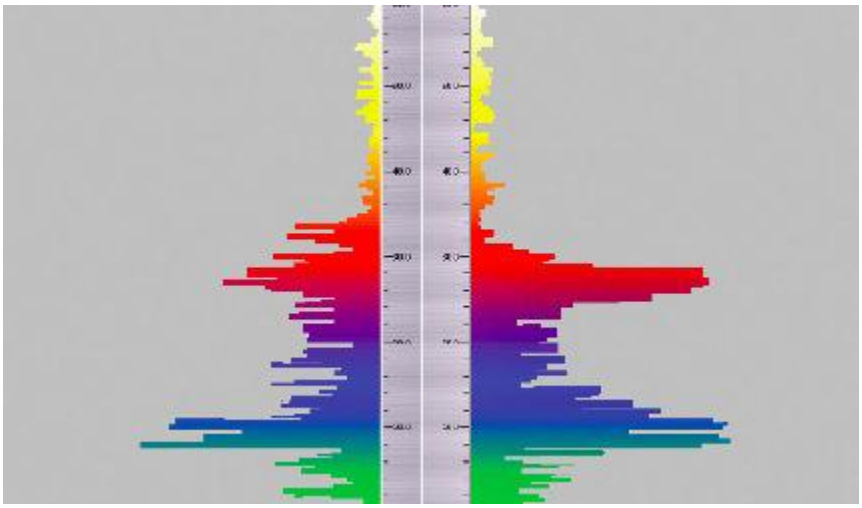
WHEN BRAINWAVES ARE DISRUPTED

On the other hand, if brainwaves are not in balance and harmony, one is more likely to feel out

of sorts, and it is unlikely that restful sleep will be attained. Years ago, we found that many people who are in a state of hyper-arousal—that is, they are prone to anxiety, heart palpitations or other manifestations of the fight-flight response—have an imbalance in the form of excess EEG energy on the right side of the brain [see fig. 3, below]. This pattern was highly consistent among more than 400 soldiers with post-traumatic stress disorder (PTSD) with whom we worked on a not-for-profit service project. Symptoms of PTSD include lack of restful sleep, insomnia with an inability to go to sleep, and waking with invasive thoughts, with an inability to be able to readily return to sleep. We later learned that other investigators, using other brain-assessment technologies, have confirmed that hyper-arousal corresponds to excess activity in the right hemisphere, especially in the area of the temporal lobe.

It is obvious that the patterns in figure 3 are not balanced or harmonious. The brain is agitated, even when measured in this restful state with eyes closed. And despite the state of hyper-arousal, the experience of life for these individuals may be marred by lethargy. They lead daily lives characterized by a lack of energy to do anything—even to stand up from a chair. Restful sleep cannot transpire with a brain-function imbalance that does not allow for a smooth exchange of information ("synchrony") across collections of neurons.

In these situations, people may take a medication—perhaps a sedative. It may cause them to feel more relaxed, but the underlying sleep architecture remains abnormal, as the imbalance in brainwaves persists. Truly restful sleep is unlikely.



ACHIEVING GOOD SLEEP

Based on our observations of the brainwaves of more than 6,000 people with sleep difficulties, we have found that the brain states of balance and harmony are necessary but not sufficient. Synchrony must also be achieved before restful sleep can be experienced. This function seems to have a number of moving parts—working, perhaps, like a Slinky toy crawling down steps. Frequency groups in corresponding brain areas seem to require symmetry of motion to complete the dance of sleep. This may be why rocking a baby is quieting and restful—rocking may facilitate a transition to synchrony.

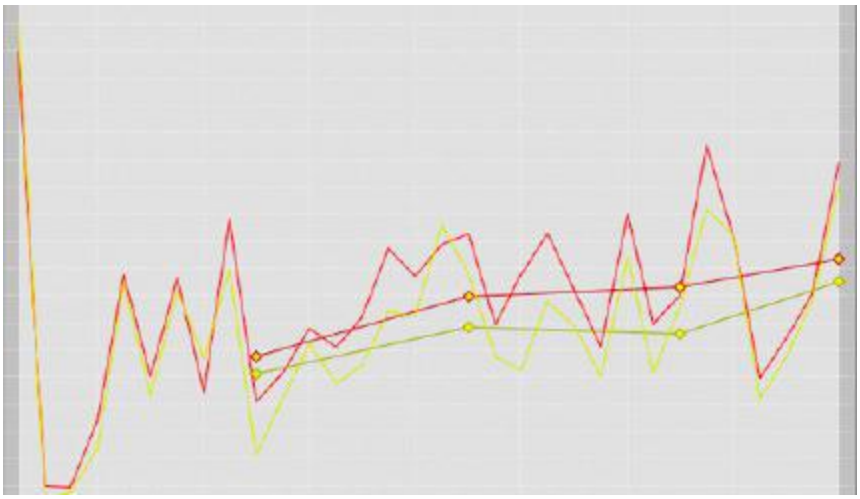


Figure 4: An example of brainwaves associated with "good" sleep onset. The left temporal lobe (yellow line) and the right temporal lobe (red line) are relatively synchronized. The brainwaves are balanced, harmonized and firing in a coordinated manner. This is a brainwave sleep-dance that is likely to lead this person into restful sleep.

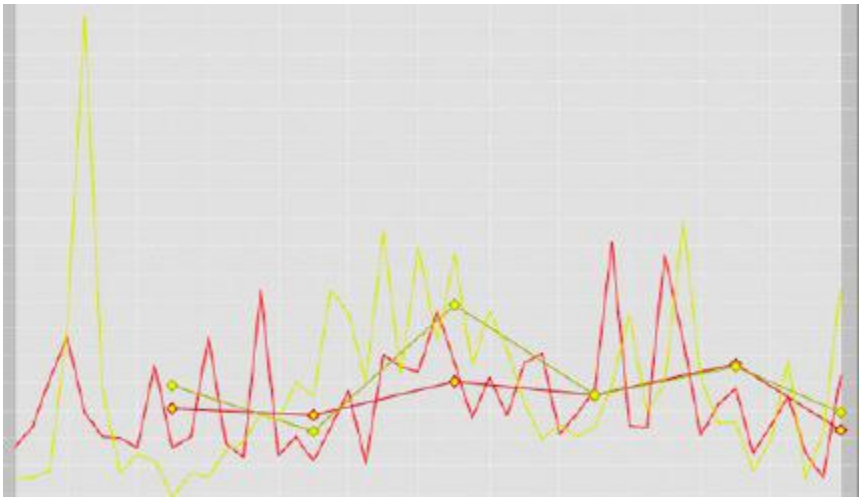


Figure 5: The left and right temporal lobes are not well synchronized. Peaks and valleys are not in alignment. This is the brainwave pattern of a person who does not sleep well at all and does not wake rested. What might cause a brain to be unsynchronized? The answer is trauma.

TRAUMA AS THE CAUSE OF BRAINWAVE DISRUPTION

We have assessed brainwave patterns of nearly 30,000 people from around the world. One of our major conclusions is that trauma—both physical and emotional—is the root cause of brainwave disturbances. Trauma can leave an imprint on the brain that causes brainwave functioning to become dissonant. Trauma creates an interference with normal brain physiology at a fundamental level. A variety of therapeutic techniques may mitigate the downstream

consequences of the interference, but they are unlikely to reconfigure the primary traumatic imprint.

To our knowledge, the only way to reconfigure the trauma imprint is to create a space for the brain to balance, harmonize and synchronize itself. In our case, our company has created a technology—and others are surely on the way—that helps the brain to reach the state of balance, harmony and synchrony in a straightforward, self-directed and noninvasive way. When this process occurs, the results can be life-changing, like being released from shackles.

During extreme trauma—which can either occur intensely during a moment of time, or can build up over an extended period, such as when one is in a verbally abusive relationship—the brain shifts to protect the person and may become stuck in a trauma-shift pattern. The trauma-shift pattern then dominates the brain's function, and the brain is no longer in a state of balance. Brainwave Optimization responds to the brain in near-real-time by mirroring the dominant frequency of the balanced-brain area and directing that frequency to the areas that are imbalanced. (The scientific term for this process is "high-resolution, relational, resonance-based electroencephalic mirroring"; essentially, it is a noninvasive technology for neuro-oscillatory calibration.) This process assists the brain in gaining balanced-brain dominance due to the resonance with this real-time sound. The result is a functionally balanced brain.

As science comes to understand the role of trauma on brainwaves and the role of brainwave functioning on sleep, a new tide of questions will appear. We believe we are all going to start paying a lot more attention to the importance and quality of our sleep. We will better appreciate that poor sleep is not just an indicator of problems but also quite possibly the source of problems. We will undoubtedly need to keep finding better ways to free our brains from trauma patterns. Better sleep and a healthier and more balanced life are birthrights for us all, and the way to arrive there will be through harnessing the primal and primary power of the brain itself.

Brainologist Lee Gerdes, author of Limitless You: The Infinite Possibilities of a Balanced Brain, is the founder and CEO of Brain State Technologies, a global neuro-network of about 140 affiliated offices that offer Brainwave Optimization, a disruptive technology that is changing the way we understand sickness and health.

Sung Lee, MD, is research coordinator for Brain State Technologies, operates Brainwell, a Brainwave Optimization practice in Sedona, Arizona, and is a member of the advisory board of the International Brain Education Association and a scientific advisor to Brain World magazine.