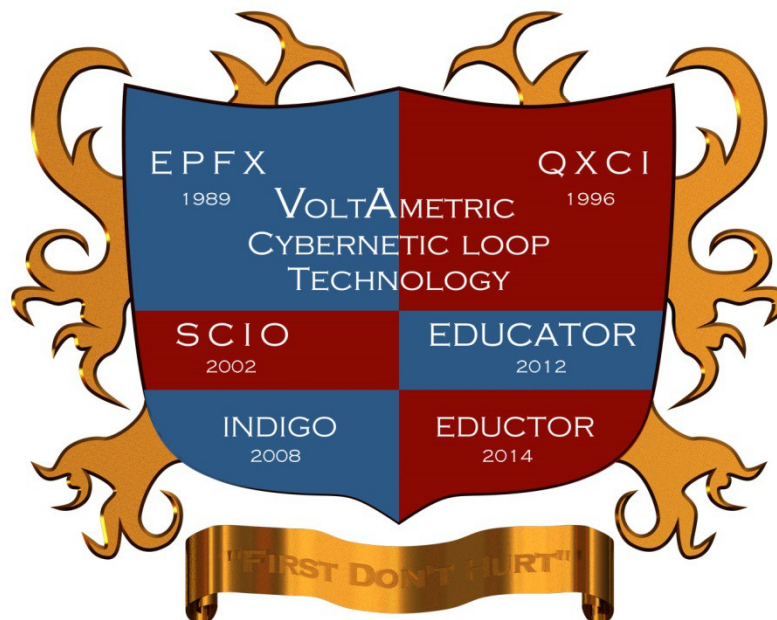




SCIO/EDUCTOR - BRAIN WAVE OPERATION MANUAL

SCIO/Eductor - Brain Wave operation manual

First developed in 1985 as the EPM this Eductor technology is a biofeedback device that also measures the galvanic skin resistance of the person's forehead. This allows for a soft subtle measurement of the electro-potential followed by a safe micro-current simulant to measure the GSR resistance. This constitutes a cybernetic –loop for measuring and then handling the body electric. When we first developed the EEG cybernetic loop treatment in 1996 there was a revolution in medicine to be able to measure a brain wave and through a self-guided autofocused process the system can correct oscillation, amplitude, and wave form problems of the brain wave. Thus this allows for a drug free treatment of brain disorders. Over 35,000 devices sold with no record of any single significant risk. All safety risk analysis show complete safety and in hundreds of studies this type of stimulus has been shown effective.



The Educator
Starts with a
Measure of
the EEG-ECG
EMG-GSR
TVEN and
VARBOPE

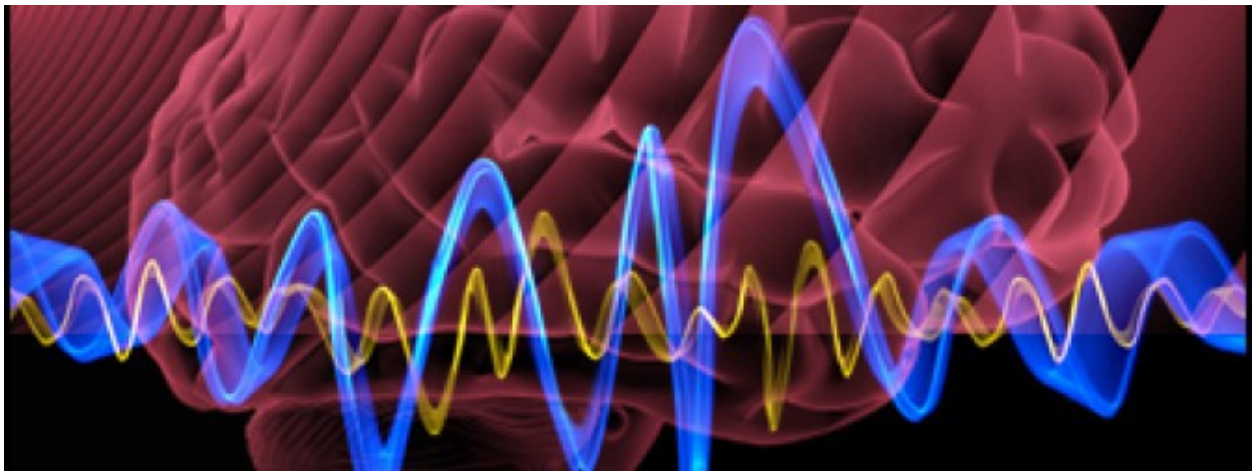


Then IT
Treats the
Body Electric
with a Soft
Safe Gentle
Touch



This is the Cybernetic Loop Quantum
Resonance Biofeedback Therapy

BRAIN AND ECG WAVE difference between SCIO and EDUCATOR (these samples are screenshots)

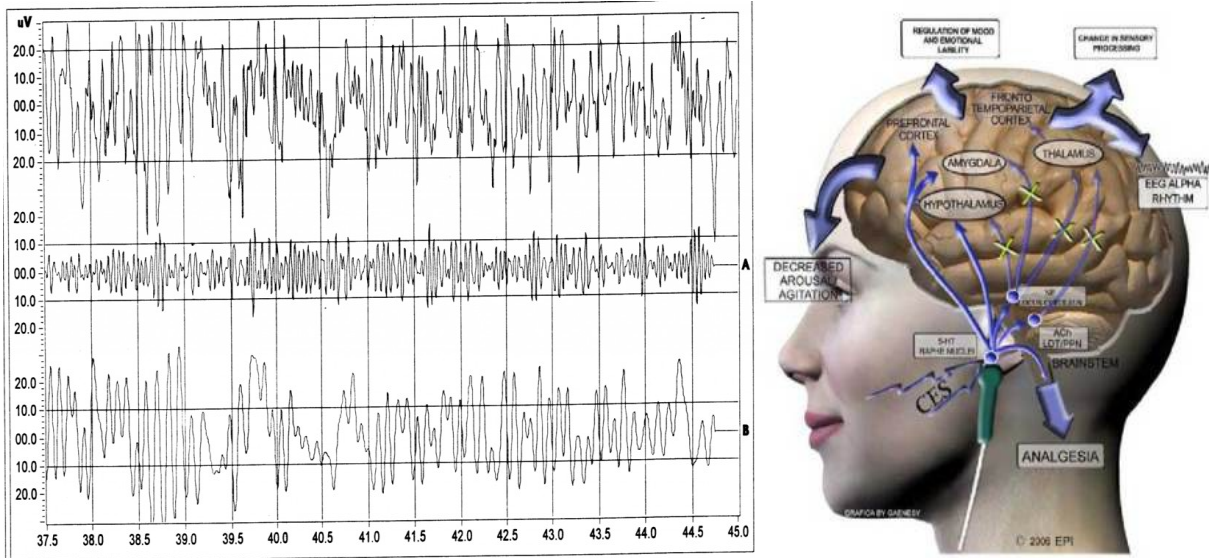


Understanding Brainwaves to Expand our Consciousness

Bhavika July 22, 2013 Spirituality 19

The human brain is a complex entity constantly at work, sending electrical signals, communicating, building new neural connections and so on. This electrical activity generated by the brain, also known as brainwaves, reflect our state of mind. Reality is not based on outside influences but is an internal process based on our thoughts, perception and emotions. If we deepen our understanding of these brainwave frequencies, we can control our reality.

There are five different kinds of brainwaves – Beta, Alpha, Theta, Delta and Gamma



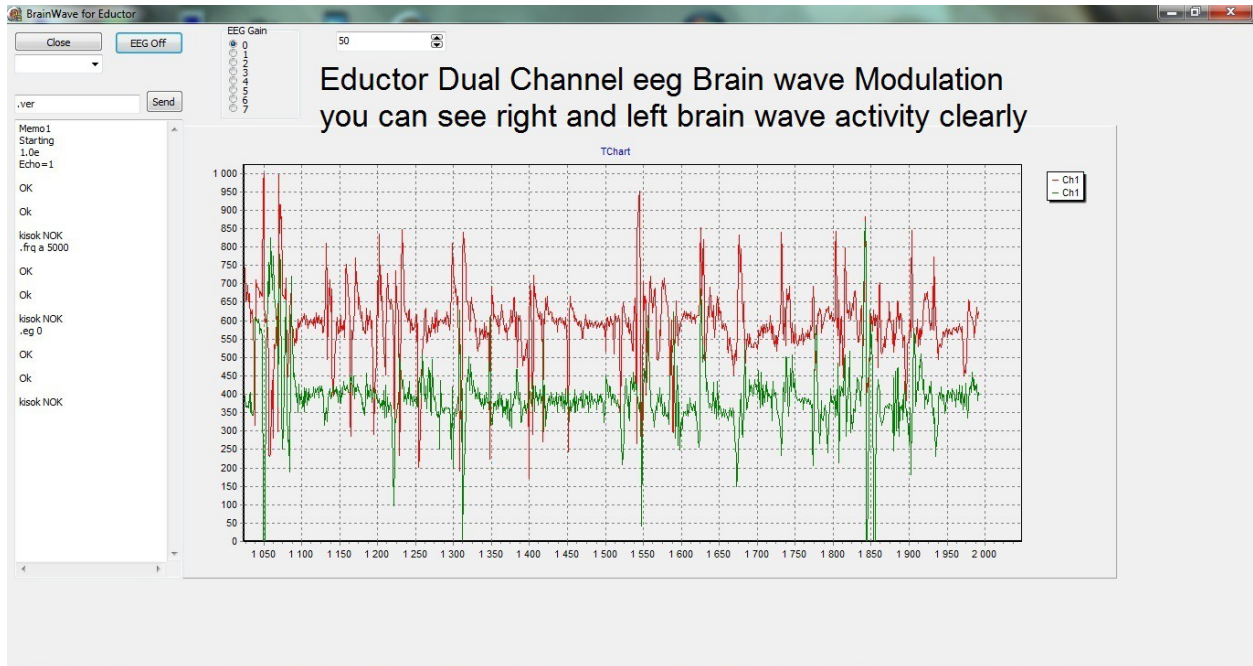
Humans have 5 different types of brainwave that take us to different levels of consciousness . Each occur at a specific frequency or pattern

| | | | | | |
|-------|-------------|--|-----------------|--|--------------------|
| gamma | inspiration | | higher learning | | focus |
| beta | alertness | | concentration | | cognition |
| alpha | relaxation | | visualization | | creativity |
| theta | meditation | | intuition | | memory |
| delta | healing | | sleep | | detached awareness |

It is completely a natural biological occurrence in every human being to experience these different states at various times in a day, and generally one state is dominant.

Did you know that each brainwave has its own set of characteristics representing a unique state of consciousness? Each brainwave state occur in a specific frequency range measured in cycles per second (Hz).

Each type of brainwave played a critical role in our mental development during our childhood. And today, they play an important role in maintaining our health and vitality as adults. Lets take a look at the different brain wave states and the associated benefits and experiences –

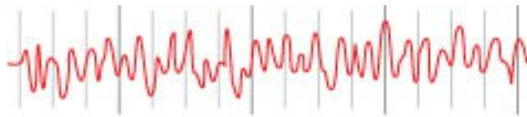


Beta (12 to 30 Hz)

Beta are the brainwaves of our normal waking consciousness. It is associated with a heightened state of alertness, logical thinking, problem-solving ability, concentration, when the mind is actively engaged in mental activities. Like a person in active conversation, playing sports or making a presentation would be in a Beta state. But higher Beta levels also result into stress, anxiety and restlessness.

Most people spend their waking lives in a beta state, no wonder many people experience high stress levels in today's world. At the same time Beta is required for effective functioning in daily life.

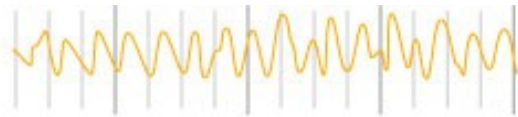




Beta (14-30 Hz)

Concentration, arousal, alertness, cognition

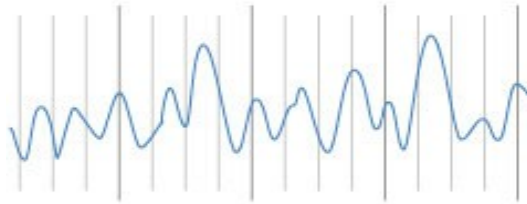
Higher levels associated with Anxiety, disease, feelings of separation, fight or flight



Alpha (8 - 13.9 Hz)

Relaxation, superlearning, relaxed focus, light trance, increased serotonin production

Pre-sleep, pre-waking drowsiness, meditation, beginning of access to unconscious mind

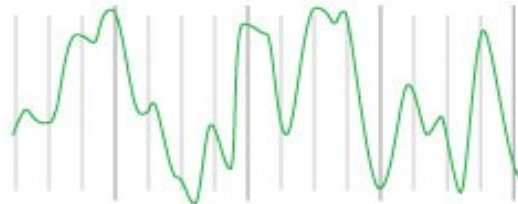


Theta (4-7.9 Hz)

Dreaming sleep (REM sleep)
Increased production of catecholamines (vital for learning and memory), increased creativity

Integrative, emotional experiences, potential change in behavior, increased retention of learned material

Hypnagogic imagery, trance, deep meditation, access to unconscious mind



Delta (0.1-3.9 Hz)

Dreamless sleep
Human growth hormone released

Deep, trance-like, non-physical state, loss of body awareness

Access to unconscious and "collective unconscious" mind,

Brainwave frequency chart showing the different frequencies and its state of mind

Alpha – (8 to 12 Hz)

Alpha brainwaves are slower in frequency as compared to Beta, which translates to a highly relaxed state of awareness. It is a normal brainwave pattern in people who are naturally relaxed and creative. Like you are daydreaming, or even when one close their eyes and meditate, this frequency enhances your imagination, memory, concentration, creativity, reduces stress so you can focus on learning and performance.

Meditation results in increase in alpha waves, therefore many meditation and energy healing techniques utilize an alpha brain wave for relaxation and healing. Even the use of Cannabis has been linked to an increase in alpha waves in the brain. Children tend to have much higher levels of alpha brainwaves than adults.

Alpha brainwaves are considered the healthiest brainwave range and 10 Hz has widely been accepted as the "safest" brainwave frequency to train.

Listen to the Alpha Brainwave Music -

Theta – (4 to 7 Hz)

Theta brainwave occur during deep relaxation and meditation, light sleep or lucid dreaming including the

REM dream state. It is the realm of your subconsciousness, where the mind is capable of profound insight, advanced intuition, healing, and oneness – in Theta state our minds can connect to the universe and manifest life-enhancing changes.

You can also experience vivid visualizations, great inspiration and profound creativity. The lower the brain frequency the faster the learning. Meditation or yoga is credited as being so relaxing because they induce the mind in a trance like state where it starts generating theta waves. People tend to have paranormal, psychic experiences when their brain is full of theta brainwaves.

Most children and teenagers have dominant theta brainwave patterns.

Listen to some Theta Meditation music -

Delta – (0.5 to 4 Hz)

Delta waves are the slowest in frequency but are the highest in amplitude. Observed in deep, dreamless sleep, this frequency is the gateway to the universal mind and the collective unconscious, where information received is otherwise unavailable at the conscious level.

Delta brainwave states have long been associated with healing, because deep sleep is necessary for regeneration and for your body's self-healing mechanisms! Delta waves in meditation are said to help experienced practitioners access the unconscious mind. It is a dominant brainwave of infants (birth to 24 months) and even adults in deep sleep.

Gamma (25 to 100 Hz)

The Gamma brainwave is the fastest frequency at which the brain functions, where an individual can experience bursts of insight or high-level information processing. Experiments on Tibetan Buddhist monks have shown a correlation between transcendental mental states and gamma waves. When the monks were asked to generate feelings of compassion, their brain activity went into gamma frequency in a rhythmic, coherent manner. It is the state of being 'in the Zone,' the feeling that you can do anything.

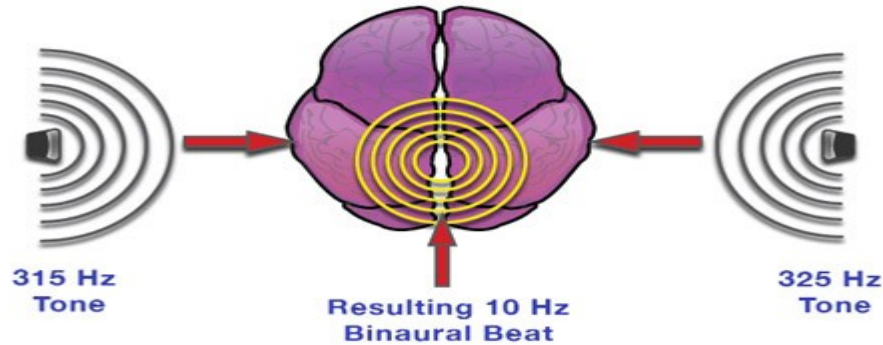
Altering Brainwave states

All of us experience these brainwave frequencies at different times every day, which take us to different levels of consciousness. Like when you are awake you are in a different brainwave state as compared to when you are sleeping. You can alter your brainwave pattern in order to reach a desired level of consciousness. For example if you can't get sleep at night when you feel stressed, you can synchronize your brainwave into the frequency that corresponds to sleep using sound.

This technique of synchronizing your brainwave frequencies to an external audio stimuli is known as Brainwave Entrainment. As this process is continued for sometime, the brainwave is tuned to the frequency of external sound and thus achieve the particular frequency level of that sound (alpha, theta or delta).

But you don't need external stimulus if you can meditate. During meditation you reach a calm and relaxed state, this is the alpha state of consciousness. As the meditation deepens you find yourself being more calm and focused and the brainwave level reaches to theta (and finally to delta) state.

How Binaural Beats work



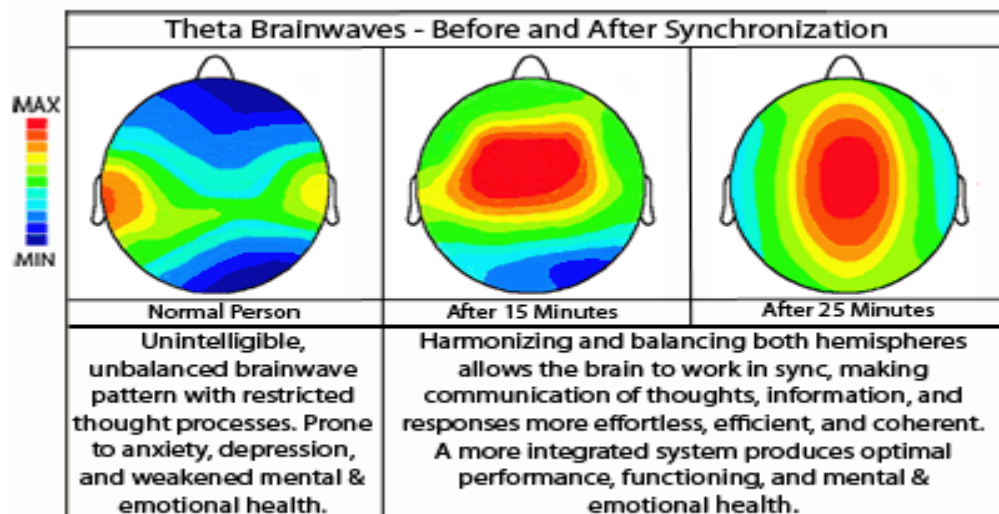
Binaural Beats are a brain wave entrainment audio stimulus that alter your state of consciousness

Ways of Brainwave Entrainment

Binaural Beats

How can a sound with frequency lower than 20 Hz range be audible to the human ear? The answer lies in a specialized sound known as Binaural beats. What it did was simple – playing two different frequencies in each ear, the brain detects the difference between the two frequencies and tunes into the third ‘binaural beat.’

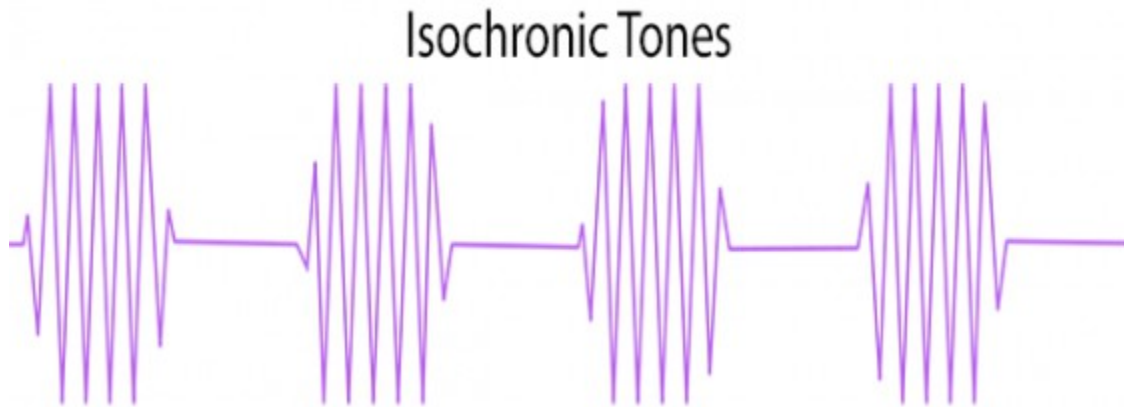
So if you play 400Hz into the right ear, and 410Hz into your left ear (using stereo headphones) your brain produces a third binaural beat pulsing at 10 Hz, which is the difference between the two tones. 10 Hz is also equal to the alpha frequency, which brings about light relaxation, meditation, and creative thinking. Binaural Beats shall provide you some excellent results often instantly which will help you in many ways. Binaural Beats (Use headphones while listening)



Enhanced for Illustration Purposes

Theta is associated with extreme relaxation, sleep or drowsiness. Generally, one feels a sense of peace and calm when the brain kicks into theta gear.

Isochronic tones



Isochronic tones are switched on and off via predictable patterns, creating a pulse effect that is extremely effective when used for therapeutic reasons

Isochronic are even more intense than binaural beats and considered more effective. An isochronic tone is a single tone that turns on and off in a particular pattern. Each of the tones are distinct and are evenly spaced to be able to create a lasting impression on the brain.

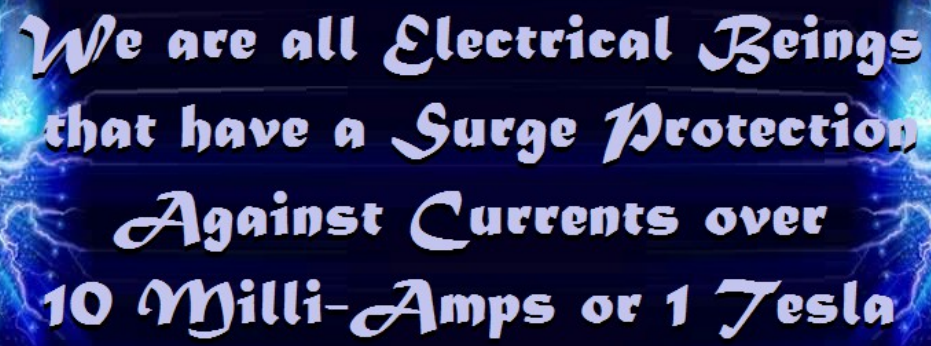
Basically our brains have to do much less work to get the same effects as binaural beats – which allows us to feel more relaxed, get in a more powerful and peaceful meditative state and visualize better. It is recommended to use headphones. Many people who do not respond well to binaural beats often respond very well to isochronic tones.

However, for a permanent life-changing spiritual focus, you need to use traditional meditation methods as your primary tools to access higher dimensions. As you know meditation can also make structural changes to the brain in powerful and positive ways and even the people around you!

Sources:

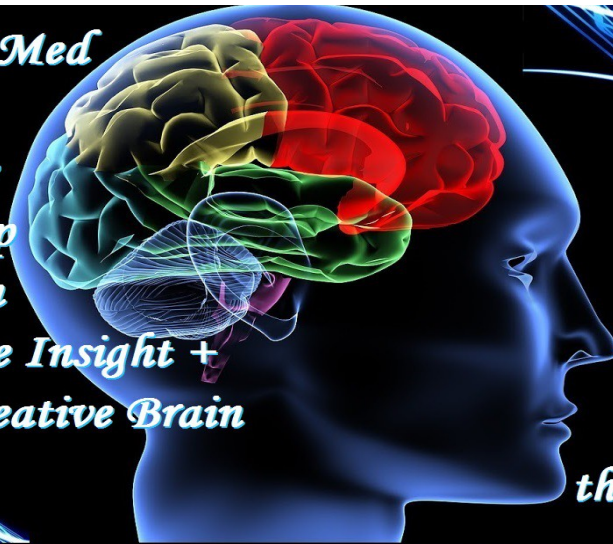
Theta Brain Waves

Brain wave Frequencies

The image features a dark blue background with two stylized human figures on either side. Each figure is surrounded by bright, glowing blue and white lightning bolts that radiate outwards. The figures themselves appear to be made of or composed of light and energy. The text is centered between the two figures.

*We are all Electrical Beings
that have a Surge Protection
Against Currents over
10 Milli-Amps or 1 Tesla*

*Peer Reviewed Med
Research has
Shown that the
Cybernetic Loop
Technology Can
Stimulate Insight +
the Creative Brain*



*There is a
Different Set
of Laws in
the Right Brain*



*In over 100 studies the
Electro-Stimulation
Technique is shown
Safe and Effective*

*When Set Free from Word Verbal
Dominance and Properly Stimulated
the Creative Insight Brain can Flourish*

*Your Attitude
Determines Your Altitude*

*"There is Nothing so terrible as
Activity or Life without Insight"*

Johann Wolfgang von Goethe (German poet)

**BIOFEEDBACK
DEVELOPS
INSIGHT**

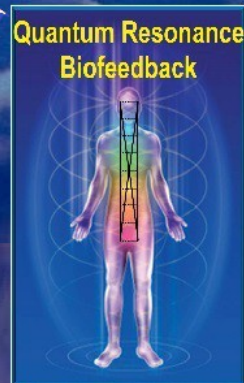
*"Energy and Persistence
conquer all things." –
Benjamin Franklin*



*Personal development of insight is the process of
achieving and expanding your full potential.
Dream big, develop yourself, unleash your
potential, play well with others, play to your
strengths, enjoy the process, share your unique
gifts with the world, and grow your greatness by testing
yourself, listening to your deeper nonverbal body electric,
expanding yourself, learning and improving . . .*

*Personal Development of Insight is a Journey,
NOT a Destination.*

*The Educator helps you to interface with your unconscious to
develop insight by interfacing with the body electric.*



What are Gamma Brain Waves? How to produce more Gamma Waves with Meditation

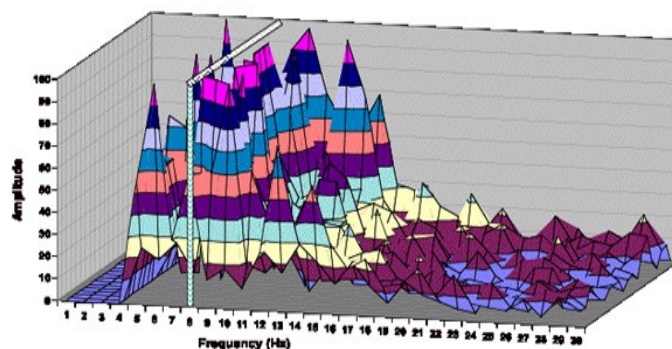
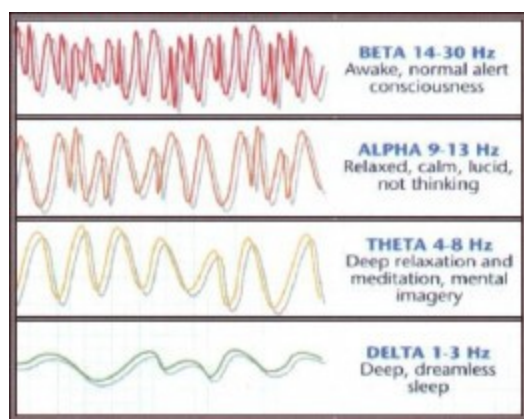


Figure 1.1. EEG patterns of healer

Source: [Overview of the four basic brain waves](#)

Introduction

The brain consists of millions and millions of neurons. These neurons communicated with each other via electrical impulses. Depending on the task one is doing (active thinking, sleeping, dreaming, meditating and so on) not all neurons need to send off these electrical impulses. While there are many neurons sending electrical impulses to one another in a task like reading or calculating, less neurons are active in sleep, for example. This makes sense, since our brain is barely active in the sleeping phases. Some neurons still send off electrical impulses, but these are different in amplitude and frequency to the electrical impulses that involve an active thinking task. When one measures these impulses with a electroencephalogram (EEG) all these impulses result into a wave. These waves originate in the brain and are called brain waves, logically.

Let us say, in non-active thinking tasks like sleeping, these brain waves are rather slow and of a low amplitude. In an active thinking task, these brain waves are quite fast and in a higher amplitude.

There are many different brain waves. Gamma waves are one of them and it has to be said that they are even rather special waves!

What are Gamma Waves?

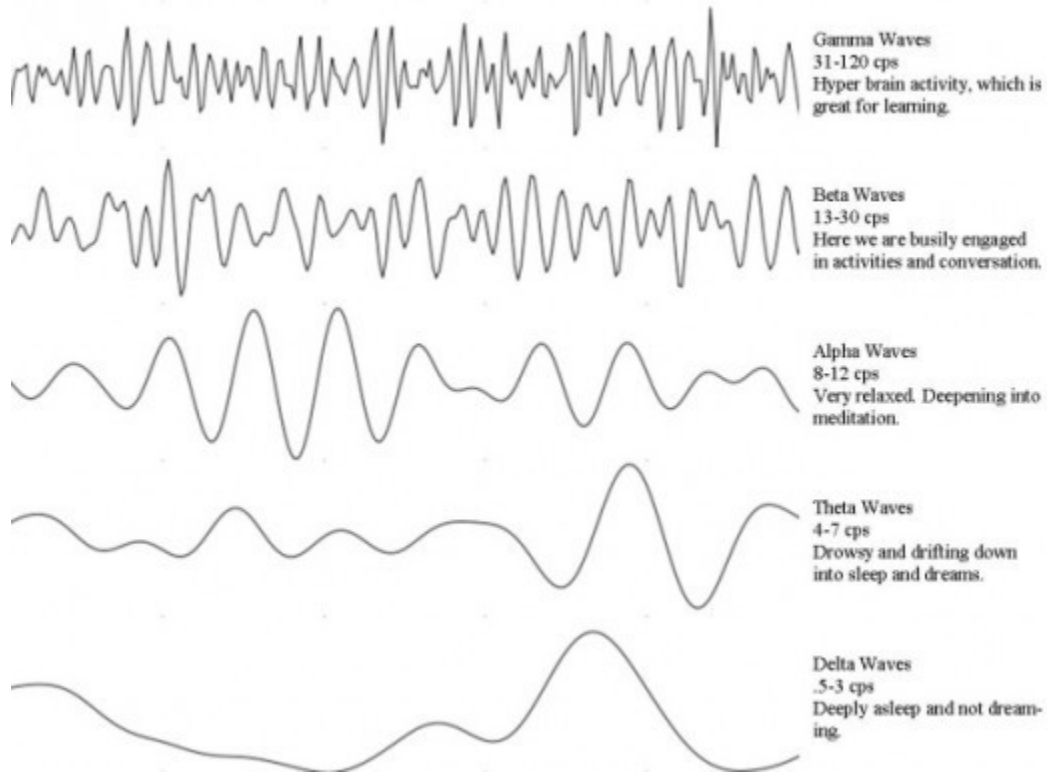
Gamma waves are typically of a high frequency and amplitude. Gamma brain waves are one of the fastest waves that reach all parts of the brain. Their frequency is normally 40 Hz and more. It has already been observed that people can produce gamma waves that have an amplitude of 100 Hz! These are called "Hypergamma brain waves" and are a subtype of gamma brain waves.

They occur when millions of neurons are active at the same time and "fire" these electrical impulses simultaneously.

Normally, people do not produce these brain waves under normal circumstances. These brain waves were mostly found in geniuses, for example, in a professor of physics. I like to call them "the genius brain waves". They were also observed in meditators who were practicing the loving kindness meditation. As it seems, gamma waves either occur in very intelligent people or in those people who experience unconditional love. It has been observed that Buddhist monks who started to practice the loving kindness meditation almost immediately at will produced gamma brain waves.

So, in essence, gamma brain waves occur when there is an unusually high brain activity.

Increasing gamma waves with either binaural beats or specific meditations can lead to a number of marvellous benefits. Afterwards, I will give you some advice on how to increase gamma waves and what to do in order to experience them more often and spontaneously.



Source: <http://charispang2013.files.wordpress.com/2013/02/...>

Gamma Waves with crashing waves in the background

Virtual Coffee with Gamma waves

Benefits of Gamma Waves

- Better Memory
- Increased Focus on tasks
- Better learning: Since the brain is so super-active, people are able to learn faster (information is processed at a much higher rate!).
- A high amount of gamma waves works like an anti-depressant.
- Studies have shown that a gamma brain wave therapy was successful against ADD
- Bliss: People have feelings of extreme bliss.
- Compassion: People tend to have a profound compassion towards other people.
- Enhanced Senses: It seems that the senses work better and reality is perceived more vividly.

- Works like coffee for some people.

3 ways How to increase Gamma Waves

One way to increase gamma waves is to listen to binaural beats. I recommend you to have a glass of water next to you after you finish your session. Sometimes, it happens that you feel a bit dizzy. Other than in the lower binaural beats I recommend you to do something that involves active thinking like reading or learning. Normally, one would silent his mind and focus on the binaural beats (like in theta brainwave entrainment for example.), but in this case you should be doing something.

Another more natural way (in my opinion) is to meditate. Most meditations are good to increase gamma wave activity, but THE best meditation for this is the loving kindness meditation. This meditation will not be described in this article, since it would be far too long. If you are interested in learning more about this special meditation, please read the full how to do the loving kindness meditation article or see the links below.

The last way I can give you from personal experience is to "recognize" their occurrence. Sometimes, especially when you start meditating or listening to binaural beats, you will have sudden feelings of bliss (for example) in your everyday life. This can happen in school, while watching TV, in the gym or anywhere else. Recognize these sudden occurrences and "hold on to them" and your brain will automatically learn that you desire these states and that they are good. Consequently, it will happen more often in the future, which will also have positively affect your behavior towards yourself and other people.

How long does it take to experience states of bliss?

This was a question from a user.

There is no definite answer to it, since these phenomena are quite individual. There are many factors that are important, such as meditation, food, physical activity and so on.

Long experienced meditators are very probable to experience these states of bliss during the gamma brainwave entrainment and for the next few hours after they stop listening to gamma binaural beats.

People, with no meditation background, do not experience these states of bliss right after the session (but some do!). In my case, as an unexperienced meditator, it took me 2 days until I started to experience these feelings of bliss. They occurred quite randomly. It is important that you listen on a daily basis to gamma binaural beats.

Personal Experience

Some time ago, I started listening to gamma binaural beats. It happened that I felt a bit dizzy and had the need to drink something. Normally, I felt better afterwards. Also, after a 15 minutes session where I simply focused on the mere binaural beats I felt "overwhelmed". It feels as if my brain is not yet ready to "embrace" the entirety or to tune in into these frequencies. This didn't happen with other binaural beats (delta, theta etc.).

When I was reading a book (for example, Faust, Ulysses and other complicated books) I was able to focus on the text very good and my reading speed even increased slightly, while listening to gamma binaural beats.

Another phenomenon, I was able to observe on myself, was that I was able to stay awake the whole night without any coffee or black tea or whatsoever! Moreover, I was more awake and more focused on learning material than with caffeine in my blood (I still recommend you to go the bed than staying awake all nights, though).

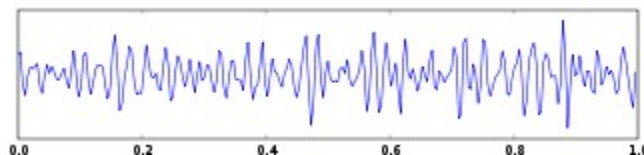
Ever since I started recognizing these sudden feelings of bliss it started to occur more often and as I realized I am a happier person in general!

Really good to know, what gamma waves and some further tips can do to change your life to the better!

Gamma brain waves

From Wikipedia, the free encyclopedia

Not to be confused with [gamma rays](#).



A **gamma wave** is a pattern of [neural oscillation](#) in humans with a frequency between 25 and 100 Hz,^[1] though 40 Hz is typical.^[2]

According to a popular theory, gamma waves may be implicated in creating the unity of conscious perception (the [binding problem](#)).^{[3][4][5]} However, there is no agreement on the theory; as a researcher suggests:

Whether or not gamma wave activity is related to subjective awareness is a very difficult question which cannot be answered with certainty at the present time.^[6]

History

Gamma waves were initially ignored before the development of digital [electroencephalography](#) as analog electroencephalography is restricted to recording and measuring rhythms that are usually less than 25 Hz.^[1] One of the earliest reports on them was in 1964 using recordings of the electrical activity of electrodes implanted in the visual cortex of awake monkeys.^[7]

Linked to unity of consciousness?

History of idea[

The idea that distinct regions in the brain were being stimulated simultaneously was suggested by the finding in 1988^[2] that two neurons oscillate synchronously (though they are not directly connected) when a single external object stimulates their respective receptive fields. Subsequent experiments by many others demonstrated this phenomenon in a wide range of visual cognition. In particular, [Francis Crick](#) and [Christof Koch](#) in 1990^[8] argued that there is a significant relation between the binding problem and the problem of visual consciousness and, as a result, that synchronous 40 Hz oscillations may be causally implicated in visual awareness as well as in visual binding. Later the same authors expressed scepticism over the idea that 40 Hz oscillations are a sufficient condition for visual awareness.^[9]

A lead article by [Andreas K. Engel et al.](#) in the journal *Consciousness and Cognition* (1999) that argues for temporal synchrony as the basis for consciousness, defines the gamma wave hypothesis thus: ^[10]

The hypothesis is that synchronization of neuronal discharges can serve for the integration of distributed neurons into cell assemblies and that this process may underlie the selection of perceptually and behaviorally relevant information.

Role in attentive focus

The suggested mechanism is that gamma waves relate to neural consciousness via the mechanism for conscious attention:

The proposed answer lies in a wave that, originating in the thalamus, sweeps the brain from front to back, 40 times per second, drawing different neuronal circuits into synch with the precept, and thereby bringing the precept into the attentional foreground. If the thalamus is damaged even a little bit, this wave stops, conscious awarenesses do not form, and the patient slips into profound coma.^[4]

Thus the claim is that when all these neuronal clusters oscillate together during these transient periods of synchronized firing, they help bring up memories and associations from the visual precept to other notions. This brings a **distributed matrix** of cognitive processes together to generate a coherent, concerted cognitive act, such as perception. This has led to theories that gamma waves are associated with solving the **binding problem**.^[3]

Gamma waves are observed as **neural synchrony** from visual cues in both conscious and **subliminal** stimuli.^[11] This research also sheds light on how neural synchrony may explain **stochastic resonance** in the nervous system.^[12] They are also implicated in REM sleep, which involves visualizations, and also during anesthesia.^[6]

Contemporary research

A 2009 study published in Nature successfully induced gamma waves in mice brains. Researchers performed this study using **optogenetics** (the method of combining genetic engineering with light to manipulate the activity of individual nerve cells). The protein channelrhodopsin-2 (ChR2), which sensitizes cells to light, was genetically engineered into these mice, specifically to be expressed in a target-group of interneurons. These fast-spiking (FS) interneurons, known for high electrical activity, were then activated with an optical fiber and laser—the second step in optogenetics. In this way, the cell activity of these interneurons was manipulated in the frequency range of 8–200 Hz. The study produced empirical evidence of gamma wave induction in the approximate interval of 25–100 Hz. The gamma waves were most apparent at a frequency of 40 Hz; this indicates that the gamma waves evoked by FS manipulation are a resonating brain circuit property. This is the first study in which it has been shown that a brain state can be induced through the activation of a specific group of cells.^[13]

Relation to meditation

Experiments on [Tibetan Buddhist](#) monks have shown a correlation between transcendental mental states and gamma waves.^{[14][15]} A suggested explanation is based on the fact that the gamma is intrinsically localized. Neuroscientist Sean O'Nuallain suggests that this very existence of synchronized gamma indicates that something akin to a singularity - or, to be more prosaic, a conscious experience - is occurring.^[14] This work adduces experimental and simulated data to show that what meditation masters have in common is the ability to put the brain into a state in which it is maximally sensitive.

As hinted above, gamma waves have been observed in Tibetan Buddhist monks. A 2004 study took eight long-term Tibetan Buddhist practitioners of meditation and, using electrodes, monitored the patterns of electrical activity produced by their brains as they meditated. The researchers compared the brain activity of the monks to a group of novice meditators (the study had these subjects meditate an hour a day for one week prior to empirical observation). In a normal meditative state, both groups were shown to have similar brain activity. However, when the monks were told to generate an objective feeling of compassion during meditation, their brain activity began to fire in a rhythmic, coherent manner, suggesting neuronal structures were firing in harmony. This was observed at a frequency of 25–40 Hz, the rhythm of gamma waves. These gamma-band oscillations in the monk's brain signals were the largest seen in humans (apart from those in states such as seizures). Conversely, these gamma-band oscillations were scant in novice meditators. Though, a number of rhythmic signals did appear to strengthen in beginner meditators with further experience in the exercise, implying that the aptitude for one to produce gamma-band rhythm is trainable.^[16]

Such evidence and research in gamma-band oscillations may explain the heightened sense of consciousness, bliss, and intellectual acuity subsequent to meditation. Notably, meditation is known to have a number of health benefits: stress reduction, mood elevation, and increased life expectancy of the mind and its cognitive functions. The current [Dalai Lama](#) meditates for four hours each morning, and he says that it is hard work. He elaborates that if neuroscience can construct a way in which he can reap the psychological and biological rewards of meditation without going through the practice each morning, he would be apt to adopt the innovation.^[17] The aforementioned study in which gamma states were induced in mice may be a step in this direction.

Opposing evidence

Many neuroscientists are not convinced of the gamma wave argument. Arguments against it range from the possibility of mismeasurement – it has been suggested that EEG-measured gamma waves could be in many cases an artifact of electromyographic activity^{[18][19]} – to relations to other neural function, such as minute eye movements^[20]

However, proponents like O'Nuallain and Andreas Engel argue that gamma evidence persists even with careful signal separation.^{[14][21]}

Moreover, recent studies using [magnetoencephalography](#) (MEG), which does not suffer the potential artifacts associated with EEG, have identified gamma activity associated with sensory processing, mainly in the [visual cortex](#).^{[22][23][24][25]}

Bearing this theory in mind, a number of questions remain unexplained regarding details of exactly how the temporal synchrony results in a conscious awareness or how a new percept "calls for"^[4] the synchrony, etc.

See also

Brain waves[edit]

- [Delta wave](#) – (0.1 – 3 Hz)
- [Theta wave](#) – (4 – 7 Hz)
- [Alpha wave](#) – (8 – 15 Hz)
- [Mu wave](#) – (7.5 – 12.5 Hz)
- [SMR wave](#) – (12.5 – 15.5 Hz)
- [Beta wave](#) – (16 – 31 Hz)
- **Gamma wave** – (32 – 100 Hz)

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EDUCTOR/SCIO ELECTROENCEPHALOGRAM DETECTION + CORRECTION

The EEG is generated from the inhibitory and excitatory postsynaptic potentials of the cortical nerves. These postsynaptic potentials come together in the cortex and extend through the skull and scalp. Neuronal action potentials have much smaller and shorter potentials (1 millsec). Postsynaptic potentials acting at 15 to over 200 millsec. The rhythmical activity of the EEG is a function of the postsynaptic cortical neuronal potentials which are synchronized by the complex interactions of vast quantities of cortical cells. The cortical neurones interact with the subcortical pacemakers. Together there is a synchronicity that results from this interaction. Subcortical structures can send synchronizing impulses to cortical neurones and induce wide spread synchronous rhythm changes. The system must filter EKG activity, external pulses, eye movements, and other artefacts.

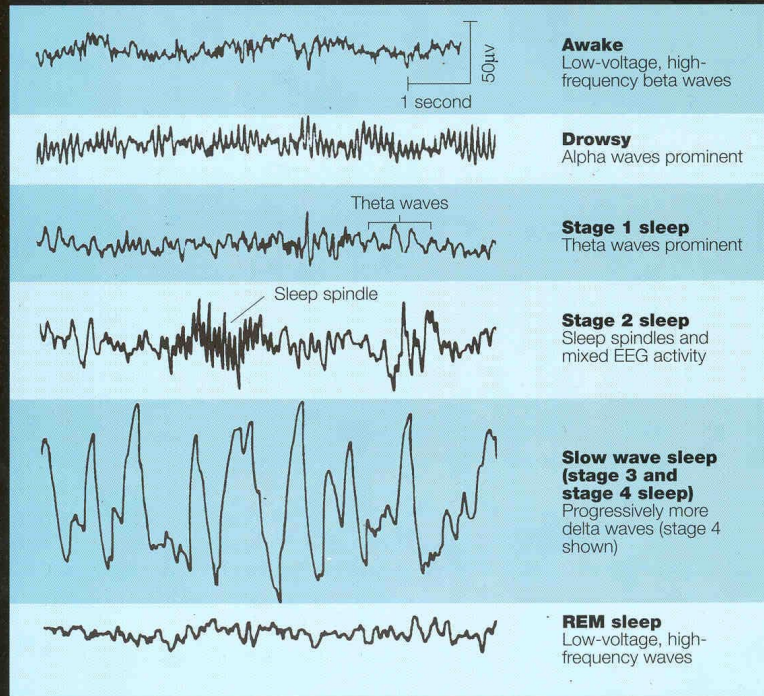
The summation of electrical potential changes in the cortex is primarily at the vertically oriented large pyramidal cells of the cortex. The polarization and depolarization of the cells creates electro-potentials of 100 microvolts or more. The EEG is far too complex to judge individual neuronal activity. But it can be useful in revealing inappropriate rhythms. The Alpha and Mu waves help to impose a regularity on the overall functions. The recruiting response originating in the medial and intralaminar thalamus. The augmenting response from nuclei of the lateral thalamus helps to stabilize sensory information. Sleep, relaxation, and thought patterns have been studied to give estimates of functions of the brain wave. Reticular formation, midbrain, limbic system and other areas of the brain have effects on the EEG.

The most exact EEG comes the multiple pole (12-24-or 36) electrodes. The QXCI uses an eighth pole placed on the forehead. This is for convenience not accuracy. So the results of the test are not for ultimate diagnosis. The system is at best 85% accurate and thus can be used as a pretest before other testing. Factors can be analyzed such as wave form, repetition, frequency, amplitude, distribution, phase relationships, timing, persistence, and of reactance.

The major wave forms are then presented in percent on the left in a group box. The largest should be beta in a normal waking patient. Alpha indicates relaxation, theta consciousness, delta sleep. If you check an area (with the check box in front of the word) the computer will help to correct any imbalance and attempt to increase the consciousness wave form in the patient.

On the right side there is a grid of wave and frequency disorders that the computer can detect. In so doing the computer here does not calculate in percent as in the wave form on the left. As the computer generates numbers ranking the arbitrary amount of the wave type it finds. Normal wave should be the highest, normally over 40. No other number should be within 10 points of normal. If any are within 10 points of normal or if any are greater than the normal score, then the computer has estimated that this area of disturbance is pathologic. To treat any such dysfunction click in the check box in front of the name of the disorder. Then the computer will attempt to treat this area of dysfunction with harmonic bio-resonance.

EEG Patterns in Sleep and Wakefulness



CYBERNETIC BIOFEEDBACK-Frequency Tests+MCES rev 3.3.2014

Organ Electrical Patterns | ECG Fast Fourier Transform | Trivector Patterns | Autonomic Nerval System | Brain Wave Pattern Therapy | Subspace |

Wave Speed in Percent

000 Alpha, treats stress

000 Beta, stabilizes worry

000 Theta, Consciousness Stim

000 Delta, For insomnia

000 Immature, slow thought

Reset to all off

Treat clicked items

Stim Brain with Wave Form Clicked, 2 min

Attention Deficit, Brain Fatigue, LEAP

Pattern Type

000 Normal

000 Cerebellar Dysfunc

000 Local Slow waves

000 Amplitude Disorder

000 Epileptic forms

000 General Asymmetry

000 Injury Profile

000 Bilateral Sync

000 Deep Brain Asymmetry

000 Personality Dysfunc

000 Attention Deficit

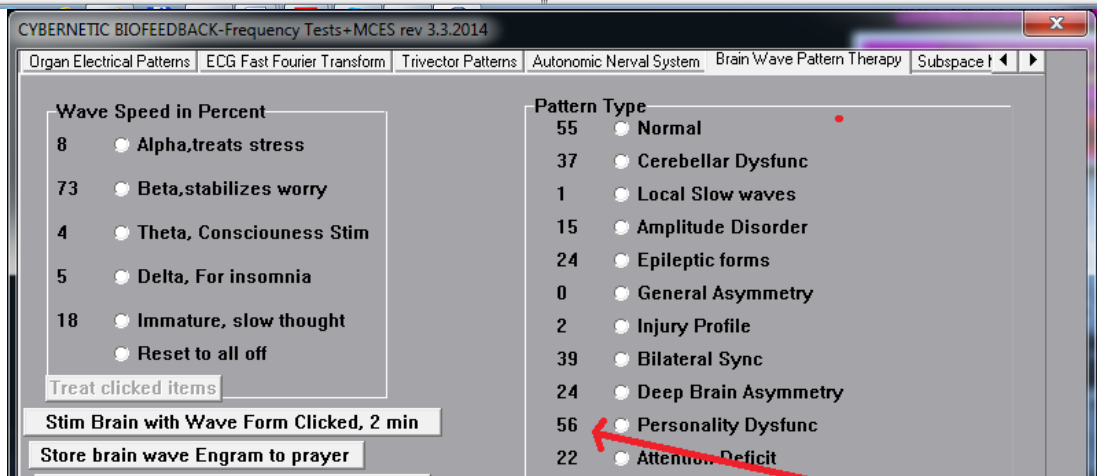
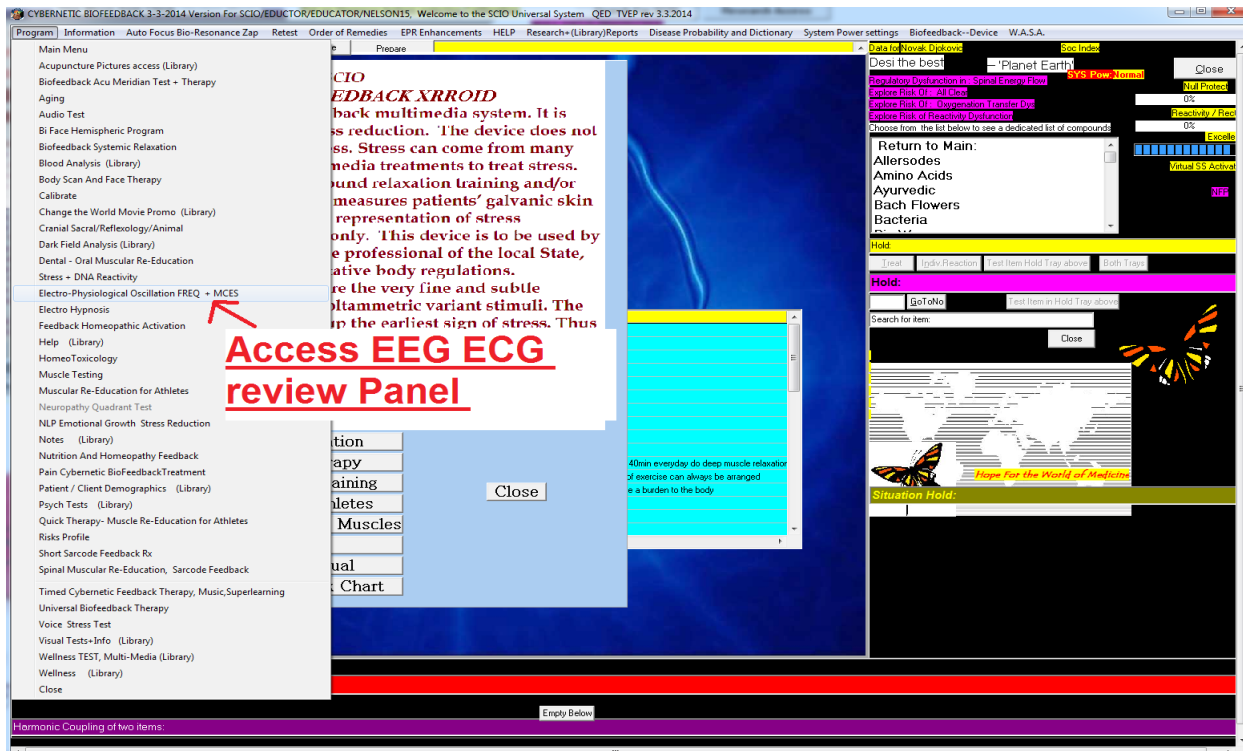
NULL FIELD PROTECTED
Average frequency : 0

Text on EEG_ECG

Fourier + Hysteresis Fractal Fuzzy Analysis
NFP-Athelete

Music Therapy | Anti-Aging

START | Results | Notes | Close



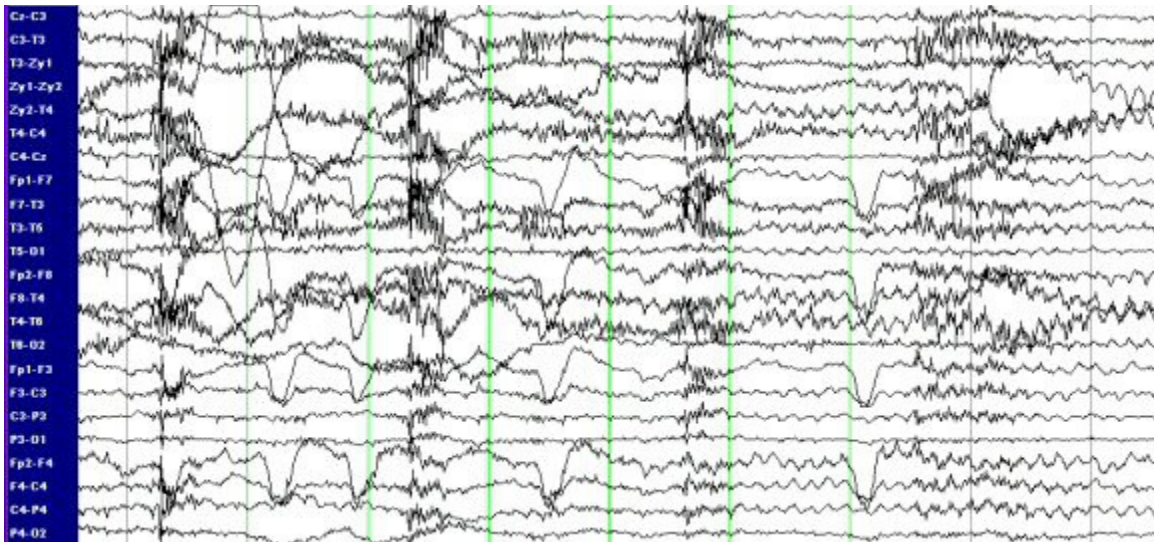
Click on the Item with the highest number and treat till the number in front of normal is the highest value

| | |
|-------------------------------------|--------------------------------|
| Addiction Pattern Detected | Fear Pattern Detected |
| Mineral Deficiency Pattern Detected | Social Stress Pattern Detected |
| Worry Pattern Detected | Guilt Pattern Detected |
| Inability to focus | |
| possible emotional superimposition | |

Make Report of Medical Reference Brain wave tune for emotional stress

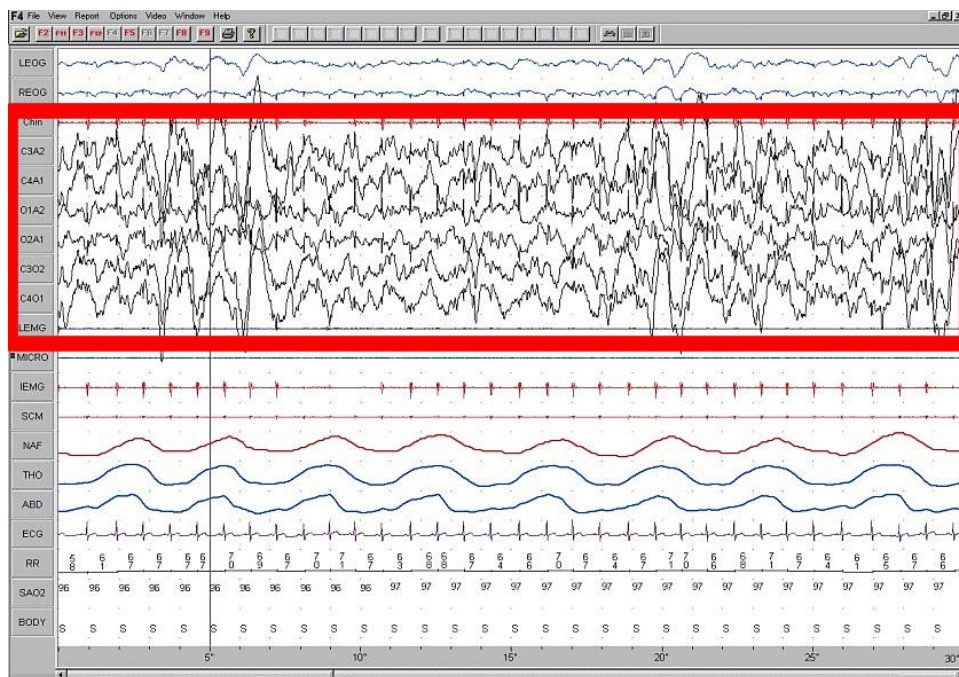
EPILEPTIC

Ictal patterns, hyper-arrhythmia, slow spike, multifocal independent spikes, epileptic spindles all are detectable. These can occur in infants sometimes without any risk. Past 8 yr. these patterns can be evidence of brain hormone deficiency, injury, or other blockage of hormonal activity.



LOCAL SLOW WAVES

Local Slow waves are less than 8 hz and appear at only one electrode. Local Slow waves come from a structural lesion, ischemia, epileptic tendencies, serotonin deficiencies, tumor, hemorrhages, abscesses, migraines, hypertension, or other.



AMPLITUDE DISORDERS

Here the overall battery of the brain is weak. This can be because of mineral, dehydration, amino acid deficiency, fatty acid deficiency, or hypo-oxygenation. This can occur in brain death, stroke, Huntington's chorea, brain toxicity, or metabolic disease. Anxiety or intense fear can also produce such a pattern.



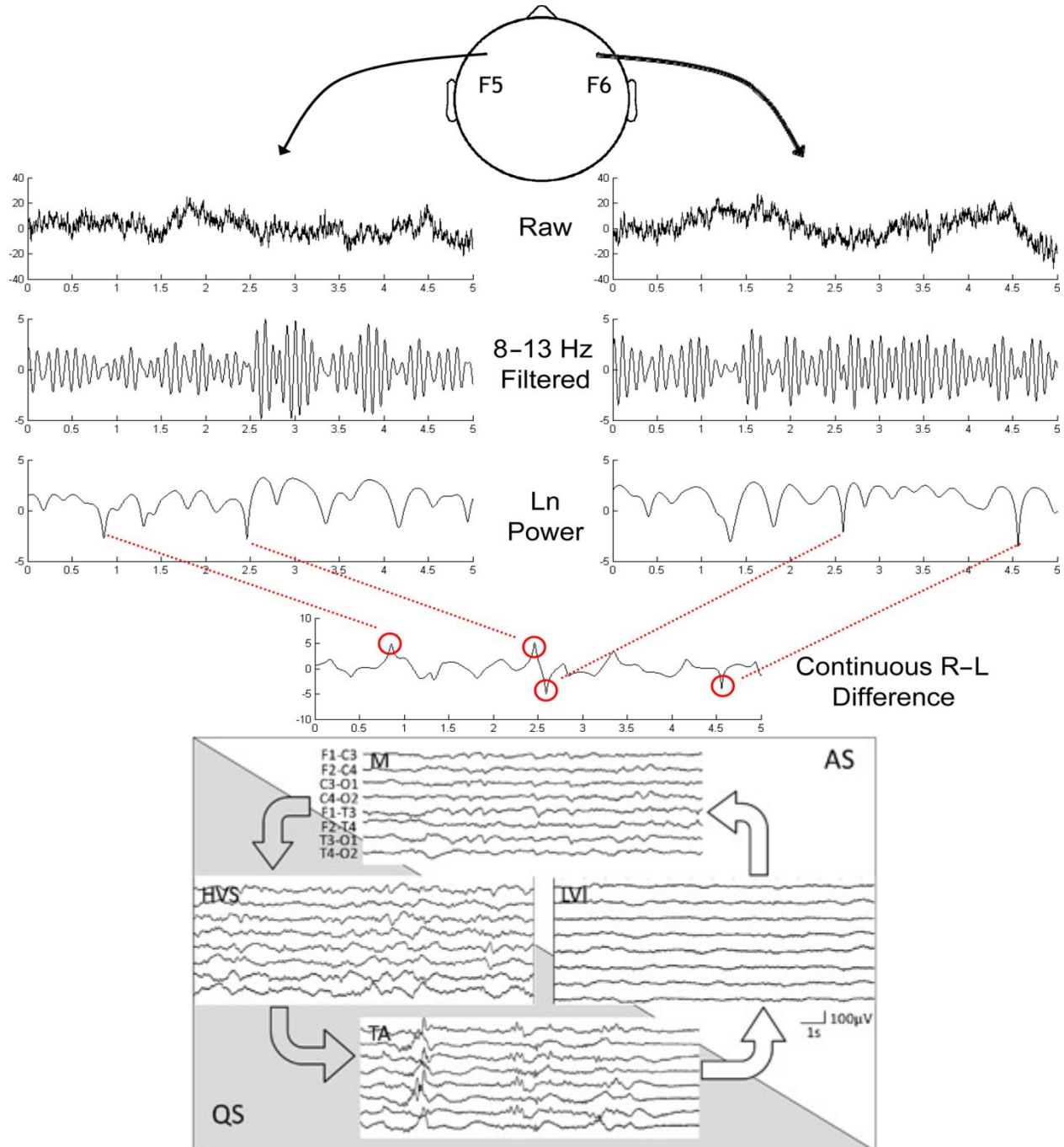
CEREBELLAR DISORDERS

Here there is a poly spike wave set at 4-6 hz with anterior maximum. This can be from demyelination of the CEREBELLAR area. There may be accompanying dizziness and inability to maintain balance. Treatment should include fatty acids and proper sarcodes.

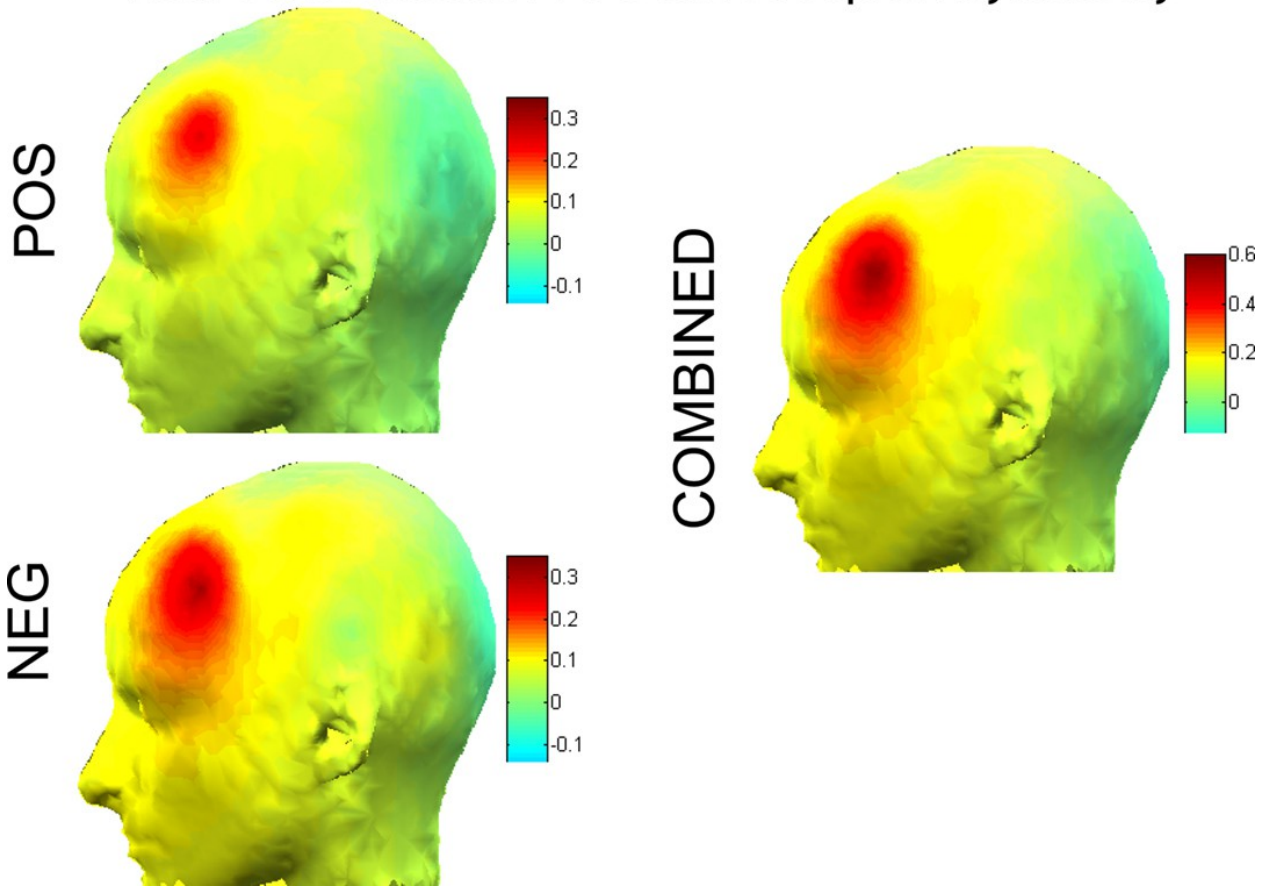


GENERALASSYMETERY

Here there is a difference in the amplitude and or phase of the waves from the two sides of the head. Thalamic cortical lesions can cause or lesions on one side. A skull defect can cause this pattern. Suggest cranial sacral therapy or other cranial adjustment.



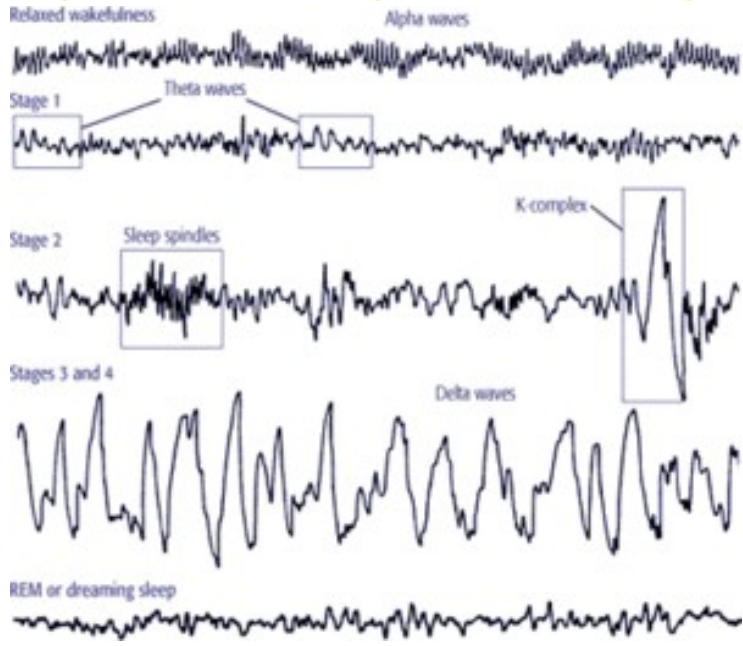
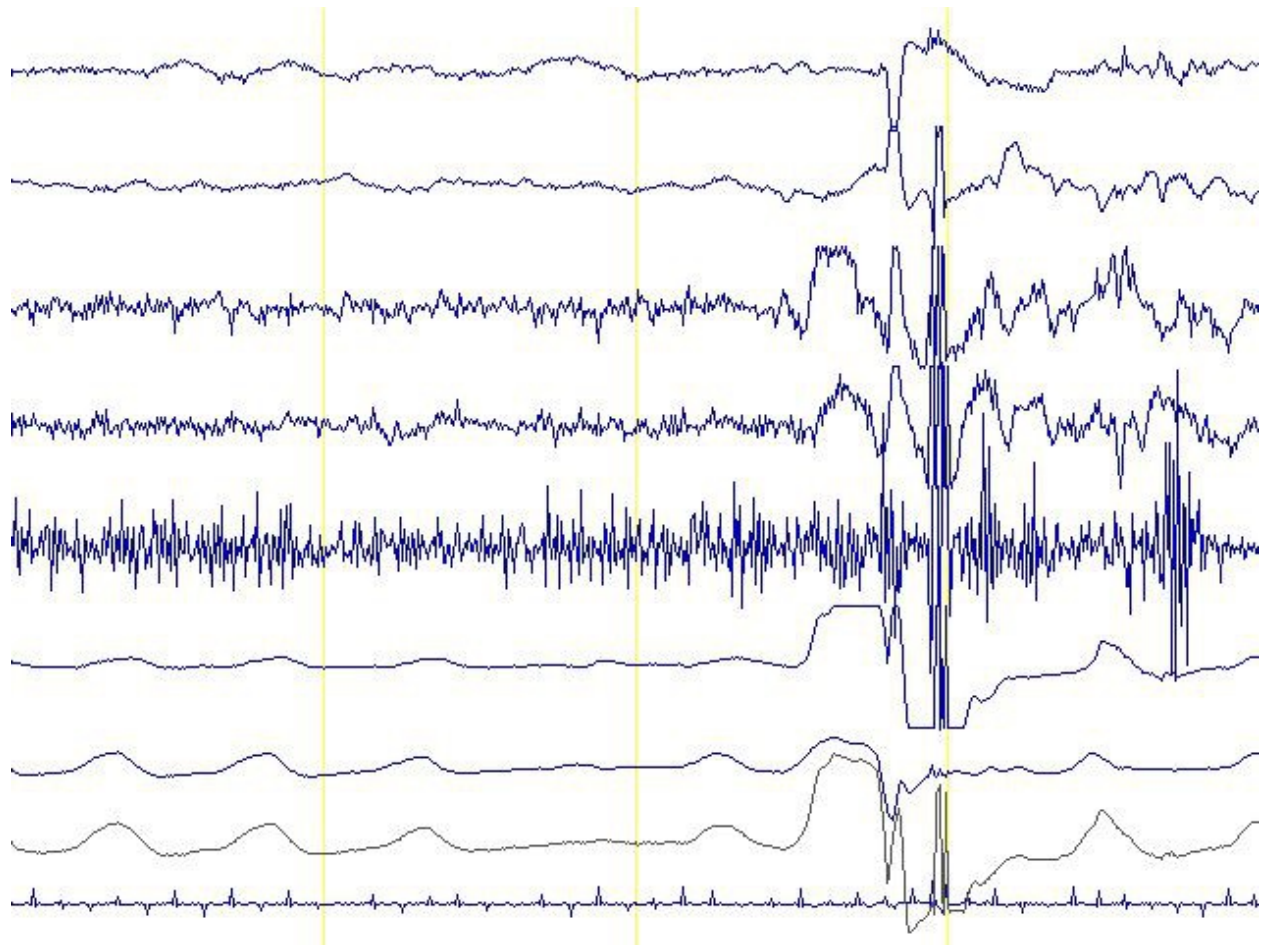
Relationship of Peri-Burst Alpha Asymmetry with Conventional FFT-Derived Alpha Asymmetry

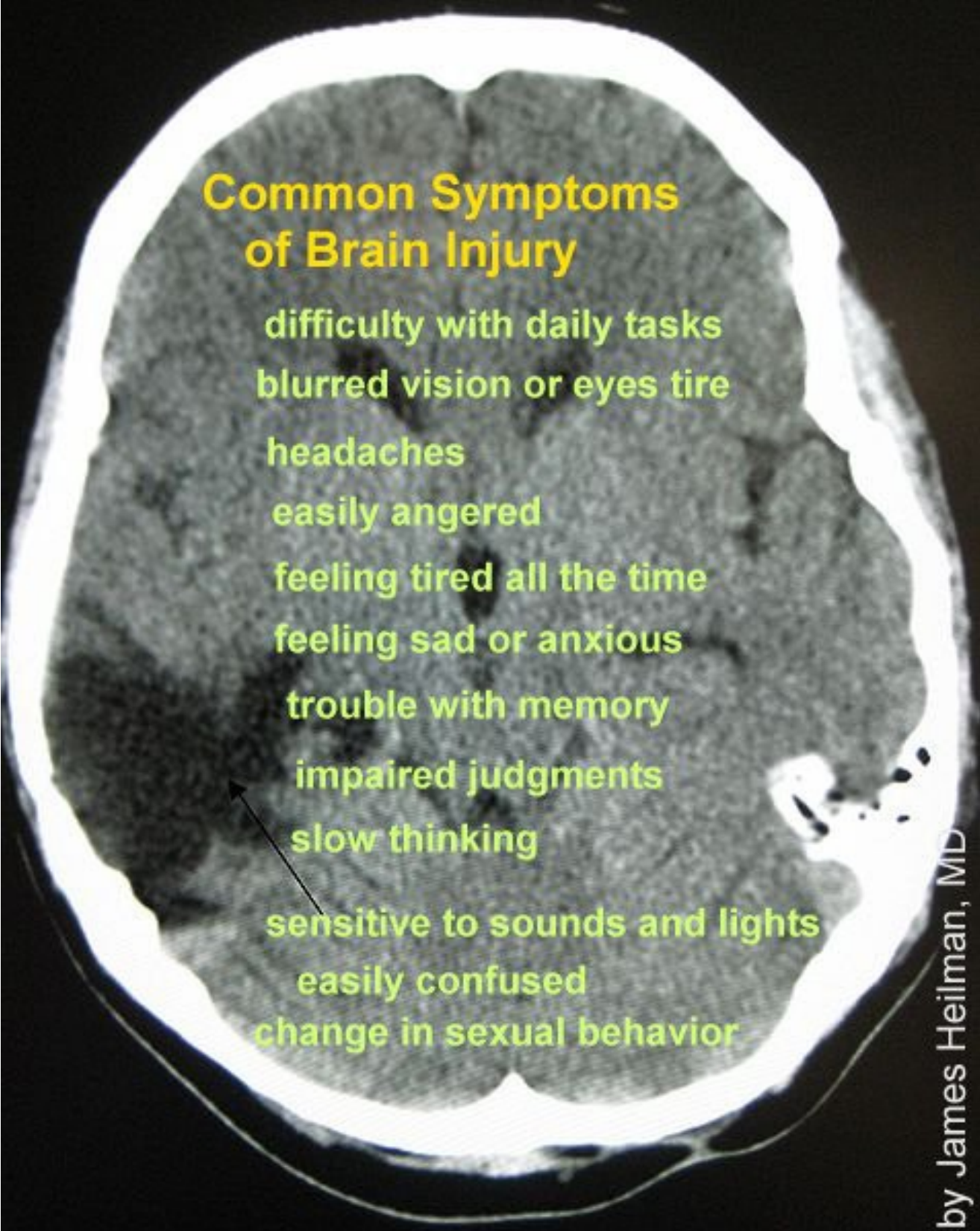


INJURY

Many traumas physical or emotional can produce certain wave forms. These forms are over synchronous for a period then non synchronous for a period. There will occur an abnormal alpha wave that prevents total relaxation. This indicates the need for the Injury homeopathic or other therapy for trauma.





An axial CT scan of the brain showing a cross-section of the cerebral hemispheres. The image is in grayscale, with the skull appearing as a bright white ring. The brain tissue is in various shades of gray. A list of symptoms is overlaid in yellow text on the left side of the brain. A black arrow points from the text 'sensitive to sounds and lights' to a specific area in the brain's white matter.

Common Symptoms of Brain Injury

difficulty with daily tasks

blurred vision or eyes tire

headaches

easily angered

feeling tired all the time

feeling sad or anxious

trouble with memory

impaired judgments

slow thinking

sensitive to sounds and lights

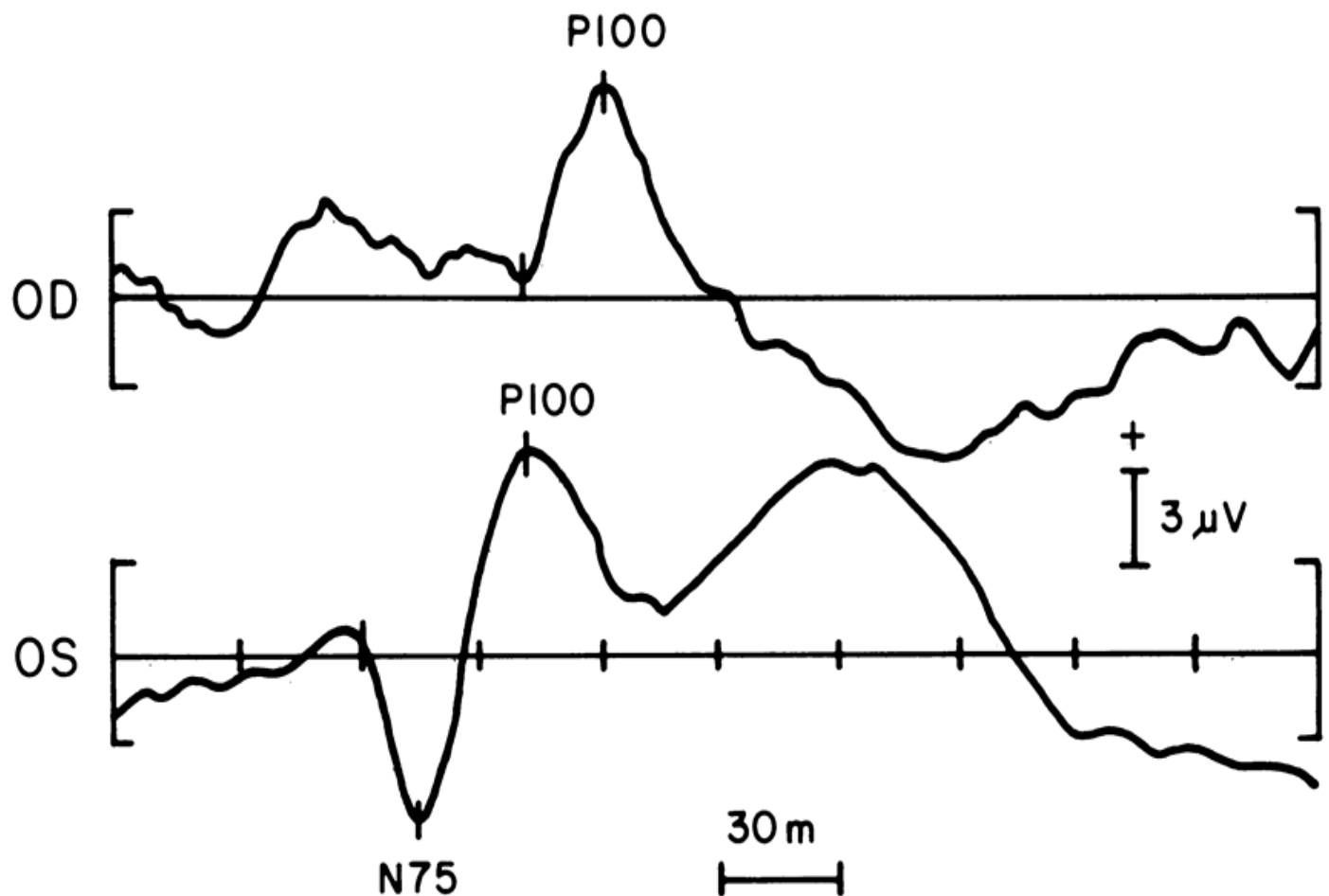
easily confused

change in sexual behavior

BILATERAL SYNCH

Here slow waves (7-8 hz) are found on both sides of the head with exactly the same occurrence. The pattern can shift location and can be detected as trains of waves on a background of lower amplitude. They can be created by hyperventilation, drowsiness, hypo-glycaemia, having a disorder more in the grey matter than the white matter, structural disorders in the mesencephalon, diencephalon, or the frontal lobe. Also treat toxins, endocrine and metabolic disease.

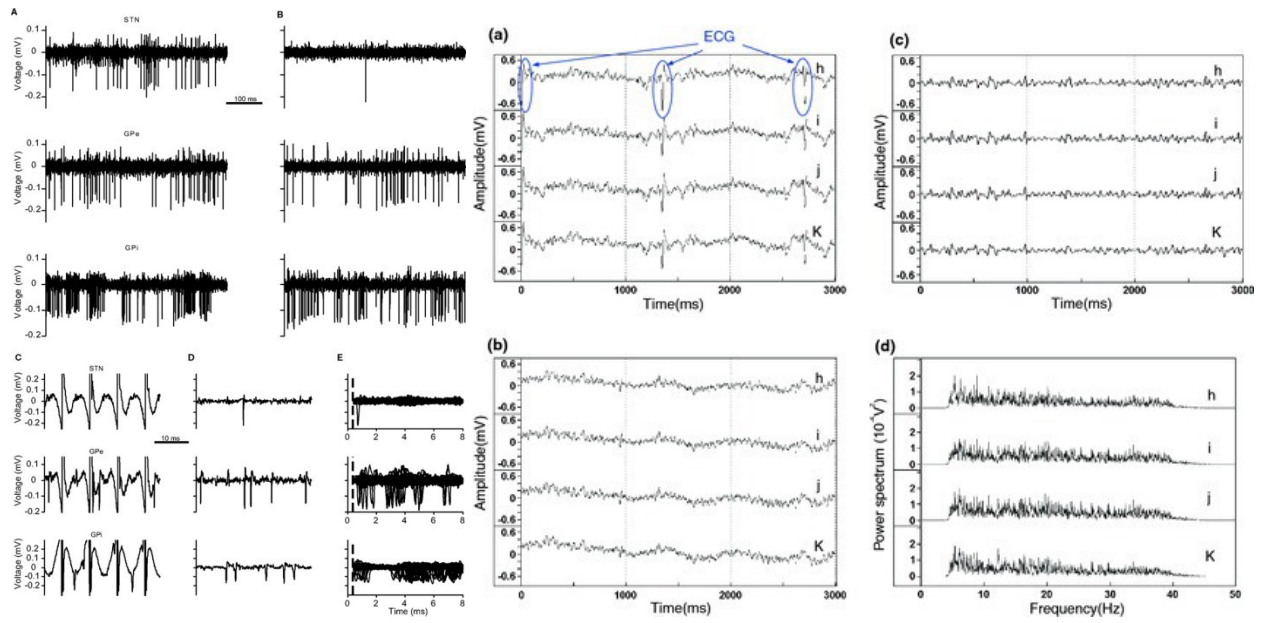
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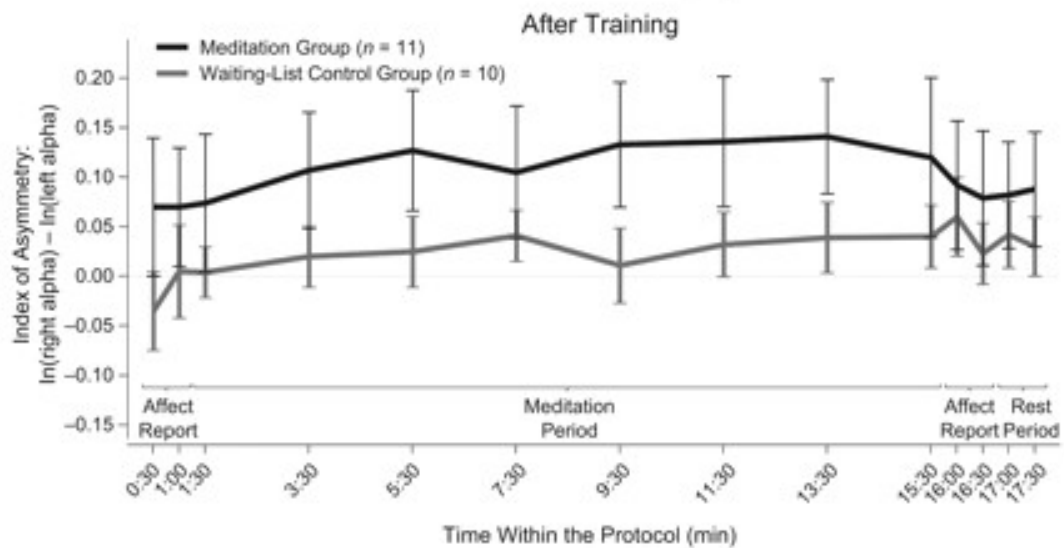
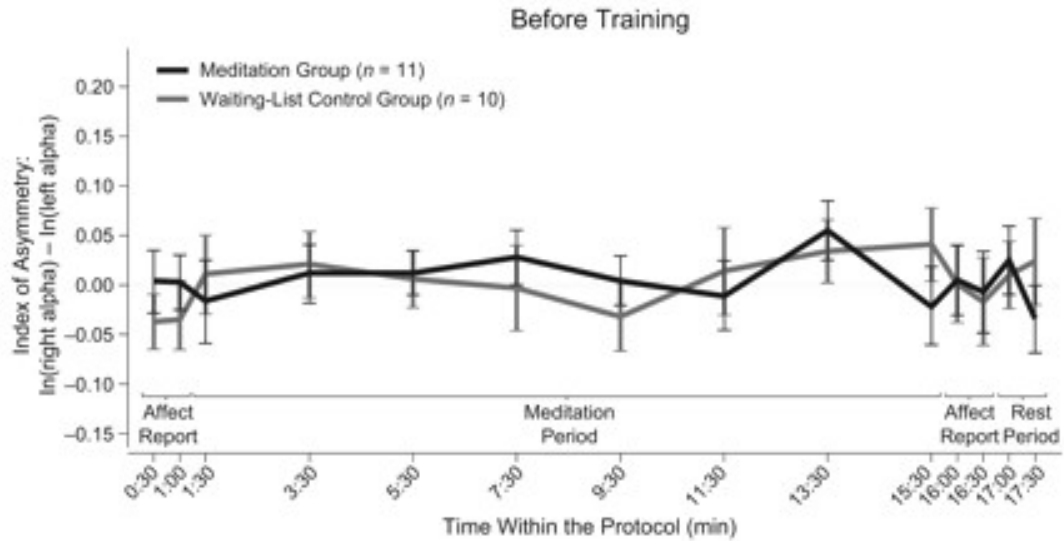


DEEP BRAIN ASSYMETERY

Many conditions can affect the deep parts of the brain. Limbic, thalamic, rhineencephalon and other areas can produce certain wave deformities that will echo on each channel and even effect the total trivector analysis. Alzheimer's, Parkinson's, Addison's, Wilson's other

metabolic diseases can produce this pattern. Toxins such as steroids, or drugs can also do the same.





PERSONALITY DISORDERS

The personality engram has a signature reactive field. If there are two engrams appearing this factor can appear. There are other wave forms which can be detected from the QXCI. These factors will need to be treated with counselling and or NLP techniques.

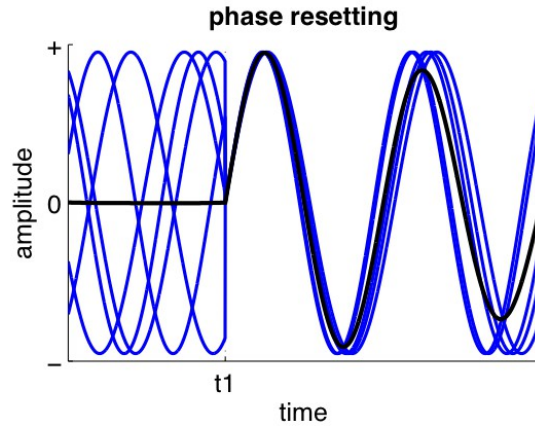


TABLE 1. EEG studies of borderline personality disorder

| Authors, Year (Reference No.) | N (Male/ Female) | Diagnostic System | Medications | Control Groups | Comorbidity | | Findings |
|--------------------------------|------------------|-------------------|--|---|--------------------------------------|---------|---|
| | | | | | Axis I | Axis II | |
| Snyder & Pitts, 1984 (7) | 37 (37/0) | DSM-III | None | Dysthymia | None | None | Increased slow wave activity |
| Cowdry et al., 1985 (8) | 39 (3/36) | DSM-III | NR | Unipolar depression | None current | NR | Posterior sharp waves |
| Cornelius et al., 1986 (33) | 69(17/52) | DIB | None | Non-BPD Axis II disorders | None current | None | 5.8% with severe EEG abnormalities, compared with 0% in a non-BPD AXIS II control group |
| Messner, 1989 (9) | 1 (1/0) | DSM-III | None | None | None | None | Focal temporal lobe slowing |
| Archer et al., 1988 (32) | 16 (NR) | DSM-III | None | Non-BPD Axis II Dysthymia Mixed diagnoses | None | None | 6.3% had spike and wave discharges. Not significantly higher than the other three groups. No normal control group |
| Schmidt et al., 1989 (10) | 1 (0/1) | DSM-III | Antidepressant and anti-psychotic | None | Depression | None | Routine EEG normal. Quantified EEG showed marked asymmetry |
| Drake et al., 1992 (37) | 6 (NR) | MMPI | NR | None | NR | NR | Normal EEGs in BPD patients with pseudoseizures |
| Ogiso et al., 1993 (34) | 18 (0/18) | DIB DSM-III | Anxiolytics, antipsychotics, antidepressants | Non-BPD with Axis I disorders | Major depression and substance abuse | NR | Positive spikes and spike wave phantoms |
| De la Fuente et al., 1998 (38) | 20 (6/14) | DSM-III-R DIB | None | None | None current | NR | 40% with diffuse slowing |

Note: DIB = Diagnostic Interview for Borderline Personality Disorder; Gunderson score of at least 7; MMPI = Minnesota Multiphasic Personality Inventory; NR = not reported.
^aDSM-III and DSM-III-R indicate diagnoses based solely on clinical interviews without use of structured or semistructured interview instruments.

TABLE 3. Presence or absence of aura in epileptic patients (n = 44) with and without personality disorders

| Status | Aura | | No Aura | |
|-----------|------|------|---------|-------|
| | n | % | n | % |
| No PD | 17 | 60.7 | 16 | 100.0 |
| PD | 11 | 39.3 | 0 | 0 |
| Cluster A | 0 | 0 | 0 | 0 |
| Cluster B | 3 | 10.7 | 0 | 0 |
| Cluster C | 8 | 28.6 | 0 | 0 |

Note: PD = personality disorders. Cluster A (odd/eccentric) includes schizoid, paranoid, and schizotypal personality disorders; Cluster B (dramatic/emotional) includes borderline, narcissistic, histrionic, and antisocial personality disorders; Cluster C (anxious/fearful) includes avoidant, dependent, compulsive, and passive-aggressive personality disorders.

TABLE 2. Evoked potential studies of borderline personality disorder

| Author, Year (Reference No.) | N (Male/Female) | Diagnostic System ^a | Medications | Control Groups | Comorbidity | | Findings |
|------------------------------|-----------------|--------------------------------|-------------------------------|---|---|--------------------------------|---|
| | | | | | Axis I | Axis II | |
| Blackwood et al., 1986 (44) | 14 (0/14) | SADS DIB BEFI | None | Non-BPD Axis II Healthy control | None | None | P300 amplitude smaller and latency longer than in a personality disorder and normal control groups |
| Kutcher et al., 1987 (46) | 22 (0/22) | DSM-III DIB SADS | None ^b | Paranoid schizophrenia Major depression Non-BPD Axis II Healthy volunteers | None | Schizotypal in half the sample | Decreased P300 amplitude and increased latency in BPD as compared with healthy, depressed, and non-BPD control subjects. BPD with and without schizotypy did not differ |
| Kutcher et al., 1989 (45) | 23 (5/18) | DSM-III SADS DIB | 11 drug free, 12 medicated | BPD with schizotypy Schizotypal personality disorder Other Axis II | Psychotic disorders and drug abuse excluded | None | Prolonged latency of the late EPs as compared with non-BPD or schizotypal PD. Similar in BPD and schizotypal PD |
| Drake et al., 1991 (47) | 20 (2/18) | DSM-III-R | Off meds for at least 1 week | Healthy subjects | None current | NR | Decreased amplitudes and prolonged latencies of mid- and long-latency EPs |
| Lincoln et al., 1998 (49) | 11 children | DSM-III-R | No current meds | Healthy children Children with ADHD | None current | NR | Decreased amplitudes as compared with healthy and ADHD children |

Note: SADS = Schedule for Affective Disorders and Schizophrenia; DIB = Diagnostic Interview for Borderline Personality Disorder; Gunderson score of at least 7; BEFI = Borderline Ego Functions Inventory; ADHD = attention-deficit hyperactivity disorder; NR = not reported.

^aDSM-III and DSM-III-R indicate diagnoses based solely on clinical interviews without use of structured or semistructured interview instruments.

^bMedication free for 1 month and no depot neuroleptics for 6 months.

Table – Indications for clinical EEGs in patients with psychiatric disorders

Nonspecific indications

- Atypical presentation (eg, unusual age of onset)
- Atypical symptoms (eg, unilateral or stereotypic hallucinations)

Isolated epileptic discharges

- Panic attacks and other dissociative symptoms
- Repetitive aggressive episodes (particularly if seemingly unmotivated)
- Medically unresponsive ADHD

Slow activity present

- Acute confusional state in the absence of medical explanation^a
- Individuals presenting with a difficult to assess mental status^a: differential diagnosis of dementia vs depression
- History of possibly significant brain insult (eg, head injury or stroke)

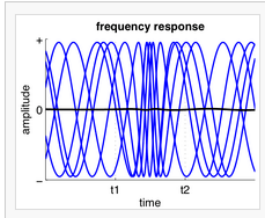
EEG, electroencephalogram. ^a Can be considered emergencies.

Activity patterns

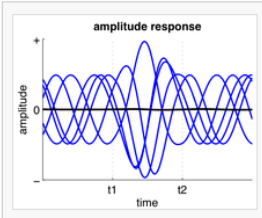
Both single and groups of neurons can generate oscillatory activity spontaneously. In addition, they may show oscillatory responses to perceptual input or motor output. Some types of neurons will fire rhythmically in the absence of any synaptic input. Likewise, brain wide activity reveals oscillatory activity while subjects do not engage in any activity, so-called resting-state activity.

These ongoing rhythms can change in different ways in response to perceptual input or motor output. Oscillatory activity may respond by increases or decreases in frequency and amplitude or show a temporary interruption, which is referred to as phase resetting. In addition, external activity may not interact with ongoing activity at all, resulting in an additive response.

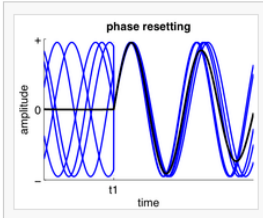
Oscillatory responses



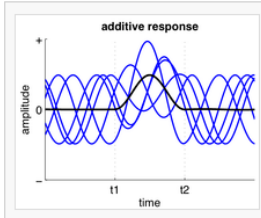
The frequency of ongoing oscillatory activity is increased between t1 and t2.



The amplitude of ongoing oscillatory activity is increased between t1 and t2.



The phase of ongoing oscillatory activity is reset at t1.



Activity is linearly added to ongoing oscillatory activity between t1 and t2.

CYBERNETIC BIOFEEDBACK-Frequency Tests+MCES rev 3.3.2014

Organ Electrical Patterns | ECG Fast Fourier Transform | Trivector Patterns | Autonomic Nerval System | Brain Wave Pattern Therapy | Subspace

Wave Speed in Percent

- 8 Alpha, treats stress
- 73 Beta, stabilizes worry
- 4 Theta, Consciousness Stim
- 5 Delta, For insomnia
- 18 Immature, slow thought
- Reset to all off

Treat clicked items

Stim Brain with Wave Form Clicked, 2 min

Store brain wave Engram to prayer

Pattern Type

- 55 Normal
- 37 Cerebellar Dysfunc
- 1 Local Slow waves
- 15 Amplitude Disorder
- 24 Epileptic forms
- 0 General Asymmetry
- 2 Injury Profile
- 39 Bilateral Sync
- 24 Deep Brain Asymmetry
- 56 Personality Dysfunc
- 22 Attention Deficit

Addiction Pattern Detected Fear Pattern Detected

Mineral Deficiency Pattern Detected Social Stress Pattern Detected

Worry Pattern Detected Guilt Pattern Detected

Inability to focus

possible emotional superimposition

SAMPLE

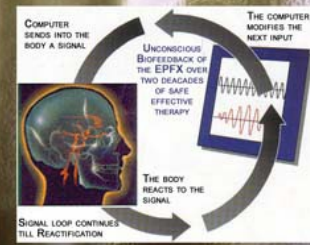
QUANTUM BIOFEEDBACK



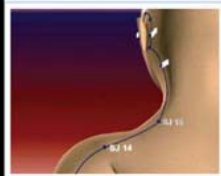
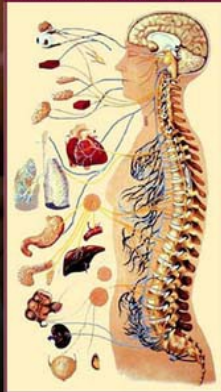
Ancient Healing Meets Quantum Technology

THE *Angel's* GIFT

TO THE WORLD
is the end of degenerative disease



The Autonomic Nervous System



The Body Electric has many global important measures. These include Volts, Amps, Resistance, Hydration, Oxidation, and Proton and Electron pressure. There are oscillatory norms of these values as well. The electrical vital signs. These are all easily measured and easily corrected in a cybernetic biofeedback loop. By interfacing with the body electric thru stimulus, response, correction and re-stimulation, we can try to normalize and stabilize the body electric. If we can reduce the causes of disease with behavioral medicine, provide good nutrition to supply needed homeostasis, repair the damage to organs, and unblock the blockages to energy flow, we have the start of a good truly modern medicine. Selye has proved that by reducing stress and the stressors we can avert the early progression of disease, and dramatically reduce degenerative disease. But this is drugless and threatening to the profits of the drug companies. We need to prefer people over profit. We need to become aware of the science and look through the sensational tabloid press to make an informed choice.

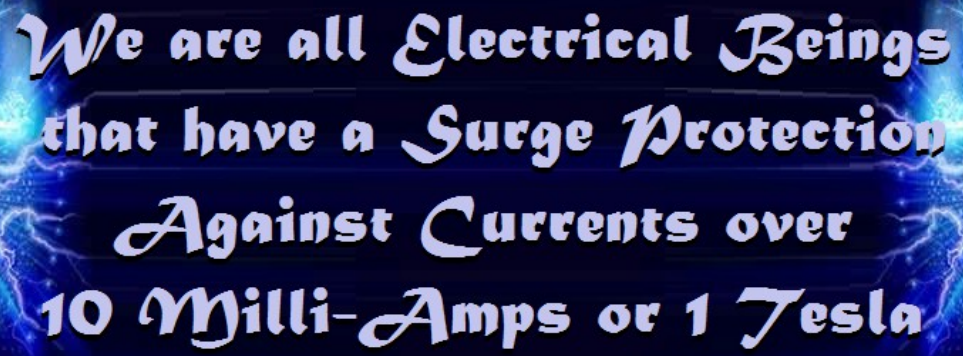
The over emphasis on drugs (SINthetic drugs) and surgery and the under emphasis on lifestyle has created a monster. The regulatory bodies, FDA, let Big Tobacco, Big Sugar, Big Pharma, run rampant while spending time and money on attacking safe, scientific, tested and effective natural medicines. This is a tragedy of modern times and profit corporations out of control.

The SCIO sends a signal to the client

The CNS of the client is guided

VoltAmmetric Cybernetic Loop





*We are all Electrical Beings
that have a Surge Protection
Against Currents over
10 Milli-Amps or 1 Tesla*



EEG Technologists on the Front Lines of Epilepsy

BY MIKE MARTIN, SPECIAL TO *epilepsyUSA*

To treat and characterize epilepsy, epileptologists combine the diagnostic arts with precision technologies such as the electroencephalograph, or EEG, a brain function exam sensitive to the abnormal electrical signals typical of seizures.

"The EEG is one of the most important tests patients with possible epilepsy undergo, and the EEG technologists who administer the test are among the first health care providers they meet," explained Duke University Medical Center neurologist and epileptologist Aatif Husain, M.D. "If the EEG is not performed with the utmost care, it may lead to misdiagnosis," which he said makes qualified EEG technologists "vital members of the health delivery team for patients with epilepsy."

“

Epilepsy and other seizure disorders represent the vast majority of patient referrals for EEG services.

UNIVERSITY OF MICHIGAN HEALTH SYSTEM
EEG TECHNOLOGIST LISA LOVELY

Accredited credentials

EEG technologists work in a variety of settings: hospitals, intensive care units, clinics, research facilities, operating rooms—and the Epilepsy Monitoring Unit (EMU).

Epilepsy and other seizure disorders represent "the vast majority of patient referrals for EEG services," said University of Michigan Health System EEG technologist Lisa Lovely, who also directs the Carnegie Institute electroneurodiagnostic technology program in Troy, Mich. "Basic EEG testing requires technologists to have a fair amount of knowledge regarding epilepsy," she explained. "Techs need to know how various epilepsy drugs affect

EEG recording; how to recognize a seizure; and even how to render appropriate first aid."

Formal EEG technologist credentialing includes education specific to epilepsy, said Janice Walbert, who directs the American Board of Registration of EEG and Evoked Potential Technologists (ABRET) in Springfield, Ill.

ABRET requires a two-part written and oral exam for the Registered EEG Technologist designation. A subsequent Certification in Long Term Monitoring (CLTM) is "an ideal credential for technologists who choose epilepsy monitoring as a career path," Lovely said.

From neurologist colleagues in his home country of Pakistan—where he practiced years ago—Aatif Husain has had a window on the importance of credentialing. Limited training opportunities and few trained technologists have made for a "big difference" between Pakistani and U.S. EEG technologists. More recently, however, foreign-trained EEG technologists have been able to take ABRET examinations.

As a result, "their training and quality have improved," Husain said.

Clinical professional

Beyond credentials, Husain looks for empathy, compassion, the ability to calm "tremendous anxiety," and intelligent teamwork in the EEG technologists with whom he works.

First and foremost, Lisa Lovely considers herself part of a team, responsible to assure her team leader—the epileptologist—gets the best data possible. She's also clear about her role with patients. "I tend to their needs, but in no way offer any opinion about the EEG," she explained. "The patient receives that information directly from the physician."

In practice for 31 years, EEG technologist Margaret Walcoff has worked with patients in all stages of epilepsy, from the earliest seizure to those seeking surgical options after years of other treatments.

"EEG technologists are the front line in assessing and diagnosing seizures," explained Walcoff, who directs the

PHOTO: ISTOCK/PHOTO/CWOLUB

New Developments in the Neurobiology of Borderline Personality Disorder

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Within the past several years, research on the clinical phenomena and neurobiology of borderline personality disorder has increased substantially. Borderline personality disorder is currently best thought of in terms of dimensions rather than as a categorical disorder. This article reviews the most recent findings on two of the core dimensions— affective dysregulation and impulsivity. Most of the neuropsychologic, physiologic, endocrinologic, and neuroimaging data support the theory that a dual brain pathology, affecting prefrontal and limbic circuits, may underlie this hyperarousal-dyscontrol syndrome.

Introduction

Within the past several years, psychiatric researchers have devoted increasing attention to borderline personality disorder (BPD). BPD is a serious mental disorder affecting approximately 1% to 2% of the general population, up to 10% of psychiatric outpatients, and up to 20% of inpatients [1]. Because of the severity of their problems, patients with BPD constitute a disproportionately large subset of psychiatric inpatients and outpatients, consuming considerably more mental health resources than most other psychiatric groups [2,3]. Although recent research suggests that BPD has a better prognosis than other serious mental illnesses, rates of completed suicide among individuals with BPD are estimated at 9% to 10% [4].

Within the past year, two large-scale, prospective studies of the course of BPD have been published [5,6••]. These studies indicated a higher rate for remission of BPD symptoms than once thought. In the longer running of the two studies [6••], approximately 75% of patients with BPD, all of whom were hospitalized at the start of the study, no longer met *Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised* or the *Diagnostic Interview for Borderlines, Revised* criteria for BPD by the end of 6 years of follow-up (47% remitted by the 2-year follow-up, 26.7% after 4 years, and 26.2% after 6 years). Only 6%

of those individuals whose symptoms remitted experienced a later recurrence of BPD. Data from a 1-year follow-up study by Shea *et al.* [5] indicated that the course of BPD symptoms follows a pattern similar to that of other personality disorders; BPD participants did not consistently meet diagnostic thresholds, and the mean number of criteria decreased significantly within a year.

In addition to examining the longitudinal course of categorical BPD diagnoses (based on rather arbitrary diagnostic thresholds), Zanarini *et al.* [6••] examined the subsyndromal phenomenology by determining the four general categories of the symptoms assessed by the *Diagnostic Interview for Borderlines, Revised*; these are affective features, cognitive features, impulsive features, and interpersonal features. The affective symptoms of BPD were the least likely to resolve and were present in approximately 70% of the patients at 6-year follow-up. Impulsivity in the domains of self-mutilation and suicide attempts also declined. Other forms of impulsivity, such as binge eating, verbal outbursts, and spending sprees, remained more consistent over time. Finally, cognitive and interpersonal symptoms declined significantly over time, with the notable exception of intolerance of aloneness and abandonment concerns; over 60% of the patients still reported these symptoms at 6-year follow-up.

Taken together, the results of these studies suggest that BPD phenomenology may be characterized by a combination of stable, trait-like features (*ie*, affect instability and borderline-specific concerns) with more acute crisis behavior (self-mutilation, suicide efforts, and pseudo-psychotic thoughts) that resolves relatively quickly over time. Notwithstanding, approximately 25% of the BPD patients did remain in the never-remitted group.

Overall, these data provide support for a dimensional approach, as described by Livesley *et al.* [7]. Additional research has supported the theory that the phenotypic features and genetic underpinnings of personality disorders are best conceptualized within a dimensional framework. Applying multivariate genetic analyses to the 18 basic personality dimensions assessed by the Dimensional Assessment of Personality Disorder–Basic Questionnaire, Livesley *et al.* [7] developed a four-factor model of phenotypic personality disorder features, which largely mirrored the genetic factors that may underlie personality disorder symptoms. The first factor (emotional dysregulation) appeared to capture a general tendency toward labile

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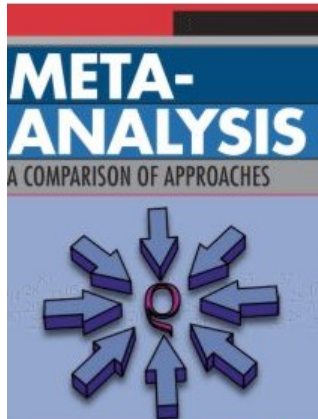
Brain stimulation promises 'long-lasting maths boost'

NOVA

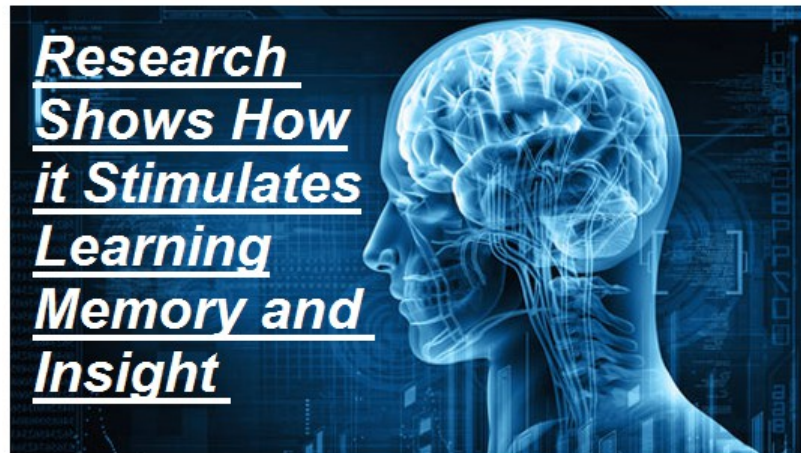
Boosting Kids' Brain Power

Clinical commentary

Mirth and laughter elicited during brain stimulation




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There is extreme evidence and an ever growing stream of research showing how we can use electrical readings to understand the body and then use soft safe electrical stimulation to treat and correct functions. And this is what we at SCIO / Educator Technology have been doing for over 30 years.

ELECTROCARDIOGRAPH

Three pole EKG is done extensively as a pre-screen of cardiac function. Although it not as accurate as an 8 or 12 pole test there is still some factors that a 3 pole test can suppose. To learn more about cardiology, we recommend the natural medicine book 'CARDIOLOGY of NATURAL MEDICINE' by Dr. Nelson. There are disorders of rhythm sometimes caused by mineral imbalance. There are disorders of conduction sometimes caused by excess fat lack of exercise or diet. The QXCI can detect these irregularities of heart rhythm. They will be displayed on the screen.

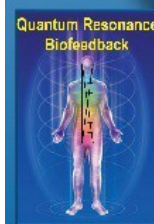


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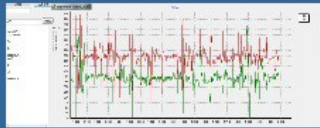


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| Educator versus Eductor | |
|---|---|
| Educator | Eductor Brain Wave |
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Eductor 3rd Party Billing functions

Do the SOC-INDEX and CALIBRATION

Demographics for Patient This software is designed For SCIO/USA

Demographics Male Female Both

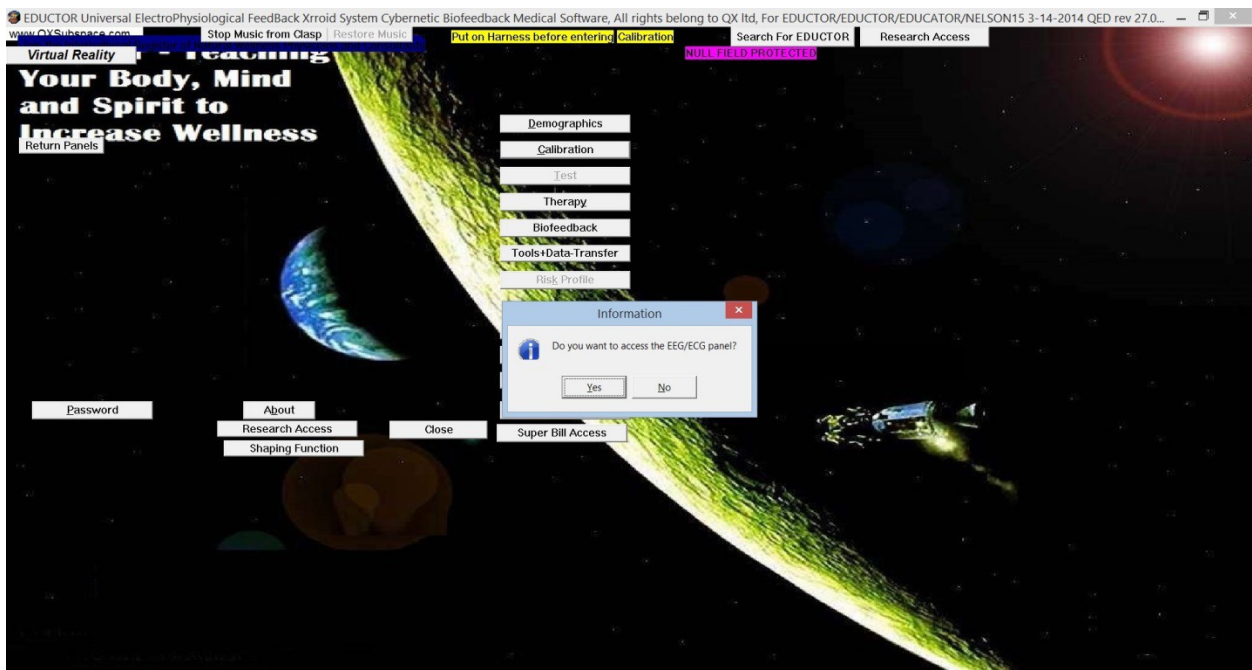
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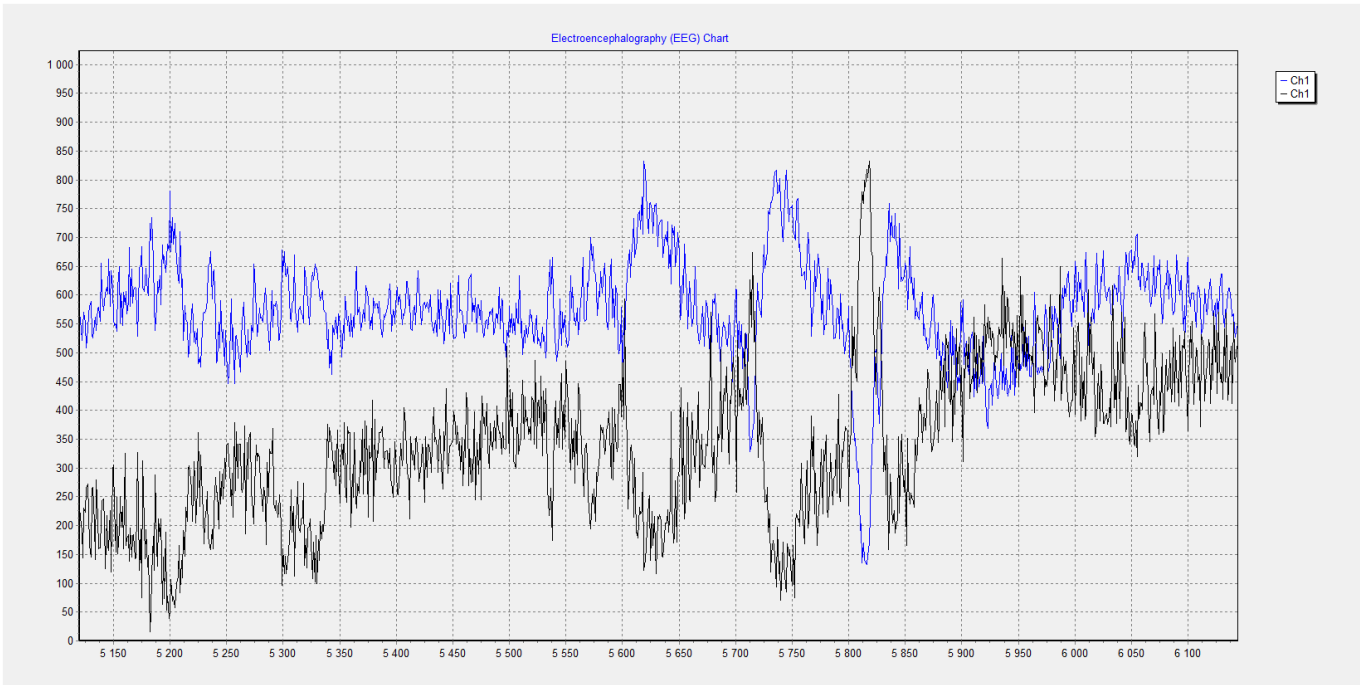
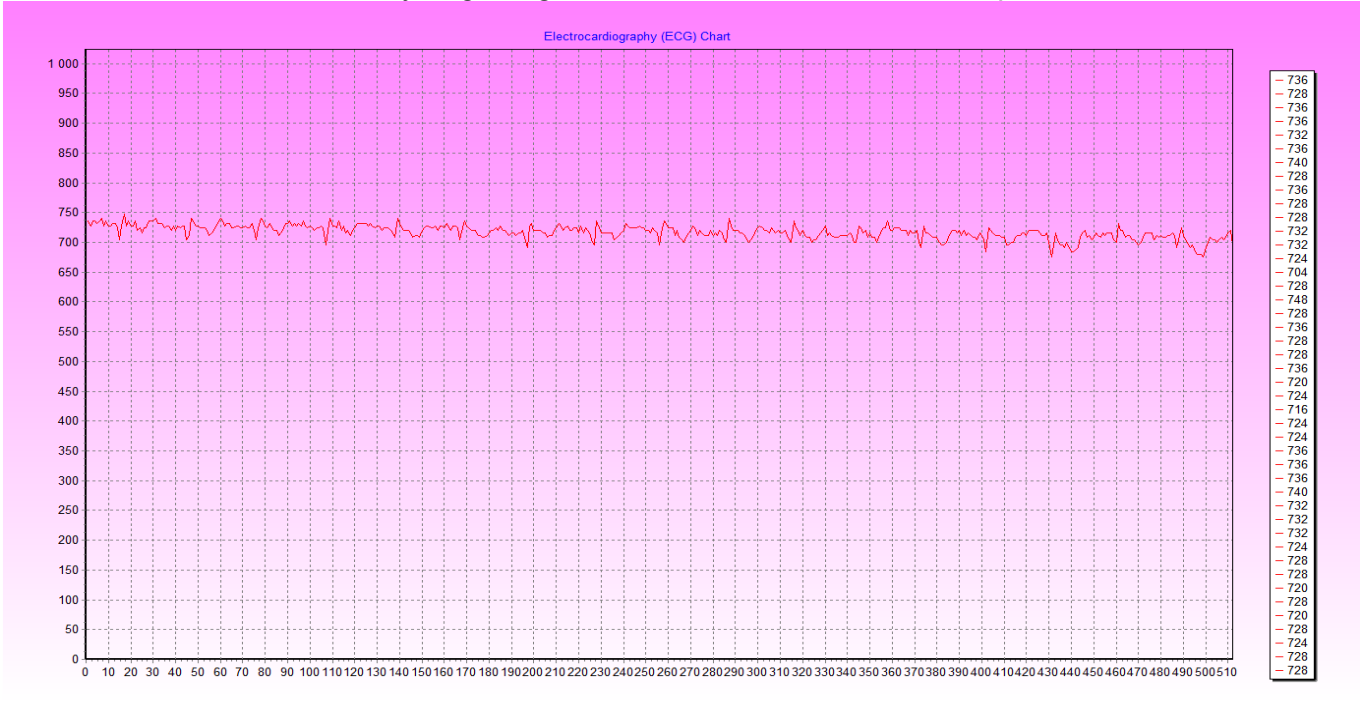
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|--|---------------------------------|---|----------------------|
| Number of organs removed | <input type="text"/> | Personal stress 0-10 10 max | <input type="text"/> |
| No.Synthetic drugs used currently | <input type="text"/> | No. of Sugar type products / day include soft drinks,ice cream etc | <input type="text"/> |
| Amount of times you smoke / day (No. of cigarets, cigars etc) | <input type="text"/> | No. of exercise sessions /wk 20 minutes or more, Not work | <input type="text"/> |
| Number of steroid type drugs used in the last year | <input type="text"/> | No. of alcoholic drinks / day on average | <input type="text"/> |
| No. of metal amalgam fillings Current or present during last year | <input type="text"/> | No. of cups of coffee,tea / day or any caffiene product | <input type="text"/> |
| Number of street drugs used/ mon. | <input type="text"/> | No.Extreme toxic exposures/yr. radiation,insecticide,chemicals | <input type="text"/> |
| Number of all known allergies | <input type="text"/> | Number of major injuries in past | <input type="text"/> |
| No. of unresolved mental factors | <input type="text"/> | Number of major infections past and present | <input type="text"/> |
| I am Responsible for my Body 0 minimum-10 maximum | <input type="text" value="10"/> | Number of glasses of water or natural fruit juice per day | <input type="text"/> |
| Amount of Fat in diet,as percent/10 Include Processed foods | <input type="text"/> | How many kilos overweight 2.2lb=1kilogram, seen by patient | <input type="text"/> |

NFP

Then do Go to the EEG ECG graph



Hit Start, Wait till you get a good Pre-Test screen shot, hit Stop Exit



Do the TEST, Do all therapies and then the EEG ECG Panel

Access EEG ECG review Panel

CYBERNETIC BIOFEEDBACK XRROID
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Close

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 Explore Risk of Disposition Transfer Dm
 Explore Risk of Personality Dysfunction
 Choose from the list below to see a dedicated list of compound:
 Return to Main:
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 Amino Acids
 Ayurvedic
 Bach Flowers
 Bacteria
 Hold
 Hold:
 Search for item:
 Situation Hold:

Harmonic Coupling of two items. Empty Below

CYBERNETIC BIOFEEDBACK-Frequency Tests+MCES rev 3.3.2014

Organ Electrical Patterns | ECG Fast Fourier Transform | Trivector Patterns | Autonomic Nerval System | Brain Wave Pattern Therapy | Subspace

Wave Speed in Percent

- 8 Alpha, treats stress
- 73 Beta, stabilizes worry
- 4 Theta, Consciousness Stim
- 5 Delta, For insomnia
- 18 Immature, slow thought
- Reset to all off

Treat clicked items

Stim Brain with Wave Form Clicked. 2 min

Store brain wave Engram to prayer

Pattern Type

- 55 Normal
- 37 Cerebellar Dysfunc
- 1 Local Slow waves
- 15 Amplitude Disorder
- 24 Epileptic forms
- 0 General Asymmetry
- 2 Injury Profile
- 39 Bilateral Sync
- 24 Deep Brain Asymmetry
- 56 Personality Dysfunc
- 22 Attention Deficit

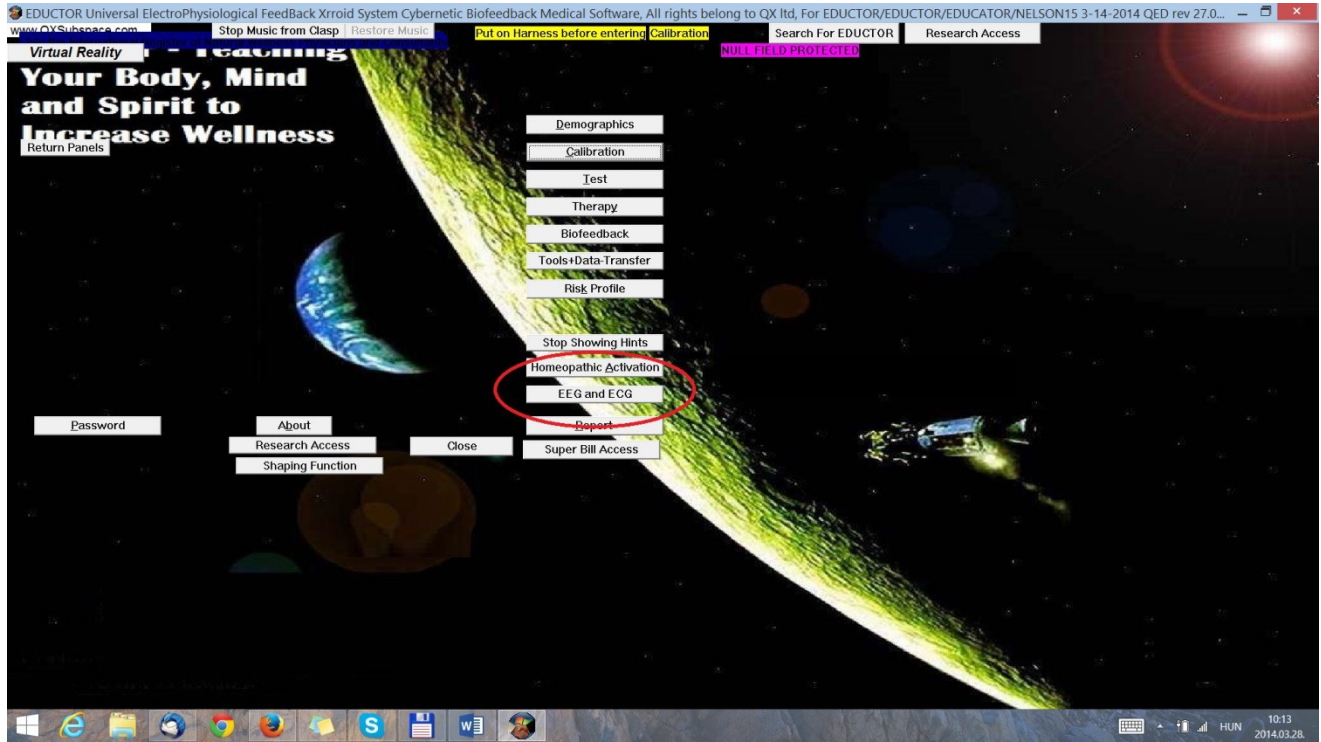
Click on the Item with the highest number and treat till the number in front of normal is the highest value

Addiction Pattern Detected
 Mineral Deficiency Pattern Detected
 Worry Pattern Detected
 Inability to focus
 possible emotional superimposition

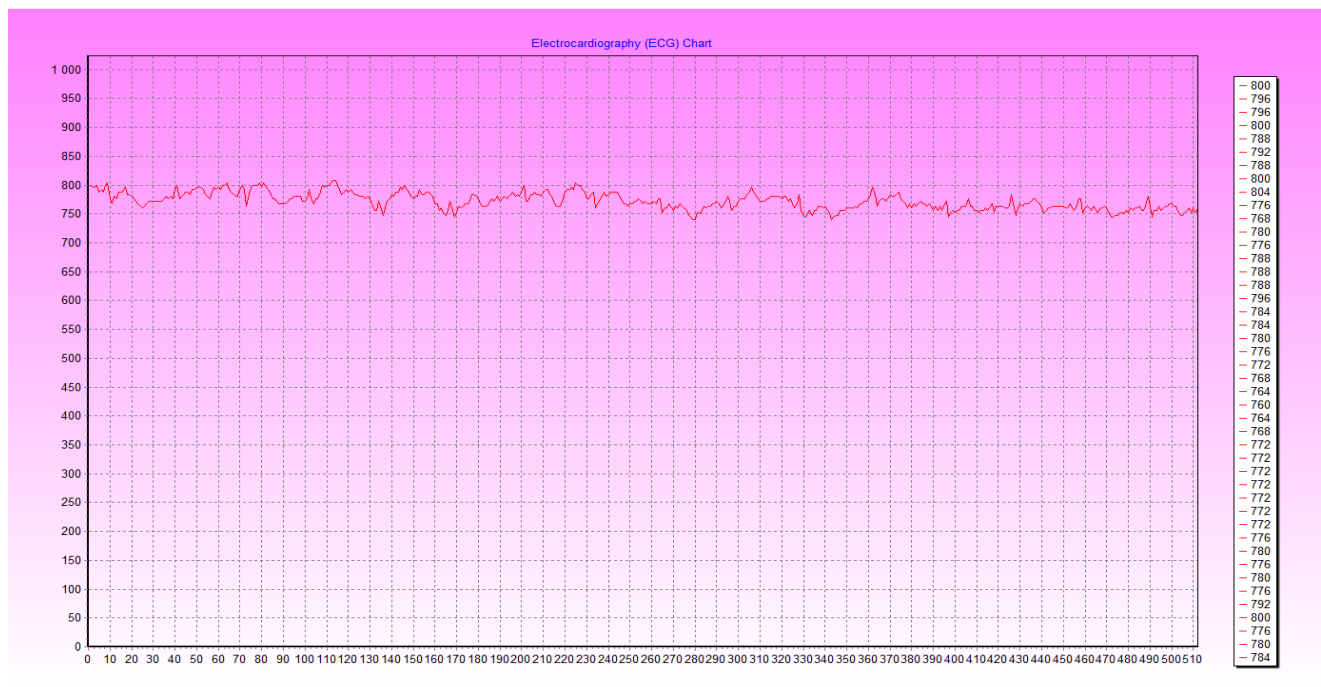
Fear Pattern Detected
 Social Stress Pattern Detected
 Guilt Pattern Detected

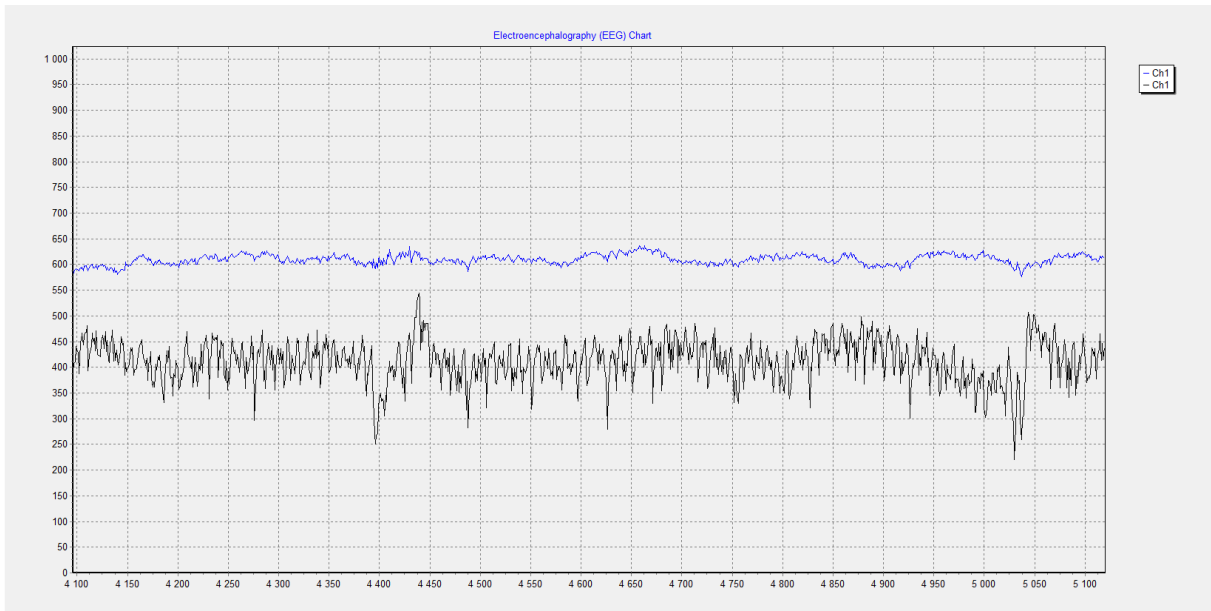
Make Report of Medical Reference | Brain wave tune for emotional stress

Access Post Test EEG ECG After all Eductor functions are over

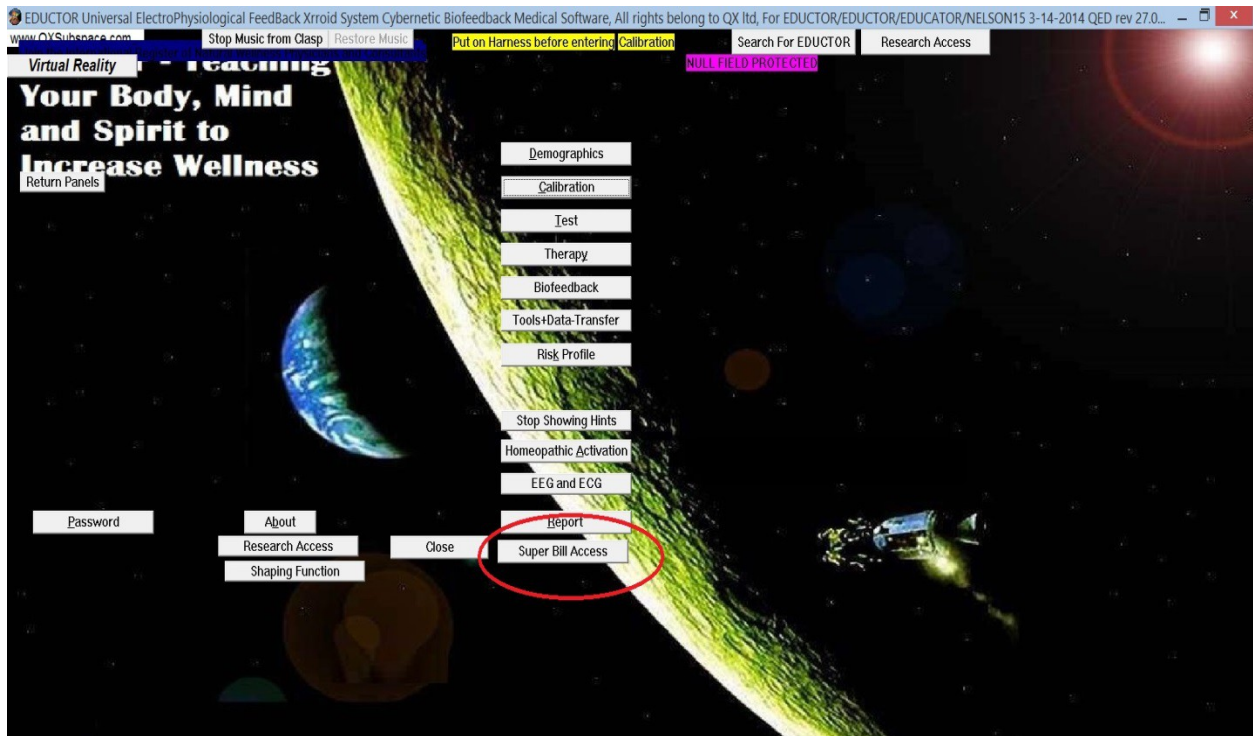


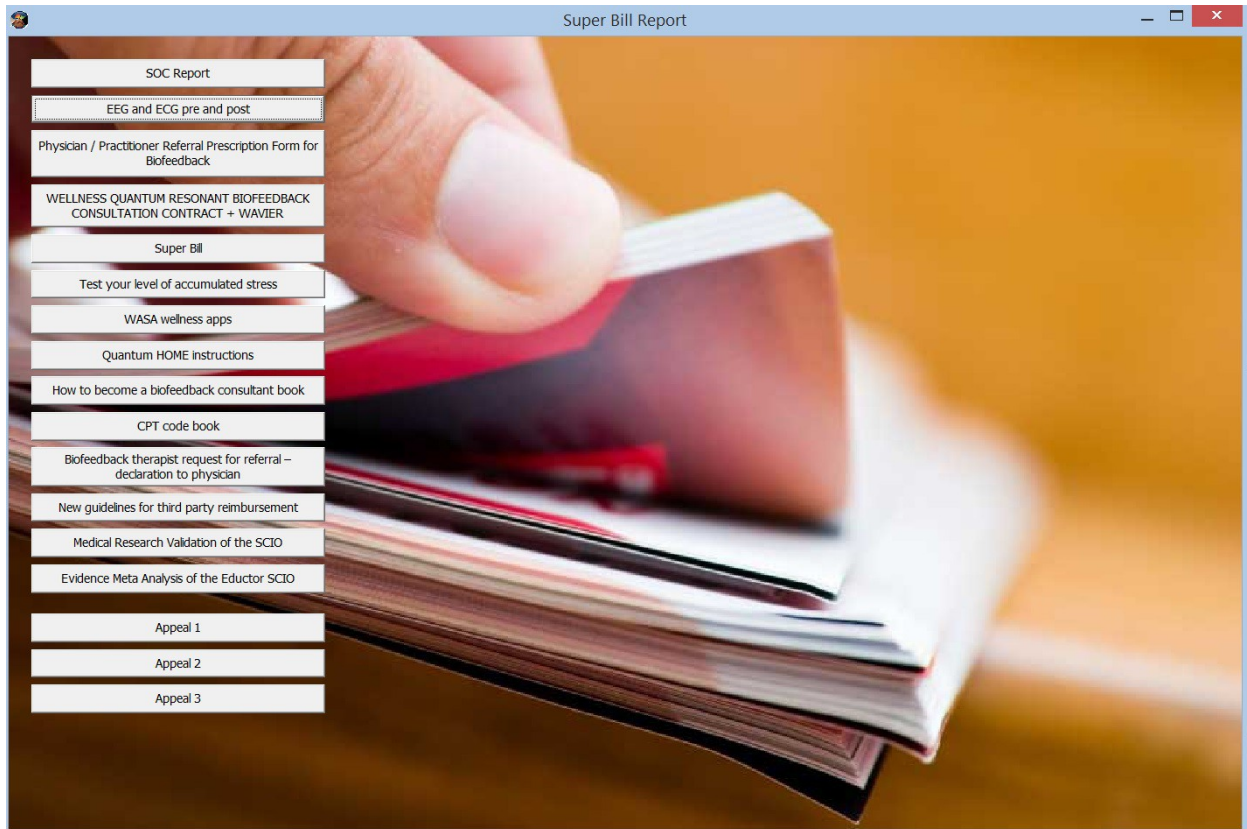
Do the Post Test EEG ECG screen shot





Go to the Super-Bill Page for Insurance Billing





Your insurance Bill patient record package should include the following

1. SOC Index review and suggestions
2. EEG ECG Pre and Post readings
3. Dr Referral and or prescription
4. Wellness QRB Contract
5. Super Bill with ICD # and CPT#
6. Comments



Natural Healing Center
Prof. Nelson

Kalvaria ter #2
36-1-303-6042

Name : test

Address :

Date of Birth : 2014.01.14.
Place of Birth :

PageNumber : 1
Date : 2014.03.24.

Our Clinic Provider Code Number is : Natural Healing Center

Our Clinic Address : Kalvaria ter #2

Our Clinic Phone Number : 36-1-303-6042

Biofeedback Therapist:

Patient's Name:

Patient ID# =

Patient Address = ,,

Patient Phone =

Patient Insurance =

ICD diagnostic Number =

Other Diagnosis =

Misc Comments =

QRB Insurance
Superbill
SAMPLE

Physician / Practitioner Making Diagnosis and or Referral:

Address, Phone, E-mail:

Insurance Provider of Services:

\$25 CPT Code – 90875 – Individual Lifestyle inventory, insight orientated behavior education

\$150 CPT Code – 90901 – 1 hr Biofeedback Training, Quantum Resonant Biofeedback, EEG ECG GSR

\$25 CPT Code-- 99090 -- Report and Computer Data Analysis, and patient Biblio-therapy - handouts

Today's Total \$200

Past Unpaid Balance Due:

Observations:

Pictures of Aura and SCIO



The aura is composed of seven fields within and outside the body. Each field called a density represents a specific energy range, corresponding to color, light, and sound. When densities are clear, energy moves freely through the body, unifying the physical body, the subtle body, and the causal body with a person's higher consciousness.

Interpretation of Photo one....Indigo Blue on the outside area indicates an old soul...many past lives...full of wisdom and this is the time to complete one's mission because of the wisdom and experiences of past lives.. The colors Rose and Fusia are signs of unconditional love and compassion White throughout the entire aura is the connection with spirituality and the spirit world. The shaded areas above the head are signs of self doubt. There is much love but a strong need to have confidence in one's own abilities with this power.



Holistic Bio Spa



Photo 2: *after* SCIO (Quantum Bio Feedback) The SCIO energetically cleanses and repairs by mending the Aura if it is ripped or torn, and then adjusts frequencies within the corresponding Auric fields that strengthens and provides protection. Aura Cleansing Cactus is used for cleansing and regeneration of the aura and the astral body. White Angelica is used to ward off bombardment of negative energy, increase the Aura, and for strength and protection.... The golden arch over the top is the energy of the Christ Consciousness. An entity appears on both sides of the person. The one on the left is Golden with green...Transformation with the Christ consciousness....The turquoise blue and white entity on the left side is about a message of the need to be in service (blue) and the focus is on the service mixed with spirituality (white). The fact that there are entities on both sides confirms the opportunity to complete one's mission in this life and this person has support from Higher beings who have come to help. There is green in the heart chakra and is mixed with purple as well. The transformation of the heart with the purple color is of the highest vibration of spirituality such as seen on Easter when the priests celebrate the Ascension he wears purple...All colors of the second photo are higher levels of vibration and show a shift from the first photo of love but with self doubt...to the golden, purple and transformational greens...

[EEG biofeedback in the treatment of attention deficit/ hyperactivity disorder](#)

[Alternative Medicine Review , June, 2007](#) by [Patrick N. Friel](#)

Abstract

Electroencephalogram (EEG) biofeedback, also known as neurofeedback, is a promising alternative treatment for patients with attention deficit/hyperactivity disorder (AD/HD). EEG biofeedback therapy rewards scalp EEG frequencies that are associated with relaxed attention, and suppresses frequencies associated with under- or over-arousal. In large-scale clinical trials, the efficacy of EEG biofeedback for AD/HD is comparable to that of stimulant medications. Many different EEG biofeedback protocols for AD/HD are available. Single-channel protocols developed by Lubar and interhemispheric protocols developed by the Othmers are widely practiced and supported by large-scale clinical studies. (Altern Med Rev 2007;12(2):146-151)

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Introduction

Attention deficit/hyperactivity disorder (AD/ HD) affects approximately 3-5 percent of school-age children in the United States, and a majority of children diagnosed with AD/HD are treated with medications, primarily stimulants. (1) It is estimated that 10 percent of 10-year old boys in the United States are currently being treated with prescription stimulants. (2) Concerns about the cardiovascular toxicity of amphetamine and methylphenidate (2) cause many patients and their families to seek alternative therapies. Well-established alternative therapies include dietary modifications and the administration of supplements, including vitamins, minerals, phytonutrients, amino acids, essential fatty acids, phospholipids, and probiotics. (3) Another alternative to drug therapy for AD/HD is electroencephalogram (EEG) biofeedback, also known as neurofeedback, which is supported by extensive peer-reviewed literature, including large-scale controlled clinical trials. (1,4) The purpose of this review is to summarize the evidence supporting the use of EEG biofeedback for treatment of AD/HD.

Background

The standard scalp EEG is recorded at 19 sites. Scalp EEG frequencies are broadly associated with various mental states, as shown in Table 1. With modern computerized systems, experts can map scalp EEG quantitatively by using spectral analysis. Quantitative electroencephalography (QEEG) studies demonstrate deviations from normal patterns in many neuropsychiatric conditions, including AD/HD. (5)

Clinical EEG biofeedback originated with the observation by Sterman that cats conditioned to produce a specific EEG frequency (SMR; sensory-motor rhythm; 12-15 hz) exhibited an elevated seizure threshold when exposed to the convulsant agent methylhydrazine. (6) Subsequent studies by Sterman and others, conducted from the 1970s onward, demonstrated that approximately 80 percent of patients with medically intractable epilepsy experience a clinically significant (> 50%) reduction in seizure frequency after a course of EEG biofeedback that rewards the SMR frequency. (7)

Patients with AD/HD exhibit characteristic surface EEG disturbances. (4) Specifically, 85-90 percent of patients with AD/HD display signs of cortical 'hypoarousal,' quantitatively described as elevated relative theta power, reduced relative alpha and beta power, and elevated theta/alpha and theta/beta power ratios (Table 1). These patterns are typically observed over frontal and central midline brain regions. A smaller subgroup of AD/HD patients exhibits an EEG pattern

suggestive of "hyperarousal," with greater relative beta activity, decreased relative alpha activity, and decreased theta/beta power ratios diffusely across multiple cortical recording sites. The hyperaroused group tends to respond poorly to stimulant medications.

Lubar et al developed EEG biofeedback protocols to inhibit cortical slowing and reward higher frequencies in hypoaroused patients, with the goal of normalizing EEG activity in regions thought to be responsible for attention and behavioral control. (4)

Modern EEG biofeedback systems, sold by a number of manufacturers, consist of a set of EEG sensors and a signal transducer/amplifier, connected to a computer or computers with software capable of analyzing the EEG signals, performing various transformations, displaying relevant signals to the patient, and providing rewards or inhibitions in the form of visual and/or audio feedback. The client learns to enhance desirable EEG frequencies and suppress undesirable frequencies at the selected scalp location(s) by being rewarded (e.g., by progress in a video game) for increasing desirable frequencies and/or reducing undesirable frequencies. Scalp electrode placements along the sensory-motor strip (C3 and C4) and temporal lobes (T3 and T4) are widely used. A typical neurofeedback configuration involves the patient seated in a reclining chair, watching one video display that provides video and audio feedback, while the therapist monitors a second video display that provides detailed, real-time data on the patient's EEG during the session.

A typical course of EEG biofeedback therapy involves at least 20 half-hour sessions, administered over a 6- to 12-week period. Although rates of progress vary from patient to patient, significant benefit is often observed within the first few weeks of therapy. Accreditation for EEG biofeedback practitioners is available through the Biofeedback Certification Institute of America.



Spontaneous Remission is expected with the SCIO

Expression of Hemispheric Asymmetry and Psychological Type in the EEG Traveling Wave

D. R. Belov, S. F. Kolodyazhnyi, and N. Yu. Smit

St. Petersburg State University, Universitetskaya nab. 7/9, St. Petersburg, 199164 Russia

Received June 5, 2002

Abstract—Spontaneous EEG patterns were recorded from 16 derivations in the parieto-occipital area over 2 min for subjects in the resting state with the eyes closed. Further, computer analysis of the current pattern of EEG phase relationships between all derivations was conducted, followed by visualization in real time of the trajectory and velocity of the traveling EEG wave as a computerized animation over the contour of the head. On the basis of visual observations and objective statistical analysis, we found consistent individual characteristics of the time course and trajectory of the traveling wave, which were compared to the results of psychological testing of the subjects. Most characteristic were modulations of the electric activity (traveling) in the transverse direction (from left to right and from right to left) and along the diagonal from the left anterior to the right posterior areas. Distinct groups of subjects were found with the predominance of one or the other trajectory type. The specific direction of the diagonal traveling was significantly correlated with the level of extroversion of the subject: extroverts were characterized by traveling of electric waves from the occiput forward to the vertex along the diagonal indicated, whereas for introverts, traveling from the vertex to the occiput was typical.

During multichannel EEG recording, the phase shift between processes usually increases with interelectrode distance. This is characteristic of various brain areas and is usually described as a *traveling* or *spreading* wave. According to Shepoval'nikov [1], the dominant rhythm of any frequency band has a phase gradient most pronounced in the longitudinal direction. However, the α rhythm is most studied in this respect.

Traveling waves in the α band are classified with respect to the direction of movement of their extrema and isopotential lines of the electric field. Frontal-occipital traveling (from the occiput to the forehead or vice versa) is most frequent and observed for up to 70% of all α waves recorded. Transverse and diagonal traveling is infrequent. There are also other patterns, such as clockwise or counterclockwise rotation of the field and transitory oscillation patterns with different periods or differently directed gradients in various regions. In-phase patterns at all points are also observed [1–3].

The spatial structure of phase relationships of the α waves changes in a quasi-periodic way. The direction and extent of phase shifts are retained in short quasi-periodically alternating sequences of alpha waves called *homogeneity intervals*. The change in the sign of the phase shift occurs almost simultaneously in all derivations, whereas, within the homogeneity intervals, phase relationships are retained with high consistency [1–6].

There are three basic hypotheses accounting for the spatial organization of the α rhythm: the hypothesis of physical interference of electric oscillations from one or several compact generators [7–9], the hypothesis of a single traveling wave moving in the cerebral cortex

due to consecutive involvement of neural elements into synchronous activity [1, 10], and the hypothesis of a thalamic pacemaker [11, 12].

Recent data convincingly point to a local compact generator of the α waves in the striate cortex. According to these data, the α rhythm is evoked at the convexital surface of the head due to physical induction via the brain tissues. The observed movement of α waves occurs as a result of a shift of the compact source (equivalent electric dipole) in the striate cortex and the rotation of its dipole moment axis [9, 13]. Thus, the convexital cortex in this model is a passive shield. This model has experimental support, including results of direct EEG experiments with mathematical localization of the equivalent electric dipole and superposition of its calculated movement on an NMR image of the calcarine sulcus. Indirect evidence for this model also exists, for example, investigations conducted by I.A. Shevelev and colleagues. With the α -scanning hypothesis in mind, they studied illusions evoked during rhythmical diffuse photostimulation, with the flicker frequency equal to the dominant frequency of the EEG α band in a particular subject [14–16]. Experiments with the perception of accelerated and uniform movements toward and from the center of the visual field were also conducted. In the opinion of the authors, it is exactly over the striate cortex that a scanning excitation wave travels every 100 ms, which sums with the activity pattern evoked by the afferent stream and reads the information for its further transmission to other areas [17, 18].

However, the hypothesis of a compact generator does not account for many earlier data on traveling of waves only within limited *generating areas*. In such

Diagnostic Value of Resting Electroencephalogram in Attention-Deficit/Hyperactivity Disorder Across the Lifespan

Martina D. Liechti · Lilian Valko · Ueli C. Müller ·
Mirko Döhnert · Renate Drechsler ·
Hans-Christoph Steinhausen · Daniel Brandeis

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Abstract The resting electroencephalogram (EEG) reflects development and arousal, but whether it can support clinical diagnosis of attention-deficit/hyperactivity disorder (ADHD) remains controversial. Here we examined whether theta power and theta/beta ratio are consistently elevated in ADHD and younger age as proposed. Topographic 48-channel EEG from 32 children (8–16 years) and 22 adults (32–55 years) with ADHD and matched healthy controls ($n = 30$ children/21 adults) was compared. Following advanced artefact correction, resting EEG was tested for increased theta and theta/beta activity due to ADHD and due to normal immaturity. Discriminant analyses tested classification performance by ADHD and age using these EEG markers as well as EEG artefacts and deviant attentional

event-related potentials (ERPs). No consistent theta or theta/beta increases were found with ADHD. Even multivariate analyses indicated only marginal EEG power increases in children with ADHD. Instead, consistent developmental theta decreases were observed, indicating that maturational lags of fewer than 3 years would have been detected in children. Discriminant analysis based on proposed simple spectral resting EEG markers was successful for age but not for ADHD (81 vs. 53 % accuracy). Including ERP markers and EEG artefacts improved discrimination, although not to diagnostically useful levels. The lack of consistent spectral resting EEG abnormalities in ADHD despite consistent developmental effects casts doubt upon conventional neurometric approaches towards EEG-based ADHD diagnosis, but is consistent with evidence that ADHD is a heterogeneous disorder, where the resting state is not consistently characterised by maturational lag.

Electronic supplementary material The online version of this article (doi:10.1007/s10548-012-0258-6) contains supplementary material, which is available to authorized users.

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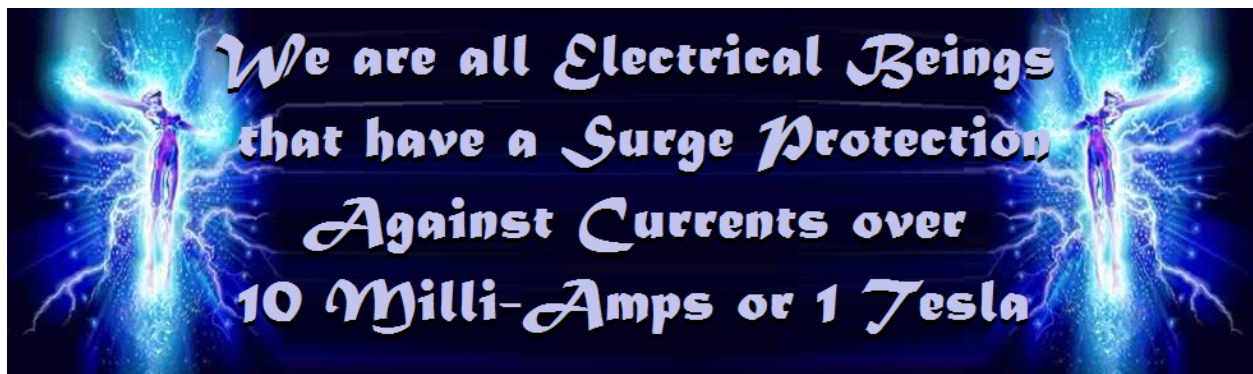
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Zürich, Switzerland

The effects of stimulant therapy, EEG biofeedback, and parenting style on the primary symptoms of attention-deficit/hyperactivity disorder.

[Monastra VJ](#), [Monastra DM](#), [George S](#).

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One hundred children, ages 6-19, who were diagnosed with attention-deficit/hyperactivity disorder (ADHD), either inattentive or combined types, participated in a study examining the effects of Ritalin, EEG biofeedback, and parenting style on the primary symptoms of ADHD. All of the patients participated in a 1-year, multimodal, outpatient program that included Ritalin, parent counseling, and academic support at school (either a 504 Plan or an IEP). Fifty-one of the participants also received EEG biofeedback therapy. Posttreatment assessments were conducted both with and without stimulant therapy. Significant improvement was noted on the Test of Variables of Attention (TOVA; L. M. Greenberg, 1996) and the Attention Deficit Disorders Evaluation Scale (ADDES; S. B. McCarney, 1995) when participants were tested while using Ritalin. However, only those who had received EEG biofeedback sustained these gains when tested without Ritalin. The results of a Quantitative Electroencephalographic Scanning Process (QEEG-Scan; V. J. Monastra et al., 1999) revealed significant reduction in cortical slowing only in patients who had received EEG biofeedback. Behavioral measures indicated that parenting style exerted a significant moderating effect on the expression of behavioral symptoms at home but not at school.



EEG Biofeedback: A Generalized Approach to Neuroregulation

Siegfried Othmer, Susan F. Othmer, and David A. Kaiser

Publication Date:

Epilepsy

Epilepsy is listed among the most difficult conditions to address with EEG training because of the variety with which epilepsy manifests, because of the ongoing structural deficits which may underlie the condition, and also because historically it has been the most intractable cases which have been referred for EEG training. This historical circumstance introduces a bias into how matters are viewed, since in fact there are many types of seizure that respond quite readily to EEG training. Since training was done at the sensorimotor strip, and was deemed to address the motor system specifically, Sterman argued initially that the training could be expected to be beneficial only for seizures with a predominantly motor symptomatology. Subsequently, however, a controlled study was successfully accomplished with primarily temporal lobe or complex-partial seizures (Lantz, 1988).

The Sterman protocol was replicated for seizures in a number of laboratories and by a number of groups (See References for Table 1.) The technique failed to be acknowledged at the time, however, because of confounding issues regarding anticipated changes in the EEG (Quy, 1979). The cat EEG had manifested a countable increase in incidence of bursts of SMR rhythmic activity with training. The human EEG does not exhibit such bursts except during Stage 2 sleep. And whereas there was in fact an increase in sleep spindles with training in epileptic subjects, the various studies which were intended to replicate Sterman's findings did not yield consistent EEG changes in the waking state (Kaplan, 1975). We now understand that this is not a contradiction. The human EEG remains more desynchronized in the waking state than the cat EEG, and observable bursts would now be considered anomalous. Some individuals did in fact show increased amplitudes of the EEG in the SMR subsequent to long-term reinforcement; others tended toward normalization of their EEG characteristics, which in many instances meant an overall decrease in EEG amplitudes, even within the training band. At the relevant time, however, during the 1970's and 1980's, the lack of consistent EEG changes accompanying the training was thought to be fatal to the hypothesis that EEG training had taken place. The behavioral benefit of EEG biofeedback training that had been replicated in all of the studies was therefore attributed instead to non-specific factors.

Subsequent developments (in our clinical setting) extended the seizure work to absence seizures as well. These generally require higher-frequency training of 15-18Hz in addition to the SMR-training. It is important to make the distinction that in the use of EEG training with seizures, no claim is made that the seizure focus is in any sense extinguished or annihilated. Rather, it is claimed that by enhancing stability conditions in the surrounding healthy brain tissue, the irritable focus will no longer as readily lead to spreading of paroxysmal activity and hence to focal or generalized seizures. The effect of enhancing stability can often be additive to the effect of anti-convulsant medication. It may also lead to the reduction or even elimination of such medication.

More than half of seizures occur at night, and most of these are closely associated with sleep transitions, particularly with falling asleep and waking. This association suggests an intimate connection of seizure susceptibility with stability of arousal. Similarly, about half of all seizures are associated with identifiable events of brain trauma. This of course suggests a connection between the seizure susceptibility with the specific organic loss suffered in the brain injury. However, an equally compelling case can be made that the association is in fact with arousal dysregulation here as well. As already indicated in our discussion of brain injury, the predominant symptomatology associated with such injury relates not to the specific location of injury, but to generalized function, in particular the management of arousal. Hence, a brain with an intrinsic seizure vulnerability could simply have been pushed over the edge by a minor head injury.

The hypothesis that efficacy for epilepsy is traceable in large measure to improved regulation of arousal comes from an unusual quarter. A Swedish study has demonstrated some 60% seizure reduction in children by behavioral methods alone (Dahl, 1992). The strategies typically involve deliberate changes in arousal level when the subject anticipates a seizure. As it happens, the 60% reduction is also the average seizure reduction obtained using the Sterman protocol in the various published studies. The nexus with arousal dysfunction helps us to address the structuralist objection that the seizure focus should be impervious to such an intervention as EEG biofeedback. (Whether articulated or not, it is this structuralist objection that has resulted in neurologists dismissing this technique out of hand for thirty years.) It is in fact quite sufficient to argue that only healthy brain tissue is affected by the training in order to explain the clinical findings.

Excerpt from "Applied Neurophysiology & Brain Biofeedback"

A controlled study of the effects of EEG biofeedback on cognition and behavior of children with attention deficit disorder and learning disabilities

| | |
|--------------------|--|
| Journal | Applied Psychophysiology and Biofeedback |
| Publisher | Springer Netherlands |
| ISSN | 1090-0586 (Print) 1573-3270 (Online) |
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| SpringerLink Date | Monday, October 10, 2005 |

Original Articles

A controlled study of the effects of EEG biofeedback on cognition and behavior of children with attention deficit disorder and learning disabilities

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Abstract

Eighteen children with ADD/ADHD, some of whom were also LD, ranging in ages from 5 through 15 were randomly assigned to one of two conditions. The experimental condition consisted of 40 45-minute sessions of training in enhancing beta activity and suppressing theta activity, spaced over 6 months. The control condition, waiting list group, received no EEG biofeedback. No other psychological treatment or medication was administered to any subjects. All subjects were measured at pretreatment and at posttreatment on an IQ test and parent behavior rating scales for inattention, hyperactivity, and aggressive/defiant (oppositional) behaviors. At posttreatment the experimental group demonstrated a significant increase (mean of 9 points) on the K-Bit IQ Composite as compared to the control group ($p < .05$). The experimental group also significantly

EEG Biofeedback for Addictive Disorders —The State of the Art in 2004

Author: Trudeau, David¹

Source: [Journal of Adult Development](#), Volume 12, Numbers 2-3, August 2005, pp. 139-146(8):

This paper reviews studies of brainwave biofeedback as a therapeutic technique for substance use disorder. This modality is attractive as a medication free, neurophysiologic, and self actualizing treatment for a substance based, brain impaired and self-defeating disorder. Three approaches are described and the literature for each reviewed. Alpha–theta occipital feedback was originally employed to facilitate autosuggestion in hypnagogic states to augment standard

therapy approaches in substance abuse treatment programs and appears most suited for chronic treatment resistant alcoholics. Beta augmentation feedback in conjunction with alpha/theta feedback has been employed in mixed substance abuse and stimulant abuse with good results. Individualized brainwave biofeedback based on correcting EEG abnormalities, or based on addressing comorbid conditions is a third approach that has been described, and may be most appropriate where confounding comorbid conditions are present. Although effectiveness in certain hard to treat populations (conventional treatment resistant alcoholics, crack cocaine addicts, cognitively impaired substance abusers) is promising, better-designed controlled studies are needed.

Keywords: [addictions](#); [EEG](#); [neurotherapy](#); [biofeedback](#); [alcohol abuse](#); [stimulant abuse](#)

Document Type: Research article

A controlled study of the effectiveness of EEG biofeedback training on children with attention deficit hyperactivity disorder

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Received: 17 February 2005

Summary In order to study the treatment of the children with attention deficit hyperactivity disorder (ADHD), the integrated visual and auditory continuous performance test (IVA-CPT) was clinically applied to evaluate the effectiveness of electroencephalogram (EEG) biofeedback training. Of all the 60 children with ADHD aged more than 6 years, the effective rate of EEG biofeedback training was 91.6% after 40 sessions of EEG biofeedback training. Before and after treatment by EEG biofeedback training, the overall indexes of IVA were significantly improved among predominately inattentive, hyperactive, and combined subtype of children with ADHD ($P < 0.001$). It was suggested that EEG biofeedback training was an effective and vital treatment on children with ADHD.

Key words children - attention deficit hyperactivity disorder - EEG biofeedback training - effectiveness

XIONG Zhonggui, male, born in 1965, Associate Professor



EEG biofeedback or Neurofeedback

Neurofeedback (NFB), also called **neurotherapy**, **neurobiofeedback** or **EEG biofeedback (EEGBF)** is a therapy technique that presents the user with realtime feedback on [brainwave](#) activity, as measured by sensors on the [scalp](#), typically in the form of a [video display](#), sound or vibration. **The aim is to provide real-time information to the Central Nervous System (CNS) as to its current activity.** The CNS has two parts, PNS and ANS. Those approaches also believe that neurofeedback training can be understood as being based on a form of operant and/or classical conditioning. In that frame of reference, when [brain activity](#) changes in the direction desired by the trainer directing the training, a positive "reward" feedback is given to the individual, and if the change is in the opposite direct from what was intended, then either different feedback is given or the provision of otherwise attained "positive" feedback is inhibited (or blocked). These ideas can be applied in various combinations depending on the protocol decided upon by the trainer. Rewards/Reinforcements can be as simple as a change in pitch of a tone or as complex as a certain type of movement of a character in a video game. This experience could be called [operant conditioning](#) for internal states even though no research has yet demonstrated that clear operant response curves occur under those scenarios.

Nonetheless, a number of different brainwave goals have been proposed by different researchers in the field following on these general ideas. Usually, these goals are based upon extrapolations from research describing abnormal EEG patterns or on results from a quantitative EEG (QEEG - also known as brain mapping) upon the particular client being offered neurofeedback training. A popular goal is the increase of activity in the 12–18 Hz band ([mu rhythm](#)/[sensorimotor rhythm \(SMR\)](#)) and a decrease in the 4–8 Hz and/or 22–28 Hz bands ([theta](#) and/or [beta](#)). The most common and well-documented use of neurofeedback is in the treatment of [attention deficit hyperactivity disorder](#): multiple studies have shown neurofeedback to be useful in the treatment of ADHD [1] (Butnik 2005) (Masterpasqual *et al* 2003). QEEG has been ambivalent with some studies showing that some forms of ADHD can be characterized by an abundance of slow brainwaves and a diminished quantity of fast wave activity (Butnik 2005); however, alternative patterns have also been described making the overall picture inconclusive at this time. Some approaches believe that neurofeedback training is best done when it seeks to teach individuals to produce more normalized EEG patterns that optimize their functioning.^[citation needed]

Some ADHD researchers are unconvinced by these studies, including the psychiatry professor and author of several books on ADHD, [Russell Barkley](#). Barkely opines that neurotherapy's effectiveness in treating ADHD can be ascribed to either uncontrolled [case studies](#) or the [placebo effect](#) [2]. In return, neurofeedback advocates note that Barkely has received research funds and personal remuneration from drug giant [Eli Lilly and Company](#) and other drug companies [3] [4] [5].

Other areas where neurofeedback has been researched include treatment of [substance abuse](#), [anxiety](#), [depression](#), [epilepsy](#), [OCD](#), learning disabilities, [Bipolar Disorder](#), [Conduct Disorder](#), anger and rage, cognitive impairment, migraines, headaches, chronic pain, [autism spectrum disorders](#), sleep dysregulation, [PTSD](#) and [MTBI](#).

Other approaches to understanding and providing neurofeedback training use non-linear dynamical control processes and joint time-frequency analyses to characterize the ongoing dynamics of EEG during the training process itself. These approaches understand the functioning

of the CNS in a more integrated or comprehensive fashion, including the structural ideas of the Russian neuropsychologist Luria and neuropsychiatrist Karl Pribram.

Related technologies include [hemoencephalography](#) biofeedback (HEG).

History and application

In 1924, the German psychiatrist Hans Berger connected a couple of electrodes (small round discs of metal) to a patient's scalp and detected a small current by using a ballistic [galvanometer](#). During the years 1929-1938 he published 14 reports about his studies of EEGs, and much of our modern knowledge of the subject, especially in the middle frequencies, is due to his research (Kaiser 2005).

Berger analyzed EEGs qualitatively, but in 1932 G. Dietsch applied [Fourier analysis](#) to seven records of EEG and became the first researcher of what later is called QEEG (quantitative EEG). (Kaiser 2005)

Later, Joe Kamiya popularized neurofeedback in the 1960s when an article^[1] about the alpha brain wave experiments he had been conducting was published in *Psychology Today* in 1968. Kamiya's experiment had two parts. In the first part, a subject was asked to keep his eyes closed and when a tone sounded to say whether he thought he was in [alpha](#). He was then told whether he was correct or wrong. Initially the subject would get about fifty percent correct, but some subjects would eventually develop the ability to distinguish between states and be correct a highly significant percentage of the time. In the second part of the study, subjects were asked to go into alpha when a bell rang once and not go into the state when the bell rang twice. Once again some subjects were able to enter the state on command. Others, however, could not control it at all. Nevertheless, the results were significant and very attractive. Alpha states were connected with relaxation, and alpha training had the possibility to alleviate stress and stress-related conditions. Neurofeedback appealed greatly to the social movements of the 1960s as well, when altered states were a lifestyle. For example, in 1973 Elmer Green took a portable psychophysiological lab to India to study Eastern holy men, all of whom possessed the incredible ability to control their heart rate, blood flow, and other autonomic functions, all of whom generated alpha waves continuously while doing so, according to Green's EEG.^[citation needed]

Despite these highly dramatic and compelling claims, the universal correlation of high alpha density to a subjective experience of calm cannot be assumed. Visuomotor activity seems to be of primary importance in alpha neurofeedback, and the ability to generate alpha with the eyes open and the lights on could develop different skills and results than if the procedure were carried out in total darkness or with the eyes closed.^[citation needed] Alpha states do not seem to have the universal stress-alleviating power indicated by early observations.^[2] However, this is not cause to reject the concept of biofeedback entirely. Many other biofeedback treatments have emerged, since Kamiya's alpha experiments.

At one point, [Martin Orne](#) and others challenged the claim that alpha biofeedback actually involved the training of an individual to voluntarily regulate brainwave activity.^[3] [James Hardt](#) and Joe Kamiya, then at [UC San Francisco's Langley Porter Neuropsychiatric Institute](#) published

a paper, ^[4] proving the efficacy of EEG biofeedback training, and that it was not just related to visuo/motor eyes open or closed factors.

In the late sixties and early seventies, [Barbara Brown](#), one of the most effective popularizers of Biofeedback, wrote several books on biofeedback, making the public much more aware of the technology. The books included *New Mind New Body*, with a foreword from [Hugh Downs](#), and *Stress and the Art of Biofeedback*. Brown took a creative approach to neurofeedback, linking brainwave self regulation to a switching relay which turned on an electric train.

The work of Barry Sterman, Joel F. Lubar and others has indicated a high efficacy for beta training, involving the role of sensorimotor rhythmic EEG activity.^[5] This training has been used in the treatment of epilepsy ^{[6][7]}, attention deficit disorder and hyperactive disorder,^[8] and other mood disorders^[citation needed]. The sensorimotor rhythm (SMR) is rhythmic activity between 12 and 16 hertz that can be recorded from an area near the sensorimotor cortex. SMR is found in waking states and is very similar if not identical to the sleep spindles that are recorded in the second stage of sleep. Studies have shown that enhancement of sensorimotor activity through operant conditioning designed to increase SMR is an anticonvulsant process and is therefore an effective treatment for epilepsy. (citation needed)

For example Sterman has shown that both monkeys and cats who had undergone SMR training had elevated thresholds for the convulsant chemical monomethylhydrazine. These studies indicate that SMR is associated with an inhibitory process in the motor system and therefore increasing SMR through operant conditioning increases the ability to control seizures.^[7] Most individuals treated with biofeedback in research studies have been sufferers of the most severe epilepsy for whom anticonvulsant drug therapy has proven ineffective.^[citation needed] However, even among these most severe cases, beta and SMR training has been found to produce an average 70% reduction in seizures and to facilitate increased control of seizures in 82% of patients.^[citation needed]

Lubar addressed attention disorders using essentially the same protocol.^[citation needed] His research indicates that inhibition of motor function also inhibits input function, which is related to attention. Lubar's protocol, which has been adopted by most practitioners as the standard protocol for treating patients with attention disorders, is to inhibit 2-10 Hz slow waves (alpha and theta) as well as 19-22 Hz waves and encouraging activity in the 12-19 Hz range.^[citation needed] This procedure has been supported since alpha activity is known to decrease during cognitive functions and to be inversely related to metabolism.^[citation needed] Lubar's hypothesis for what is happening in an ADD brain is that there is a decreased metabolism and decreased blood flow to the subcallosal cortex. Alpha is inhibited to counter these problems.^[citation needed] Lubar has published 10-year follow-ups on cases and found that in about 80% of patients biofeedback can substantially improve the symptoms of ADD and ADHD, and these changes are maintained.^[citation needed] Currently, treatment for attention disorders is the most common application of EEG biofeedback.^[citation needed] However, the treatment is also effective in the treatment of traumatic head injuries and [sleep disorders](#) as well as epilepsy.^[citation needed]

Neuroimaging studies have correlated ADHD with abnormal functioning in the anterior cingulate cortex (ACC) during tasks involving selective attention. In 2006, Johanne Levesque and

colleagues at the University of Montreal published results from their fMRI study showing normalization of ACC activation during a selective-attention task in ADHD subjects who had undergone neurofeedback training (Levesque, 2006). Subjects in the study were randomly assigned to either the neurofeedback treatment group or a no-treatment control group, and subjects from the latter showed no difference in ACC activation compared to their baseline.

In 1974 the pioneer Canadian psychologist (holding Registration #1 as a registered psychologist^[citation needed]) D.A. Quirk heard a presentation by Serman and discussed with him the method. Quirk immediately conferred with his colleague, G.von Hilsheimer, Director of the Green Valley Psychiatric Hospital in Orange City Florida^[citation needed]. Quirk and von Hilsheimer began applying EEG biofeedback, training the amplitude of 4-7 Hz (theta)down, whilst training the amplitude of 13-14 Hz (sensori-motor) up over the Fissure of Roland (Ten-20 locations C-3 and C-4). From 1974 until his retirement in 1995 Quirk trained 2700 felons incarcerated at the Ontario Correctional Institute near Toronto using temperature at the left ring finger, skin conductance (palm to palm), and EEG detected at Ten-20 sites C-3 and C-4.^[citation needed] The three year recidivism rate for these felons was 15%, which compares well to the range of 40-70% widely reported in the correction literature.^[citation needed]

A significant bibliography on the efficacy of EEG biofeedback documented in refereed journals is listed at isnr.org.

For years, EEG biofeedback was treated as a minor part of the field of biofeedback, particularly by the primary biofeedback organization, [AAPB](#). In 1993, three different efforts, somewhat overlapping, dramatically increased the energy and influence of EEG biofeedback.

In February 1993, Rob Kall, president of Futurehealth, organized the first annual [Winter Brain Meeting](#), in Key West Florida. The meeting brought together many of the leading figures in the field and it created a setting where the leaders could discuss and plan strategies for building greater influence and organization to move the field forward.

In April 1993, Ken Tachiki, Jim Smith and Bob Grove organized a meeting of leaders in the field of Neurofeedback on Catalina Island, immediately before the 1993 AAPB meeting. Further planning took place at this meeting and the beginnings of SSNR occurred. SSNR= Society for the Study of Neuronal Regulation. Since then, SSNR has evolved to become ISNR International Society for Neuronal Regulation.

Immediately after the Catalina meeting, at the 1993 AAPB meeting, a new EEG section was formed, after plenty of lively discussion. It quickly grew to become the biggest section of the organization. Things were never the same at AAPB. Neurofeedback had become a mainstream part of the field, though it took a few years to fully integrate into the annual meeting and journals.

Within the last 5-10 years, neurofeedback has taken a new approach, in taking a second look at deep states. Alpha-theta training has been used in the treatment of alcoholism (first reported by Penniston in 1989^[citation needed]) and other addictions as well as post-traumatic stress disorder, the dysphoric disorders of women, musicians, and psychopathic offenders.^[citation needed] This low

frequency training differs greatly from the high frequency beta and SMR training that has been practiced for over thirty years and is reminiscent of the original alpha training of Elmer Green and Joe Kamiya. Beta and SMR training can be considered a more directly physiological approach, strengthening sensorimotor inhibition in the cortex and inhibiting alpha patterns, which slow metabolism. Alpha-theta training, however, derives from the psychotherapeutic model and involves accessing of painful or repressed memories through the alpha-theta state. The alpha-theta state is a term that comes from the representation on the EEG. During this therapy, when the alpha waves amplitude is crossed over by the rising amplitude of theta waves, the state is called the alpha-theta crossover state and is associated with resolution of traumatic memories. [\[citation needed\]](#)

The physiological mechanisms behind these therapies are very unclear. EEGs of alcoholics have revealed an inability to produce the alpha waves generally associated with feelings of relaxation and comfort. [\[citation needed\]](#) However, following the use of alcohol, theta and alpha waves increase. [\[citation needed\]](#) This can be expected considering the drowsiness and relaxation are common effects of alcohol. Therefore, alcoholics may be [self-medicating](#) their abnormal level of low frequency waves. Studies have demonstrated a high efficacy of alpha-theta therapy in treating alcoholism. [\[citation needed\]](#) Peniston and Kulkosky found that while alcoholics in a control group receiving standard treatment showed significant increases in beta-endorphin levels as a result of stress caused by abstinence from alcohol, alcoholics receiving the alpha-theta treatment did not. On four-year follow-ups only 20% of the traditionally treated group of alcoholics remained sober, compared with 80% of the experimental group who received neurofeedback training. [\[citation needed\]](#)

Low Energy Neurofeedback System (LENS)

The Low Energy Neurofeedback System (LENS) uses a device, under control of a computer program, to produce electromagnetic fields and apply them as brain stimuli. The stimuli are applied by EEG leads that serve as bi-directional conduits for both the stimuli and returning EEG signals. Treatment sessions are very short, typically only a few minutes (treatments that are too long or use incorrect settings can cause hyper-arousal, headache, irritability, nausea, etc). During treatment sessions, the subject is completely passive; there is no auditory or visual feedback.

LENS treatment is preceded by a diagnostic Quantitative EEG (QEEG) brain map to identify zones of the brain at which the various brain waves deviate from the norm. Both electrode placement and system settings are determined by the condition being treated and the clinician's interpretation of the brain map. System settings must be adjusted by the clinician over the course of treatment to accommodate the effects of treatment. The number of treatments needed to achieve improvements for ADD/ADHD, depression, PTSD, and seizures is claimed to be fewer than for more traditional neural feedback methods.

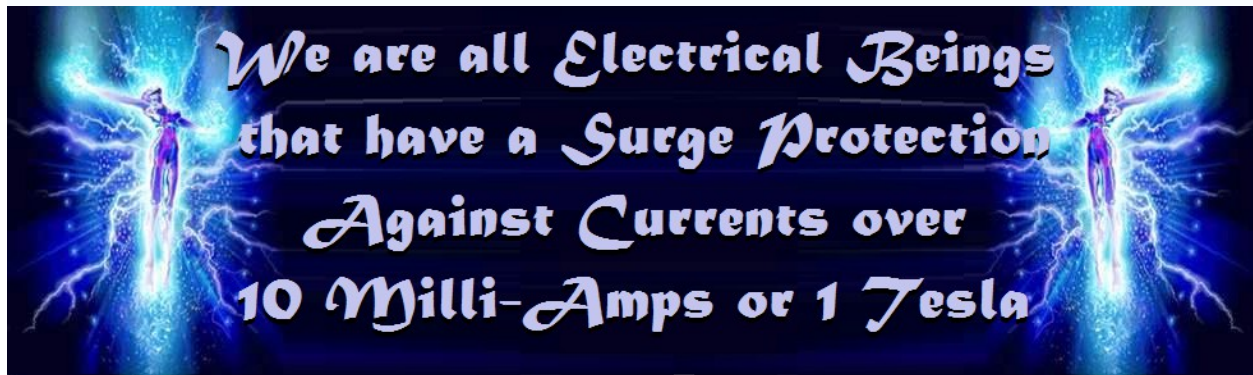
At least two books detailing the concept and methodology of LENS are available commercially: "The Healing Power of Neurofeedback: The Revolutionary LENS Technique for Restoring Optimal Brain Function" by Stephen Larsen and Thom Hartmann (Paperback - May 2, 2006); and "Lens: The Low Energy Neurofeedback System," by D. Corydon Hammond (Paperback - Feb 13, 2007).

Neurofeedback in practice

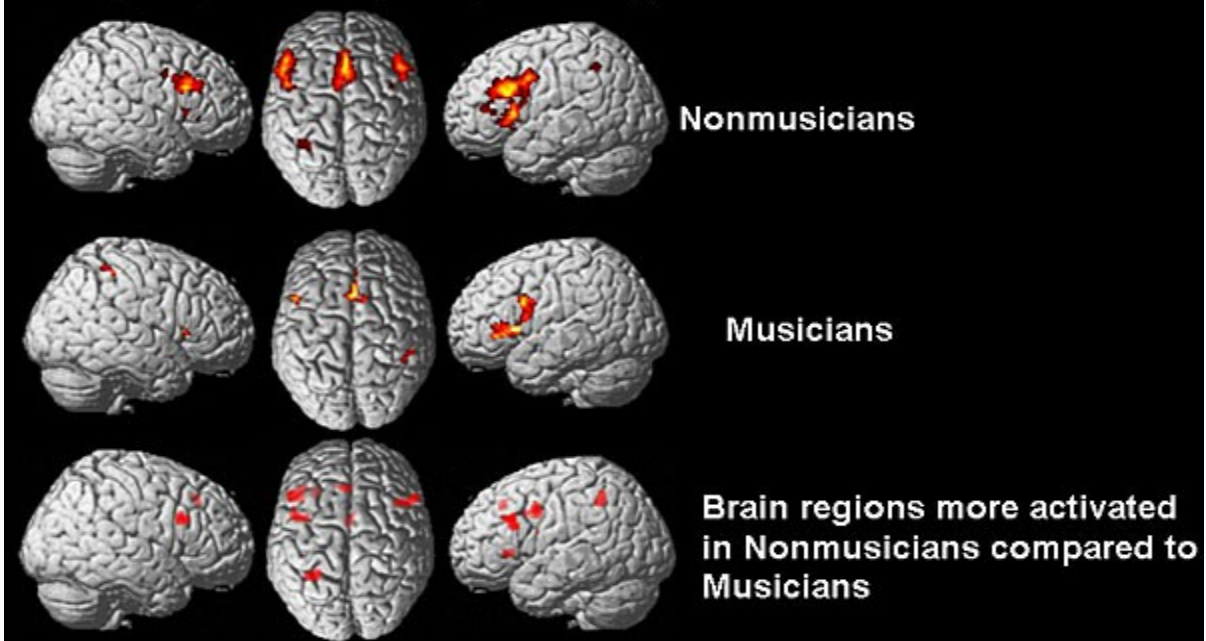
A common professional neurofeedback therapy nowadays goes as follows:

1. In an intake of about 90 minutes the patient will get a questionnaire and a first EEG reading. The questionnaire specifies the complaints and filters out people with serious psychological problems. The EEG serves both for diagnosis and as a reference to check later whether there is progress. In about 20% of the patients neurofeedback has no effect.
2. The EEG recording is typically done on a few points on the head. It results in a brainmap ("quantative EEG"). This is a series of maps (for each frequency one) where for each measured spot the average level of activity is shown. The brainmap is compared to a database to determine spots of over- and underactivity compared to the average people of the patient's age and sex. There are several commercial providers of such databases.
3. On the basis of the complaints, the brainmap and the database results a therapy is chosen. This involves an electrode on a single spot on the head that needs to become more or less active for specific frequencies. During the therapy the patient gets feedback that helps them improve. This feedback may involve for example a simple light or tone, some game where "good" brainwaves are rewarded and "bad" ones punished or some image that becomes less sharp when the patient loses focus.
4. A typical therapy takes 20 to 40 sessions. Some forms of psychotherapy are considerably faster, so neurofeedback is not always the most efficient solution. At the beginning of each session the patient reports the course of his complaints and also mentions other mental effects. On the basis of this report the therapy may be adjusted. In some cases a patient is allowed to take a feedback machine home and have most - but not all - sessions there.

See also: [Psychophysiology](#), the study of the connections between [neurobiology](#) and [psychology](#).



The rapid spectro-temporal processing effect:



Research Shows Music Improves Brain Function



For most people music is an enjoyable, although momentary, form of entertainment. But for those who seriously practiced a musical instrument when they were young, perhaps when they played in a school orchestra or even a rock band, the musical experience can be something more. Recent research shows that a strong correlation exists between musical training for children and certain other mental abilities.

EEG BIOFEEDBACK: A GENERALIZED APPROACH TO NEUROREGULATION

Siegfried Othmer, Susan F. Othmer, and David A. Kaiser

Publication Date:

September 16, 2003

Epilepsy

Epilepsy is listed among the most difficult conditions to address with EEG training because of the variety with which epilepsy manifests, because of the ongoing structural deficits which may underlie the condition, and also because historically it has been the most intractable cases which have been referred for EEG training. This historical circumstance introduces a bias into how matters are viewed, since in fact there are many types of seizure that respond quite readily to EEG training. Since training was done at the sensorimotor strip, and was deemed to address the motor system specifically, Sterman argued initially that the training could be expected to be beneficial only for seizures with a predominantly motor symptomatology. Subsequently, however, a controlled study was successfully accomplished with primarily temporal lobe or complex-partial seizures (Lantz, 1988).

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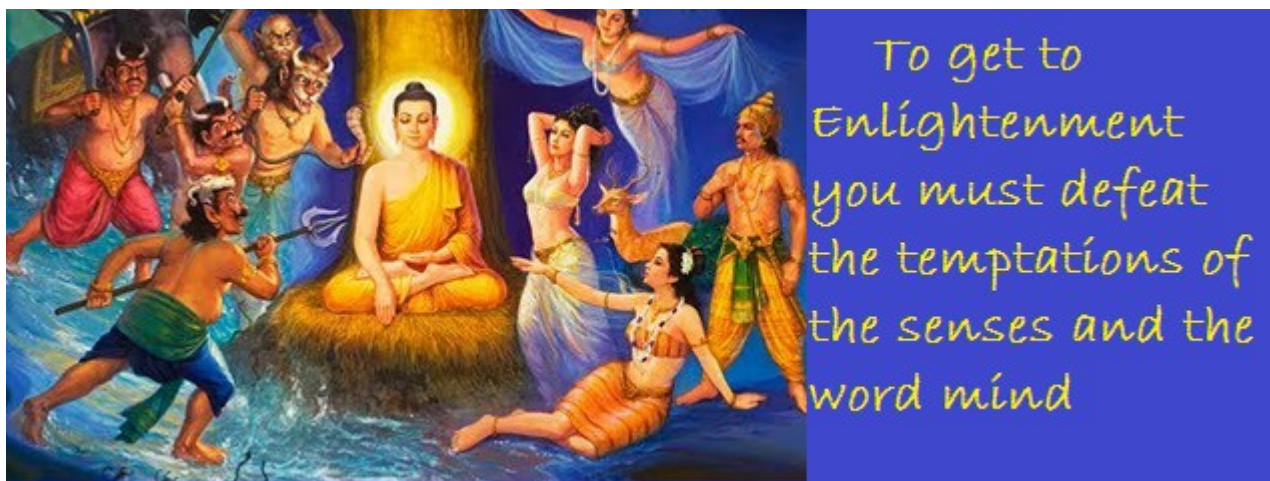
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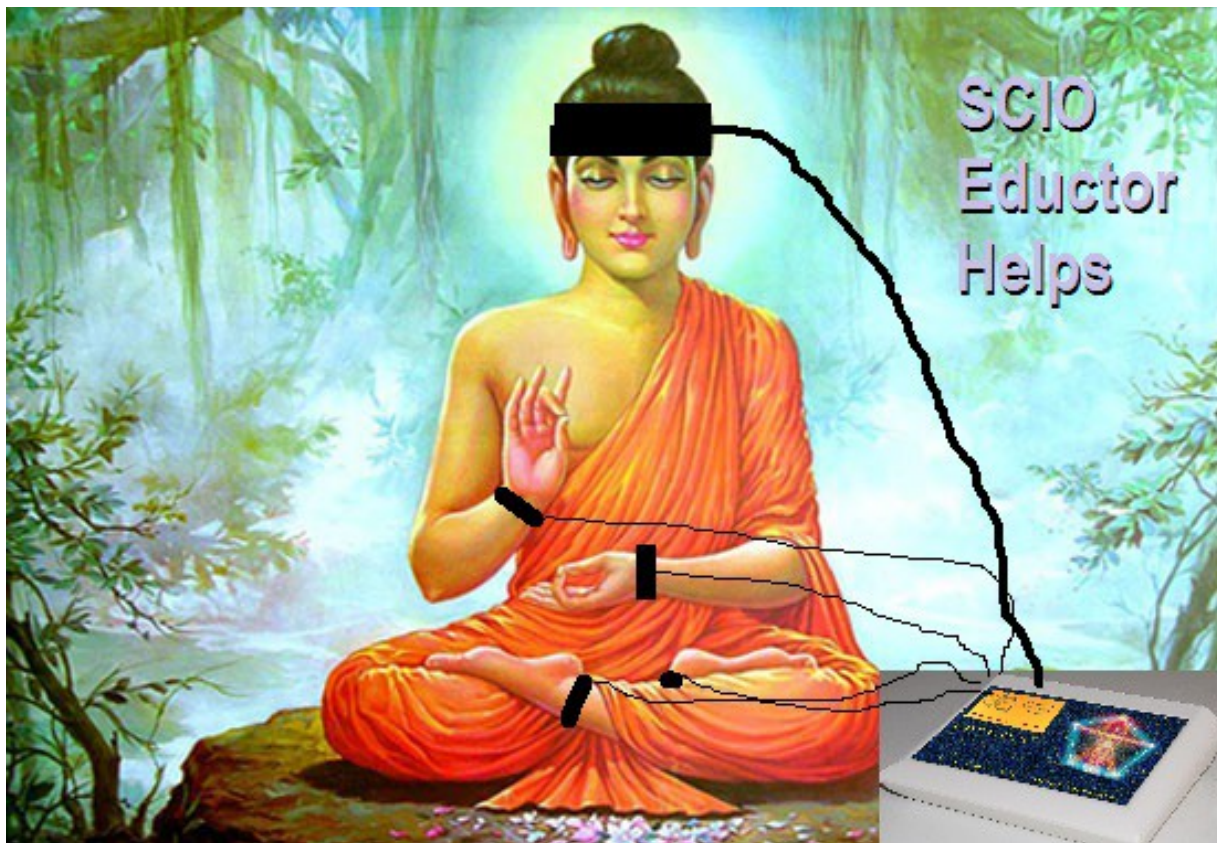
seizure focus is in any sense extinguished or annihilated. Rather, it is claimed that by enhancing stability conditions in the surrounding healthy brain tissue, the irritable focus will no longer as readily lead to spreading of paroxysmal activity and hence to focal or generalized seizures. The effect of enhancing stability can often be additive to the effect of anti-convulsant medication. It may also lead to the reduction or even elimination of such medication.

More than half of seizures occur at night, and most of these are closely associated with sleep transitions, particularly with falling asleep and waking. This association suggests an intimate connection of seizure susceptibility with stability of arousal. Similarly, about half of all seizures are associated with identifiable events of brain trauma. This of course suggests a connection between the seizure susceptibility with the specific organic loss suffered in the brain injury. However, an equally compelling case can be made that the association is in fact with arousal dysregulation here as well. As already indicated in our discussion of brain injury, the predominant symptomatology associated with such injury relates not to the specific location of injury, but to generalized function, in particular the management of arousal. Hence, a brain with an intrinsic seizure vulnerability could simply have been pushed over the edge by a minor head injury.

The hypothesis that efficacy for epilepsy is traceable in large measure to improved regulation of arousal comes from an unusual quarter. A Swedish study has demonstrated some 60% seizure reduction in children by behavioral methods alone (Dahl, 1992). The strategies typically involve deliberate changes in arousal level when the subject anticipates a seizure. As it happens, the 60% reduction is also the average seizure reduction obtained using the Serman protocol in the various published studies. The nexus with arousal dysfunction helps us to address the structuralist objection that the seizure focus should be impervious to such an intervention as EEG biofeedback. (Whether articulated or not, it is this structuralist objection that has resulted in neurologists dismissing this technique out of hand for thirty years.) It is in fact quite sufficient to argue that only healthy brain tissue is affected by the training in order to explain the clinical findings.

Excerpt from "Applied Neurophysiology & Brain Biofeedback"

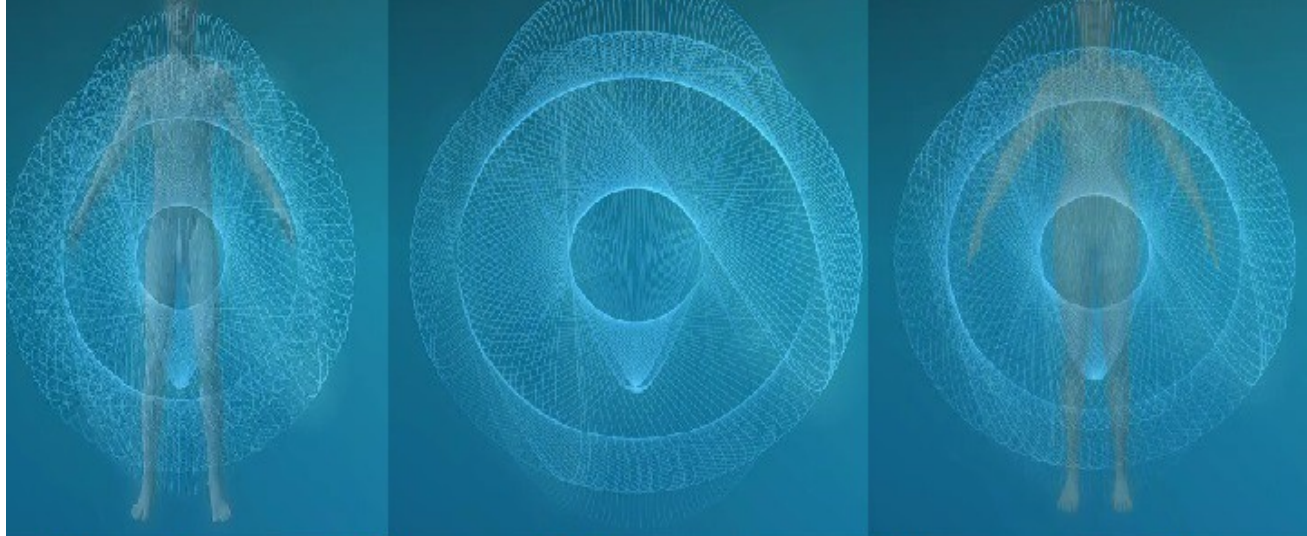






SCIO
Educator
Helps

Eductor has a 2nd + 3rd Wave form Generator

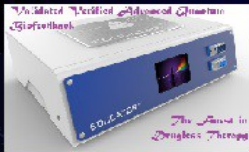


*With Quantum Biofeedback We can Deepen Meditation by Using
ETM which is Electro-Transcendental Meditation.
People can Attain Faster Results with More Mental Control,
Less Effort, Relaxed Peace and Aware Enthusiasm*



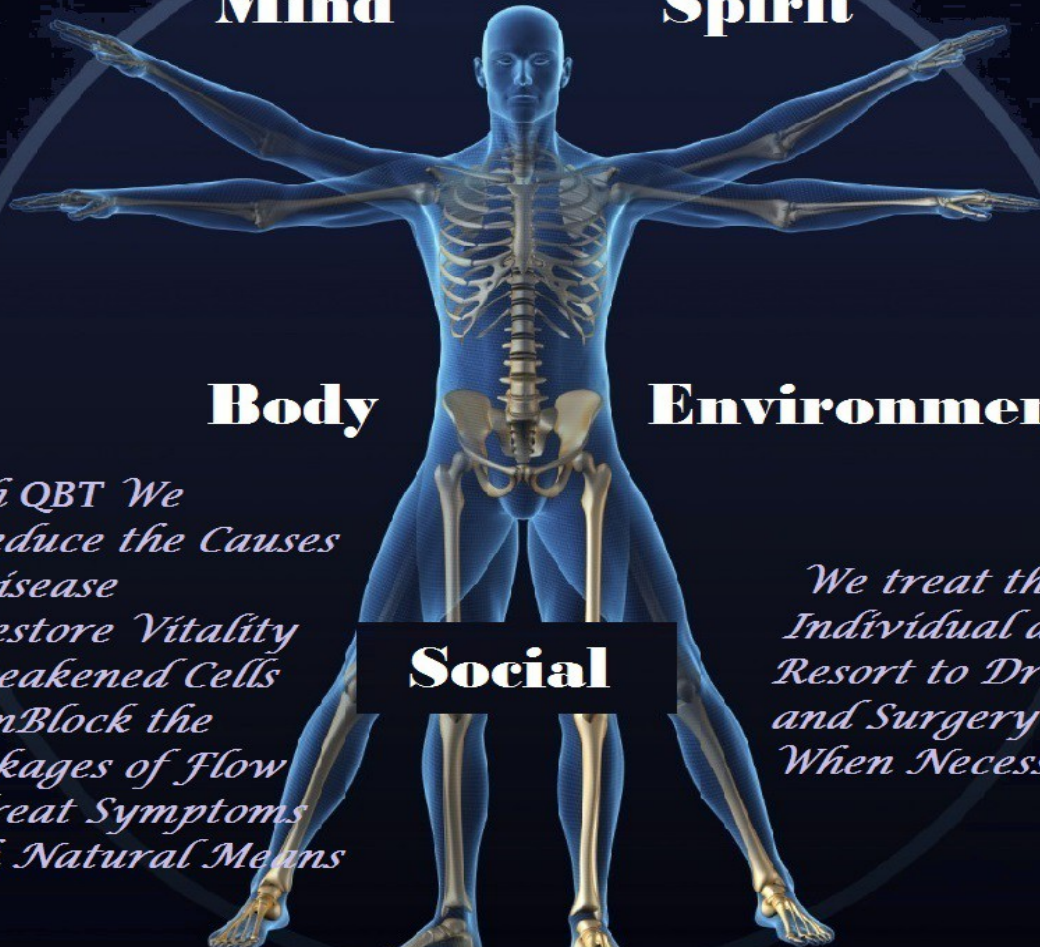
Luke 4:23
"Physician, Heal Yourself"

Educate Your Mind
with QBT to Take
RESPONSIBILITY



Mind

Spirit



Body

Environment

Social

With QBT We
1. Reduce the Causes of Disease
2. Restore Vitality to weakened Cells
3. Unblock the Blockages of Flow
4. Treat Symptoms with Natural Means

We treat the Individual and Resort to Drugs and Surgery Only When Necessary

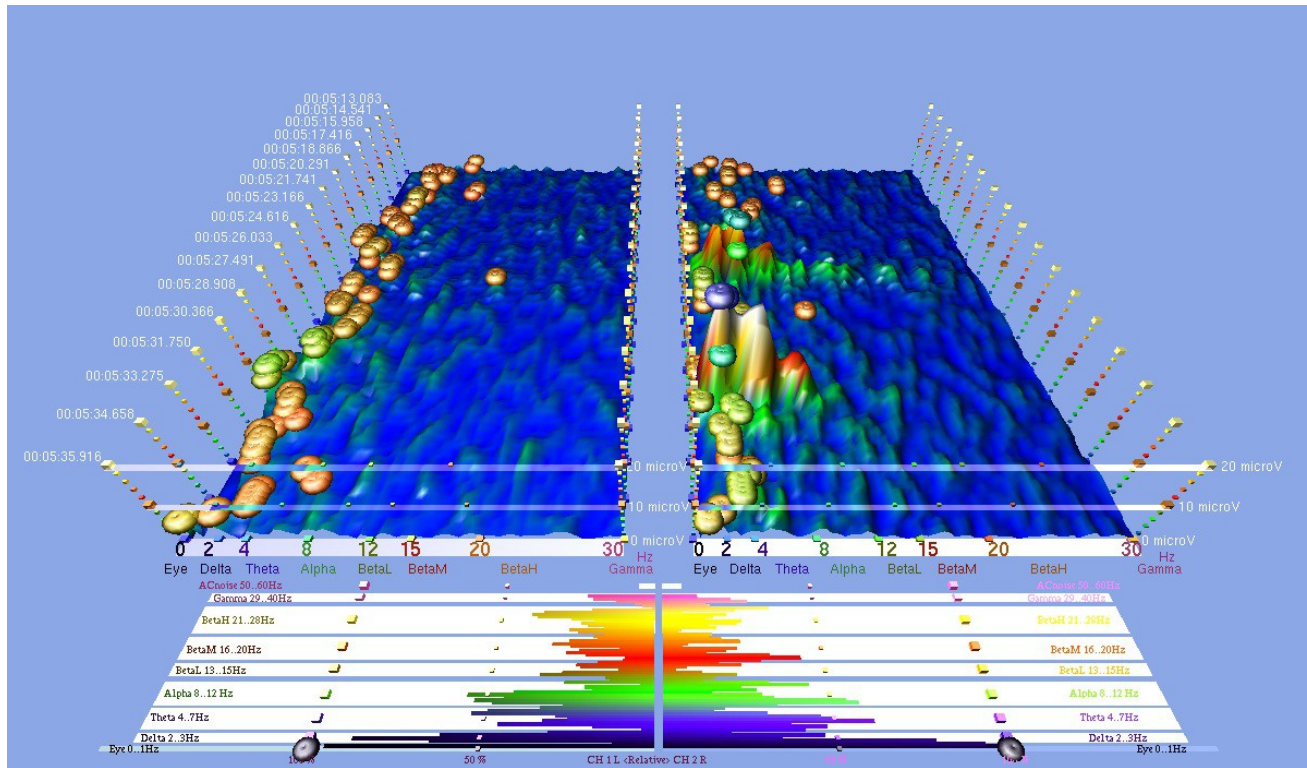
Brain Wave Measurement and Frequencies of Healers

The fact that the brain emits measurable frequencies has been known since the beginning of the last century. In the 1960s, it was discovered that a person could exert some control over these frequencies and the term “biofeedback” was coined to describe this process. With the advent of increased computing power and a deeper understanding of the brain, the research focus is now on “neurofeedback.” The year 2010 saw the first hard evidence of neuroplastic changes occurring directly in the brain after voluntary control of brain rhythms. (T. Ros et al., *Endogenous control of waking brain rhythms induces neuroplasticity in humans*)

The range of brain frequencies has been divided up and named as follows:

- Delta (0 to 4 Hz) – deep nighttime sleep
- Theta (4 to 7 Hz) – dreams at night and trance state of somnambulism
- Alpha (8 to 12 Hz) – background brain activity in the waking state. (Named alpha because it was the first one discovered by Hans Berger in 1908.)
- Beta (12 to 30 Hz) – awake, alert, focused
- Gamma (30 to 100 Hz) – certain cognitive or motor functions

The diagrams below are a 3D representation of brain wave patterns recorded using an IBVA recorder. Across the width of the diagram is the frequency from delta on the left to gamma on the right. Time is recorded in the length of the strip – each diagram



Note: These EEG (Electroencephalography) experiments were done by Jean-Charles Chabot, a hypnotherapist specialized in Life Between Lives spiritual hypnosis, who uses the IBVA recorder in his practice. (www.life-between-lives.ca).

Note: Jean-Charles and I carried out these experiments without knowing whether such an experiment had been done before. On October 29, 2012, reading Ervin Laszlo's *Science and the Akashic Field*, (p. 152-153) I discovered a description of a similar experiment showing the same result and giving a bit more information about the condition. Laszlo's book was first published in 2004, a new edition appeared in 2007 both from Inner Traditions in Vermont.

"An experiment carried out in the presence of this writer took place in southern Germany in the spring of 2001. At a seminar attended by about a hundred people, Dr. Günter Haffelder, head of the Institute for Communication and Brain Research of Stuttgart, measured the EEG patterns of Dr. Maria Sági, a trained psychologist and gifted natural healer, together with that of a young man who volunteered from among the participants. The young man remained in the seminar hall while the healer was taken to a separate room. Both the healer and the young man were wired with electrodes, and their EEG patterns were projected on a large screen in the hall. The

healer diagnosed the health problems of the subject, while he sat with closed eyes in a light meditative state. When the healer found the subject's areas of organic dysfunction, she sent information designed to compensate for it. During the approximately fifteen minutes that the healer was concentrating on her task, her EEG waves dipped into the deep Delta region (between 0 and 3 Hz per second), with a few sudden eruptions of wave amplitude. This was surprising in itself, because when someone's brain waves descend into the Delta region, he or she is usually in a state of deep sleep. But the healer was fully awake, in a state of intense concentration. Even more surprising was that the test subject exhibited the same Delta-wave pattern--it showed up in his EEG display about two seconds after it appeared in the EEG of the healer. Yet they had no sensory contact with each other."

Alpha Brain Waves: Definition, Functions, & Benefits

Article by Brain Waves Jr.

What are Alpha Brain Waves?

Alpha Brain Waves are a sign of relaxed activity in your brain. Alpha brainwaves are defined as brain waves that cycle between the frequency 8 Hz – 12 Hz. They are commonly produced in synchronized fashion connecting both hemispheres of your brain, though they can be found solely in the right hemisphere as well. Alpha brainwaves are the dominant brain wave activity when your body and mind are able to relax. If you have ever practiced meditation, yoga, or even felt relaxed after drinking alcohol – you have experienced alpha brain waves.

Alpha brain wave activity is common among highly creative individuals who have a clear mind or are experiencing relaxation. If you close your eyes for a minute or so, your alpha brain wave activity will significantly increase. As you open your eyes, the more stressful beta brain waves become the dominant pattern. In comparison, as a child you will have had significantly greater amounts of alpha brain wave activity than you will as an adult. Alpha brain waves have long been considered to be regarded as the healthiest brain wave range, but also the "safest" brain wave range to entrain – especially at 10 Hz (e.g. 10 cycles per second).

As an early teen or child, you likely had a dominant alpha brainwave pattern. Should you choose to experience a dominant alpha brain wave again, I recommend checking the products section. Most of the products recommended will do a nice job at increasing your alpha brain wave activity. I want to make it clear that there isn't a single brain wave state that is "better" than the others to be in – each have their advantages and disadvantages. However, most people are lacking in at least one brain wave pattern. For the majority of individuals, alpha brain waves happen to be the lacking frequency range. Things like environmental stressors, fear, anxiety, tension, and overworking tend to deplete your alpha wave activity. Below, I will outline several benefits of alpha brain waves and also discuss ways in which you can naturally increase your alpha activity.

Benefits of Alpha Brain Waves:

- **Relaxing Thoughts / Relaxed Body** – The alpha brainwave is produced when your body calms down and your mind is completely relaxed. Your brain's thinking is slower, your mind is clear and you may even feel slightly drowsy. Your body has zero stress, tension, anxiety, or other feelings of being nervous. Increasing your alpha brain wave activity is a profound way to reduce your stress.
- **Access Creative States** – If you consider yourself to have above-average creativity, chances are that you often experience an alpha brain wave state. Artists, innovative thinkers, and singers are generally found to have higher alpha activity than the average person. If you feel that your creativity is lacking, an increase in your alpha waves will feel great.
- **Enhanced Problem Solving** – Most people cannot seem to tap their alpha waves to help them problem solve. Alpha waves integrate both hemispheres of your brain for better communication and clearer thinking. The problem with lacking alpha waves is that your left-hemisphere is pulling all the weight in solving a problem, when your right-hemisphere has a solution waiting to communicate to the left. Increasing your alpha brain waves can benefit artists, writers (for writers block), and creative thinkers. You certainly won't feel mentally "stuck" in the alpha state. In order to tap your inner creativity, your brain must be able to produce synchronous bursts of alpha waves.
- **Calming, Centered Emotions** – Alpha brain waves will put you in a calm emotional state. You will not feel powerful emotions, however, you will feel "content" and centered. If you are stressed out or nerved up, you likely haven't had access to the alpha brain waves in a long time. Getting back in an alpha state will stabilize your intense emotions and you will feel good about yourself.
- **Optimal Athletic Performance** – Interestingly enough, if you are an athlete, you could significantly improve your performance by entraining some alpha brain waves. There is published evidence showing that just before a golfer hits their best shot or a basketball player sinks a shot (think LeBron and Kobe), alpha activity bursts in the left-hemisphere of their brain. Elite marksmen also have shown a significant burst of alpha wave activity before perfect shots. Also unique is the fact that the EEG's (brain wave measurement) of pro-athletes are very likely to display the alpha rhythm, whereas newbie athletes and even decent athletes do not demonstrate any alpha activity. The best brain wave to entrain for peak performance has been widely considered to be 10 Hz (i.e. 10 cycles per second). I encourage athletes to give some alpha entrainment a shot and see if it puts you "in the zone."
- **Reductions of Fear, Tension, Stress, Nervousness, Anxiety** – Increasing your alpha brain waves automatically leads to decreasing your fears, tension, stress, nerves, and anxiety. If you have ever gotten so caught up in a stressful or fearful state, that you literally "forgot how to relax," then having the ability to increase your alpha brain waves would feel like you've been given a miracle drug.
- **Everything Seems to "Flow"** – Being able to access "flow" means that you are able to tap a state of mind where all of life's events seem to pass quickly and all challenges are easily and quickly overcome. "Flow" is a period of time when you do not have any resistance or problems. You are in a mental state with optimal brain wave stimulation – you are not thinking too rapidly as to stress yourself out, yet you are also not thinking too slow as to be tired; you are right in the middle between the two. You feel "balanced" and understand that you are in a desirable state of mental functioning.
- **Ability to Tap "Super Learning"** – The ability to learn quickly and effortlessly has been described as the phenomena of "super learning." Basically, your brain is able to remember

and recall information with less effort than normal. Alpha waves will allow your brain to retain large quantities of information. This is due to the fact that both hemispheres of your brain are integrated and communicating with each other.

- **Improved Immune System Functioning** – Your alpha waves are responsible for amping up your immune system. They have been linked to health, recovery from sickness, and serve as protection from stress-related illnesses. Stress can quickly ramp up damage on your immune system if you go long periods without taking some time to relax; thus increasing alpha activity.
- **Think Positive** – Research indicates that due to the calm, wellbeing as a result of increasing alpha brain wave activity, positive thinking and positive emotions also result. I can personally testify for this one – after having gotten caught up in stress for a prolonged period – my thinking became increasingly positive after a few sessions of alpha entrainment; likely resulting from increased mental peace and calmness.
- **Alpha Brain Waves = Natural Antidepressant** – Alpha brain waves allow for increased release of an important neurotransmitter called “Serotonin.” Serotonin production usually drops to lower than normal levels in your brain when you feel depressed. In fact, most antidepressants nowadays aim to increase low levels of serotonin in the brain (do a search for “SSRI’s” to find out more). For these reasons, it makes sense that alpha brain waves may help ward off your blues.
- **Internal Awareness** – Alpha brainwaves are associated with an increased awareness of your self: body and mind. Where as beta brainwaves cause the mind to focus more on external events, the alpha brainwaves enhance the overall awareness of one’s self.

People with Higher than Average Amounts of Alpha Brain Waves

- **Outgoing People, Extroverts** – Generally, if you are more outgoing and consider yourself extroverted, you have more alpha brain waves than introverts. The consensus seems to be that if you have plenty of alpha activity, you are more than 3X as likely to be outgoing. It makes perfect sense – introverts are less comfortable during social interaction – whereas being social comes natural for extroverts.
- **People who Meditate** – If you practice meditation, then you have definitely accessed the alpha brain wave state. Each time as you close your eyes to meditate, you experience a surge of alpha brain wave activity. If you want to naturally increase your alpha activity, try meditation.
- **As a Child** – As a child, you tend to experience much greater activity in the alpha range. As you age, your brain shifts away from alpha to another range (commonly the beta range). It is important to recognize that even though you are not still a child, you can still have access to alpha waves. The majority of the adult population would benefit from increasing their alpha brain waves.

What Are Beta Brain Waves?

Beta Brain Waves are considered to be among the fastest [brainwave frequencies](#) and are documented as brain waves within the frequency range of 12 Hz – 38 Hz (or 12 to 38 cycles per second). They are typically produced by the left hemisphere of your brain, but can be synchronized. Each time you solve a tough math problem, logic puzzle, or read a book, your Beta Brain Waves kick in.

People who think logically tend to have a lot of Beta Brainwave activity. Adults tend to have more Beta Brainwaves than children and teens – and Beta Brain Waves have been known to increase as you get older. In the majority of healthy adults, Beta Waves seem to be the dominant rhythm. Beta Waves have also been associated with an increased ability to focus on our external reality. When we experience too many Beta Brain Waves, there can be problems like stress and anxiety. However, when produced in normal amounts, there are definitely many benefits to be had from experiencing Beta Brain Waves.

How Can You Experience Beta Brain Waves?

If you want to experience logical thinking, the ability to think more critically, and cultivate the ability to be quick-witted, then you may want to experience Beta Brain Waves. People who have increased their Beta Waves have been known to increase their I.Q. and productivity. Beta Brain Waves have also been associated as being a natural antidepressant (similar to [Gamma Brain Waves](#)). People have recorded that they were able to experience more motivation after increasing their Beta Brainwaves.

Tapping the highly energetic mental state of Beta is very possible now that there is such solid, scientifically supported brainwave technology. Cultivating brainwave flexibility by learning how to access other brainwave states of awareness like Beta is a valuable skill. There are many benefits and new experiences that can be had by experiencing an altered state of consciousness. If you'd like to experience Beta Brain Waves, I suggest that you check out some [brainwave products](#) – many of which you can test out for free before you buy. Read below for more benefits that result from Beta Brainwave Entrainment.

Benefits Of Beta Brain Waves

If you are able to access your Beta Brainwave state, you will know and understand exactly what it feels like. When you are in a Beta State, you are far from relaxed. You may have a lot of energy in the form of nervousness, excitement, or anxiety. When you are in a Beta Brainwaves state, you are able to think rapidly and quickly come up with logical solutions to problems. The Beta Waves state is ideal for solving math problems, conducting research, reading books, and writing articles. Each time a student takes a test, they experience a large surge in their Beta Brainwave activity.

Another side-effect from having lots of Beta Wave activity is being more socially outgoing. Talk-show hosts, lawyers, radio announcers, and people involved in debates tend to experience significant increases in their Beta Brainwave activity each time they begin talking. Beta Waves increase your ability to hold an interesting and stimulating conversation with others. You also have feelings of excitement and energy while talking to someone else.

Due to the fact that excitement and nervous energy accompany the Beta Range, many people experience leaps in their motivation to take action. If you've ever read about someone being able to perform an amazing feat out of fear (i.e. out of adrenaline), then you understand that these Beta Waves can be highly motivating and action-oriented. If you've ever run away from someone because you were scared – your Beta Brain Waves kicked in at their highest levels.

It is natural that people become more goal oriented when their Beta Waves dominate their mental activity. Though they may be using this fear or excitement type energy, it does produce results. You can get a heck of a lot better performance out of someone who is performing as if their life depended on it – versus someone who is calm and not very concerned with how they end up performing. It is because of this increase in energy from the Beta State that sometimes peak performance is associated with the higher-range Beta frequencies

What Are Delta Brain Waves?

Delta Brain Waves are the brain's slowest **frequency range** cycling at a rate of 1-4 times per second (e.g. 1 Hz – 4 Hz). Delta Brain Waves become active in your brain when you are in the deeper stages of sleep (e.g. stage 3 and stage 4). They are associated with being completely unconscious (i.e. you usually won't know or remember anything while Delta Waves are dominant). Delta Brain Waves have been known to oscillate throughout all parts of the brain and are not usually synchronized. Of all brainwave ranges, the Delta Waves have the greatest amplitude and are responsible for the slowest form of mental processing.

Having access to the Delta Brainwave state not only implies that we are in a deep stage of sleep though. In some cases, people can learn to increase their delta activity. People with high amounts of Delta Waves have been found to have increased empathy (or understanding of others' emotions). Other interesting effects have been documented as a side-effect of having Delta Brainwaves.

Delta Brain Waves Benefits

Delta Brain Waves have been proven to have a number of beneficial side-effects. When Delta Brain Waves increase, so does your natural ability to: Release Anti-Aging hormones, tap an increased amount of empathy (understanding how others feel), heal the mind and repair your muscles, and access the deepest possible states of relaxation. Other side-effects as a result of Delta Brain Waves include: the release of natural growth hormone, the release of melatonin, connecting with your intuition and accessing deep states of spirituality.

Another great thing about Delta Brain Waves is that they have been known to reduce levels of cortisol in your body. Cortisol is a hormone released when you are under stress that basically kills off brain cells and can cause damage to parts of your body. Cortisol has been linked to quicker aging, while having less cortisol has been known to be associated with anti-aging. For some individuals with high amounts of stress, Delta Brain Waves may also work great at reducing adrenaline levels.

The great thing about Delta brainwaves is that they are able to connect you with deeper parts of your unconscious mind. Even though you must travel down through **Alpha Brain Waves** and Theta Brain Waves before you can reach Delta, many people are able to greatly appreciate a Delta Brainwaves experience. If you spend too much time caught up in the higher ranges of brain waves, then chances are you may be able to benefit from Delta Waves, especially if you increase them right before you go to bed. Since Delta Brainwaves are associated with sleep, listening to a **brainwave entrainment** session in the Delta frequency range of 1 Hz to 4 Hz will do a nice job at helping you fall asleep.

Advanced monk meditators have also been known to access the Delta Brain Waves range when they practice meditation. The average, less experienced meditator usually is only able to access the Alpha or Theta Brainwaves range. However, if you practice long enough and get proper training, you too will be able to tap into your Delta awareness. Having a brainwave pattern that is dominated by Delta Brainwaves is impossible if the person is awake. Many people have also reported having spiritual experiences and sometimes O.O.B.E. (Out-Of-Body-Experiences) while having Delta Brainwave activity. These paranormal experiences are more common if a person has access to slower levels of their Brain Waves.

People With Delta Brain Waves

Typically, Delta Brain Waves are most commonly documented in E.E.G. brain activity while a person is asleep. However, other individuals like: babies, very young children, monks/advanced meditators,

people who have had Near-Death-Experiences, people suffering from brain damage, and people with brain damage have also been known to have higher than average amounts of Delta Brain Waves.

If you saw a boxer get K.O.'d (Knocked-Out), he would have been experiencing Delta Brain Waves. If you have ever been put to sleep with anesthesia, you were knocked into your Delta Brain Waves state. Other individuals who lack focus and suffer from attention-deficit can also have high amounts of Delta Brain Waves – even though having Theta Waves is more common

What Are Theta Brain Waves?

Theta Brain Waves are the second slowest [frequency of brain waves](#). They typically cycle at a rate of 4-7 times per second (4 Hz – 7 Hz). Theta Brain Waves have long been associated with early stages of sleep and the process of dreaming. Theta Brain Waves are of high amplitude and usually kick in when you experience powerful surges of emotion. Theta Waves have been associated with states of enhanced creativity, "Super Learning," deeper relaxation, day-dreaming, and sleep-dream activity.

Theta Brain Waves can kick in when you have a spiritual experience or while you are in a highly-creative state. On other occasions, Theta Waves may dominate our brain wave activity when we are not able to concentrate. People with attention-deficit problems (ADD and ADHD) are not able to shift out of the Theta State when events that require focus (i.e. Taking a test) arise. This makes school work much harder for people with attention problems. However, the majority of healthy people are able to naturally shift their brainwave state from Beta to Alpha to Theta and back from Theta to Alpha to Beta in cases where extreme mental focus is required.

Benefits Of Theta Brain Waves

If you are able to recall how relaxed and carefree you were as a child, then you are able to remember what it felt like to access your Theta Brain Waves. Children tend to have significantly higher amounts of Theta Waves than do adults – which is why children are not generally as stressed out as their parents. Children are able to say what's on their mind and not be fearful of trying something new; this is the Theta Brainwave State.

Accessing your Theta Brain Waves means having a deeper emotional connection with yourself. Generally, people have much stronger emotions – whether they be happy or sad – while in the Theta Range. If you have been too caught up in the Beta State for an extended period of time – chances are good that you forgot what your natural emotions feel like. Some Theta Brainwave Entrainment will get you more closely connected with your inner self and back to experiencing natural emotions – not artificially or stress-induced ones.

Not to mention, Theta Waves have been linked to having a strong intuition. Have you ever gotten a strong "gut-feeling" about something and your gut turned out to be right? Well, it has been proven that Theta Brainwaves are accessed when you have an instinctual-type "feeling" in the pit of your stomach. Much of the time, our gut-instinct turns out to be right – even when our logical Beta Brainwaves want to take over. Other benefits from having more Theta brainwave activity include: A connection to your subconscious mind or subconscious processing, advanced problem solving, and learning ability.

Each and every day, you receive subconscious programming from your environment that you may not be aware of. This information and processing cycles into your brain and has actually been found to have an influence on behavior. You can benefit from tapping your Theta Waves to connect with your sub-conscious because it will allow you to reprogram your brain with ideas and beliefs that you truly want to believe. This helps you avoid falling victim to environmentally induced thought patterns.

People with Theta Waves have been known to be able to think far more creatively than those who don't. Usually musicians, painters, designers, or anyone with a job that involves a certain degree of creativity – has more Theta Waves than average. It has also been found that people with lower levels of anxiety, stress, and neurosis – are able to maintain stable Theta Brainwave activity.

Theta Brain Wave activity has also been noted among individuals who are able to learn quickly. This is due to the fact that like Alpha Waves, Theta Brain Waves can induce a similar state of "Super Learning." In fact, the Theta State of "Super Learning" has been found to be the most powerful state for learning a new language.

This makes perfect sense due to the fact that children (who have high amounts of Theta activity) are able to learn new languages much more quickly and easily than adults. Additional Theta Brainwave benefits are: Long-term memory improvements, improvements in the healing of the brain and body, the ability to hyperfocus (i.e. Get in "The Zone"), and boosted immune system functioning (as is true with all forms of slower brainwave).

People With Theta Brain Waves

Groups of people that already experience Theta Waves include: people who meditate, people who are extroverted, children, artists, and inventors. Meditation can allow you to tap into your Theta Brain Waves quickly and experience a deeper connection with your subconscious. It has been documented that Theta Brain Waves also occur in extroverts when they communicate and during emotional bonding.

What Are Gamma Brain Waves?

The fastest documented [brainwave frequency](#) range is that of Gamma Brain Waves – which oscillate within the range of 40 Hz to 70 Hz. Gamma Brain Waves have the smallest amplitude on an E.E.G. in comparison to the other four basic types of brainwave frequencies. Gamma Brain Waves have long been considered the brain's information and sensory-binding brainwave – or the brainwave that is able to link and process information from all parts of the brain. Having high amounts of Gamma Brainwave activity has been associated with: having high levels of intelligence, being compassionate, having high amounts of self-control, and feelings of natural happiness.

Gamma Brain Waves have also been linked to having a great memory and an increased perception of reality. People lacking in Gamma Brainwaves tend to experience difficulties with learning and mental processing. Usually people with impaired or retarded mental functioning tend to have significantly less Gamma Brainwave activity than those who have average and above-average intelligences. There seems to be a correlation with higher amounts of Gamma Brainwave activity and increased brain functioning ability.

Benefits Of Gamma Brain Waves

People with higher amounts of Gamma Brainwaves are lucky due to the fact that they will often experience improvements in memory and their ability to vividly recall past experiences. One

frequency in the Gamma Waves range, which cycles 40 times per second (e.g. At a rate of 40 Hz), has been known to regulate memory processing in the brain. If you are currently having difficulty remembering information like: names, dates, events, plans, etc. – you would likely benefit from increasing your Gamma Brainwave range.

Gamma Brain Waves are also known to boost your perception of reality through your five senses. Gamma Brainwave activity is responsible for making smells more powerful, increasing your visual acuity, sharpening your hearing, and making foods taste better. Those who lack Gamma Brain Waves may have the same foods or be put in the same environment, but their brain's will not have as much sensory-rich processing as individuals with Gamma activity.

The Gamma Brainwave range is able to properly combine or “bind” your senses and memory together for one ultimate experience. This is why on a memorable night you'll often remember the music that was playing, the aroma of the atmosphere, what you saw, the foods you ate, etc. The Gamma Brain Wave state is an incredibly focused one and allows us to get the richest possible sensory experience as a result of our external world.

Gamma Brain Waves have also been linked with the ability to process large amounts of information in relatively small amounts of time. Think of having more Gamma Activity as getting a processor upgrade for your brain. People without much Gamma activity literally cannot imagine what they are missing out on – unless they have experienced Gamma activity before.

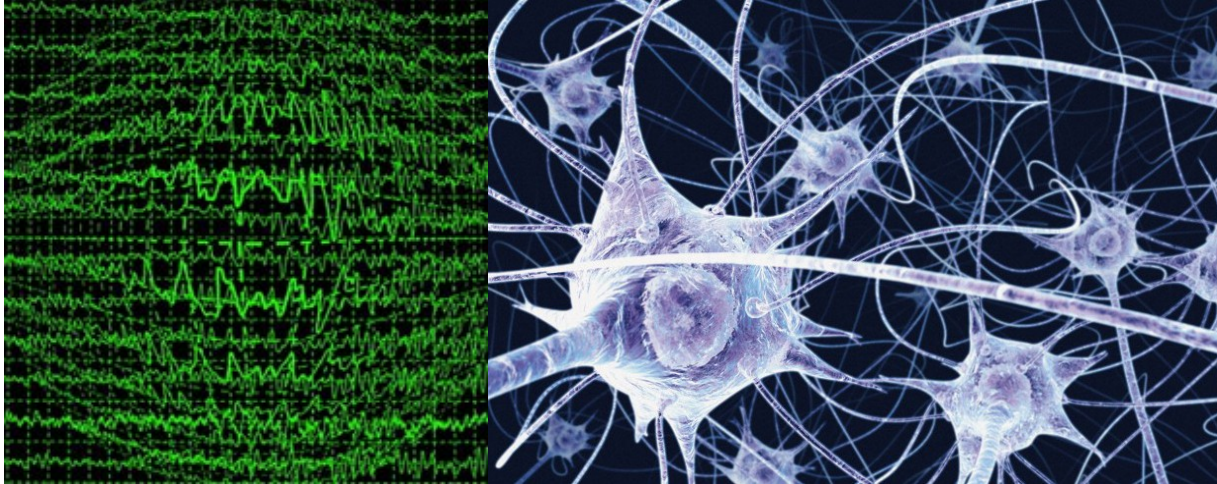
One of the best side-effects from Gamma Brainwave Entrainment is that you'll naturally begin to feel more compassionate towards others and internally happier. Gamma Brain Waves have been documented as being a powerful antidepressant-type brainwave. This makes complete sense due the fact that people suffering from clinical depression tend to have lower-than-average amounts of Gamma Brain Waves.

People With Gamma Brain Waves

Everyone has some Gamma Brainwave activity, but some groups of people have more Gamma activity than others. People with plenty of Gamma Brainwave activity include: People in advanced stages of meditation and people living in a state of peak-performance. Gamma Brain Waves is the most common brainwave state for top-notch athletic performers to be in when they perform perfectly (i.e. When Tiger Woods sinks put from far away OR when an Olympic performer receives a perfect score from the judges).

Brain Oscillations Reveal We Experience the World in Rapid Snapshots

May 14, 2012



Neuroscientists from the University of Glasgow have demonstrated that our brains experience the world in discrete snapshots determined by the cycles of brain rhythms. While studying a brain rhythm associated with visual cortex, they used a “simple trick” to affect and “reset” the oscillations of this rhythm.

It has long been suspected that humans do not experience the world continuously, but rather in rapid snapshots.

Now, researchers at the University of Glasgow have demonstrated this is indeed the case. Just as the body goes through a 24-hour sleep-wake cycle controlled by a circadian clock, brain function undergoes such cyclic activity – albeit at a much faster rate.

Professor Gregor Thut of the Institute of Neuroscience and Psychology, said: “Rhythms are intrinsic to biological systems. The circadian rhythm, with its very slow periodicity of sleep and wake cycles every 24 hours has an obvious, periodic effect on bodily functions.

“Brain oscillations – the recurrent neural activity that we see in the brain – also show periodicity but cycle at much faster speeds. What we wanted to know was whether brain function was affected in a cyclic manner by these rapid oscillations.”

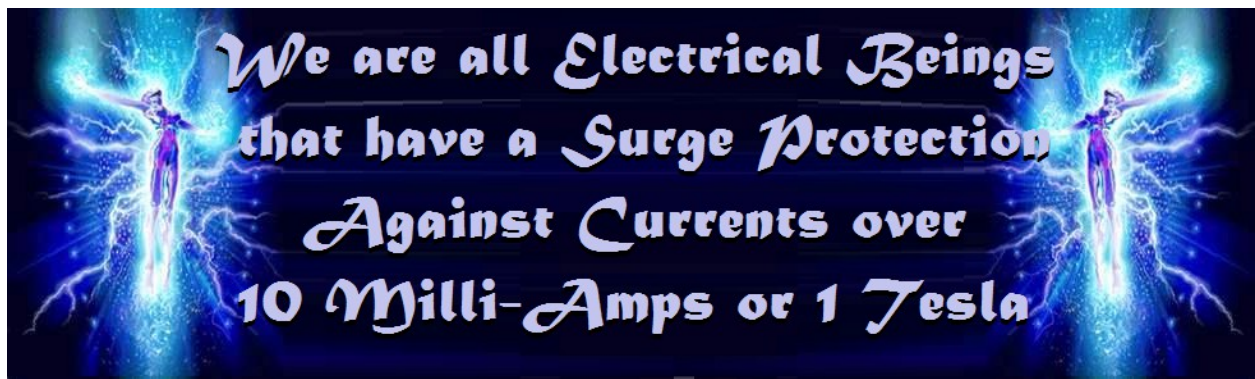
The researchers studied a prominent brain rhythm associated with visual cortex functioning that cycles at a rate of 10 times per second (10Hz).

They used a ‘simple trick’ to affect the oscillations of this rhythm which was presenting a brief sound to ‘reset’ the oscillation.

Testing subsequent visual perception, by using transcranial magnetic stimulation of visual cortex, revealed a cyclic pattern at the very rapid rate of brain oscillations, in time with the underlying brainwaves.

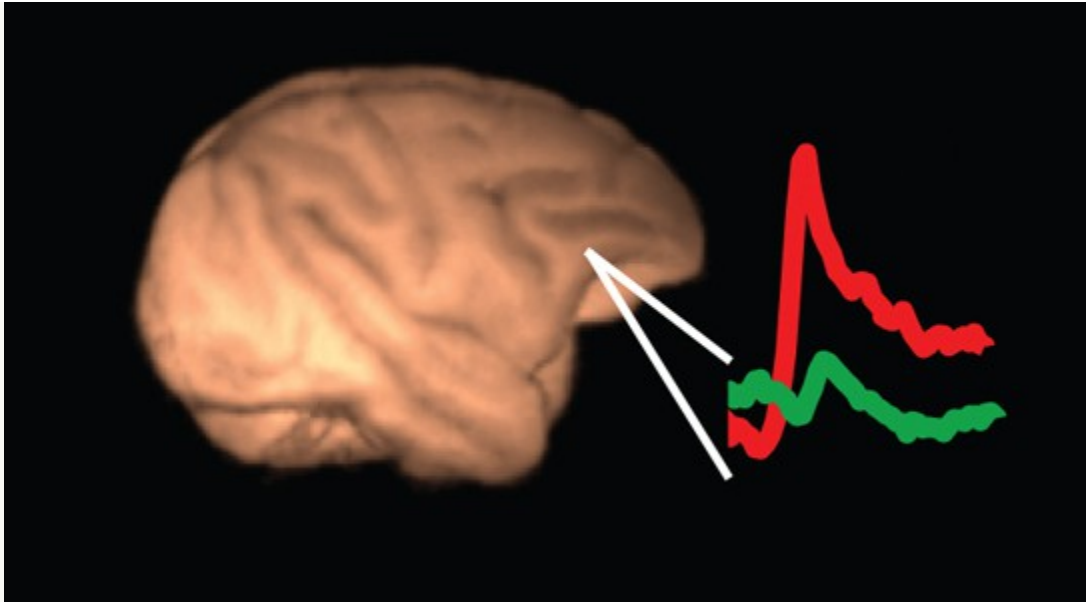
Prof Thut said: "Rhythmicity therefore is indeed omnipresent not only in brain activity but also brain function. For perception, this means that despite experiencing the world as a continuum, we do not sample our world continuously but in discrete snapshots determined by the cycles of brain rhythms."

The research, 'Sounds reset rhythms of visual cortex and corresponding human visual perception' is published in the journal Current Biology.



Conscious Perception from a Global Network of Neurons

June 12, 2012



Neurons in the lateral prefrontal cortex represent the content of consciousness. The red trace depicts neural activity (neuronal discharges) in the lateral prefrontal cortex when a stimulus is consciously perceived for 1 second while the green trace depicts neural activity when the same stimulus is suppressed from awareness. MPI for Biological Cybernetics

New research from scientists at the Max Planck Institute for Biological Cybernetics supports the view that the content of consciousness is not localized in a unique cortical area but, rather, that a global network of neurons from different areas of the brain is responsible for it.

Consciousness is a selective process that allows only a part of the sensory input to reach awareness. But up to today it has yet to be clarified which areas of the brain are responsible for the content of conscious perception. Theofanis Panagiotaropoulos and his colleagues – researchers at the Max Planck Institute for Biological Cybernetics in Tübingen and University Pompeu Fabra in Barcelona – have now discovered that the content of consciousness is not localized in a unique cortical area, but is most likely an emergent property of global networks of neuronal populations.

The question which parts of the brain are responsible for the things that reach our awareness is one of the main puzzles in neurobiology today. Previous research on the brains of primates has shown that neurons in primary and secondary cortices provide poor representation of visual consciousness. In contrast, the neurons in the temporal lobe seem to reliably reflect the actual conscious perception of a visual stimulus. These findings indicated that not all parts of the brain are responsible for the content of conscious awareness. Nevertheless, the question whether only one of the brain's areas is responsible for the content of perception or whether more regions are involved in the process has so far remained unanswered.

The Max Planck scientists in Tübingen led by Nikos Logothetis have now addressed this issue using electrophysiological methods to monitor the neural activity in the lateral prefrontal cortex of macaque monkeys during ambiguous visual stimulation. The visual stimuli used allow for multiple perceptual interpretations, even though the actual input remained the same. In doing so, Panagiotaropoulos and his team were able to show that the electrical activity monitored in the lateral prefrontal cortex correlates with what the macaque monkeys actually perceive.

They thus concluded that visual awareness is not only reliably reflected in the temporal lobe, but also in the lateral prefrontal cortex of primates. The results depict that the neuronal correlates of consciousness are embedded in this area, which has a direct connection to premotor and motor areas of the brain, and is therefore able to directly affect motor output. These findings support the “frontal lobe hypothesis” of conscious visual perception established in 1995 by the researchers Crick (the co-discoverer of the structure of the DNA molecule) and Koch that awareness is related to neural activity with direct access to the planning stages of the brain.

The results support this theory in so far as they show that the lateral prefrontal cortex is involved in the process of visual awareness. However, the fact that neural activity in two different cortical areas reflects conscious perception shows that the decision which sensory input reaches our awareness is most likely not made in a unique cortical area but, rather, that a global network of neurons from different areas of the brain is responsible for it. “Our results therefore broaden the hypothesis and create new questions regarding the cortical mechanisms of visual awareness”, Panagiotaropoulos explains. In the near future the group is going to record the electrical activity in both regions simultaneously.

By this they will try to find out which of the two areas is activated first and draw conclusions on how the two areas interact with each other during conscious perception. This may lead to a better understanding of why only certain things reach our awareness and others remain suppressed.

Source: Max Planck Institute

EEG Biofeedback Treatment

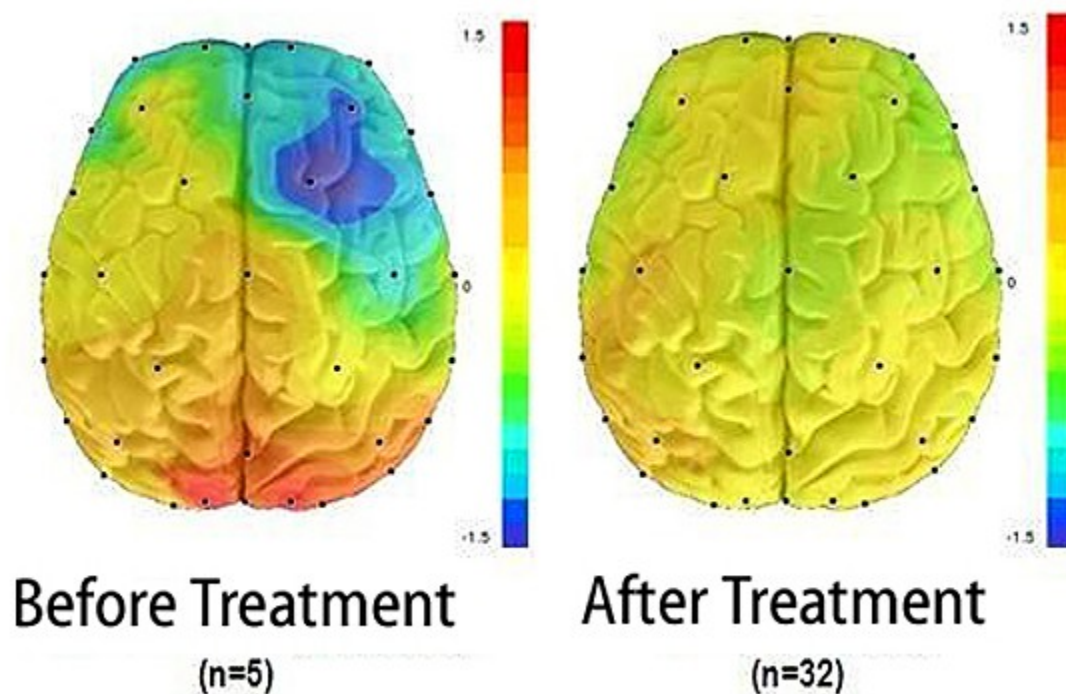
EEG Biofeedback Treatment –

EEG Biofeedback Treatment also known as electromyograph, is the process of identifying, measuring and manipulating many physiological functions. Some of the processes that can be controlled include brainwaves, muscle tone, skin conductance, heart rate and pain perception.

The goal of Crosby's EEG Biofeedback Treatment is to improve health, performance, and the physiological changes which often occur in conjunction with changes to thoughts, emotions, and behavior. Eventually, these changes may be maintained without the use of extra equipment or medication.

EEG Biofeedback monitors physiological reactions while Neurofeedback monitor neurological reactions. **Crosby utilizes EEG Biofeedback Treatment to accurately diagnose your condition and its root causes and to treat addictions and any co-occurring emotional disorders.** Biofeedback performs several functions in your recovery:

- Part of your diagnostic testing
- Part of your individualized therapy
- A benchmark to measure the effectiveness of your on-going therapy
- For your treatment team to make adjustments to your therapy
- To display your results on the video monitors so that you can see your healing & recovery.



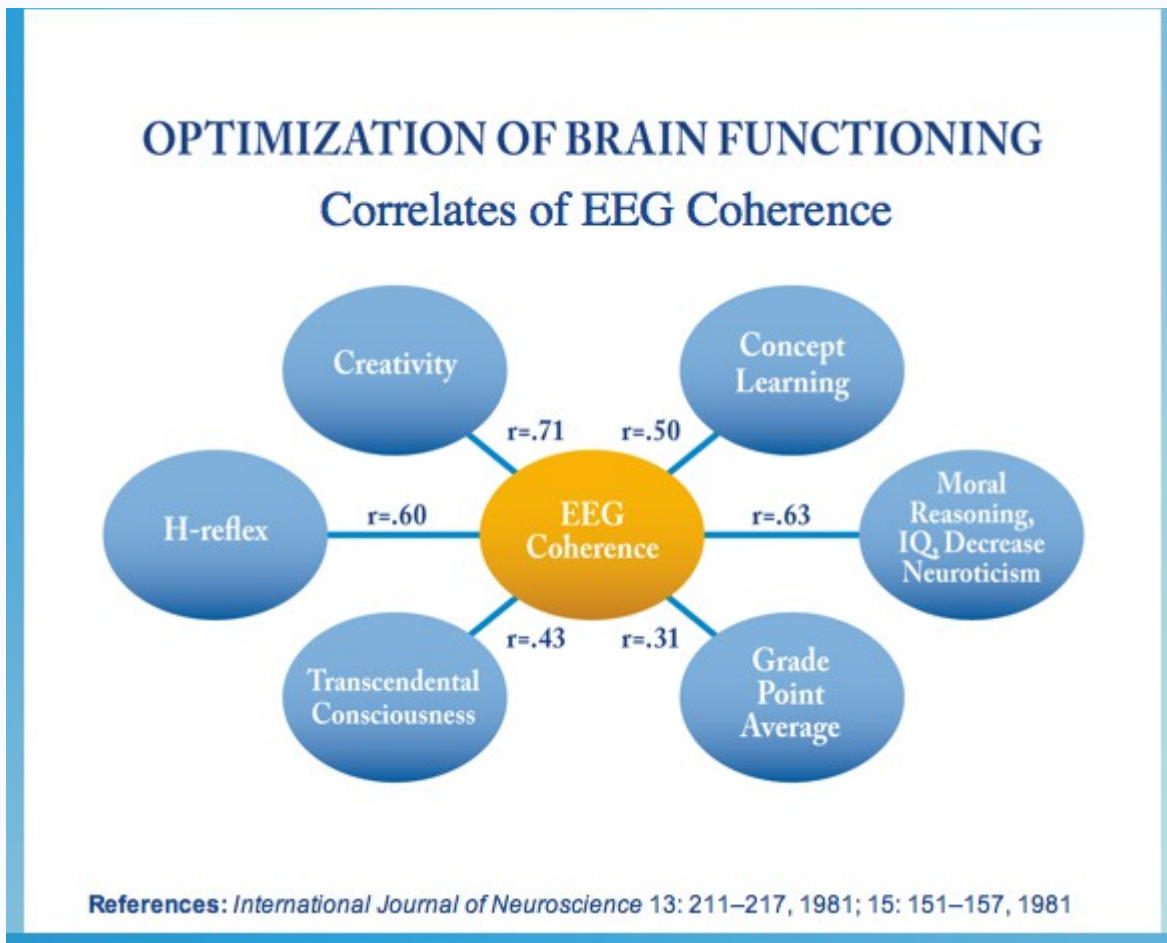
How Does EEG Biofeedback Treatment Work?

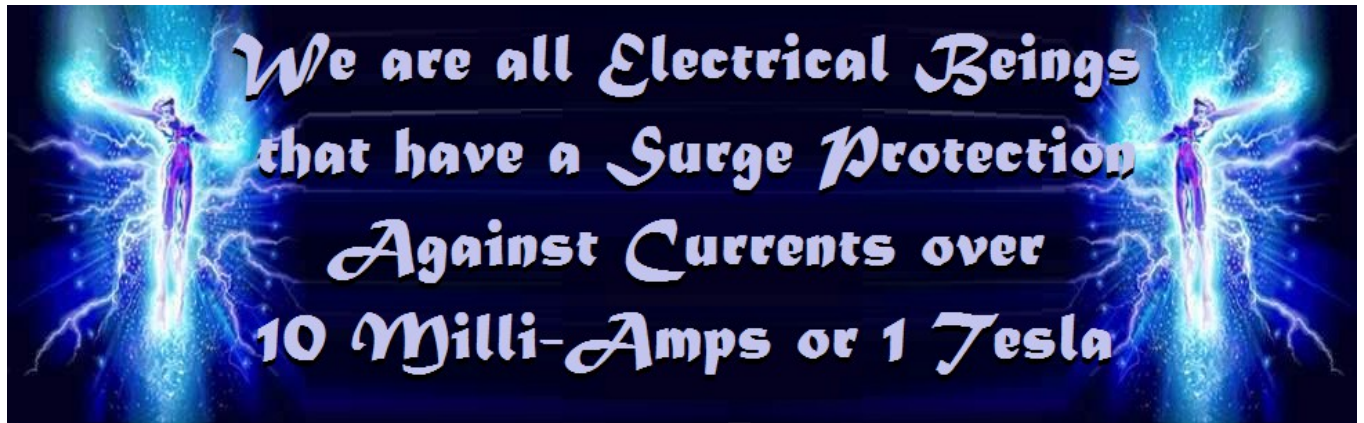
EEG Biofeedback Treatment is completely non-invasive and painless. Electrical sensors are placed on the patient to measure activity. The electrical activity is sent via the sensors to the wires which connect to the EEG biofeedback device. These measurements are displayed on a video monitor. You can actually see your physical reactions and

watch as our therapy addresses areas your reaction. EEG Biofeedback Treatment helps identify the root cause to psychological disorders, drug addictions or both.

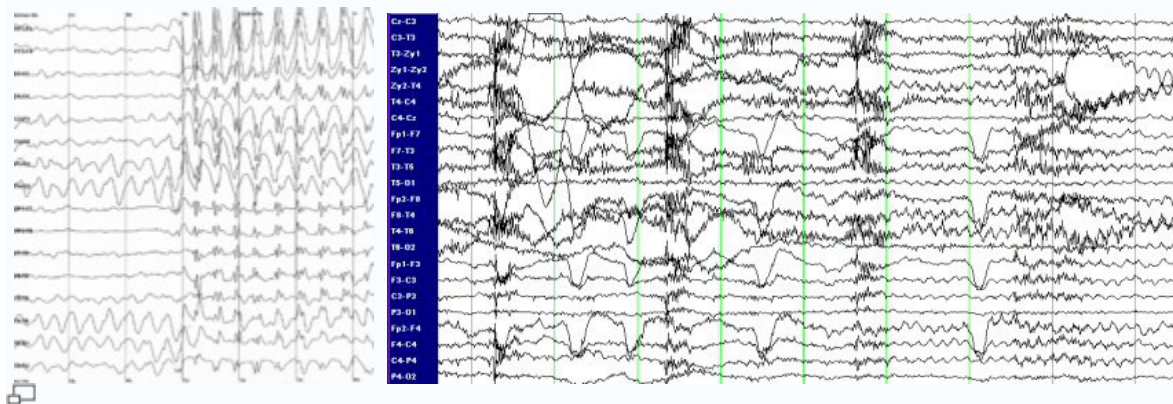
EEG Biofeedback Treatment

With successful EEG Biofeedback training, prescribed medications that target brain function may no longer be needed. During EEG Biofeedback treatment, medication dosages may be lowered as you are able to control and regulate your physical reactions reducing the need for pharmacological intervention. This decrease in medications is particularly striking when the medications play a supportive role as is often the case for the more severe disorders.





Electroencephalography



[Epileptic](#) spike and wave discharges monitored with EEG.

Electroencephalography (EEG) is the recording of [electrical](#) activity along the scalp produced by the firing of [neurons](#) within the [brain](#). In clinical contexts, EEG refers to the recording of the brain's spontaneous electrical activity over a short period of time, usually 20-40 minutes, as recorded from multiple [electrodes](#) placed on the [scalp](#). In [neurology](#), the main [diagnostic](#) application of EEG is in the case of [epilepsy](#), as epileptic activity can create clear abnormalities on a standard EEG study. A secondary clinical use of EEG is in the diagnosis of [coma](#) and [encephalopathies](#). EEG used to be a first-line method for the diagnosis of [tumors](#), [stroke](#) and other focal brain disorders, but this use has decreased with the advent of anatomical imaging techniques such as [MRI](#) and [CT](#).

Derivatives of the EEG technique include [evoked potentials](#) (EP), which involves averaging the EEG activity time-locked to the presentation of a stimulus of some sort (visual, [somatosensory](#), or auditory). [Event-related potentials](#) refer to averaged EEG responses that are time-locked to

more complex processing of stimuli; this technique is used in [cognitive science](#), [cognitive psychology](#), and [psychophysiological](#) research.

Source of EEG Activity

The electrical activity of the brain can be described in spatial scales from the currents within a single [dendritic spine](#) to the relatively gross potentials that the EEG records from the [scalp](#), much the same way that the economics can be studied from the level of a single individual's personal finances to the macro-economics of nations. [Neurons](#), or nerve cells, are electrically active cells which are primarily responsible for carrying out the brain's functions. Neurons create [action potentials](#), which are discrete electrical signals that travel down [axons](#) and cause the release of chemical [neurotransmitters](#) at the [synapse](#), which is an area of near contact between two neurons. This neurotransmitter then fits into a [receptor](#) in the [dendrite](#) or body of the neuron that is on the other side of the synapse, the [post-synaptic](#) neuron. The neurotransmitter, when combined with the receptor, typically causes an electrical current within dendrite or body of the post-synaptic neuron. Thousands of post-synaptic currents from a single neuron's dendrites and body then sum up to cause the neuron to generate an action potential (or not). This neuron then synapses on other neurons, and so on.

It is generally accepted that the activity measured by EEG is electrical potentials created by the post-synaptic currents, rather than by action potentials. More specifically, the scalp electrical potentials that produce EEG are due to the extracellular ionic currents caused by dendritic electrical activity (whereas the fields producing [magnetoencephalographic](#) signals are associated with intracellular ionic currents).

Although post-synaptic potentials generate the EEG signal, it is not possible for a scalp EEG to assess the activity within a single dendrite or neuron. Rather, a surface EEG reading is the summation of the synchronous activity of thousands or millions of neurons that have similar spatial orientation, radial to the scalp. Currents that are tangential to the scalp are not picked up by the EEG. The EEG therefore benefits from the parallel, radial arrangement of apical dendrites in the cortex. Because voltage fields fall off with the fourth power of the radius, activity from deep sources is more difficult to detect than currents near the skull.^{[[citation needed](#)]}

Scalp EEG activity shows oscillations at a variety of frequencies. Several of these oscillations have characteristic frequency ranges, spatial distributions and are associated with different states of brain functioning (e.g., waking and the various [sleep stages](#)). These oscillations represent synchronized activity over a network of neurons. The neuronal networks underlying some of these oscillations are understood (e.g., the thalamocortical resonance underlying sleep spindles), while many others are not (e.g., the system that generates the posterior basic rhythm).

Clinical use

A routine clinical EEG recording typically lasts 20-40 minutes (plus preparation time) and usually involves recording from 21 scalp electrodes. Routine EEG is typically used in the following clinical circumstances:

- to distinguish [epileptic seizures](#) from other types of spells, such as [psychogenic non-epileptic seizures](#), [syncope \(fainting\)](#), sub-cortical [movement disorders](#) and [migraine](#) variants.
- to differentiate "organic" [encephalopathy](#) or [delirium](#) from primary psychiatric syndromes such as [catatonia](#)
- to serve as an adjunct test of [brain death](#)
- to prognosticate, in certain instances, in patients with coma

At times, a routine EEG is not sufficient, particularly when it is necessary to record a patient while he/she is having a seizure. In this case, the patient may be admitted to the hospital for days or even weeks, while EEG is constantly being recorded (along with time-synchronized video and audio recording). A recording of an actual seizure (i.e., an [ictal](#) recording, rather than an inter-ictal recording of a possibly epileptic patient at some period between seizures) can give significantly better information about whether or not a spell is an epileptic seizure and the focus in the brain from which the seizure activity emanates.

Epilepsy monitoring is typically done

- to distinguish [epileptic seizures](#) from other types of spells, such as [psychogenic non-epileptic seizures](#), [syncope \(fainting\)](#), sub-cortical [movement disorders](#) and [migraine](#) variants.
- to [characterize seizures](#) for the purposes of treatment
- to localize the region of brain from which a seizure originates for work-up of possible seizure surgery

Additionally, EEG may be used to monitor certain procedures:

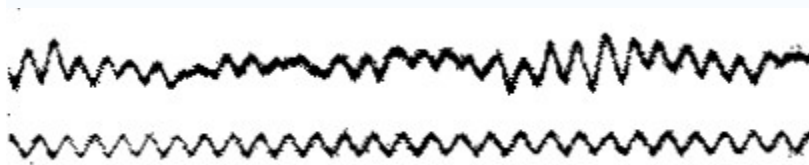
- to monitor the depth of [anesthesia](#)
- as an indirect indicator of cerebral perfusion in [carotid endarterectomy](#)
- to monitor amobarbital effect during the [Wada test](#)

EEG can also be used in [intensive care units](#) for brain function monitoring:

- to monitor for non-convulsive seizures/non-convulsive status epilepticus
- to monitor the effect of sedative/anesthesia in patients in medically induced coma (for treatment of refractory seizures or increased [intracranial pressure](#))
- to monitor for secondary brain damage in conditions such as [subarachnoid hemorrhage](#) (currently a research method)

If a patient with epilepsy is being considered for [resective surgery](#), it is often necessary to localize the focus (source) of the epileptic brain activity with a resolution greater than what is provided by scalp EEG. This is because the [cerebrospinal fluid](#), skull and scalp *smear* the electrical potentials recorded by scalp EEG. In these cases, neurosurgeons typically implant strips and grids of electrodes (or penetrating depth electrodes) under the [dura mater](#), through either a [craniotomy](#) or a [burr hole](#). The recording of these signals is referred to as [electrocorticography](#) (ECoG), subdural EEG (sdEEG) or intracranial EEG (icEEG)--all terms for the same thing. The signal recorded from ECoG is on a different scale of activity than the brain activity recorded from scalp EEG. Low voltage, high frequency components that cannot be seen easily (or at all) in scalp EEG can be seen clearly in ECoG. Further, smaller electrodes (which cover a smaller parcel of brain surface) allow even lower voltage, faster components of brain activity to be seen. Some clinical sites record from penetrating microelectrodes.

Research use



An early EEG recording, obtained by [Hans Berger](#) in 1924. The upper tracing is EEG, and the lower is a 10 [Hz](#) timing signal.

EEG, and its derivative, [ERPs](#), are used extensively in [neuroscience](#), [cognitive science](#), [cognitive psychology](#), and [psychophysiological](#) research. Many techniques used in research contexts are not standardized sufficiently to be used in the clinical context.

A different method to study brain function is [functional magnetic resonance imaging \(fMRI\)](#). Some benefits of EEG compared to fMRI include:

- Hardware costs are significantly lower for EEG sensors versus an fMRI machine

- EEG sensors can be deployed into a wider variety of environments than a bulky, immobile fMRI machine
- EEG enables higher temporal resolution, on the order of milliseconds, rather than seconds
- EEG is relatively tolerant of subject movement versus an fMRI (where the subject must remain completely still)
- EEG is silent, which allows for better study of the responses to auditory stimuli
- EEG does not cause claustrophobia

Limitations of EEG as compared with fMRI include:

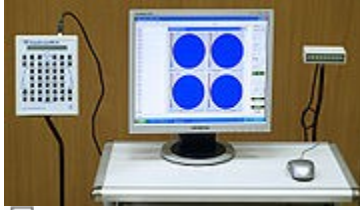
- Significantly less spatial resolution
- Need to apply electrodes to the scalp (which may bother people with severe tactile sensitivities, e.g., some individuals with [autism](#))
- ERP studies require relatively simple paradigms, compared with block-design fMRI studies

EEG recordings have successfully obtained simultaneously with fMRI scans, though successful simultaneous recording requires that several technical issues be overcome, such as the presence of ballistocardiographic artifact, MRI pulse artifact and the induction of electrical currents in EEG wires that move within the strong magnetic fields of the MRI.

EEG also has some characteristics that compare favorably with behavioral testing:

- EEG can detect covert processing (i.e., that which does not require a response)
- EEG can be used in subjects who are incapable of making a motor response
- Some ERP components can be detected even when the subject is not attending to the stimuli
- As compared with other reaction time paradigms, ERPs can elucidate stages of processing (rather than just the final end result)

Method



Computer Electroencephalograph *Neurovisor-BMM 40*

In conventional scalp EEG, the recording is obtained by placing [electrodes](#) on the scalp with a conductive gel or paste, usually after preparing the scalp area by light abrasion to reduce [impedance](#) due to dead skin cells. Many systems typically use electrodes, each of which is attached to an individual wire. Some systems use caps or nets into which electrodes are embedded; this is particularly common when high-density arrays of electrodes are needed.

Electrode locations and names are specified by the [International 10–20 system](#) for most clinical and research applications (except when high-density arrays are used). This system ensures that the naming of electrodes is consistent across laboratories. In most clinical applications, 19 recording electrodes (plus ground and system reference) are used. A smaller number of electrodes are typically used when recording EEG from [neonates](#). Additional electrodes can be added to the standard set-up when a clinical or research application demands increased spatial resolution for a particular area of the brain. High-density arrays (typically via cap or net) can contain up to 256 electrodes more-or-less evenly spaced around the scalp.

Each electrode is connected to one input of a [differential amplifier](#) (one amplifier per pair of electrodes); a common system reference electrode is connected to the other input of each differential amplifier. These amplifiers amplify the voltage between the active electrode and the reference (typically 1,000–100,000 times, or 60–100 [dB](#) of voltage gain). In analog EEG, the signal is then filtered (next paragraph), and the EEG signal is output as the deflection of pens as paper passes underneath. Most EEG systems these days, however, are digital, and the amplified signal is digitized via an [analog-to-digital converter](#), after being passed through an [anti-aliasing filter](#). Analog-to-digital sampling typically occurs at 256–512 Hz in clinical scalp EEG; sampling rates of up to 20 kHz are used in some research applications.

During the recording, a series of activation procedures may be used. These procedures may induce normal or abnormal EEG activity that might not otherwise be seen. These procedures include hyperventilation, photic stimulation (with a strobe light), eye closure, mental activity, sleep and sleep deprivation. During (inpatient) epilepsy monitoring, a patient's typical seizure medications may be withdrawn.

The digital EEG signal is stored electronically and can be filtered for display. Typical settings for the [high-pass filter](#) and a [low-pass filter](#) are 0.5–1 [Hz](#) and 35–70 Hz, respectively. The high-pass filter typically filters out slow artifact, such as [electrogalvanic](#) signals and movement artifact, whereas the low-pass filter filters out high-frequency artifacts, such as [electromyographic](#) signals. An additional [notch filter](#) is typically used to remove artifact caused by electrical power lines (60 Hz in the United States and 50 Hz in many other countries).

As part of an evaluation for epilepsy surgery, it may be necessary to insert electrodes near the surface of the brain, under the surface of the [dura mater](#). This is accomplished via burr hole or [craniotomy](#). This is referred to variously as "[electrocorticography \(ECoG\)](#)", "intracranial EEG (I-EEG)" or "subdural EEG (SD-EEG)". Depth electrodes may also be placed into brain structures, such as the [amygdala](#) or [hippocampus](#), structures which are common epileptic foci and may not be "seen" clearly by scalp EEG. The electrocorticographic signal is processed in the same manner as digital scalp EEG (above), with a couple of caveats. ECoG is typically recorded at higher sampling rates than scalp EEG because of the requirements of [Nyquist theorem](#)—the subdural signal is composed of a higher predominance of higher frequency components. Also, many of the artifacts which affect scalp EEG do not impact ECoG, and therefore display filtering is often not needed.

A typical adult human EEG signal is about $10\mu\text{V}$ to $100\mu\text{V}$ in amplitude when measured from the scalp ^[4] and is about 10–20 mV when measured from subdural electrodes.

Since an EEG voltage signal represents a difference between the voltages at two electrodes, the display of the EEG for the reading encephalographer may be set up in one of several ways. The representation of the EEG channels is referred to as a *montage*.

Bipolar montage

Each channel (i.e., waveform) represents the difference between two adjacent electrodes. The entire montage consists of a series of these channels. For example, the channel "Fp1-F3" represents the difference in voltage between the Fp1 electrode and the F3 electrode. The next channel in the montage, "F3-C3," represents the voltage difference between F3 and C3, and so on through the entire array of electrodes.

Referential montage

Each channel represents the difference between a certain electrode and a designated reference electrode. There is no standard position at which this reference is always placed; it is, however, at a different position than the "recording" electrodes. Midline positions are often used because they do not amplify the signal in one hemisphere vs. the other. Another popular reference is "linked ears," which is a physical or mathematical average of electrodes attached to both earlobes or [mastoids](#).

Average reference montage

The outputs of all of the amplifiers are summed and averaged, and this averaged signal is used as the common reference for each channel.

Laplacian montage

Each channel represents the difference between an electrode and a weighted average of the surrounding electrodes.

When analog (paper) EEGs are used, the technologist switches between montages during the recording in order to highlight or better characterize certain features of the EEG. With digital EEG, all signals are typically digitized and stored in a particular (usually referential) montage; since any montage can be constructed mathematically from any other, the EEG can be viewed by the electroencephalographer in any display montage that is desired.

The EEG is read by a [neurologist](#), optimally one who has specific training in the interpretation of EEGs. This is done by visual inspection of the waveforms. The use of computer signal processing of the EEG—so-called quantitative EEG—is somewhat controversial when used for clinical purposes (although there are many research uses).

Limitations

EEG has several limitations. Most important is its poor spatial resolution. EEG is most sensitive to a particular set of post-synaptic potentials: those which are generated in superficial layers of the cortex, on the crests of [gyri](#) directly abutting the skull and radial to the skull. Dendrites which are deeper in the cortex, inside [sulci](#), in midline or deep structures (such as the [cingulate gyrus](#) or [hippocampus](#)), or producing currents which are tangential to the skull, have far less contribution to the EEG signal.

The [meninges](#), [cerebrospinal fluid](#) and skull "smear" the EEG signal, obscuring its intracranial source.

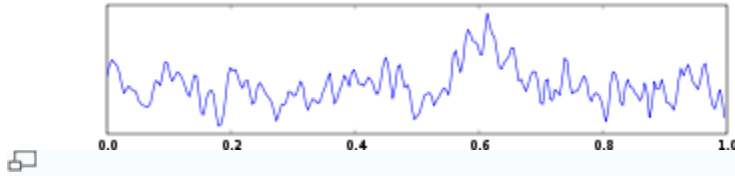
It is mathematically impossible to reconstruct a unique intracranial current source for a given EEG signal, as some currents produce potentials that cancel each other out. This is referred to as the [inverse problem](#). However, much work has been done to produce remarkably good estimates of, at least, a localized [electric dipole](#) that represents the recorded currents.

EEG vs fMRI and PET

EEG has several strong sides as a tool of exploring brain activity; for example, its time resolution is very high (on the level of a single millisecond). Other methods of looking at brain activity, such as [PET](#) and [fMRI](#) have time resolution between seconds and minutes. EEG measures the brain's electrical activity directly, while other methods record changes in blood flow (e.g., [SPECT](#), [fMRI](#)) or metabolic activity (e.g., [PET](#)), which are indirect markers of brain electrical activity. EEG can be used simultaneously with [fMRI](#) so that high-temporal-resolution data can be recorded at the same time as high-spatial-resolution data, however, since the data derived from each occurs over a different time course, the data sets do not necessarily represent the exact same brain activity. There are technical difficulties associated with combining these two modalities, including the need to remove the *MRI gradient artifact* present during MRI acquisition and the ballistocardiographic artifact (resulting from the pulsatile motion of blood and tissue) from the EEG. Furthermore, currents can be induced in moving EEG electrode wires due to the magnetic field of the MRI.

EEG can be recorded at the same time as [MEG](#) so that data from these complimentary high-time-resolution techniques can be combined.

Normal activity



One second of EEG signal

The EEG is typically described in terms of (1) rhythmic activity and (2) transients. The rhythmic activity is divided into bands by frequency. To some degree, these frequency bands are a matter of nomenclature (i.e., any rhythmic activity between 8-12 Hz can be described as "alpha"), but these designations arose because rhythmic activity within a certain frequency range was noted to have a certain distribution over the scalp or a certain biological significance.

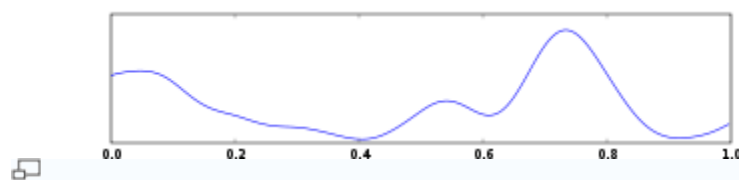
Most of the cerebral signal observed in the scalp EEG falls in the range of 1-20 Hz (activity below or above this range is likely to be artifactual, under standard clinical recording techniques).

Comparison table

| Comparison of EEG bands | | | | |
|-------------------------|----------------|--|--|---|
| Type | Frequency (Hz) | Location | Normally | Pathologically |
| <u>Delta</u> | up to 3 | frontally in adults, posteriorly in children; high amplitude waves | <ul style="list-style-type: none"> adults slow wave sleep in babies | <ul style="list-style-type: none"> subcortical lesions diffuse lesions metabolic encephalopathy hydrocephalus deep midline lesions. |
| <u>Theta</u> | 4 - 7 Hz | | <ul style="list-style-type: none"> young children drowsiness or arousal in older children and adults | <ul style="list-style-type: none"> focal subcortical lesions metabolic encephalopathy |

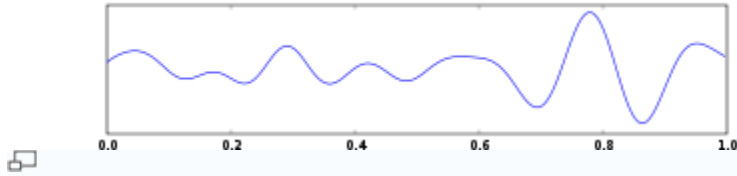
| | | | | |
|--|------------|--|---|---|
| | | | <ul style="list-style-type: none"> • idling | <ul style="list-style-type: none"> • deep midline disorders • some instances of hydrocephalus |
| Alpha | 8 - 12 Hz | posterior regions of head, both sides, higher in amplitude on dominant side. Central sites (c3-c4) at rest . | <ul style="list-style-type: none"> • relaxed/reflecting • closing the eyes | <ul style="list-style-type: none"> • coma |
| Beta | 12 - 30 Hz | both sides, symmetrical distribution, most evident frontally; low amplitude waves | <ul style="list-style-type: none"> • alert/working • active, busy or anxious thinking, active concentration | <ul style="list-style-type: none"> • benzodiazepines |
| Gamma a | 34 – 100 + | | <ul style="list-style-type: none"> • certain cognitive or motor functions | |

Wave patterns



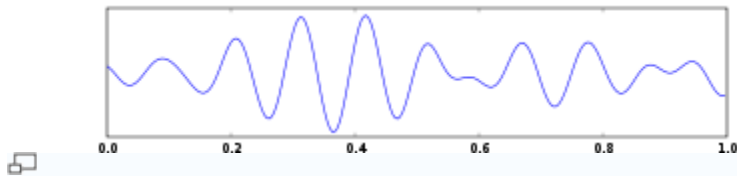
[delta waves.](#)

- [Delta](#) is the frequency range up to 3 Hz. It tends to be the highest in amplitude and the slowest waves. It is seen normally in adults in [slow wave sleep](#). It is also seen normally in babies. It may occur focally with subcortical lesions and in general distribution with diffuse lesions, metabolic encephalopathy hydrocephalus or deep midline lesions. It is usually most prominent frontally in adults (e.g. FIRDA - Frontal Intermittent Rhythmic Delta) and posteriorly in children (e.g. OIRDA - Occipital Intermittent Rhythmic Delta).



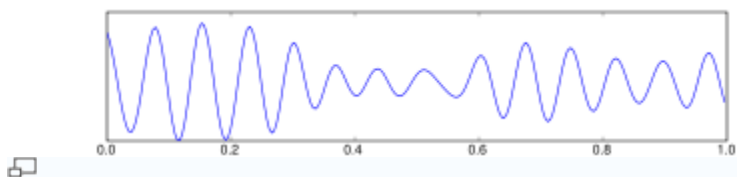
[theta waves.](#)

- [Theta](#) is the frequency range from 4 Hz to 7 Hz. Theta is seen normally in young children. It may be seen in drowsiness or arousal in older children and adults; it can also be seen in [meditation](#)^[citation needed]. Excess theta for age represents abnormal activity. It can be seen as a focal disturbance in focal subcortical lesions; it can be seen in generalized distribution in diffuse disorder or metabolic encephalopathy or deep midline disorders or some instances of hydrocephalus. On the contrary this range has been associated with reports of relaxed, meditative, and creative states.



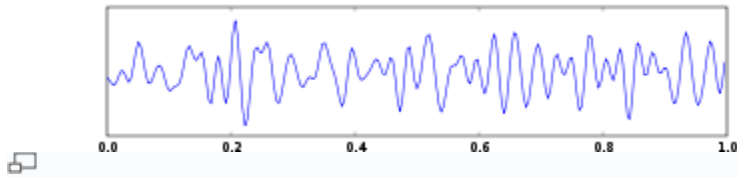
[alpha waves.](#)

- [Alpha](#) is the frequency range from 8 [Hz](#) to 12 Hz. [Hans Berger](#) named the first rhythmic EEG activity he saw, the "alpha wave." This is activity in the 8-12 Hz range seen in the posterior regions of the head on both sides, being higher in amplitude on the dominant side. It is brought out by closing the eyes and by relaxation. It was noted to attenuate with eye opening or mental exertion. This activity is now referred to as "posterior basic rhythm," the "posterior dominant rhythm" or the "posterior alpha rhythm." The posterior basic rhythm is actually slower than 8 Hz in young children (therefore technically in the theta range). In addition to the posterior basic rhythm, there are two other normal alpha rhythms that are typically discussed: the mu rhythm and a temporal "third rhythm". Alpha can be abnormal; for example, an EEG that has diffuse alpha occurring in coma and is not responsive to external stimuli is referred to as "alpha coma".



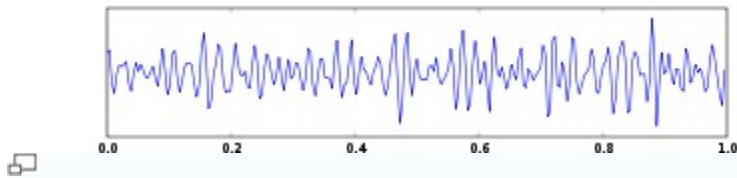
[Sensorimotor rhythm](#) aka [mu rhythm](#).

- [Mu rhythm](#) is alpha-range activity that is seen over the [sensorimotor cortex](#). It characteristically attenuates with movement of the [contralateral](#) arm (or mental imagery of movement of the contralateral arm).



[beta waves.](#)

- [Beta](#) is the frequency range from 12 Hz to about 30 Hz. It is seen usually on both sides in symmetrical distribution and is most evident frontally. Low amplitude beta with multiple and varying frequencies is often associated with active, busy or anxious thinking and active concentration. Rhythmic beta with a dominant set of frequencies is associated with various pathologies and drug effects, especially [benzodiazepines](#). Activity over about 25 Hz seen in the scalp EEG is rarely cerebral (i.e., it is most often artifactual). It may be absent or reduced in areas of cortical damage. It is the dominant rhythm in patients who are alert or anxious or who have their eyes open.



[gamma waves.](#)

- [Gamma](#) is the frequency range approximately 26–100 Hz. Because of the filtering properties of the skull and scalp, gamma rhythms can only be recorded from electrocorticography or possibly with [magnetoencephalography](#). Gamma rhythms are thought to represent binding of different populations of neurons together into a network for the purpose of carrying out a certain cognitive or motor function.

"Ultra-slow" or "near-DC" activity is recorded using DC amplifiers in some research contexts. It is not typically recorded in a clinical context because the signal at these frequencies is susceptible to a number of artifacts.

Some features of the EEG are transient rather than rhythmic. Spikes and sharp waves may represent seizure activity or [interictal](#) activity in individuals with epilepsy or a predisposition toward epilepsy. Other transient features are normal: vertex waves and sleep spindles are transient events which are seen in normal sleep.

It should also be noted that there are types of activity which are statistically uncommon but are not associated with dysfunction or disease. These are often referred to as "normal variants." The mu rhythm is an example of a normal variant.

The normal EEG varies by age. The neonatal EEG is quite different from the adult EEG. The EEG in childhood generally has slower frequency oscillations than the adult EEG.

The normal EEG also varies depending on state. The EEG is used along with other measurements ([EOG](#), [EMG](#)) to define [sleep stages](#) in [polysomnography](#). Stage I sleep (equivalent to drowsiness in some systems) appears on the EEG as drop-out of the posterior basic rhythm. There can be an increase in theta frequencies. Santamaria and Chiappa cataloged a number of the variety of patterns associated with drowsiness. Stage II sleep is characterized by sleep spindles--transient runs of rhythmic activity in the 12-14 Hz range (sometimes referred to as the "sigma" band) that have a frontal-central maximum. Most of the activity in Stage II is in the 3-6 Hz range. Stage III and IV sleep are defined by the presence of delta frequencies and are often referred to collectively as "slow-wave sleep." Stages I-IV comprise non-REM (or "NREM") sleep. The EEG in REM (rapid eye movement) sleep appears somewhat similar to the awake EEG.

EEG under general anesthesia depends on the type of anesthetic employed. With halogenated anesthetics, such as [halothane](#) or intravenous agents, such as [propofol](#), a rapid (alpha or low beta), nonreactive EEG pattern is seen over most of the scalp, especially anteriorly; in some older terminology this was known as a WAR (widespread anterior rapid) pattern, contrasted with a WAIS (widespread slow) pattern associated with high doses of [opiates](#). Anesthetic effects on EEG signals are beginning to be understood at the level of drug actions on different kinds of synapses and the circuits that allow synchronized neuronal activity (see: <http://www.stanford.edu/group/maciverlab/>).

Artifacts

Biological artifacts

Electrical signals detected along the scalp by an EEG, but that originate from non-cerebral origin are called [artifacts](#). EEG data is almost always contaminated by such artifacts. The amplitude of artifacts can be quite large relative to the size of amplitude of the cortical signals of interest. This is one of the reasons why it takes considerable experience to correctly interpret EEGs clinically. Some of the most common types of biological artifacts include:

- Eye-induced artifacts (includes eye blinks and eye movements)
- [EKG](#) (cardiac) artifacts
- [EMG](#) (muscle activation)-induced artifacts
- Glossokinetic artifacts

Eye-induced artifacts are caused by the potential difference between the [cornea](#) and [retina](#), which is quite large compared to cerebral potentials. When the eye is completely still, this does not affect EEG. But there are nearly always small or large reflexive eye movements, which generates a potential which is picked up in the frontopolar and frontal leads. Involuntary eye movements, known as [saccades](#), are caused by ocular muscles, which also generate [electromyographic](#) potentials. Purposeful or reflexive eye blinking also generates [electromyographic](#) potentials, but

more importantly there is reflexive movement of the eyeball during blinking which gives a characteristic artifactual appearance of the EEG (see [Bell's phenomenon](#)).

Eyelid fluttering artifacts of a characteristic type were previously called Kappa rhythm (or Kappa waves). It is usually seen in the prefrontal leads, that is, just over the eyes. Sometimes they are seen with mental activity. They are usually in the Theta (4–7 Hz) or Alpha (8–13 Hz) range. They were named because they were believed to originate from the brain. Later study revealed they were generated by rapid fluttering of the eyelids, sometimes so minute that it was difficult to see. They are in fact noise in the EEG reading, and should not technically be called a rhythm or wave. Therefore, current usage in electroencephalography refers to the phenomenon as an eyelid fluttering artifact, rather than a Kappa rhythm (or wave).^[2]

Some of these artifacts are useful. Eye movements are very important in [polysomnography](#), and is also useful in conventional EEG for assessing possible changes in alertness, drowsiness or sleep.

EKG artifacts are quite common and can be mistaken for spike activity. Because of this, modern EEG acquisition commonly includes a one-channel EKG from the extremities. This also allows the EEG to identify [cardiac arrhythmias](#) that are an important [differential diagnosis](#) to [syncope](#) or other episodic/attack disorders.

Glossokinetic artifacts are caused by the potential difference between the base and the tip of the tongue. Minor tongue movements can contaminate the EEG, especially in [parkinsonian](#) and [tremor](#) disorders.

Environmental artifacts

In addition to artifacts generated by the body, many artifacts originate from outside the body. Movement by the patient, or even just settling of the electrodes, may cause *electrode pops*, spikes originating from a momentary change in the [impedance](#) of a given electrode. Poor [grounding](#) of the EEG electrodes can cause significant 50 or 60 Hz artifact, depending on the local power system's [frequency](#). A third source of possible interference can be the presence of an IV drip; such devices can cause rhythmic, fast, low-voltage bursts, which may be confused for spikes.

Artifact correction

Recently, [source decomposition](#) techniques have been used to correct or remove EEG contaminates. These techniques attempt to "unmix" the EEG signals into some number of underlying components. There are many source separation algorithms, often assuming various behaviors or natures of EEG. Regardless, the principle behind any particular method usually allow "remixing" only those components that would result in "clean" EEG by nullifying (zeroing) the weight of unwanted components.

Abnormal Activity

Abnormal activity can broadly be separated into epileptiform and non-epileptiform activity. It can also be separated into focal or diffuse.

Focal epileptiform discharges represent fast, synchronous potentials in a large number of neurons in a somewhat discrete area of the brain. These can occur as interictal activity, between seizures, and represent an area of cortical irritability that may be predisposed to producing epileptic seizures. Interictal discharges are not wholly reliable for determining whether a patient has epilepsy nor where his/her seizure might originate. (See [focal epilepsy](#).)

Generalized epileptiform discharges often have an anterior maximum, but these are seen synchronously throughout the entire brain. They are strongly suggestive of a generalized epilepsy.

Focal non-epileptiform abnormal activity may occur over areas of the brain where there is focal damage of the cortex or [white matter](#). It often consists of an increase in slow frequency rhythms and/or a loss of normal higher frequency rhythms. It may also appear as focal or unilateral decrease in amplitude of the EEG signal.

Diffuse non-epileptiform abnormal activity may manifest as diffuse abnormally slow rhythms or bilateral slowing of normal rhythms, such as the PBR.

History

A timeline of the history of EEG is given by Swartz.^[3] Richard Caton (1842–1926), a physician practicing in [Liverpool](#), presented his findings about electrical phenomena of the exposed cerebral hemispheres of rabbits and monkeys in the British Medical Journal in 1875. In 1890, Beck published an investigation of spontaneous electrical activity of the brain of rabbits and dogs which included rhythmic oscillations altered by light.

In 1912, Russian physiologist, [Vladimir Vladimirovich Pravdich-Neminsky](#) published the first EEG and the [evoked potential](#) of the [mammalian](#) (dog).^[4] In 1914, Cybulsky and Jelenska-Macieszyna photographed EEG-recordings of experimentally induced seizures.

German physiologist and psychiatrist [Hans Berger](#) (1873–1941) began his studies of the human EEG in 1920. He gave the device its name and is sometimes credited with inventing the EEG, though others had performed similar experiments. His work was later expanded by [Edgar Douglas Adrian](#). In 1934, Fisher and Lowenback first demonstrated epileptiform spikes. In 1935 Gibbs, Davis and Lennox described interictal spike waves and the 3 cycles/s pattern of clinical [absence seizures](#), which began the field of clinical electroencephalography. Subsequently, in 1936 Gibbs and Jasper reported the interictal spike as the focal signature of epilepsy. The same year, the first EEG laboratory opened at Massachusetts General Hospital.

[Franklin Offner](#) (1911–1999), professor of biophysics at [Northwestern University](#) developed a prototype of the EEG which incorporated a piezoelectric inkwriter called a Crystograph (the whole device was typically known as the Offner Dynograph).

In 1947, The American EEG Society was founded and the first International EEG congress was held. In 1953 Aserinsky and Kleitman describe REM sleep.

In the 1950s, [William Grey Walter](#) developed an adjunct to EEG called [EEG topography](#) which allowed for the mapping of electrical activity across the surface of the brain. This enjoyed a brief period of popularity in the 1980s and seemed especially promising for psychiatry. It was never accepted by neurologists and remains primarily a research tool.

Various uses

The EEG has been used for many purposes besides the conventional uses of clinical diagnosis and conventional cognitive neuroscience. [Neurofeedback](#) remains an important extension, and in its most advanced form is also attempted as the basis of [brain computer interfaces](#). There are many commercial products substantially based on the EEG.

EEGs have been used as evidence in trials in the [Indian](#) state of [Maharashtra](#).^[5]

Games

- In March 24th 2007 a [US](#) company called [Emotiv](#) launched a pointing device for [video games](#) based on electroencephalography.^[6]
- Announced at the end of 2008/start of 2009 were two games based monitoring Theta waves using technology by a company called [Neurosky](#). *Mindflex* by [Matel](#)^[7] and *Force Trainer* by [Uncle Milton](#)^[8]

Images



Girl wearing electrodes for EEG



Person wearing electrodes for EEG



Portable recording device for EEG



EEG used during a music performance in which bathers from around the world were networked together as part of a collective musical performance, using their brainwaves to control sound, lighting, and the bath environment

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EEG Biofeedback: A Promising New Therapy for Attention Deficit

Disorder, Learning Disabilities, and Mild Traumatic Brain Injuries

EEG Biofeedback (neurofeedback) is a promising new therapy in the field of applied psychophysiology. This field studies the relationship between the mind and the body. Specifically, it involves teaching people effective ways to control body functions. For example, therapists use biofeedback to help people learn how to relax. However, EEG Biofeedback is more inclusive, as it involves opening up new avenues for communication between your body and your brain. EEG biofeedback helps you to learn how to access and maintain different states of physiological arousal. In other words, it is education for your brain.

EEG Biofeedback is an ideal therapy as it is noninvasive with minimal side effects. This therapy involves placing one or more sensors on the scalp and one to each ear. These sensors are then connected to a device which depicts a graphical recording of the electrical activity of the brain, referred to as brain waves. From the EEG, the therapist helps the client to associate specific mental states with his/her brain waves. Feedback regarding brain activity is presented to the client via a video game in which the brightness and speed of a Pacman like figure corresponds to a preset threshold. The therapist guides the client by telling him/her to make the video game work with his/her brain.

As brain waves in the desirable frequency occur, the video game moves faster, or an alternative reward is given. However if brain waves in the undesirable frequency occur, then the video game is hindered. Since EEG Biofeedback training is a learning process, progress is gradual. For most conditions, initial improvements can be observed within ten sessions. In the case of hyperactivity and attention deficit disorder, training usually is recommended for about forty sessions and more sessions may be needed depending on the severity. Whereas, some symptoms related to head injury such as quality of sleep, fatigue, and chronic pain frequently improve in less than twenty sessions (EEG Spectrum website, 2000).

Using EEG Biofeedback as a therapy is becoming more acceptable due to the previous 20 years worth of research in the field. EEG Biofeedback has been investigated for use with a multitude of disorders such as: epilepsy, hyperactivity, attention deficit disorder, and specific learning disabilities. Furthermore, it has been used clinically to help alleviate sleep disorders, and the motor, sensory, and cognitive deficits caused by minor closed head injury.

However, the one characteristic which unites all of these disorders is that each typically causes abnormal brain waves on EEG. For example, in the instance of hyperactivity, the EEG shows inadequate beta activity related to arousal (Othmer and Othmer, 1989). Additionally, Lubar, Bianchini, Calhoun, Lambert, Body, and Shabsin (1985) compared the brain wave patterns of learning disabled (LD) children with those of normal control children. They found that LD children displayed slower brain wave patterns than those without LD.

Brain activity can be assessed by examining the graphical recording of the waves. Brain waves are classified as either alpha, beta, theta, or delta. When alpha waves are present, they indicate a calm and relaxed state of unfocused attention. Whereas, beta waves indicate an alert and awake state such as when you focus on solving a problem. And, lastly delta and theta waves are observed when you are daydreaming or drowsy (Linden, Habib, and Radojevic, 1993). By examining brain waves, the therapist can evaluate how your brain is functioning and then devise a treatment plan if abnormalities are present.

EEG Biofeedback for Epilepsy:

The field of EEG Biofeedback began with Joe Kamiya and Elmer and Alyce Green who examined the connections between physiology and different states of consciousness. They found that clients could get into a deeply relaxed state in merely one to two sessions when trained to increase alpha waves. Sterman discovered that the 12-15 Hz region of the EEG was associated with specific rhythmic activity. He labeled this rhythm as the SensoriMotor Rhythm (SMR) due to its location at the sensorimotor cortex. (Chase and Harper;1971, Howe and Sterman; 1972, Sterman, 1977). Sensory motor rhythm has control over our body sensations and voluntary movements. Barry Sterman focused on the effects of EEG Biofeedback on epilepsy.

Sterman first worked with cats who had been exposed to toxic chemicals which usually induce seizure activity. In their study, Fairchild and Sterman (1974) found that the cats who were operantly conditioned for SMR exhibited a higher threshold for seizure activity. Following this study with cats, Sterman and Friar (1972) then focused on whether SMR training could reduce seizures in humans; they published a report that SMR training did in fact reduce the seizures of one individual and also helped her sleep to improve.

Sterman, MacDonald, and Stone did further research and found that there was a 66% reduction in seizures for four epileptics; the protocol they followed was a combination of enhancing the SMR along with inhibition of excessive slow-wave

activity (Sterman, 1974). Additionally, Sterman reviewed the literature on treating epilepsy with EEG Biofeedback and found that seizures were reduced in approximately 70% of the clients (Sterman, 1980).

EEG Biofeedback for Hyperactivity:

Using EEG Biofeedback as a therapy for hyperactivity stemmed from the previous work with epilepsy. During EEG Biofeedback training with epileptics, it was observed that symptoms of hyperactivity decreased (Lubar and Bahler, 1976a). This decrease is not that unexpected since hyperactivity can also be ascribed to insufficient motor inhibition. Lubar and Shouse (1976b) conducted the first study on the effectiveness of EEG biofeedback with hyperactivity.

In this study, EEG training was observed to be more effective than the sole use of stimulant medication such as Ritalin. Then, Lubar and Shouse completed a more comprehensive study of using EEG Biofeedback for hyperactivity; they found that combining SMR training with drug therapy resulted in considerable improvements in behaviors which surpassed the effects of the drugs alone. Additionally, these changes in behavior were maintained with SMR training even after the withdrawal of medication.

EEG Biofeedback for Attention-Deficit/Hyperactivity Disorder (ADHD):

Attention Deficit Hyperactivity Disorder (ADHD) is generally diagnosed in children who exhibit attention difficulties, impulsive behaviors, and extreme levels of hyperactivity. ADHD is not classified as a disease and no single diagnostic test exists. Rather, ADHD is generally viewed as an inherited disorder which may be intensified by minor traumatic brain injury, birth trauma, emotional and dietary factors, and inadequate sleep (Othmer and Othmer, 1992).

Also, children with ADHD frequently exhibit a variety of physical problems such as headaches and immune system deficiencies, resulting in frequent illnesses. Additionally, anxiety, depression, oppositional-defiant disorder, obsessive-compulsive behaviors may be present. The fact that ADHD is typically treated with

stimulant medication such as Ritalin indicates that this disorder is characterized by insufficient arousal. EEG biofeedback is a way to train those areas of the brain involved in arousal and focus. And, it appears that once the brain learns how to regulate itself again that it does not revert back (EEG Spectrum website, 2000).

The EEG of ADHD children differs from that of other children, in that, the brain waves tend to be of a larger amplitude. Specifically, the EEG shows excess theta activity along with lower amounts of beta activity (Lubar, 1991). This pattern of brain wave activity usually indicates a sleep or day dreaming state, rather than an alert and focused state. The goal of EEG Biofeedback training is to alter these abnormal brain waves by decreasing theta waves, while simultaneously increasing beta waves. In EEG Biofeedback training, the therapist explains to the child the connection between what is happening in his/her cortex and what is recorded on the EEG. Then, the therapist helps the child to learn how to gain control over his/her brain waves.

Joel Lubar has extensively studied biofeedback with ADD and ADHD children and adults. He devised the protocol for treating ADD with neurofeedback in the 1970s and his findings have been published in journals such as the *Journal of Pediatrics* and *Pediatric Neurology*. Lubar states that between 80-90% of people with attention deficit disorder (ADD) and attention deficit hyperactivity disorder can benefit significantly from treatment (Robbins, 1997).

Additionally, Othmer and Othmer (1992) observed that significant change occurred when EEG Biofeedback training was utilized. Fifteen children were tested with the Wechsler Intelligence Scale-Revised by an independent clinical psychologist. In the pretest, the lowest scores were observed in those categories dealing with attention and sequence such as math, coding, information, and digit span. After EEG training, the scores in all of these categories improved. Additionally, an average increase in IQ was apparent, as much as 23 points.

Othmer and Othmer explain this IQ increase as: "We assume that we are not making children smarter. We are simply making their intrinsic mental capability more accessible and useable to them." (Othmer and Othmer, 1992). Several months after EEG training was completed a follow up with the parents of the children in the study was conducted. The parents noted an improvement in sleep and a reduction in headaches, as well as an increase in self-esteem. However, parents noted that problems in skills (math and reading) and behavior remained. From this study, it is evident that children with behavior problems may benefit from psychotherapy in addition to EEG Biofeedback (Othmer and Othmer, 1992).

Several researchers further corroborate that EEG Biofeedback is an effective treatment for ADHD. In two studies, Michael Linden observed that EEG training had a positive impact on IQ scores, as well as behavior. Henry Cartozzo reported his findings at the annual meeting of the Association for Applied Psychophysiology and Biofeedback. Like the Othmers, Cartozzo found that problems in math, coding, and digit span were remediated with EEG training. He also noted improvements in scores on a computerized test called T.O.V.A. (Othmer, Kaiser, and Othmer, 1995).

The T.O.V.A. (Test of Variables of Attention) is a relatively new test which assesses attention deficits in adults and children. It is a continuous performance test which evaluates deficiencies. Although this test is only 22 minutes, data from it can serve as indicators of inattention, impulsivity, reaction time, and variability of reaction time. (Othmer and Othmer, 1992). Since the T.O.V.A is computerized and computer scored, it removes the variable of human bias; therefore, it helps to increase the validity of EEG biofeedback. Othmer and Othmer studied the effects of EEG training on the T.O.V.A. and they observed significant improvements in inattention, impulsivity, and variability of response time. Additionally, they found that one child in their study improved with EEG Biofeedback even after he stopped taking Ritalin.

This study is further supported by current research regarding EEG biofeedback with ADD/ADHD. After EEG training, clinicians noted that children with ADD/ADHD improved (60 to 80 percent) and that their medication could be reduced without regressing (Association for Applied Psychology and Biofeedback website, 2000).

EEG Biofeedback is not a cure for ADHD, but can help these children to improve their academic performance, social skills, and most of all their self esteem (Othmer and Othmer, 1992a). Biofeedback helps ADHD children to realize that they can overcome their problems (inattention/ hyperactivity) and are not at the mercy of this disorder.

EEG Biofeedback for Learning Disabilities:

According to The National Institute of Mental Health (1993), nearly 4 million school-aged children exhibit learning disabilities. Studies indicate that children with learning disabilities also have increased rates of attention deficits, hyperactivity, and impulsivity. Holobrow and Berry conducted a study which investigated the relationship between hyperactivity and learning disabilities.

In this study, teachers at six state primary schools and one private school rated their students on learning difficulties. The results from this study revealed that 26.5% of children rated as hyperactive also displayed learning difficulties; while, only 5.2% of non hyperactive children had learning problems (Holobrow & Berry, 1986). From these results, it appears that there is a connection between learning disorders and hyperactivity.

Scientists originally thought that all learning disorders stemmed from a single neurological problem. But, research supported by the National Institute of Mental Health (NIMH) indicates that this theory is not accurate. Rather, many factors may contribute to learning disorders. For example, researchers at the NIMH are studying if environmental toxins can lead to the development of learning disorders. Since there are many potential causes for the development of learning disabilities, mental health professionals suggest that the family not concentrate on tracing the reason for the disability, but rather that they focus on finding an effective treatment. Unlike ADHD which is frequently treated with a stimulant medication, a medical remedy for learning problems currently does not exist. However, recent evidence indicates that EEG biofeedback training can be helpful in specific learning challenges such as visual retention, articulation, and dyslexia (Othmer, 1999).

Tansey and Bruner (1983), Joel and Judith Lubar (1984) conducted the first studies of EEG Biofeedback as a treatment for both attention and learning problems. However, these early studies were not conclusive as to whether biofeedback training was effective. For example, in Lubar's study, five of the six children in the study were also receiving academic support in addition to EEG training. And, in Tansey and Bruner's study, they employed conventional biofeedback and EEG biofeedback training, so improvements could not unequivocally be attributed to EEG biofeedback. Then, Tansey (1985) published a study which removed the ambiguity of these previous studies. In his study of four learning disabled children, he observed that IQ scores improved after EEG training.

In 1990, Tansey conducted another study with 24 learning disabled children which further supported his theory that EEG biofeedback was effective. He noted that after EEG training there was an average improvement of 19 points on the Wechsler full scale IQ test. The results from these studies suggest that EEG biofeedback has an impact on specific learning disabilities, while others appear to remain unaltered. It is clear that more research is necessary to differentiate between which learning problems improve with EEG biofeedback training and which are resistant to it.

EEG Biofeedback for Minor Traumatic Brain Injury :

The consequences of minor traumatic brain injury are headaches, body pain, dizziness, depression, sleep problems, irritability, and even personality changes (Hoffman, et al., 1995). Traditionally, treatment of these symptoms was multidisciplinary and included: education, family therapy, coping skills training, stress and pain management, vocational training, and individual psychotherapy (Howard, 1993). However, since the early 1980's, clinicians have been utilizing EEG biofeedback as a therapy for brain injuries. Psychologist Steven Stockdale, director of the Neuro-Health Center in Colorado Springs is one of these clinicians who has been successful in using EEG biofeedback to treat head injuries.

Recently, Stockdale finished a three- year-study (not published yet) involving his patients' progress. He states that " About 80 percent of people we work with learn to do the feedback. Of that 80%, there is a 75-90 percent reduction in symptoms. They clear up" (Robbins, 1996). Examples of brain injuries which respond to EEG biofeedback are concussion, whiplash, infection of the central nervous system, chemical central nervous system injury, stroke, and cerebral palsy (Othmer and Othmer, 1989). Although currently there is no definitive answer to explain the mechanism behind EEG biofeedback, EEG biofeedback still remains a promising new treatment for minor traumatic head injuries.

EEG Spectrum : A Biofeedback Treatment Center:

In 1985, Susan and Sigfried learned about EEG biofeedback as a possible treatment for their son, Brian's epilepsy. Years earlier, Professor M. Barry Sterman had developed the technique of treating epilepsy with EEG biofeedback at the UCLA School of Medicine and the Sepulveda VA hospital. Brian was treated with EEG biofeedback and he improved immensely. Because Brian had made such progress, the Othmers believed that EEG biofeedback could be applied to a variety of disorders. Thus, in 1988, Susan and Sigfried Othmer along with Edward Dillingham founded the company, EEG Spectrum, with the mission to promote all aspects of EEG biofeedback such as clinical services, training of professionals, research, and instrumentation development (EEG Spectrum website, 2000).

Within the biofeedback community, EEG Spectrum is now recognized to be on the forefront of treating disorders ranging from attention deficits to traumatic brain injuries. EEG biofeedback for attention deficits is now offered at over 1,500 centers within the country and abroad. EEG Spectrum has offices nationwide and more than 60 affiliates in 20 countries. In "EEG Biofeedback: Medicine, Therapy, or Learning?" (1994), the Othmers state, "Biofeedback, at its best, is empowerment of the individual. We are simply the agency of that empowerment." For more information regarding EEG

biofeedback including specific locations of EEG Spectrum treatment centers, please visit their web site at: <http://www.eegspectrum.com/>

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What Our Clients Are Saying About Neurofeedback

"Our son clearly benefited after every session of NF. The benefits he gained are areas which cannot be taught. (It's like it has to come from within him). His awareness of events and surroundings are much better and he even helped me on his own accord by carrying a bag of groceries. Normally he would have ignored what I was doing and walked away. He is much more together and connected with us."

Mother of 5 year old with autism

"As we near our yearly celebration of things for which we are thankful, I am mindful of your organization and the many instances of dramatic healing that are occurring through Neurofeedback around the world - due in large part to your efforts. Blessings to you and that which you seek to accomplish."

Neurofeedback client who is home training

"In the fall of 2009 our 14-year-old son began having migraine headaches. He would have one to two per week accompanied by vomiting and followed by 24 hours of sleep. Between the last week of October and the 19th of December, he missed 17 days of school. On January 4, 2010, he had his first appointment with Roxana at the EEG Institute. He has had a weekly session since that time and has not experienced a single migraine since he began the therapy. It is an incredible relief to have found a way to help our child when he was in such debilitating pain. The

healing that my son has experienced is nothing short of a miracle. We cannot recommend the EEG Institute highly enough."

Parents of child who suffered with migraines

"We believe very strongly in treating our daughter's autism developmentally - in looking at the source of her constrictions and challenges from the inside out. We chose neurofeedback because it addresses the issues that cause the symptoms/behaviors, versus "band-aid" therapies, treatments, or drugs. After her FIRST neurofeedback session she, for the first time in her five years of life, slept soundly through the night. We all did! She is now 7 1/2 and has slept soundly and deeply ever since, allowing her to feel and be the best she can be and receive the best results possible in life and in her other areas of therapy. That was only one of many positive results that we experienced as a result of neurofeedback. We will be forever grateful to Sue and her team at EEG Institute."

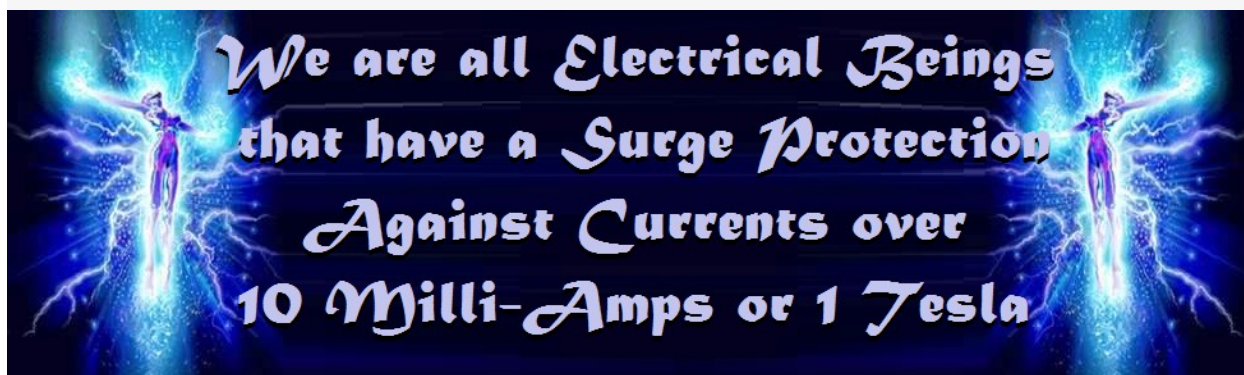
Mother of autistic child

"About 8 months ago, my son's behavior changed dramatically. He started having moderately severe tics and trouble in school concentrating and following directions. He then was diagnosed with Tourette's Syndrome. Needless to say, my husband and I were devastated. We immediately starting searching the web and looking for ways to help my son that didn't involve medication. That is how we found Neurofeedback, and more importantly, Mrs. Othmer at the EEG Institute. My son has had about 20 sessions, and the change in him is nothing short of a miracle!!! His tics have calmed down to where we barely notice them, and his teacher is reporting that he is able to focus better and stay on task now. He also is less volatile, and just generally a happier child. Thank you Mrs. Othmer and the dedicated staff at EEG Institute, for giving me my son back, and giving my son the tools and ability to live a happy, healthy life."

Mother of child with Tourette's Syndrome

"I'm a Viet Nam vet who had a violently physically abusive dad. For most of my adult life I dealt with it by drinking a fifth or two a day. Needless to say, I was a very angry human being. I was angry about the war and unconsciously angry about my childhood. Within four or five neurofeedback sessions, I began experiencing a dramatic change. I started becoming more mentally stable and I started coming out of my shell. I stopped drinking. Completely. I noticed I wasn't angry on the job any more. Actually, my workers noticed it first. Then I noticed that things that used to make me explode no longer existed. Tomorrow I'm on my 40th session and my life has changed completely. In six months, I've shed 40 years of anger, anguish and pain. For the first time in my life – my entire life – at age 60, I am a genuinely happy human being. My friends and family have noticed a major difference and because I finally became my true self, I finally found true love and happiness. I can honestly say that I am a whole human being and I will be forever grateful to Sue and Siegfried Othmer and Roxana Sasu for making this possible. If not for the EEG Institute's generous program for veterans, I would never have reached this point."

Viet Nam Veteran



"For most of my life, I was a rageaholic. Of course, I didn't realize it. But along the way, I've destroyed a lot of telephones and a lot of computers. Smashed them all to bits. Tiny bits. I'm female, by the way, in case you think only guys get this enraged. I was desperately lonely and unhappy. There was no joy in my life. No amount of psychotherapy, drugs, meditation, hypnotherapy, psychic healings, great love life, or vacations in Maui could lighten the bruising black pain of my spirit. Now, things that used to incite me to a killing rage just roll right off my back. My friends have been blown away by the changes in me. Even my boss has noticed it. He says I've become "totally mellow." For the first time since early childhood I actually have serenity in my daily life. Finally, at age 55, I'm actually happy. And what I love about it is – this is for keeps. My brain has changed the way it processes things. Instead of "luffing" – shaking like a sail set too close to the wind -- my neurons sail serenely, plump and full, down gentler, kinder pathways. For the first time that I can remember I am experiencing a sense of grace and equanimity in my life."

Client with previous rage control issues

"We're definitely doing something right! Our 6-year old son has become very polite, courteous and agreeable. He is concerned about other's feelings and whether he is being good. He is showing more initiative to do things that he has been asked to do. He has drawn more pictures in the last three weeks than in three years."

Mother of Asperger's child who is now home training

"With Neurofeedback my adopted son has improved his ability to focus in school (best grades ever), his athletic ability (best tennis rating ever), and has eliminated all medications. Most importantly his behavioral outbursts are gone. He has a new sense of calm attentiveness, and increasing self-esteem. All these changes have helped him bond and develop meaningful relationships. He is a joy to be around. I thank the EEG Institute for their help and commitment."

Mother of teenager with Reactive Attachment Disorder

"The change in my daughter is remarkable. While doing homework she is focused; she is able to comprehend without going to blank-out and frustration; she is solving problems and feeling good about it. She is not panicking and falling apart over her present heavy course load. And she is now rarely irritable – a very pleasant change."

Mother of college student with anxiety and depression

"Our son underwent a remarkable transformation following our visit to your clinic. He was an extremely difficult child, and he now sleeps through the night, he is no longer constipated, he listens, he is extremely connected and he smiles and relishes life."

Father of child with seizures, behavior and learning problems

"Our son was just chosen to be one of five first graders out of 120 to receive an award at his elementary school for success in academic and social arenas as well as enthusiasm, cooperation, participation and respect for others. Last year, this would have seemed as far away as the moon, and it is still hard to believe the amazing progress that has been possible in such a very short time. Thank you. You have made the life he was supposed to have possible!"

Mother of high functioning autistic child

"Thank you for my new life. I can now sleep with no nightmares or night sweats, and I'm eating well. I feel very good most of the time."

War veteran with PTSD for 10 years

"My son is doing AWESOME!!!! We are thrilled. Now that summer is here, I hope to train him every day. He finished school on a great note. He is becoming more independent there and needing his aides less. The biggest change is in his verbal skills. WOW!! is all I can say."

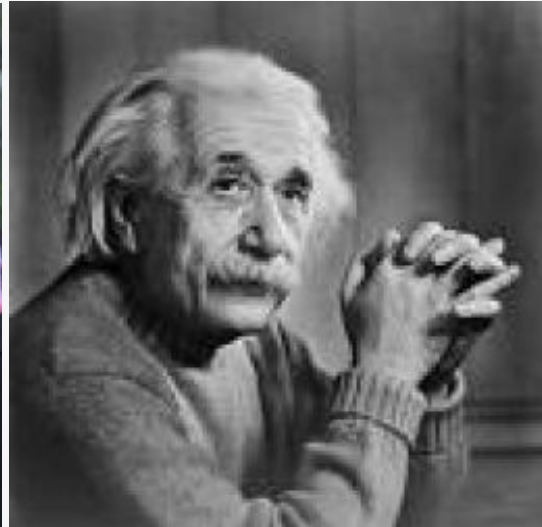
Mother of autistic child

"My grandson is doing better in general and concentration is definitely improving, too. All in all positive. Thank you, thank you."

Grandmother of an ADHD teenager

"I had no 'moments' yesterday. Neurofeedback is working for me. I am so happy to be doing this."

Asperger's adult



"Everything in my life has been in so much disarray, but Neurofeedback has kept it all good."

ADD adult

"A whole night's sleep! Less irritability and impulsivity and improved attention - just some of the permanent improvements that my daughters experienced with Neurofeedback. As a mom and an occupational therapist, I believe that Neurofeedback training will revolutionize how we treat children with ADHD."

Mother of child with ADHD

"After Neurofeedback training, I am finally pain free and able to live my life without the fear of being paralyzed by a migraine headache."

Former migraine sufferer

Reports from Clinicians

A case vignette reported by a Neurofeedback practitioner in Germany:

A six-year-old boy came in with extreme night sweats, nocturnal teeth grinding, and very poor attention. All these issues vanished over just a few training sessions.

Another child came into the same office shortly thereafter with very similar symptoms, but in this case also had extreme difficulty in social relationships. At age eight, he had no friends, and no one would play with him. This boy trained very differently from the first, but he started being different with people after just the first session. His older brother is now playing with him routinely. The boy is now taking the initiative in making friendships.

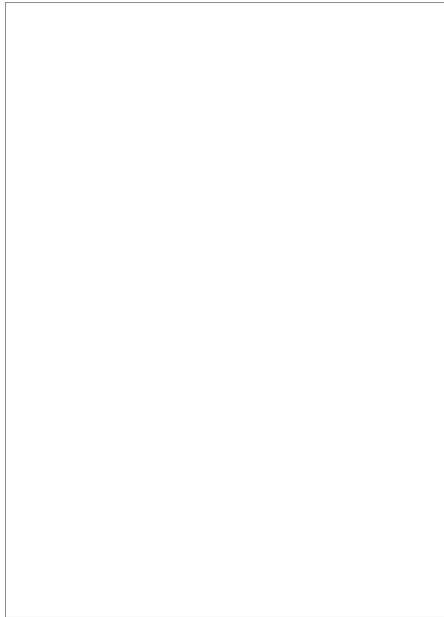


BRAIN MAPPING

unlocking the mystery of human behavior

The Unique and Mysterious Brain

Each human brain is unique in the way it processes information. This uniqueness accounts for the vast differences in ideas, beliefs and behaviors between individuals. Appreciating what makes each of us unique and understanding what makes one person's behavior "normal" and another's "abnormal" is part of the study of the human brain. Until recently, the brain's exact function in matters of abnormal behavior was obscure; but now scientists can isolate, identify



and pinpoint the location of those brain waves responsible for various behaviors.

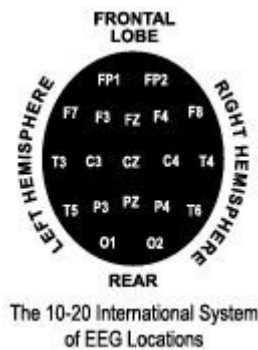
By conducting a recording of an individual's electrical brain waves, and through the use of specialized computer equipment and software, brain wave patterns can be identified, quantified and displayed in a diagnostic tool called a

"Of all the imaging modalities, the greatest body of replicated evidence regarding psychiatric and developmental disorders, has been provided by EEG and Brain Map EEG studies."
— Dr. John R. Hughes, M.D., Ph.D. and E. Roy John, Ph.D. University of Illinois School of Medicine, and the Brain Research Laboratories, New York University Medical Center

"brain map."

Obtaining Brain Map Information

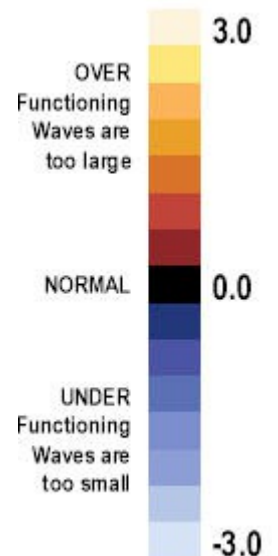
The first step in brain mapping is conducting an electroencephalogram or "EEG". An EEG measures fluctuating electrical activity in the brain's hemispheres. The procedure is completely noninvasive and does not cause any pain. Brain wave activity is relayed from electrodes placed at strategic points on the scalp (see electrode location map at left) to a computer where the data is recorded and stored. This raw data is then compared and charted within a specialized normative database, and then converted into a "map" of the brain that can be easily printed and analyzed by experts in the field of brain mapping and neurofeedback.



Discovering And Establishing What Is "Normal"

Although a brain map is as unique as each individual, patterns of "normal" and "abnormal" emerge when compared within an extensive brain map database – just as an individual is considered relatively normal or abnormal when compared against other individuals in a societal grouping.

Researchers have studied thousands of brain maps of individuals who do not possess any neurological conditions considered as abnormal. From these studies, benchmarks for normal range brain function are established for various age categories and gender.



The NxLink Brain Map Database

The NxLink brain map database, utilized by Nu-Brain, employs a color-based standard deviation model to identify abnormal brain wave patterns. On the NxLink standard deviation scale shown at right, “normal” corresponds to 0.0 and is shown by the color black. As you deviate by degrees away from the norm, problematic brain wave patterns increase.

The Blue Side

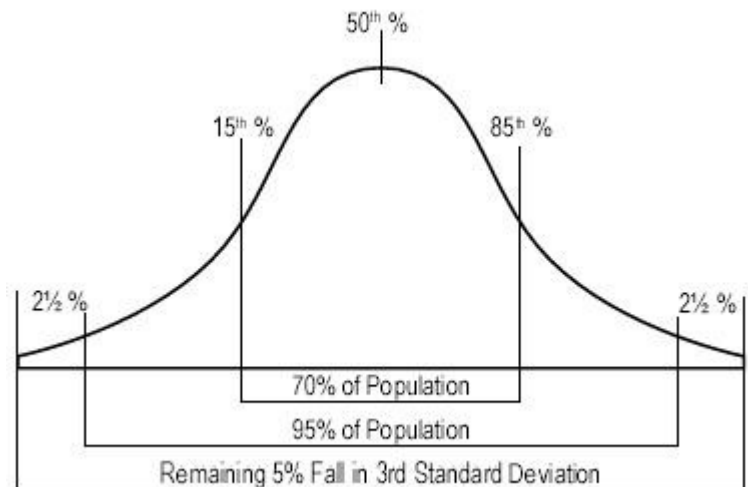
The blue side of the scale indicates brain waves that are lower in amplitude compared to normal waves. This means the brain is UNDER functioning – the brain waves are not up to par to do their jobs and are too small to be effective. The further down on the scale, the lower the amplitude of the brain waves and the greater the problems within the brain.

The Red Side

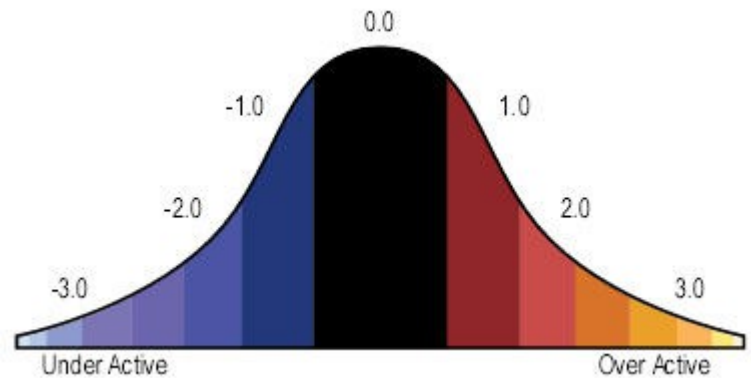
Anything in this range is OVER functioning – the brain waves are too large in amplitude. Areas of the brain with these colors are considered as “hot spots” especially the higher up the chart to white. These areas of the brain are like a car with the gas peddle stuck on, and the car is racing out of control. So too may the brain be stuck in “on” with the peddle to the metal, the brain is racing and driving beyond its means of being in control. As this happens, the brain is not functioning effectively, and inappropriate behavior is the result.

Deviation From Normal

Understanding “standard deviation” is important, as standard deviations help to show the severity of problems occurring within the brain. Consider the bell curves at right in conjunction with the standard deviation scale shown on the preceding page.



Beneath the apex of the bell curve, lies the average or normal range of behavior. Brain waves here are considered to be a normal height. Seventy percent of all people typically fall within this range. As you move toward the outer fringes of the curve, the averages change, and the brain waves become increasingly either too large or too small to be effective.



For example, when the color burgundy/red shows up on the brain map, the condition is one standard deviation away from normal. But if the brain map shows an orange color, the condition is two standard deviations away from normal and is much more severe. If the color shown is in the yellow/white range, then the condition is three standard deviations away from normal, and the problem in this area is considered extremely severe.

A Brain Map Identifies the Path to Improvement

Changing and improving one's life is important, and the brain map identifies the most effective path to take to accomplish this. As each brain map is unique from all other brain maps, so too, is the course of action and treatment toward the final destination of improving the identified neurological concerns.

Sample Brain Maps and Their Explanations

Map 1

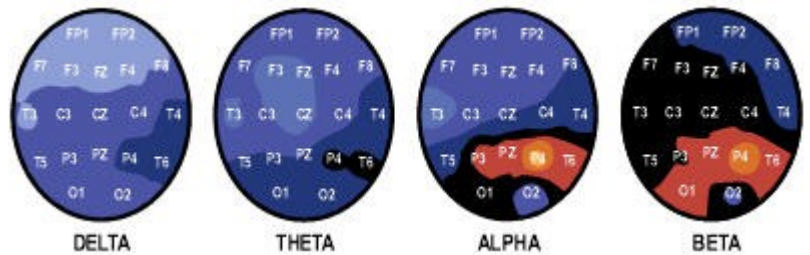
In the first brain map example shown below, we see that the brain waves in most regions of the brain fall in the blue range, indicating under activity. The exception is the theta wave in the front part of the brain, which appears in the burgundy/red range. The amplitude of the large, slow theta wave is too high in this region – it's over functioning here. Immediately we can determine that this abnormality involves an "Attention Deficit Disorder" (ADD) behavior, such as difficulty paying attention. How we know this, is because the abnormality of too high a theta wave in the frontal lobe and central regions of the brain is an ADD pattern. If the same pattern had shown in orange, the problem would be more severe.

Attention Deficit Disorder has 12 subtypes, including difficulty paying attention, impulsivity, hyperactivity and distractibility, to name a few. ADD is a broad diagnosis, but brain maps help to determine the exact subtype(s) that are occurring so that the treatment is more effective. This may be why certain medications will work for one individual diagnosed with ADD, but not another, because the sub-types of ADD vary so much within the neurological functioning of the

brain.

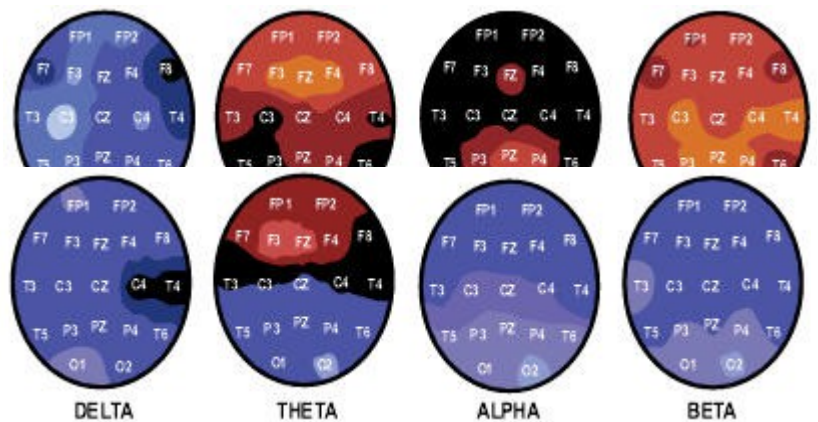
Map 2

This next map shows the brain wave patterns of a 19-year-old male. Before his EEG, the client shared that he had been told all of his life that he had ADD. But when the map was processed, instead of seeing over-active colors showing up in theta in the frontal area of the brain, those indicators were absent. When reviewing the map with the client, he was asked if distractibility was the reason he was told he had ADD. He said yes, that he was easily distracted by things around him. He was also asked if he had math learning disabilities; again he answered yes. Problems with distractions typically show up in the P4 area (note P4 on his map), and problems with math and numbers usually show up in the parietal area of the brain at P3, PZ and P4. On his map it is evident that the parietal lobe area is in red, indicating these problems.



Map 3

In this map, several areas show over activity in the brain: Theta is red in the frontal area, alpha is red in the back, and beta shows in red all over. First, consider the large theta waves in the front. These indicate problems in paying attention, and it is worst at F3, FZ, and F4. Next, take a look at alpha in the back. Alpha should be in the back as alpha is generated there, but not this much alpha. Now look at beta. Here you see beta in red, blanketing the majority of the brain area. Over functioning beta is responsible for a number of problems such as anxiety, nervousness, constant worry, difficulty sleeping, inability to relax, and the feeling of being “wired”.



The person with a brain map like the one above has difficulty taking in information and processing it due to the abnormal theta wave. In this case, the information may be presented, such as a teacher talking to a student, or a parent giving instructions to a child, but overall, the result is an inability to pay attention – the homework doesn't get completed or the room properly cleaned. This individual may also appear to be in an overly relaxed state due to alpha being so high in the back, but the opposite is actually true; inside, he or she is a nervous jitter and is internally “wired” due to the high beta throughout the brain.

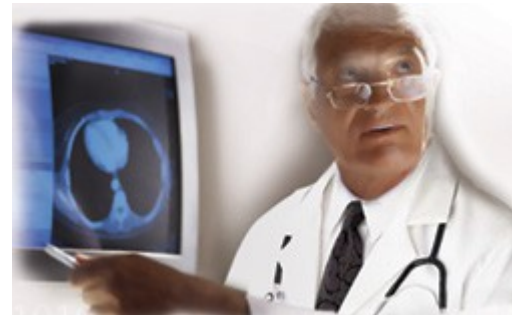
Map 4

This next map of just theta, shown at right, shows a person who may struggle with impulsivity, obsessive-compulsive (OCD) behavior and oppositional defiant (ODD) behavior. These behaviors are typical with high theta in the central area at CZ. Variations may include high theta in front as well as high theta in the central area.



The Brain Map is an Important Diagnostic Tool

The work of brain mapping is to identify areas of the brain where brain waves are malfunctioning so that an effective and efficient process of neurofeedback can then be administered to correct the abnormalities. The brain map examples shown above were only a small piece of an actual, full-blown brain map - which is usually around 50 to 70 pages and includes a detailed report of the identified problems.



The Educator
Starts with a
Measure of
the EEG-ECG
EMG-GSR
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Then JT
Treats the
Body Electric
with a Soft
Safe Gentle
Touch



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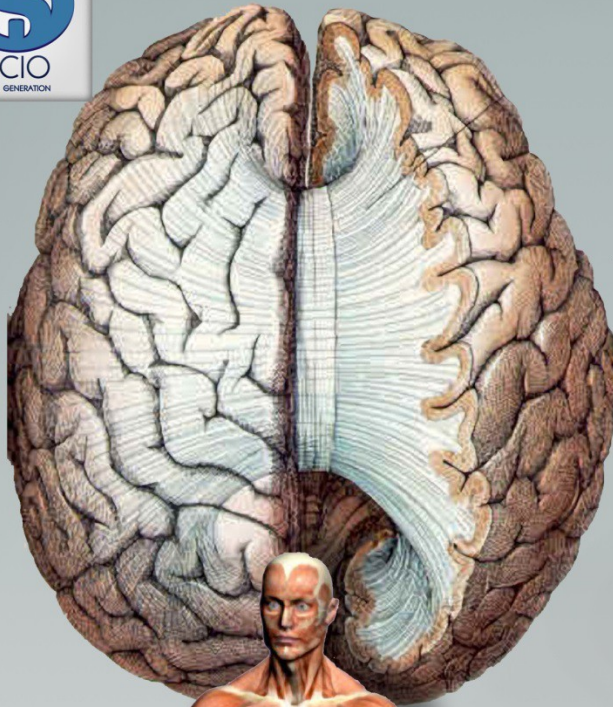
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The SCIO device can use the Trivector and Cybernetic Loop to rectify aberrant and disharmonious energy patterns in the body. This has profound effects on all body functions but affects the corpus callosum most intensely.

This means that the ability of the conscious verbal mind to relate to the subconscious is increased with the rectification process. The patient will probably not feel the effect. There will always be a positive effect. If there is a negative effect, it is because there is shielded or covert feelings or memories in the subconscious. These will cause disease if left untreated. A simple release may solve the problem.

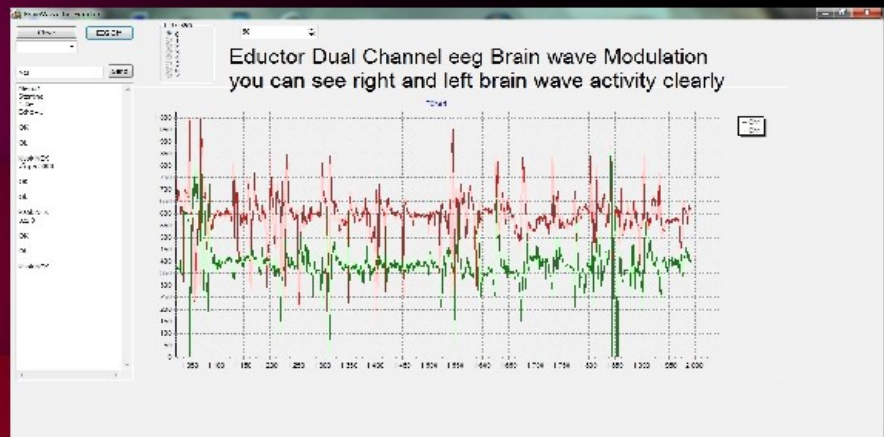
The changes include:

1. Activate the innate intelligence to balance the body energies. This is the basic principle of chiropractic, acupuncture, and osteopathy medicine.
2. There is an easier exchange of energy and information from right brain to left brain via the corpus callosum. The corpus callosum is the largest energy form in the body and the rectification process has profound effects on stabilizing it, so it dramatically reduces switching phenomena.
3. The SCIO thereby increases the ability of the conscious to interface with the unconscious. This allows greater knowledge of self and of the higher self.
4. There is a greater memory access, a more true access of memory without emotional clouding.
5. There is a greater flexibility of connective tissue, allowing for more resilience.
6. There is a greater oxygenation and hydration ability of the body.
7. There is a smoother muscle control.
8. There is a general increase in well being that the conscious mind is so often unable to perceive. And thus there are thousands of subtle improvements to be found.

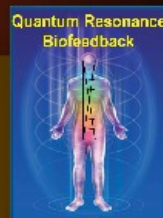


**The Eductor is a
registered EEG
Biofeedback Device
measuring the
Electro-
EncephaloGraph
of each side
of the Brain**

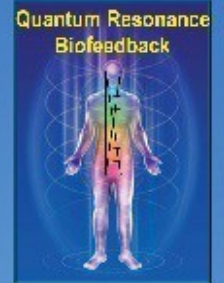
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International Journal of the Medical Science of Homeopathy, Naturopathy and Energetic Medicine

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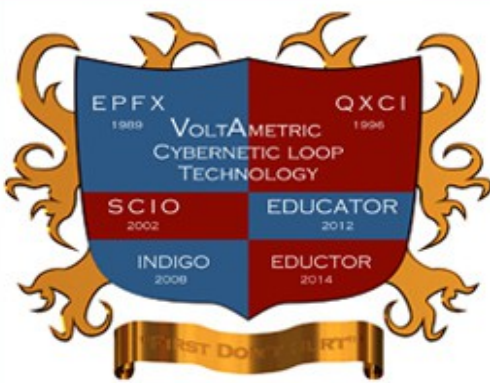
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We start with a lifestyle evaluation we call the SOC Index and we Educate the Mind, Body and Spirit to Attain Health via Stress Reduction and Awareness

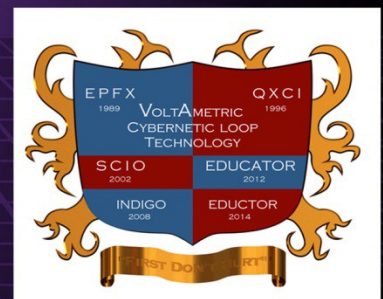
THE AVERAGE COST OF FULLY VALIDATING + VERIFYING A MEDICAL DEVICE IS WELL OVER \$400 MILLION DOLLARS

You must Prove and Develop the Science for Five Years of Published Research

Educator + Educator Cybernetics

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You Must get an IRB, do Several Double Blind Medical Supervised Studies, Publish them in Recognized Peer Review Medical Journals for over Five Years, and then get the Studies Published in Certified Medical Univ Textbooks



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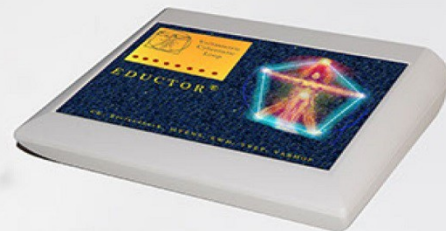
Eductor

The word 'Doctor' comes from
the Latin word
'Eductor'
which means 'to teach'.

Thomas Edison said that the
doctor of the future will teach the
patient how to live and how to eat,
exercise and meditate.

The Eductor is a Biofeedback
Teacher

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PROFESSOR DESIRÉ DUBOUNET
THE DEVELOPER