ELECTROENCEPHALOGRAMS
(the basic use of the SCIO EEG sorting and treating device)

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 synchronised 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 synchronising impulses to cortical neurones and induce widespread 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 polarisation and depolarisation of the cells create electropotentials 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 stabilise 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 from the multiple pole (12-24-or 36) electrodes. The SCIO uses an eight 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 analysed 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 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 bioresonance.

EPILEPTIC

Ictal patterns, hyperarrhythmia, 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 under 8hz 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 demyleination of the CEREBELLAR area. There may be accompanying dizziness and inability to maintain balance. Treatment should include fatty acids and proper sarcodes.

GENERAL ASYMMETRY 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.

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.

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, hypoglycemia, 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.

DEEP BRAIN ASSYMETERY
Many conditions can effect 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. Vitamin and mineral deficiency such as B12, Copper, Potassium, can also result in this function. Carbon Monoxide or oxygen deficiency such as emphysema can produce this phenomena. Hypoglycemia or liver disease must also be treated.

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 counseling and or NLP techniques.

The SCIO can take a basic simple brain wave and then calculate the amount of times the disturbance is observed in a one minute stretch. A mathematical probability is established and reported on the screen. There should be more
normal probability observation than any other category. If there is more in another category there is a treatable anomaly. The SCIO device will on the next run treat the pattern you click on. The SCIO device will then use electrical treatments to enhance normality and decrease abnormality.

EEG biofeedback, also known as Neurofeedback, is a biofeedback technique that presents the user with feedback on brainwave activity, measured from sensors on the scalp.

Several studies investigated the effectiveness of EEG biofeedback on different conditions. Xiong Z, Shi S and Xu H. found in a controlled trial that involved 60 children that EEG biofeedback training was an effective and vital treatment on children with Attention Deficit / Hyperactivity Disorder.

Mezei Iosif MD, Sarca Ovidiu MD, Igor Cetojevic MD, Matthias Heiliger M.D. Klara Hilf M.D, Anna Maria Cako M.D., Debbie Drake M.D., Bacean Aurel MD investigated in a Randomized Controlled Trial people with a wide variety of diseases to see who gets or feels better while using the SCIO for stress reduction and patient monitoring. They found that EEG simple biofeedback training is very effective in stress reduction.

EEG biofeedback was reported to be effective on Attention Deficit / Hyperactivity Disorder by Pop-Jordanova N, Markovska-Simoska S and Zorcec T, as a result of a trial. However, limitations of this study include small sample size and its uncontrolled nature.

The effectiveness of EEG biofeedback in ADHD was also analyzed by Friel in his article where he states that the effectiveness of EEG biofeedback on ADHD is comparable to stimulant medications.

Martelli MF, Zasler ND, Pickett TC state that preliminary evidence is emerging which also suggests that EEG biofeedback training may be useful for simultaneously reducing frequently seen abnormalities in EEG patterns and remediating persistent cognitive, emotional, fatigue and sleep related problems following Traumatic Brain Injury.

Angelakis E, Stathopoulou S, Frymiare JL, Green DL, Lubar JF, Kounios J. investigated whether training older individuals to increase peak alpha frequency would result in improved cognitive performance. The results suggest that peak alpha frequency neurofeedback (PAF NF) is a promising technique for improving selected cognitive functions.

EEG biofeedback protocols were shown to have positive effects on mixed substance abusing inpatient population also, a study by Scott WC, Kaiser D, Othmer S, Sideroff SI. finds. The EEG biofeedback protocol enhanced treatment retention, variables of attention, and abstinence rates one year following treatment.

Gage Tarrant LBT, C.H.T, Mezei Iosif MD, Debbie Drake M.D. William Cuningham CBT, Igor Cetojevic MD, Matthias Heiliger M.D. Anna Maria Cako M.D. Bacean Aurel MD view the SCIO as an important biofeedback tool useful in many stages of stress reduction-oriented therapy and would encourage allied professionals and regulatory
bodies to recognize its value. There are several quite apparent results from their study. First the safety of the device is firmly established as a minimal risk. There is an insignificant report of negative results and no reports of any significant problems. Second the difference in the placebo group versus the Virtual group is significant although minimal. This proves the efficacy of Virtual therapy. There is a large difference in the harness group. This notes the large effect of the harness versus the virtual. Next there is a significant difference in the SOC Index. Patients below SOC Index 150 had significantly better results in all conditions. This points to value of behavioral medicine interview and the need to reduce suppression and obstruction of cure ability. The major findings are the significant positive effect on healing the SOC Index and the harness have.

Judit Nagy MD. Garnet Dupis LBT Lynne Crawford and William Cunningham LBT review the clinical results and experiences of users of the SCIO/EPFX biofeedback device after almost two decades of use. Stress is a part of all disease pictures and stress reduction should be a part of all medicine. The EPFX or in fact any biofeedback can be helpful for stimulating awareness, control, responsibility and return of health. The techniques of the EPFX tested in this paper were shown extremely helpful in reducing stress. In conclusion, the authors view the EPFX as an important biofeedback tool useful in many stages of stress reduction-oriented therapy and would encourage allied professionals and regulatory bodies to recognize its value.

Several biofeedback devices have been proven to have beneficial effects in detecting and affecting stress, which has many secondary benefits in improving health and easing the effects of different conditions. Lifestyle education and educational awareness could have a larger impact.

Marshall F. Gilula finds that the EPPX, an evoked potential biofeedback device that is used for stress reduction in the U.S.A, known as the SCIO in Europe and other countries outside U.S.A., has the potential for pointing out a large variety of relevant stressors for the individual patient and is an avenue for reducing stress in the patient by helping to restore energy balance in the human system. Because many Fibromyalgia patients obtain at least temporary pain relief from Acupuncture, the EPFX is relevant here as he has been told by his patients that there are some elements of this biofeedback experience that produce a similar type of relief. The “suppression and obstruction to cure” function of the EPFX system can be an ideal and nonpunitive way of identifying stress points in the patient’s life and gently turning the patient’s attention to those points that need to be addressed.

Kinga Gulyas, a practitioner that has been using the SCIO device since 2004, worked for three years with the SCIO device in a center for handicapped young adults. She states that the system is useful in helping to sedate and relax the children when there were temper tantrums. The SCIO was able to help with immune system balancing and was used to stimulate cellular regeneration. The device seems to reduce healing time by reducing the stress of the handicapped young adults and thus accelerating healthier living. Heavily handicapped people were brought to ease and guided to an even emotional mood level with the regular use of the SCIO system.
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BRAIN FUNCTIONS

1. Sleep is said to be induced in the hypothalamus. It has been concluded that a sleep center discharges inhibitory impulses to cortical cells and waking may occur when alternately excited. This center is more effected by fatigue than the cortex.

2. Eyes, ears, etc. (exteroceptors) send impulses to the cerebrum, which is the integration center and seat of psychic functions, such as: sensation, perception, memory, judgement, volition, and consciousness. In general, frequencies originating from stimulation to the left side of the body are received by the right side cerebral cortex, and vice versa. This is comparable to camera reversal image on a ground glass.

3. Pain is relieved by severing the white matter within the pre-frontal lobes and opening their circuits connecting the cortex with the thalamus and hypothalamus; relieving anxiety, chronic depression, and emotional impulses such as fear, delusion and melancholia. The pituitary gland hormones are also controlled here.

4. Emotional reactions are said to originate in the hypothalamus, which is under the influence of the thalamus and the cerebral cortex, which upon maturity establishes a balance between emotion and reason. Chronic nervous and mental diseases due to malfunction of the area electrons are said to incapacitate more people than any other ailment. Average reaction time for sight is .25 second; for hearing - .17 seconds; for touch - .15 seconds, and may vary by worry, fatigue, alcohol, narcotics, nutrient deficiencies, and lack of oxygen in the blood can cause complete brain damage in four minutes (outside body parts turn blue).

5. Equilibrium, muscle contraction, and voluntary muscle activity is said to be the concern of the cerebellum such as the labyrinthine impressions from the inner ear and the kinaesthetic impression from the muscles and tendons. When damaged the patient, with his eyes closed, is unable to maintain an erect position or may stagger or reel in his gait. The flocculondular area seems to be involved in motion sickness. On the other hand reflexes may be jerky and associated with tremors due to spastic contractions where areas in the anterior CEREBELLAR cortex are stimulated at a slow rate by electron resistance’s increasing. Voluntary muscular co-ordination is located in this electron network.
6. The vital nerve center for respiration, phonation, vasoconstriction, vasodilatation, cardiac inhibition and acceleration, mastication, deglutition, and salivary and gastric secretions are in the medulla oblongata and some nerve fibers merely pass through being bound for other parts of the electronic system in the brain.

7. Twelve pairs of cranial nerves carry function frequencies as command stimuli: pair 1, olfactory; pair 2, optic; pair 3, oculomotor; pair 4, trochlear; pair 5, trigeminal motor and sensory; pair 6, abducent; pair 7, facial; pair 8, acoustic; pair 9, glossopharyngeal; pair 10, vagus; pair 11, spinal accessory; pair 12, hypoglossal.

SINGLE OR MULTIPLE ELECTRON ACTIVATION

1. Impulses carried for sense of smell
2. Relays impulses to occipital lobes and to 3rd, 4th, & 6th
3. Motor nerve for 4 of 6 intrinsic eye muscles and upper eyelid elevator
4. Innervates the superior oblique eyeball muscle
5. Innervates the muscles of mastication
6. Motor nerve for external rectus muscle and of eyeball
7. This is the motor nerve for the muscles of the face, ears, and scalp
8. Auditory nerve - sensory composed of cochlear and vestibular connections
9. Mixed nerve with motor branches controlling the muscles of the pharynx and the base of the tongue and supplies secretory fibers to the parotid (salivary) gland. The sensory fibers are supplied to the tongue and pharynx, and with the 7th cranial nerve constitute the electron path of taste nerves.
10. Called vagus or pneumogastric nerve with motor fibers supplied to the muscles of the larynx and of the alimentary tract (extending from the esophagus to the large intestines), and its inhibitory fibers supply the heart. The glands of the stomach and the pancreas are innervated by this nerve conductor. Its sensory fibers end in the heart and in the mucous membranes of the larynx, trachea, lungs, esophagus, stomach, gallbladder and intestines.

11. Motor nerve for sternomastoid and trapezius muscles, and sends many other motor fiber conductors directly into the vague nerve.

12. Arises in the medulla oblongata and is the motor nerve conductor of electrons for the muscles of the tongue and larynx.
EEG biofeedback or Neurofeedback

Neurofeedback (NFB), also called neurotherapy, neurobiofeedback or EEG biofeedback (EEGBF) is a therapy technique that presents the user with real-time 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.

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 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.

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. Alpha states do not seem to have the universal stress-alleviating power indicated by early observations. 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. James Hardt and Joe Kamiya, then at UC San Francisco’s Langley Porter Neuropsychiatric Institute published a paper, 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. This training has been used in the treatment of epilepsy, attention deficit disorder and hyperactive disorder, and other mood disorders. 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.

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. Most individuals treated with biofeedback in research studies have been sufferers of the most severe epilepsy for whom anticonvulsant drug therapy has proven ineffective. 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.

Lubar addressed attention disorders using essentially the same protocol. 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. This procedure has been supported since alpha activity is known to decrease during cognitive functions and to be inversely related to metabolism. 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. 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. Currently, treatment for attention disorders is the most common application of EEG biofeedback. However, the treatment is also effective in the treatment of traumatic head injuries and sleep disorders as well as epilepsy.
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 D.A. Quirk heard a presentation by Sterman 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. 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. 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.

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) and other addictions as well as post-traumatic stress disorder, the dysphoric disorders of women, musicians, and psychopathic offenders. 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.

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. However, following the use of alcohol, theta and alpha waves increase. 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. 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.

**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 ("quantitative 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.

Overview:

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 daydreaming 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/

References


Hammond, Corydon D. "Neurofeedback Treatment of Depression and Anxiety." Journal of Adult Development, Vol 12, Nos. 2/3, August 2005


EEG Biofeedback: A Promising New Therapy for Attention Deficit Disorder, Learning Disabilities, and Mild Traumatic Brain Injuries

Association for Applied Psychophysiology and Biofeedback website (2000). What Kind of Health
Problems Can Biofeedback Help?


OTHER FREQUENCIES EFFECTING BIOLOGY

The eyes are photoreceptors of electromagnetic frequencies that range from 380 trillion to 800 trillion cycles per second. By spectrum the colors have been detected in their resonant frequency ranges where: Red is 460 trillion cps, yellow is 520 trillion cps, and blue is 630 trillion cps in the entire range from 380 to 800 trillion cps. Brightness and amplitude received and transduced depends upon retina sensitivity in the eye. Being a photoconductive conductor of electrons the eye detects and receives and excites these light frequencies into electrons in relation to the amplitude imposed upon the retina. These electrons are induced into many conduction bands, where they move freely and carry current to the brain. Two types of conduction are said to be activated: (1) primary conduction is the direct result of radiation and electromagnetic energy penetrating the vision system; (2) secondary conduction effects
depending upon the electromagnetic frequency range of the spectrum variables used.

BRAIN FUNCTIONS

1. Sleep is said to be induced in the hypothalamus. It has been concluded that a sleep center discharges inhibitory impulses to cortical cells and waking may occur when alternately excited. This center is more effected by fatigue than the cortex.

2. Eyes, ears, etc. (exteroceptors) send impulses to the cerebrum, which is the integration center and seat of psychic functions, such as: sensation, perception, memory, judgement, volition, and consciousness. In general, frequencies originating from stimulation to the left side of the body are received by the right side cerebral cortex, and vice versa. This is comparable to camera reversal image on a ground glass.

3. Pain is relieved by severing the white matter within the pre-frontal lobes and opening their circuits connecting the cortex with the thalamus and hypothalamus; relieving anxiety, chronic depression, and emotional impulses such as fear, delusion and melancholia. The pituitary gland hormones are also controlled here.

4. Emotional reactions are said to originate in the hypothalamus, which is under the influence of the thalamus and the cerebral cortex, which upon maturity establishes a balance between emotion and reason. Chronic nervous and mental diseases due to malfunction of the area electrons are said to incapacitate more people than any other ailment. Average reaction time for sight is .25 second; for hearing - .17 seconds; for touch - .15 seconds, and may vary by worry, fatigue, alcohol, narcotics, nutrient deficiencies, and lack of oxygen in the blood can cause complete brain damage in four minutes (outside body parts turn blue).

5. Equilibrium, muscle contraction, and voluntary muscle activity is said to be the concern of the cerebellum such as the labyrinthine impressions from the inner ear and the kinaesthetic impression from the muscles and tendons. When damaged the patient, with his eyes closed, is unable to maintain an erect position or may stagger or reel in his gait. The flocculonodular area seems to be involved in motion sickness. On the other hand reflexes may be jerky and associated with tremors due to spastic contractions where areas in the anterior CEREBELLAR cortex are stimulated at a slow rate by electron resistance's increasing. Voluntary muscular co-ordination is located in this electron network.

6. The vital nerve center for respiration, phonation, vasoconstriction, vasodilatation, cardiac inhibition and acceleration, mastication, deglutition, and salivary and gastric secretions are in the medulla oblongata and some nerve fibers merely pass through being bound for other parts of the electronic system in the brain.

7. Twelve pairs of cranial nerves carry function frequencies as command stimuli: pair 1, olfactory; pair 2, optic; pair 3, oculomotor; pair 4, trochlear; pair 5, trigeminal motor and sensory; pair 6, abducent; pair 7, facial; pair 8, acoustic; pair 9, glossopharyngeal; pair 10, vagus; pair 11, spinal accessory; pair 12, hypoglossal.

SINGLE OR MULTIPLE ELECTRON ACTIVATION
1. Impulses carried for sense of smell
2. Relays impulses to occipital lobes and to 3rd, 4th, & 6th
3. Motor nerve for 4 of 6 intrinsic eye muscles and upper eyelid elevator
4. Innervates the superior oblique eyeball muscle
5. Innervates the muscles of mastication
6. Motor nerve for external rectus muscle and of eyeball
7. This is the motor nerve for the muscles of the face, ears, and scalp
8. Auditory nerve - sensory composed of cochlear and vestibular connections
9. Mixed nerve with motor branches controlling the muscles of the pharynx and the base of the tongue and supplies secretory fibers to the parotid (salivary) gland. The sensory fibers are supplied to the tongue and pharynx, and with the 7th cranial nerve constitute the electron path of taste nerves.
10. Called vagus or pneumogastric nerve with motor fibers supplied to the muscles of the larynx and of the alimentary tract (extending from the esophagus to the large intestines), and its inhibitory fibers supply the heart. The glands of the stomach and the pancreas are innervated by this nerve conductor. Its sensory fibers end in the heart and in the mucous membranes of the larynx, trachea, lungs, esophagus, stomach, gallbladder and intestines.
11. Motor nerve for sternomastoid and trapezius muscles, and sends many other motor fiber conductors directly into the vague nerve.
12. Arises in the medulla oblongata and is the motor nerve conductor of electrons for the muscles of the tongue and larynx.

As we have demonstrated, if two electrodes are placed on the surface of a uniform strip of irritable tissue, a diphasic action potential is recorded when the tissue responds to a stimulus. Excitation and recovery under the first electrode are found in the first phase; the second indicates the same event under the second electrode. If the two electrodes are close together, the phases will be temporally closer. If one of the surface electrodes is advanced through the membrane into the cell, the membrane potential appears. If the cell is excited, the monophasic action potential will be recorded rising from, and returning to, the resting membrane potential. This shows two boundary conditions (i.e., both electrodes are extracellular), which give rise to the idealized diphasic action potential; when one electrode is extracellular and the other is intracellular, the idealized monophasic action potential results. Imagine a strip of irritable tissue, injured at one end (i.e., depolarized) by crushing at B as in Fig. G. The membrane potential is not fully maintained all the way to the site of injury.

Graham and Gerard (1946) used frog sartorius muscle and explored the potential along the membrane with transmembrane electrodes up to and within the site of injury. It was found that the potential between the exploring electrode was within 5 mm of the site of injury. As electrode B was moved toward the cut end, the potential decreased; at 2 mm from the site of injury, the potential was twenty-five percent of the membrane potential. Graham and Gerard
placed one electrode on the intact surface of a muscle cell and another in the region of injury, comparing the potential difference so measured with the resting membrane potential. The injury potential was thirty to thirty-nine percent of the membrane potential. This accounts for electrical measurement of tissue.

At the site of injury the spatial distribution of membrane potential, whatever it may be, causes current to flow through the fluid environment. Thus in the fluid there will be established more electrical current, or amps.

This is necessary to provide greater electrical flow for rebuilding and reconstruction.

Consequently, the potential measured between an electrode inside the cell and one at the site of injury will depend on the local conditions at the site of injury and the position of the electrode in the fluid environment. If this potential (the injury potential) is measured under optimum conditions, it may amount to slightly more than one-third of the membrane potential. The same type of information developed by Woodbury and others (1951) demonstrated that if the diameter of an intracellular electrode is large with respect to the size of a cell, the potential measured is considerably less than the membrane potential and approximated thirty percent of the true membrane potential. It is apparent that a typical injury potential may be about one-third of the membrane potential. This will allow us to measure the probability of injury in the body.

This situation has an important implication when an action potential is measured with one electrode on the surface of an irritable tissue and the other in an area of injury. Suppose that before excitation, the resting membrane potential is -70 mV, that electrode A is on the intact surface of the irritable tissue, and that electrode B is in the site of injury. Under this condition the potential difference between the electrodes may be thirty-five percent of the membrane potential and amount to about -25 mV. Now if the tissue is stimulated to the left of electrode A, when excitation reaches this electrode the potential difference measured between the electrodes will be the algebraic sum of the potentials at the two electrodes. For example, assume that the membrane depolarizes and reverse polarizes to +20 mV; the potential difference was -25 mV just before depolarisation and +65 mV at the peak of reverse polarisation. It will then return to -25 mV when the wave of excitation passes the surface electrode. This sequence illustrates that a fair representation of the wave form of the transmembrane action potential can be obtained by injuring the tissue under one electrode. Important to note that, although the magnitude of the reverse polarisation of the membrane amounted to only 20 mV, in the record it showed up as a much larger potential of +65 mV. This situation probably serves to explain the considerable reverse potential observed by Bernstein (1871) when he measured the nerve action potential with the rheotome (see Hoff and Geddes, 1957).

There is another point to consider when the action potential is measured with one electrode on an intact membrane and the other in a region of injury. Before excitation there will be a standing potential difference (the injury potential), whose magnitude will depend primarily on the location of the electrode at the site of injury. If electrode B is over the injured area, an appreciable percentage of the membrane potential may be detected; if it is moved a short distance from the site of injury and is over-excitable tissue, the steady (injury) potential difference between the electrodes will be less. Now if the tissue is excited and excitation and recovery passes under the surface electrode, the usual monophasic action potential will occur, superimposed on a baseline of the injury potential. If the strip of irritable tissue is long with respect to the time of propagation of the impulse and the amount of tissue occupied by excitation is small with respect to the inter-electrode distance, excitation and recovery will take place under the first electrode before it enters the region of electrode B, which is near the area of injury. Electrode B may also be close to uninjured tissue, and therefore detect not only the
injury potential but also an attenuated action potential as it advances toward the area of injury. Thus the resulting action potential measured between the two electrodes will be diphasic, consisting of a large monophasic action potential superimposed on the injury potential, followed by a smaller monophasic action potential in the opposite direction reflecting what electrode B detects from the depolarisation and repolarization of normal tissue near the site of injury. This is a factor used by QXCI machinery to find improper reactivity or to correlate proper reactivity.

If we move the electrodes together, or if the area of the tissue occupied by excitation is great compared to the inter-electrode distance, the smaller downward phase of the action potential will be moved towards the upward phase. A type of this wave form is often recorded when a needle electrode inserted into active tissue is compared to another electrode on uninjured tissue (see PROMORPHEUS).

Multiple Measurement of Irritable Tissues. Previously we analysed the situation involving the potential expected from electrodes on the surface of a strip of isolated injured tissue. We can predict the anticipated potential from electrodes on a bundle of isolated irritable tissues. In particular, this line of reasoning has value in explaining the action potentials recorded from the surface of a nerve trunk and the effect of injury determining the action potentials recorded from myocardial tissue. Sometimes the analysis is better performed by use of the dipole concept.

The injury and monophasic action potential.

Imagine a bundle of irritable fibers with similar propagation velocity. Place on the surface of the bundle one electrode, and place the other electrode at the cut (injured) end. Without excitation there will be a standing potential difference (the injury potential) between the electrodes. If we stimulate the fibers at the end opposite the cut, all the propagated excitations will pass by the surface electrode at the same time. The surface electrode will preferentially detect the action potentials in fiber 1, which is immediately under it. The action potentials in the more distant underlying fibers will also be detected, but the more distant fibers will contribute less to the voltage detected by the surface electrode. In accordance with Fig. H, the resulting action potential will be a combination of all the action potentials of the local and distant fibers. Because all fibers were chosen to be identical, the action potential will be a smooth monophasic wave; no action potentials will be detected at the site of injury.

If we do not stimulate the individual fibers simultaneously, as for example in skeletal muscle by nerve stimulation, the action potentials of the individual fibers will not pass under the surface electrode synchronously. The potential between the electrodes reflects this situation and the action potential recorded. The potential will still be unidirectional and polyphasic. The form of the potential will reflect the temporal pattern of excitation and the spatial distribution and velocities of propagation of the various fibers.

This is by no means uncommon in the routine measurement of bioelectric events with local extracellular electrodes. In nerve trunks, a spatial distribution of fibers has various diameters. Velocities of propagation are related to fiber diameters. Larger fibers propagate excitation much more rapidly than the smaller ones. When we stimulate all the fibers simultaneously, we induce a larger time separation between the action potentials of the rapidly and slowly propagating fibers. Sequential action potentials can then be detected by a surface electrode. This is how the variances in nerve conduction velocity were found by Erlanger and Gasser (1937). Their Nobel Prize-winning study and experiments with some sample oscillograms are found in Fig. I. The investigators employed injured tissue to obtain unit activity. They proved that the propagation velocity in nerve is related to fiber diameter. Erlanger and
Gasser demonstrated that the wave form of the action potential recorded by a surface electrode placed on a mixed nerve trunk, in which all of the axons are stimulated simultaneously, will depend on the propagation velocities and the distance from the point of stimulation to the active (surface) electrode. The electrode can detect the action potentials of the fibers below it. Electrodes in the more distant fibers will contribute less to the recorded action potential.

The science and mathematics contained in this report are quite challenging. Just as the science and mathematics of a television are extensive. It is not necessary to know the science of a television to use it, nor is it necessary for a therapist or doctor to know the science of the instrumentation to use a device in a clinical setting. But it is necessary for someone to know the science. This report contains some of the science in the Quantum Med system. Rest easy it is not necessary for you to know the science to use the system, Rest easier for Prof. Nelson knows the science and he has made use of it easy for us. For a more extensive description of the science and mathematics see the PROMORPHEUS.

INTRODUCTION

Energetic Medicine has concentrated on resistance for too long. There is much more to the body electric than resistance. It is impossible to measure a frequency with a resistance device such as the Listen, Voll, Vega or other simple resistance devices. This makes for a very complicated fractal system that can be difficult to analyse. With a computer a vast amount of electrical data can be collected and analysed. This can then allow for the beginning of a true energetic medicine. Below is a abbreviated list of electrical variables and their corresponding components that our Quantum Med system can analyse in the short space of minutes in a clinical setting. The time of ionic exchange is approximately one hundredths of a sec. Thus it would be impossible for a person who wants to test a patient with a manual device.

CriterialImplicationforce measurements - cellular capacityconnection (see* Voltametry), catecholamine connection (see *Voltametry)versus degeneration - reactivitytesting (see *Electroacupuncture)transfer and storage, voltage and amperage regulationin capacitance, resistance that determines the ability of the body to react to medication testingInductioncontrol, voltage and amperage regulation's Law of capacitance and frequency that allows for medication testing*Frequency versus nervous tendencies (see* Mitogenic Radiation)potential (see* The Biological Pool)Stability (see *Polymorphic Studies), EElectron transfer (see *The Biological Pool)Angle's law sets boundaries of electroacupuncture testing

*articles in Promorpheus As we pointed out in the Promorpheus, electricity as an electrical entity travels in the direction of, for example, your right thumb. Then for conduction of the electron, there is a magnetic field produced at 90°, and a static field will be produced at another 90°. This electromagnetic and electrostatic combination and its effect on conductance and from conductance is the basis for understanding electrical phenomena.

The factors of the electrolyte in the body greatly effect the electrical nature of the body. The amount of minerals, liquids, oxygen, amino acids, fatty acids and others effect the nature of the electrolyte. So our total energetic medicine (beyond simple resistance variables) can offer us great insights into many factors of health. Since so much of energetic medicine is fixated in one channel resistance point probetechniques it is time for a quantum leap in the technology. In this article we will outline some basic aspects of energetic medicine for electroencephalographs electrocardiology and energetic medicine.

This article will outline the electron and its action. The photon link is outlined in the Promorphes.

French physicist Coulomb laid out a law, which states: "The force of attraction or repulsion between two charged bodies is directly proportional to the product of the charges and inversely proportional to the square of the distance between them."
Thus the force can be allowed in the following equation
\[ F \approx \frac{Q_1 \times Q_2}{D^2} \]
The inverse square law is a dictum of four-dimensional physics. Our ten-dimensional model questions its pervasiveness.
Here \( Q \) represents the force of the charges, \( D \) is the distance, and \( F \) is the force in dynes. A coulomb of charge, \( C \), is nearly 3 times \( 10^9 \) esu. The strength of an electrical field will have the equation
\[ E \approx \frac{9 \times 10^9 \times q}{R^2} \]
This is called the electrical potential. The potential at a point is equal to the work needed to bring one coulomb charge to the point from an infinite distance away. Biology will need to monitor this effect very closely.
An electric potential is thus work per unit of charge. Kinetic energy, which is equivalent to work, is measured in a relationship of force to distance. A gram that is moved at one centimeter per second of velocity is an erg. A kilogram that is moved at one meter per second is known as a joule. When we have a joule per coulomb, this is known as a volt. One volt equals one joule divided by one coulomb. The volt is often a measure of potential energy. It is the difference between two points, between positive and negative charge; thus a six-volt battery with a potential difference of 6 joules or coulombs that can flow from one terminal to the other. Potential difference, thus, is an integral measurement of profound importance in biology and medicine.
If the surface of an item has a charge that is stored as potential energy, the ratio of charge to potential is called the capacitance of the body. The basic unit of capacitance is known as the farad, which is one coulomb per volt. If one coulomb of charge added to a body gives it potential of one volt, it has the capacitance of one farad. In a capacitor current is proportional to the rate of change of voltage.
Thus capacitance can be measured as a fluctuation in voltage (\( \Delta V \)) over a qualitative time.
\[ 1 \text{ Farad} = \frac{1 \text{ Coulomb}}{1 \text{ Volt}} \]
\[ \text{Capacitance} = \frac{\Delta V}{\Delta T} = \text{Amps} \]
The farad is a very large unit, measuring a lot of potential. Often in electronics we use micro-farads, or even pico-farads; a micro-farad being 10-6 farads and a pico-farad being 10-12 farads. By having two sheets of a high conductor, such as metal, with an insulating material between them, we can produce a condenser or capacitor. In biology cellular forces will invoke pico-farads. Organismic forces must relate to and control micro-farads.
The capacitance of the capacitor is the amount of the electrical charge on its plate divided by the potential difference between its plates. This depends on several factors, such as the area of the plates. If the plates are made larger, greater charge can be put on them. The thickness of the insulating layer is important. The closer the plates are to one another, the greater the amount of charge that is held. It is the strength of the electric fields of the electric plates as they are brought closer together. In biology organs, cells, organ systems, and organisms must store charge to deal with metabolism and growth.
The material between the plates will have an influence on the capacitor. These insulators, or non-conductors between the plates, are also known as dielectrics. Biology is filled with membranes that act as storage entities. We have only to review neuronal axon transfer to see biocapacitance at work.
The dielectric constant of an insulating material is a relationship between the effect of the material and that of a vacuum between the plates. The dielectric constant of water is 80; the dielectric constant of air is 1.001, as compared to a vacuum. The dielectric constant of rubber is 2.5.
Water has such an enormous dielectric constant because the water molecule is already
polarized, even if it is not in an electric field. One end of the water molecule is positive and the other negative, because of the dipole magnetic effect. Biology uses this concept of water to store and use energy. The molecules can now rotate easily in the liquid state, and in response to the electric forces on them can readily produce strong layers of induced charge on its surfaces. Capacitance action is of extreme importance to biology.

When we move one coulomb of charge per second, this is known as an ampere. An amp is movement or quantity of charge. Movement of charge, amps, is the most important criteria of biology. This correlates to life force and indolamine production.

\[ 1\text{ Amp} = 1\text{ Coulomb per second} \]

Volts = Inductance \( \sim \frac{d\text{ Amps}}{d\text{ Time}} \)

Amps = Capacitance \( \sim \frac{d\text{ Volts}}{d\text{ Time}} \)

Dr. Ohm, a German physicist, found that electric current in a conductor is directly proportional to the potential difference between its ends. Thus he generated Ohm's law, finding that the resistance of one ohm is generated in a conductor if the potential difference of one volt between its ends will cause a current of one ampere to flow through it. Thus we have generated and found Ohm's law, which is

Amperes = Volts \( \text{DIV} \) Ohms

\[ \text{or Volts} = \text{Amps \times Resistance} \]

Ohm's law is not strictly adhered to in electrolytes, discharge of gasses, and semiconductors; nor is it followed perfectly applicable to biology, for there are many different factors that can affect it. Changing potentials over time causes an instability in Ohm's law for biology. But in knowing an electrical system we must know the amperage, the voltage, and the resistance in order to be able to calculate variables more accurately. Ohm's law, when involved in quantic systems, is not precise, but still shows the tendencies of electromotive force. For biology Ohm's law offers an invaluable systemic measuring system for easy bio force analysis.

Now let us look at some of the basic components and relationships of magnetic fields.

When strongly polarized molecules align, they induce stronger and stronger magnetic poles. An electric current flowing through a wire will also generate a magnetic field of 90° (right-hand rule). The strength of the magnetic field created by a current is directly proportional to the strength of the current and inversely proportional to the distance from the wire. The formula for this will show that

\[ \text{Magnetic Fields} = \left( \frac{\text{Amp}}{2\pi d} \right) \]

Thus a magnetic field strength can be measured in units of amperes per meter. Inductance is the factor measured for biological significance. Magnetic and paramagnetic forces can have strong implications in the long- and short-range forces of biology (see PROMORPHEUS).

A magnet near a stationary electric charge will not have an effect on it. If there is movement, then they have a natural influence on each other. Biology will need to be dynamic, and move constantly to use magnetic properties. The force of this influence is at right angles to both the velocity of the charge and the direction of the field. Stagnation is a magnet's enemy.

The magnitude of this force is

\[ \text{Force} = \text{Charge in Coulombs} \times \text{Velocity in meters per second} \]

and Magnetic Force of Amperes per meter \( \times \) the Permeability Factor through which the Magnetic Field permeates.
This permeability factor times the magnetic factor, which is amperes per meter, is known as the magnetic flux density, or the magnetic induction, and is expressed in Webers per square meter. In an inductor the voltage is proportional to the rate of change in the current. 

Inductance \times \frac{\text{d Amps}}{\text{d Time}} = \text{Volts} \phantom{x}

1\text{ Henry} = 1\text{ Volt/ (1 Amp/1 Sec)} = 1\text{ Volt/ Second/Amp}

These permeability factors are rated between that of the material and that of permeability of a vacuum. Materials that are high-ratio (that increase the flux density) are called ferro-magnetic; such as iron, cobalt, and nickel. Substances that are close to the ratio of 1, or other substances (which are very near to the relationship of the vacuum) are para-magnetic, and will contribute weakly, such as aluminum. There are substances like bismuth that are actually detrimental to the magnetic field. These are called diamagnetic, and their ratio is actually less than 1. Items which are non-magnetic will have no influence, and thus have a ratio of 1. Bismuth will have a place in biology, and is used in several homeopathics for energetic stability. Magnetic induction can be measured by changes in amperage over a qualitative analysis, such as the QXCI* machine test. This might be used to infer magnetic interaction, and thus, involvement of geopathic stress.

Thus we have outlined the concept of magnetic, static, and conductive forces, which are used to our understanding of the electrical nature of our homeopathic pharmaceuticals. By measuring the inductance, the dielectric constant and the conductance relationship, we can find an electrical profile for these various substances. This makes up an electrical fingerprint that allows us to calculate and plot its electrical nature. The trivector analysis is born. The long-range implications on energetic medicine are profound.

By charting the resistance, inductance, and dielectric constant of various homeopathic items we can get a trivector analysis of their electromagnetic fields. This trivector analysis gives us three vectors, which we will be able to apply to a three-dimensional space. Thus a variety of homeopathics have been analysed for their trivector analysis. The dimension of time gives us a four-dimensional relation that with some superb mathematics we can extrapolate the six virtual dimensions using a trinary logic system.**

Here we can see some of the effects that sarcodes, nosodes, allersodes and classic herbals have in their relationship to each other. This trivector analysis gives us a quality control factor for the electric field of a homeopathic item. In analyzing patients we can analyse serum in blood or personal field in a similar fashion. We can measure body PH from urine, blood, breath, etc., as well as redox capacity and body fluid resistance. Skin resistance readings can be taken at several points and easily averaged. Body voltage can be easily measured by dissimilar metals creating potential across the electrolyte capacity of the body, just as in a battery. Most proficient instruments choose to use silver and zinc (zinc because of its equi-potential for giving or receiving electrons, silver because of its great medicine history). Amperage is a correlate of voltage and resistance by placing similar metals in contact with the body (two silver probes contacting the frontal eminences). We can get an amperage reading. Capacitance is measured by changes in voltage during a scheduled interview. Inductance can be calculated through changes in amperage over the same interview. Resonant frequencies of the body can be calculated from the equation

\text{Resonance~ Freq.~} = \frac{10}{\sqrt{1 - (\text{\textcircled{CAP}}^2 + \text{\textcircled{IND}}^2)}}

From these readings we can now calculate a true metabolism chart to define a patient's overall health and energetic well-being. We can now compare a patient's readout to the homeopathic product's trivector analysis.

The preliminary work has shown that where patients have valleys, or dips, in their fields, homeopathic peaks will be helpful. Work on this is just starting; more work, funding and time will be needed before we can find out if this is a viable technique for quality control and/or for
homeopathic utilization. Now, with the help of the computer, matching remedies is high-tech and easy.

Another factor that we can use with this trivector analysis is that once we know the first three vectors, and the vector of time, we might be able to extrapolate the other six virtual dimensions. If we know the four factors of conductance, capacitance, inductance and time, we might be able to extrapolate other dimensional effects from this four-dimensional type of field.

Biology needs to not only look into quantum physics but also needs to embrace an energetic philosophy as well. This seems complicated at first, but is easy with today’s tools. This author has written some energetic articles on medical application of these theories in A Legal Outline of the Medical Practice of Electroacupuncture. Applying our right-hand rule and Ohm’s Law to energetic medicine represents a dramatic quantum leap in energetic medicine which is significant to the field. Many doctors who just do resistance will have their egos assaulted, and will thus have a hard time accepting such a technological jump. Let me assure you that the jump does not take as much mental activity as you might fear.

The technology of electroacupuncture (with just resistance) was important in the early 1960s and 1970s. When we get there we will see that electronic duplication has its limitations; and proper homeopathy, nutrition and behavioral medicine have their place.

Welcome to the new age of energetic medicine. If I can make the transition easier, please call.

As pointed out in the PROMORPHEUS impedance is a correlate of resistance that is also affected by capacitance and inductance. Now let us understand the application of applying an electrode to the surface of the skin with an interface of the electrolytes not only at the surface area, caused by sweat, but also an understanding of the electrolytes and their effect on the impedance circuitry of the intradermal layers of electrolyte within the body.

The composition of human sweat is very dilute compared to other bodily fluids. Sweat is about ninety-nine percent water, and the remaining one percent is a rich variety of other substances. A table of these substances is shown below.

| CONDUCTION RANGE IN THE HUMAN ANATOMY |

Using Ohm’s law and data given where:
E = 1000 millivolts or .001 volt
R = 350 ohms min.
R = 500,000 ohms max. or 500K

\[ E = I \times R \]

(A) Using R = 350: \[ I = \frac{0.001}{350} = 0.0000028 \text{ amps} \]

(B) Using R = 500K: \[ I = \frac{0.001}{500,000} = 0.000000002 \text{ amps} \]

Power measured in watts (P) = Volts times amperes or P = EI

From (A) - above: \[ P = 2.8 \times 10^{-6} (1 \times 10^{-3}) = 2.8 \times 10^{-9} \text{ Watts} \]

From (B) - above: \[ P = 2.0 \times 10^{-9} (1 \times 10^{-3}) = 2.0 \times 10^{-12} \text{ Watts} \]
The body electric

In 5th grade we are all taught a basic scientific fact, we are made of atoms. All things are made of atoms. Atoms are made of electrons, protons, neutrons, and other much less numerous subatomic particles. The electrons and protons make up by far most of things and thus most of our bodies. The electrons and protons are electrically charged. The electrons are so highly charged that they never touch but instead repel when they approach another. The electrons, protons, and neutrons are very small and they are held apart from each other by fields. If we condense the solid matter of the electrons, protons and neutrons together the human body would be so small it would take a microscope to see it. If the proton is the size of a golf ball, the electron is smaller than the size of the point of a pin and it is over a mile away. Between the electron and proton thus is electro-magnetic-static fields, held by Quantic forces. So our bodies are more than 99.99999999999999999999999 fields empty of matter. These Quantic electro-magnetic-static fields are what we are. Nothing ever really touches it is all field interaction.

No one has yet to see the true nature of our existence. No one can see the electrons, protons, or the fields they make. So we are only able to see a macro form of it. Our brains are trapped inside our skull and thus we cannot directly perceive anything. We are thus stuck with an indirect perception. A perception that comes thru the brain and is effected by our brain state. We project our own feelings, memories, psychic mental states onto our perceptions. It is difficult not to. So as humans developed we have made many assumptions of how the universe works, what is the nature of our bodies and lives, and our belief in a power greater than our own. And with a sense of history and knowing that we must project, and twist ideas, we should always be humble and recognize that we can never know. We are stuck making good guesses, better and better guesses, but always guesses. This book is about making a better guess. (REF my Perception book 1 + 2) As Albert Szent-Györgyi the Nobel Prize winning researcher once said “the cell is an electrical operation, life is electrical”. I had the pleasure of working a summer with Albert Szent-Györgyi in New Hampshire. His inspiration and levity were astounding. He laughed when he said He won the Nobel Prize for discovering Vitamin C, but it wasn’t Vitamin C at all.

In 9th grade we are taught about light. Light is made of photons. Photons are electro-magnetic radiation, particles in wave formations that can transfer energy. Quantum Electro-Dynamics QED tells us of how when a electron absorbs a photon the electron goes to a higher quantum energy state. When the electron releases a photon it goes to a lower state. QED tells us of virtual photons and just how all electron, proton, neutron movement is connected to the photon.

Voltammetry is the science of understanding how a substance’s electro-magnetic field reacts with it’s environment. A hormone has electrons and protons and how they are placed in a 3 dimensional space will determine how it exchanges electron-magnetic action and this is measured by measuring the 3 dimensional effect of it voltammetric field. The amount of charged particles is the amperage, the pressure or potential of the charged particles is the volts. Basic 7th grade physics. Every compound having it’s own individual and distinct voltammetric signature field. REF Voltammetry
The single cell systems such as bacteria set up a boundary layer such as a cell membrane to separate the thermodynamic world from the quantic interior. Entropy and thermodynamics dictate process in the non-living exterior versus the Quantic organized non random entropy interior. Metabolism and reproduction guided by a organized accounting of energy intake and outgo. All is Geared for metabolism and reproduction. Quantic Electromagnetic fields in cyclic organized fashion that is mostly dependent on the Quantic actions of DNA. DNA can only be described in the Quantic electromagnetic actions of the fields of it voltammetric structure.

Single celled organisms develop or evolve if you will allow us to say into multi celled organisms. This needs more complex DNA structures and the number of chromosomes needed grows. DNA acts as the chief accountant as it sends off RNA and messenger RNA to accomplish the goals of life. Life develops with tremendous diversification over 100,000,000 organisms have evolved with various and diverse functions. But all are Quantic electromagnetic exchange devices taking in energy, excreting waste products, and trying to reproduce. Everything having it's own set of field intricacies, and a single reactive ever changing overall field signature. The Quantic Electro-magnetic-static field of an organism is reacting towards nutrition and away from toxins. To maximize metabolism. It reacts to mating signals and
reproductive gesticulations to maximize reproduction.

Everything is a wash of field interactions and electromagnetic radiation photons. The cells of biology use this electromagnetic radiation for communication. Information for reproduction or Mitogenic radiation is in the visible, metabolism radiation is in the Infrared. Biology does not just send heat out as a waste product it is a communication network for cellular info exchange.

The multi-celled organisms diversify and all have an innate non-verbal Quantic electro-magnetic drive for survival. Biology operates thru field interactions. The height of DNA diversification is presently the development of a word are of the brain. And are where we think in words. This allows for explicit communication and exchange of thoughts, feelings, desire, fears, etc.

**The Human Body Electric**

There are over one hundred trillion cells in the human body and all are sending signals to the brain via enervation and photon exchange. Making some ten to the 16 bits of data per sec. Or less. 1,000,000,000,000,000 bits of data. The word area of the brain has developed as a small part of the human brain. About the size of a golf ball this small Broca area for words. Words coming in and words going out. The rest of the Brain is for life, metabolism and reproduction. Life is an unconscious process. Life is non-verbal. We do not have to think words to live. Words are for helping us function in social ways.

We have a reticular formation in the base of our brains that act as a filter to screen out unneeded data from our word area. The word area has the ability to assay about one million 1,000,000 bits of data at a time. More and the word area goes into overload. Below one thousand sensory bits and the system goes into sensory deprivation mode. It invents sensory data.

This means that ten to the sixteenth bits of data minus the ten to the 6 bits of data for the word area and the word area of the brain gets one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of the data sent to the brain. The unconscious non-verbal body electric gets all of this data and much more.
The spiritual cultures of the world know this and all exercises in spiritual development revolve around diminishing the words in the brain and coming aware more of the unconscious process. Mantras, meditation, stillness, yoga, kundalini, and many others all say we must control and diminish to effects of
the verbal word mind to get in touch with our body energetic. The true self is the body electric.

Much of the mistake of modern science and modern societies is to over value the words and the verbal process. Our society is presently over valuing the paper pushers and letting their need for words be more important than people. We need paper pushers and we need to have quality systems but there should be a requirement to try to minimize the over wordy and clarify the process of our society for everyone to understand not just the small minded paper pushers. This is especially true for biology and medicine.

The very process of life in an innate unconscious non-verbal Quantic electromagnet field interaction. Words have little to do with it. But so-called modern medicine has overvalued the words. They wait for the patient to verbally notice something is wrong, go to the doctor office and announce what is wrong, answer the doctors’ verbal questions, and receive verbal instruction. And yet this verbal exercise of medicine is only aware of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of one percent of the data. The body

Now as we learned in 5th grade everything is made mostly of electrons and protons. Photons are involved in all exchange of energy states. Now in some materials the electrons are tightly bound and are unwilling to allow electron exchange. In concrete the atoms are bound tightly and the electrons are not very conductive. In a metal like copper the electrons are quite willing to allow electro energy exchange and transport of electrons. So copper is a good conductor.

The organization of atoms and electrons determines the nature of the substance. Atoms seek to have a balanced outer level of electrons as per quantum law. This is the nature of atoms and it is calculated in the Mendeleev table of elements. Atoms seek to find the balance of the noble elements. This is the lesson from 10th grade chemistry. It is a simple lesson that tells us just how all atoms combine to make molecules. This lesson is based in Quantum theory. Those to say that quantum theory is not relevant to biology are expressing a rather concerning ignorance.

Molecules can be very very complex. But all of them are made of electrons, protons, neutrons etc held by Quantic forces. These molecules all have a structure of their outer electrons that can be assayed by the voltammetric signature. Voltammery is the science of electrodes checking the individual style of electron and proton interaction. This is how every substance reacts to another, the outer electrons never touch but the field interaction as determined by voltammery is a definition of how they work.

Every atom or molecule can be balanced, positive charge, negative charge, or combination of both. This depends on the amount of protons and electrons. This is Basic grade school science.

The charged particles that travel make a current flow. The amount of charged particles in the amperage, the pressure or potential of the flow is the voltage, the resistance to the flow is the resistance. All organisms use this electrical flow of charged particles for each and every biological process.

The electron is the smallest charged particle to move, and most of electricity is of the traveling electron. But protons and ions range from the small to very large.

The outer electrons of a plant are taken to higher energy states thru the QED phenomena known as photosynthesis. These electrons are most often stored in carbohydrates and natural sugars. The body use them for energy, making ATP from the electrons.

Energy transfer in the body takes place in many voltammetric ways. Water has free protons and free electrons and thus it is essential for life. Water does not conduct electricity, unless there are some mineral salts or electrolytes in the water. But as in the salt water the body has lots of water and
electrolytes. Thus the body electric can thrive. REF

Fish like the shark swim and thus live in an electrolyte conductive medium. They develop electrical sensing systems, and can detect foods by their voltammetric signatures. In other land creatures like humans this electro sense is transferred to the skin and nose. But still voltammetric sensing of items are the basis for life.

We have the sense of sight for photon sensing, hearing for sound vibration detection, feeling for movement, pressure, heat, cold, balance, and the alkaline acid balance of chemicals. Smell and taste are voltammetric shape receptors sensors. (REF 2004 Nobel prize + electro sense). The largest gene family of our DNA is dedicated to the smell, over 3% in humans, 7% in some animals. All of our senses are electrical in action and transfer mechanism. Some of our sensory system is directed to our verbal or conscious mind and most to our non-verbal unconscious.

In the human body there is massive transfer of electrical signals. The flow of food entering the colon during digestion is based on static electrical attraction. Water facilitates the entire body electric. The body heat is photonic and also contributes to information transfer. If we look at the body human with today's modern science of QED and electronic physics, a whole new science develops a world different than the synthetic drug and surgery medicine we have today. Today's so called modern medicine is based on a 200 year old reductionism 17th century Newtonian antiquated physics. A true new modern medicine of the body electric opens the door to a more affordable, sophisticated, safer, and more efficient modern medicine. (REF Body Electric, Science over Convention)

There is resistance to the flow of electricity. Louis Ampere discovered amperage, Volta discovered Volts, and Dr. Ohm put a law together to describe the relationship in terms of resistance. Resistance is in Ohms and Ohms law states that voltage equals amperage times resistance. This is the first week of electronics class usually taught in 9th grade physics.

The right hand rule describes the fields around a flowing current. And it says that as current flows like your outstretched right thumb, a magnetic field is made at 90 degrees like your outstretched forefinger, and a static field is made at 90 degrees like your outstretched middle finger. Thus the fields of electricity are described. This is the second week of electronics class usually taught in 10th grade physics.

So all electrical action or flow of electricity generates a three dimensional field, at least. So we called the process of measuring this field the trivector. This is a type of 3-dimensional voltammetry.

Voltammetry is the science of understanding how a substance's electro-magnetic field reacts with it's environment. A hormone has electrons and protons and how they are placed in a 3 dimensional space will determine how it exchanges electron-magnetic action and this is measured by measuring the 3 dimensional effect of it voltammetric field. The amount of charged particles is the amperage, the pressure or potential of the charged particles is the volts. Basic 7th grade physics. Every compound having it's own individual and distinct voltammetric signature field. REF Voltammetry

Volts times amps is a power index or what is known as Watts. Once we measure simple variables we can easily calculate a great variety of electrical forces. We can thus calculate volts, amps, ohms, reactance, susceptance, watts, capacitance, inductance, impedance, and other virtual mathematical calculations.

Knowing that reductionism has filed as a way to analyze the human body we can make more global measures of these energies of a human, compare them to norms, and then using safe micro-current stimulation change them.
We can detect and affect the body electric is safe and effective ways. The SCIO system is designed and registered to do just this. To detect and affect, EEG, ECG, EMG, GSR, electro-osmosis, trauma tissue, wounds, pain, charge stability, acid alkaline balance, voltammetric reactance of substances, oxygenation, hydration, redox potentials, electro-acupuncture, bio-resonance, super-learning, and other bio-electric functions. All from simple basic science taught in our schools today. REF clinical evaluation

Life must keep Potassium inside the cell and Sodium outside of the cell. The natural thermodynamic balance is for them to gravitate to be equal. So potassium has a natural pull to go out and sodium to go into a cell. Because the concentration gradient for potassium is directed out of the cell, while the concentration gradient for sodium is directed into the cell, there is a need for a sodium pump to stabilize the life of the cell. This takes the energy of ATP to operate the sodium pump. The sodium-potassium pump transports 2 potassium ions inside and 3 sodium ions outside at the cost of 1 ATP molecule. There should be twice as much potassium as sodium in the healthy human body.

Membrane potentials are defined relative to the exterior of the cell; thus, a potential of −70 mV implies that the interior of the cell is negative charge relative to the exterior. Life is electrical.

Factors that influence the body voltage and membrane potential are fatty acids in the cell membrane, minerals, especially salts, hydration water, oxygenation, stress, toxins, and life style. The SCIO has been proven in tests to increase the electrical potential of the body. Increased cellular membrane potential makes osmosis increase which increases detoxification, nutrient transfer and absorption, hydration, oxidation, and all cellular functions in general.
small electro-potential stimulation. The membranes shown above have different electro-potentials across them. The main factors of membrane potential are membrane consistency which is based on the quantity and quality of the fatty acids and minerals. Calcium is the best universal membranous mineral. So lifestyle, nutrition, and exercise are the first considerations and the SCIO approaches them first in the SOC inventory. The second factors of membrane potential are the existence of the free charges in the body. if the body is acid (as over 80% of our patients are) they crave electrons. The SCIO can supply electrons and electro-stimulation that will increase osmosis, increase membrane transport of nutrients in and toxins out, increasing hydration and oxidation. If there is an alkaline terrain the SCIO can ground out excess electrons and help to balance the body electric while still increasing osmosis.

Slight electro-stimulation is shown to not only increase osmosis, but to have pain reducing qualities (MENS), relaxation effects, mood stabilization (CES), and charge stability. When you charge your car battery you use a trickle trickle charger. It supplies a similar charge to the battery over a long period to tickle and trickle the needed electrons into the battery. The SCIO works this way as well. In the picture of the two cells we see that the sad cell has less electro-potential or is a weak battery. The SCIO sense the proper frequency the patient’s body electric responds to and the trickle tickles the charge into the cells. This increases osmosis and charges the cells back to proper cellular membrane potential.

Just like the tickle trickle battery charger, too much current will not be accepted. The body is especially designed to not accept large charges. A small charge that is much like the body’s own level of volts, amps resistance and oscillation resonance is best to use for charging the body’s cell membrane batteries. The SCIO having measured the body electric factors then applies a stimulus to charge or balance the system and monitors it’s progress with a feedback loop.

Our experimental research shows an increased VARHOPE score after the SCIO treatment proving it effectiveness and safety. The short term effects will be better and longer lasting if they are coupled with life style changes. REF STUDIES

POTASSIUM AND SODIUM

As we have said there should be twice as much potassium as sodium in the healthy human body. But people like salt and producers put more salt into foods to sell and satisfy customers. Potassium occurs mostly in fruit and vegetables. Potassium makes foods turn Orange. So oranges, pumpkin, paprika, squash etc have the most. Most people get too much sodium and too little potassium. This puts pressure on the potassium-sodium pump. This wastes ATP needed for other cellular functions and stress the body electric. The excess sodium makes the body go acid with excess positive charge. This drives the charge stability of the body to the acid state and is reflected in the measurements made from the SCIO. There are many other factors that can upset this electrical balance.

The electro-potential of the cell membrane must be kept inside some strict limits to assure proper electrical activity for life. The cell is an electrical dynamo needing energy for activity. This energy comes from hot electrons (high quantum state energy of electrons in food). The food has gotten it’s energy from the sun’s visible light photons energizing the electrons to higher quantum states. The quantum energy is
broken down in Krebs cycle to make ATP. Photons of heat are released. The cells will have electrical activity that is of a tight range and thus electro-medicine will need to decipher the code of the types of variations in the body electric that hallmark disease states. The cell must fight thermodynamics to live.

The factors of mineral balance especially sodium to potassium is largely a nutritional issue. Too much sodium versus potassium is one of the greatest single health risks today. Oxygenation is also key. Smoking and lack of exercise is epidemic and killing millions. Over use and improper use of doctor prescribed medicines is also killing millions. Too much animal fat, trans-fatty acids, dextrose sugar, processed foods, food additives, environmental toxicity, mercury amalgams, and uncontrolled stress are life style factors that are killing millions of people. So the first place to start with health care is the behavior. Behavioral medicine is a ever growing issue of responsibility in health care. The SCIO devotes its first level of use and design to the education and possible correction of life style issues. It is important to point out the value and importance of correcting these issues for health.
Correlations between whole-body impedance measurements and various bio-conductor volumes, such as total body water and fat-free mass, are experimentally well established; we can measure many different factors of the body electric. First there is skin electro-potential.
Each of these small little batteries we call cells blend in harmony to make the multi-cellular organism we call the human. The hundred trillion cells in the human body act both in series and in parallel to make the electro-potentials of the human body. Most of these cells are surrounded by fluid (interstitial, lymph, blood etc.). These fluids are mostly water with lots of free protons, electrons and minerals which further enhance the electrical factors. The normal cell has a resting voltage potential across the membrane of 70 milli-volts (-70mv). The brain cell will fire at peak voltage of +30mv so as to create a difference of 100 milli-volts.

Thus the body has a measurable voltage and amperage while living. This electro-potential is oscillating and or pulsing. Cells charge and discharge electricity at varying speeds. Global measures reflect trends of the cells in the area to be measured. There are norms of these measures.

The amperage and voltage coming off of the body’s skin is of a range of zero to 5 milliamps and 1.5 volts. Zero is obvious as we all have seen the flat line in a movie telling us the person is dead. Normal people put off micro-amperage and milli-volts, the extreme can be seen at over a volt. The criteria of these potentials are derived from their location and oscillation.

The brain cell will fire with a process called action potential. An action potential is a very rapid change in membrane potential that occurs when a nerve cell membrane is stimulated. Specifically, the membrane potential goes from the resting potential (typically -70 mV) to some positive value (typically about +30 mV) in a very short period of time (just a few milliseconds).

\[
\begin{align*}
+30 \text{ mV} \\
0 \text{ mV} \\
-70 \text{ mV}
\end{align*}
\]

What causes this change in potential to occur? The stimulus causes the sodium gates (or channels) to open and, because there's more sodium on the outside than the inside of the membrane, sodium then diffuses rapidly into the nerve cell. All these positively-charged sodium ions rushing in causes the membrane potential to become positive (the inside of the membrane is now positive relative to the outside). The sodium channels open only briefly, and then close again. This difference makes a potential at the skin measured by the SCIO system, as with all biofeedback systems.

The SCIO measures electro-potential at the 12 harness points in the clear, then applies a voltammetric signal into any or all of the points, then measures the harness points with the applied signal. The amperage and voltage coming off of the non-stimulated body’s skin is usually of a range of zero to 5 milliamps and 1.5 volts. Zero is obvious as we all have seen the flat line in a movie telling us the person is dead. Normal people put off micro-amperage and milli-volts, the extreme can be seen at over a volt. The criteria of these potentials are derived from their location and oscillation. Thus we can calculate the base body voltage, amperage and resistance from our readings.

If we measure on the scalp or the forehead as in the case of the SCIO, we can measure the transcutaneous correlate of the activity of brain cells firing in the brain below the point of measure. This is called EEG or electroencephalography. We can ascertain the Brain wave from the oscillation pattern. The
Pattern or rhythm of the brain wave is from 4 hertz as delta waves, 4-8 Hz for theta, 8 to 20 for alpha, and 20 to 100 for beta waves. If we measure the electro potential of the skin and filter out these waves we can get the EEG.

If we measure on the forehead, wrists and ankles as in the case of the SCIO, we can measure the transcutaneous correlate of the activity of muscle cell activity between the points of measure. This is called EMG or electromyography. We can ascertain the muscle activity from the oscillation pattern. The pattern or rhythm of the muscle waves is from 2 to 20 normally with variant spindles up to 1000 Hz. If we measure the electro potential of the skin and filter in these waves we can get the EMG.

If we measure on the wrists and left leg as in the case of the SCIO, we can measure the transcutaneous correlate of the activity of heart cells between the points of measure. This is called ECG or electrocardiography. We can ascertain the Heart wave from the oscillation pattern. The pattern or rhythm of the heart wave is from zero to 2 Hz. If we measure the electro potential of the skin and filter out these waves we can get the ECG. The heart signal is the largest in potential and smallest in time measured in biofeedback.

To measure skin resistance, we must apply a known voltammetric signal as an input and then see how much of it is resisted by the body, most applicably by the skin. The measure the galvanic skin resistance or impedance we need to be able to input a voltammetric signal into the electrode points. This is a variant signal in the SCIO of variant wave forms, and wave potentials. The measured output of resistance is usually non hertzian. Pulsations in resistance reactivity are fractal and non repeating.

The voltammetric signal of the SCIO is of a micro-current nature. The applied signal strength is derived from the base signal strength of the patient body natural. We are of the philosophy that signals exceeding twice the body norm will be considered invasive and the body will react adversely to such signals. We wish to just tickle the body with electro-stimulus near the natural. Thus the upper limits of the SCIO body stimulation output will be 5 volts, and 50 micro-amps. All of this is under the regulatory safety criteria specified.

Thus as seen in the EPFX FDA 1989 registration the SCIO is registered to measure volts and amps at 12 points of forehead, wrist and ankles. Input a voltammetric signal to these points, and then measure the reaction of resistance at these points. The SCIO then can acts as a frequency generator sending out voltammetric waveforms and a frequency counter measuring frequency response.

From these simple criteria a host of electrophysiological data can spin out to assist the SCIO in correcting aberrant electrophysiological functioning. Electro-stimulation is helpful in osmotic stimulation, transcutaneous electro-nerval-stimulation for pain control and injury or wound healing, redox stimulation, and others. The SCIO uses a cybernetic loop of analysis to use this electro stimulation to adjust electrophysiology of the patient.

Smooth muscle intracellular pH: measurement, regulation, and function

Smooth muscle performs many functions that are essential for the normal working of the human body. Changes in pH are thought to affect many aspects of smooth muscle. Despite this, until recently little was known about either intracellular pH (pHi) values or pHi regulation in smooth muscle. Recent work measuring pHi with either microelectrodes or nuclear magnetic resonance spectroscopy is now providing some of this much needed information for smooth muscles. From these studies, it can be concluded tentatively that pHi is the same in different smooth muscles, approximately 7.06 (37 degrees C). This value is very close to those obtained in cardiac and skeletal muscle. It is clear that H+ is not in equilibrium across the smooth muscle membrane; i.e., pH is regulated. Preliminary results in smooth muscle suggest that certain aspects of this regulation are different from that described for other muscle types. Changes in pH have been found to produce marked effects on contraction in smooth muscle. Of particular interest is
the fact that, unlike striated muscles, some smooth muscles can produce more force during an intracellular acidification.

**VARHOPE and Stress**

The above diagram shows a key little known fact of biology. The factors of the wave formations of people differ from person to person. The values shown are not perfect. The height of the curve is the voltage. We take approximately 1000 readings of voltage in a second. The non-aberrant maximum reading is then the correlate of the voltage reading of the SCIO. The area under the curve is the Amperage. After each second we calculate the volume of area under the graph or average and this is the correlate of the amperage reading of the SCIO. Resistance is measured in ohms as we calculate the applied current to received current. Using ohms law we can know calculate amperage more carefully. Each second there is a changing amperage, resistance and voltage measure that reveals trends of the patient’s electrophysiology. Brain wave and heart system amplitude are widely used in electrophysiology. It is surprising that someone would not know of this approach.

Proton pressure or the charge stability of the system affects the polarity and the resting potential. The slight changes in these electrical profiles can be measured. Thus there are definitely electrical values of each patient at multiple globally placed electrodes that make up a VARHOPE profile. These factors are most often controlled by life style behaviors and stress. Slight regulatory balancing from the guided electro-stimulation of the SCIO can also make changes.

Brain wave readings of amplitude can be assayed for peak voltage if we reduce aberrant noise. Averages give us a more current (amperage) correlate of the systems electrophysiology.

In conclusion:
Lies, rumors, and innuendos have led to slander and liable as well as collusion and prejudice against me and the companies I consult for. This disturbing and illegal prejudice is being investigated and pursued. I would hope that a resolution and honest discussion could ensue to allow all to see that the SCIO device is safe, effective and fully compliant with worldwide regulations.

List of just some articles that refer to voltage amplitude.

**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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**Michael Linden¹ Thomas Habib¹ and Vesna Radojevic¹**

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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 reduced inattentive behaviors as rated by parents (p<.05). The significant improvements in intellectual functioning and attentive behaviors might be explained as a result of the attentional enhancement affected by EEG biofeedback training. Further research utilizing improved data collection and analysis, more stringent control groups, and larger sample sizes are needed to support and replicate these findings. Page 3. EEG Biofeedback for ADD 37 Research efforts into new treatment options are vital considering the extent and intractability of these disorders. ... This finding of underarousal correlates with low *amplitude* in EEG beta frequencies found in this population.

**Descriptor Key Words** EEG biofeedback - attention deficit disorder -
attention deficit hyperactivity disorder - intelligence - learning disabilities

This research was supported by an equipment grant by Autogenics Systems. Portions of this paper were presented at the annual convention of the Association of Applied Psychophysiology and Biofeedback, March, 1993 in Los Angeles and at the annual meeting of the Biofeedback Society of California, November, 1992 in Monterey, California. The authors gratefully acknowledge Todd Fischer and Paul Clopton for their valuable assistance in statistical analysis for this article.

Human EEG gamma oscillations in neuropsychiatric disorders
Clinical Neurophysiology, Volume 116, Issue 12, Pages 2719-2733
C.Herrmann, T.Demiralp

Abstract
Due to their small amplitude, the importance of high-frequency EEG oscillations with respect to cognitive functions and disorders is often underestimated as compared to slower oscillations. This article reviews the literature on the alterations of gamma oscillations (about 30–80Hz) during the course of neuropsychiatric disorders and relates them to a model for the functional role of these oscillations for memory matching. The synchronous firing of neurons in the gamma-band has been proposed to bind multiple features of an object, which are coded in a distributed manner in the brain, and is modulated by cognitive processes such as attention and memory. In certain neuropsychiatric disorders the gamma activity shows significant changes. In schizophrenic patients, negative symptoms correlate with a decrease of gamma responses, whereas a significant increase in gamma amplitudes is observed during positive symptoms such as hallucinations. A reduction is also observed in Alzheimer's Disease (AD), whereas an increase is found in epileptic patients, probably reflecting both cortical excitation and perceptual distortions such as déjà vu phenomena frequently observed in epilepsy. ADHD patients also exhibit increased gamma amplitudes. A hypothesis of a gamma axis of these disorders mainly based on the significance of gamma oscillations for memory matching is formulated.

Discourse on the development of EEG diagnostics and biofeedback for attention-deficit/hyperactivity disorders
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Abstract This article presents a review of work that my colleagues and I have been doing during the past 15 years developing a rationale for the diagnosis of attention-
deficit/hyperactivity disorder (ADHD) and treatment of ADHD employing EEG biofeedback techniques. The article first briefly reviews the history of research and theory for understanding ADHD and then deals with the development of EEG and event-related potential (ERP) assessment paradigms and treatment protocols for this disorder, including our work and that of others who have replicated our results. Illustrative material from our current research and child case studies is included. Suggestions for future experimental and clinical work in this area are presented and theoretical issues involving the understanding of the neurophysiological and neurological basis of ADHD are discussed.

... This disorder is primarily found in boys (James and Taylor, 1990), with the ratio of boys ... (1992), in a study of children with ADHD, found an increase in absolute amplitude in the ... The ADHD children were found to have EEG frequency distributions that resembled profiles typical of

Physiological studies of the hyperkinetic child: I

JH Satterfield, DP Cantwell, LI Lesser ... - American Journal of ..., 1972 - Am Psychiatric Assoc
... We feel that in the absence of known etiology or pathogenesis, as in the more common psychiatric disorders, marked differences in response to adequate trials of the same ... The mean resting EEG amplitude and the range of the mean resting EEG amplitudes were also computed ...

Event-related EEG/MEG synchronization and desynchronization: basic principles
G Pfurtscheller, FH Lopes da Silva - Clinical Neurophysiology, 1999 - Elsevier
... In addition it was also shown that visual stimuli can reduce the amplitude of the ongoing EEG amplitude (Vijn et al., 1991), thus demonstrating that the model assuming that an ERP can be represented by a signal added to uncorrelated noise does not hold in general. ...

Brain and human pain: topographic EEG amplitude and coherence mapping
ACN Chen, P Rappelsberger - Brain Topography, 1994 - Springer
... awake states, sensory ac-tivation, cognitive processing, learning, stress and emotionality, mental disorders, effects of ... and pain, the tasks of this study were: (a) to employ both amplitude and coherence analysis in pain study, (b) to expand the EEG recording channels ...

... CT scan and sensorimotor EEG rhythms in patients with cerebrovascular disorders

... Fifty subjects with cerebrovascular disorders and motor deficits, all able to perform a voluntary ... From the mu rhythm, the hemispheric asymmetry in amplitude and ERD during movement (ERD ... Comparisons of CT scan data and EEG findings indicate a high correlation between ...

EEG biofeedback training and attention-deficit/hyperactivity disorder in an ...

DP Carmody, DC Radvanski, S Wadhwani ... - Journal of ..., 2000 - informaworld.com
... on the most frequent methods of treatment of Attention Deficit Hyperactivity Disorder (ADHD) over ... either by inhibiting high-ampli-tude theta activity or by rewarding high-amplitude beta activity. For the participants who decreased their slow EEG activity, changes were found on a ...

Evaluation of the effectiveness of EEG neurofeedback training for ADHD in a ...
JF Lubar, MO Swartwood, JN Swartwood, PH O' ... - Applied ..., 1995 - Springer
... aspect of the electrical activity of the brain such as the frequency, location, amplitude, or duration of ... or to enhance certain types of EEG activity and decrease other types of EEG activity when ... above) and the inhibition of theta activity in the case of Attention Deficit Disorders or the ...

Sleep bruxism: an oromotor activity secondary to micro-arousal

sagepub.com [PDF]
T Kato, P Rompre, JY Montplaisir, BJ ... - Journal of Dental ..., 2001 - jdr.sagepub.com
... frequent and the burst amplitudes are higher in SB patients than in normals ... abrupt change in
the frequency of cortical EEG that is occasionally ... snoring, apnea, periodic leg movement syndrome, or insomnia) or medical disorders (eg, psychiatric, neurological, or movement ...

M Fink - Annual review of pharmacology, 1969 - Annual Reviews
... In some rigorous EEG quantitative studies, threshold drug effects were observed when a simple reaction-time task was periodically introduced with the EEG frequency and amplitude changes measured immediately after correct performance of the task (46, 47, 50). ...

MS Buchsbaum, E Hazlett, N Sicotte, M Stein, J Wu, ... - Biological ..., 1985 - Elsevier
... Day 0 predrug minus day 0 Benzodiazepine EEG in Anxiety Disorder BIOL PSYCHIATRY 835 1985;20:832-842 postdrug (2 hr) and day 0 predrug minus day 14 group means and t-tests for the ... 1985 ;20:832-842 Figure 1. Change in EEG amplitude with drug administration. ...

DJ Kupfer, FG Foster, P Coble, RJ ... - American Journal of ..., 1978 - Am Psychiatric Assoc
... Page 2. EEG SLEEP AND AFFECTIVE DISORDERS Am J Psychiatry 135:1, January 1978 70 ... schizo-affective disorder. All EEG sleep records were scored independently and without knowledge of the patient's clinical diagnosis. The sleep values for each of the 95 patients rep- ...

M Matsuura, Y Okubo, M Toru, T Kojima, Y He, Y ... - Biological ..., 1993 - Elsevier
... 8.3 (I.0) 41 (36, 5) 8.6 (1.0) 26 (17, 9) 8.2 (1.6) 87 (55, 32) 8.1 (1.5) 29 (19, 10) 8.0 (!.9) aADDH: attention deficit disorder with hyperactivity. amplitude theta with 30 p,V or more, and consecutive alpha with three or more waves). Calculation of Hypothetical EEG Maturation Material ...

A Burgess, J Gruzelier - Electroencephalography and Clinical ..., 1993 - Elsevier
... L., Ahn, H., Easton, P., Fridman, J. and Kaye, H. Neurometric evaluation of cognitive dysfunction and neurolog- ical disorders in children. ... Pollock, VE, Schneider, LS and Lyness, SA Reliability of topo- graphic quantitative EEG amplitude in healthy late-middle-aged and elderly ...
