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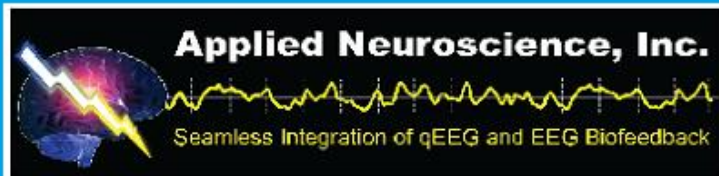
Abstracts 6th Annual Conference Society for the Study of Neuronal Regulation, September 10-13, 1998, Austin, TX

PRESENTED PAPER AND POSTER ABSTRACTS: Alphabetical by first author.

Baehr, Elsa, Ph.D. The remarkable effects of "Brain Brightening" in a 70 year old woman.

The concepts of "brain brightening", outlined by Dr. Tom Budzynski, were applied to the neurofeedback treatment of a 70 year old professional woman. The presenting complaints were memory loss and lack of energy. The treatment consisted of 40 sessions and was designed to lower frontal slow waves at FP1 and FP2, and to increase beta at F3. The client was experienced in meditation, and her levels of alpha were comparatively high at the onset of therapy. Audio-visual stimulation, and practice on "Thinkfast" was used adjunctively during the therapy. Pre and post MicroCog tests demonstrated significant improvement in cognitive functioning. Behavioral changes included an increase in energy and creativity, improved mood, and weight loss.

Bars, Donald R., Ph.D.; F. La Marr Heyrend, MD; C. Dene Simpson, PhD; James C. Munger, PhD; & Tracy McDonald, BA. Electrophysiological Indicators of Attention-Deficit/Hyperactivity Disorder and Mood Disorders.

This paper presents the results of an on-going quasi-experimental research project investigating the use of quantitative electroencephalographic (QEEG) and visual evoked potential (VEP) studies as aids in the differential diagnosis of children and adolescents commonly grouped under the umbrella of Attention-Deficit/Hyperactivity Disorder (ADHD). Participants were 329 individuals (199 not medicated at the time of testing) between the ages of 6 and 18, evaluated over a two year period. Individuals were organized into four groups by the electrophysiological data: (1) Attention-Deficit/Hyperactivity Disorder (ADHD), (2) Affective disorder (Affective 1), (3) Affective disorder with VEP indicators of explosive and/or ruminating behaviors (Affective 2), and (4) ADHD with VEP indicators of explosive and/or ruminating behaviors (MIX ADHD). The sample sizes were 43, 83, 118, 85 (23, 47, 78, 51 non-medicated) respectively. The distribution of Mu activity across these groups and relationships to behavioral variables was analyzed. The effect of medication on the EEG was evaluated by comparing the electrophysiological patterning of the entire sample to those found in individuals not medicated during the recording session. Statistical analysis of QEEG absolute power, across all standard frequency bands (delta, theta, alpha, beta), at two frontal and two occipital electrode positions (F3, F4, O1, O2), revealed that each group could be significantly distinguished (p's < .001). While medication affected the statistical significance levels there were no changes in the specific electrophysiological activity of each group. The relationship within the distribution of absolute power remained constant, even if the individual was on medication. The number of individuals with Mu activity from the entire sample was significantly higher than seen in reported normal samples and the ADHD and Affective 1 groups produced significantly more than the other two groups. The results suggest that it is possible to utilize electrophysiological data to obtain more precise diagnostic placement of individuals with ADHD and affective disorders, enhancing therapeutic specificity and outcomes. The results will be reviewed for their application in therapeutic interventions with individuals who present with ADHD symptomatology and a dialogue will be initiated about the significance of Mu activity to behavior and learning.

Broussard, Michael, Ph.D. The Relationship of Adult EEG Characteristics During Cognitive Performance to Attention Deficit Disorder.

This study is intended as a reference point to establish EEG correlates of cognitive task behaviors to resting state baselines in Attention Deficit Disordered (ADD) adults. Eleven high ADD and eleven low ADD adults were assessed using Quantitative EEG (QEEG). Seven two Hertz bands from 3 to 17 Hz of mean magnitude data were analyzed during seven conditions including two baseline eyes open and eyes closed tasks, and three cognitive conditions of math, reading and vocabulary. Results indicated significant differences in low and high theta bands in frontal derivations during resting states, progressing to

predominantly posterior right hemisphere derivations during cognitive task engagement. Significant differences (p=.01) were found in the 3-5 and 5-7 hertz bands primarily in frontal-central derivations. These attenuated in the next level of activation, eyes open tasks. In the cognitive tasks of math, reading and vocabulary, significant differences shifted to posterior and predominantly right parasagittal and right temporal derivations. There were few significant differences above 9 hertz, and differences in the 7-9 hertz frequency range were predominant in parietal derivations with cognitive tasks. The progression of findings from anterior to posterior derivations, and global to focal topography, with changes in frequencies under 9 Hz, provides support for existing theories of neural substrate mechanisms. Significant differences in parietal areas are consistent with findings of cognitive engagement or task processing being localized to parietal and right posterior hemispheric regions. This finding is contrasted with generalized fronto-central differences in ADD populations, which have been previously reported. The data suggest that there are two mechanisms in operation in attention deficit disorder and possibly learning disabilities, disruption in frontal lobe processing during resting states and non-focused attention, with a shift to more posterior, parietal, and right hemispheric regions during cognitive task engagement. These findings are discussed in relation to previous studies of EEG and significant parameters in this type of research.

Budzynski ,Thomas, Ph.D. and Helen Kogan Budzynski Ph.D. Identical Twins: One has Chronic Fatigue Syndrome - Can QEEG Discriminate?

This is a report on a continuing blinded study of identical twins, one of which has been diagnosed with Chronic Fatigue Syndrome. Various measures of the QEEG, such as peak alpha frequency, A3/A1 (high/low) alpha ratio, SMR/theta, ratio of EC/EO alpha, etc. have been applied to the data. The QEEG has also been compared with the Lifespan Database. Common "links," or deviations from the norm in coherence, phase, asymmetry and power have been identified. These should represent the common genetic endowment, while those links not shared should be more reflective of environmental influences including the effects of CFS.

Brown, Valdeane W., Ph.D. and Susan Dermit, Ph.D. The non-linear data analysis of the 21 Hz augmentation training.

The question of the appropriate mathematical tools for analyzing real-time EEG has recently become more complex and chaotic - and that is the good news. As Non-Linear Dynamical Time-Series analysis has gained more precision and acceptance, it has demonstrated interesting trends in EEG patterns as an effect of Neurofeedback - trends which could not be seen through older, linear techniques. Even though Non-Linear Dynamical Analysis may seem more difficult, abstruse or challenging - especially to the mathematically challenged among us - it ultimately makes clinical decision making simpler. Simply being able to conceptualize a system as Non-linear has one particularly important implication for Neurofeedback: Non-linear dynamical system can be influenced or "controlled" through the use of four distinct procedures, regardless of the specific organization, parameters or effects of the particular system being controlled. The implications of this for Neurofeedback are profound. Using

Non-linear dynamical control procedures, simple interventions can lead to profound shifts, and these shifts can be understood functionally, with no particular need for neuroanatomical localization. The recent ascendancy of wideband suppression paradigms at various sites represent one such case, as does the utility of a new augment target: viz. 21 Hz center frequency. In this presentation, non-linear dynamical techniques will be used to demonstrate the increased and systematic spectral effects of the 21 Hz center augment, within a "quasi" wideband suppression paradigm. This direct application of Non-Linear Dynamical Control Procedures has been called the Period 3 Approach, and has broad application across the range of clinical disorders with which Neurofeedback is used. Moreover, the principles underlying this approach can be used with any kind of equipment. Thus, a seemingly complex tool (viz. NLD mathematics), can lead to a simple clinical approach for practitioners that works across the entire range of disorders that respond to neurofeedback.

Chabot, Robert J. PhD(1), Flavia Di Michele MD(1), E.R. John PhD(1) & Pedro Valdes MD, PhD (2). Quantitative EEG profiles and LORETA imaging of children with attention deficit and learning disorders. 1. Dept. of Psychiatry, New York University Medical Center, NY, NY 2. National Scientific Research Center of Cuba, Havana. Cuba.

INTRODUCTION: Differential diagnosis and treatment of children with attention deficit disorder with or without hyperactivity can be difficult when only clinical information about behavior and learning is available. Quantitative EEG (QEEG) may provide useful information that contributes to the process of differential diagnosis,

treatment selection and evaluation, and to an understanding of the Neurophysiology of this disorder. The Neurometric QEEG technique is a sensitive indicator of cortical electrophysiological dysfunction in children and adults with neurological and psychiatric disorders (John '83). This technique can be used to discriminate children with attention disorders from normal children with a specificity of 88% and a sensitivity of 93.7% (Chabot '96a), and from children with learning disorders with a specificity of 84.2% and a sensitivity of 97% (Chabot '96b). Further, we found three major profiles of QEEG abnormality within the ADHD/ADD population, one characterized by an alpha excess, one by a beta excess and the other by a theta excess (Chabot '96b). In the present paper we examined the relationship between QEEG profile type and response to stimulant treatment. We also used the LORETA method which allows an estimation of the 3-D distribution of brain electrical generators to identify the underlying pathophysiology of these three QEEG profiles (Pascualmarqui '97).

METHODS: Attention Disorder Population: All children were referred to the Developmental Paediatrics and Learning Disorders clinic in Sydney, Australia. Children with histories of epilepsy, drug abuse, head injury, or psychotic disorders were excluded. At their initial visit each child underwent a QEEG and a clinical evaluation by a behavioral neurologist with Conners and DSM-III rating scales of inattention, impulsivity, and hyperactivity, measures of reading and math achievement, and the Wechsler IQ test for children also obtained. The result was a sample of 319 children with normal IQ, and 88 with IQ scores between 65 and 85, of which 179 reached DSM-III criteria for ADHD, 165 for ADD without hyperactivity, and 63 who failed to reach criteria for ADD but reported attention and learning problems (OTHER). Repeat behavioral and QEEG evaluations were obtained on 130 of these children 6-10 months after the initiation of treatment with either methylphenidate or dexamphetamine (Chabot '96a, Chabot '96b). Learning Disorder Population: The learning disorder children were those from the studies of John and associates (John '83). Children with hyperactivity were excluded, and all had been selected by their respective school systems because of learning problems. These children had no known neurological disorders. The majority of these children would meet current diagnostic criteria for specific developmental learning disorder (SDLD). This sample included; (1) 127 children (mean age = 11.4 years) whose learning disorder occurred in only one academic area, and had normal full-scale IQ scores, and (2) 115 children (mean age = 11.8

years) whose learning disorder spanned two or more academic areas with full-scale IQ scores between 65 and 84. Normal Population: ALL QEEG measures were compared to a data base of 310 normal children between the ages of 6-16 years. All "normal" subjects were free of neurological or medical disease, had no history of head injury, drug or alcohol abuse, were of normal IQ, showed evidence of normal functioning at home/school for the past two years, and had not taken any prescription medication for at least 90 days prior to evaluation. The reliability of this normal data base has been independently replicated and found to be free of cultural and ethnic bias. QEEG Data Acquisition: Patients were seated comfortably in a sound and light attenuated room during the evaluation. One to two minutes of artifact-free eyes-closed resting EEG was extracted from 20-30 minutes of continuous EEG. Monopolar recordings were obtained using the 19 electrodes of the 10/20 system referred to linked earlobes. Bipolar features were constructed by computer during subsequent off-line analysis. QEEG features computed were absolute and relative power, mean frequency, inter and intra-hemispheric coherence and asymmetry. Each feature was calculated for four frequency bands, for the 19 monopolar and eight bipolar derivations, and compared with the normal data using Z-scores, after transformations to ensure Gaussianity. Low Resolution Brain Electromagnetic Tomography: LORETA was used to localize the neural sources of the absolute power at that frequency band which was most abnormal for two ADHD/ADD clusters to be defined in the results. This was accomplished by applying a mathematical inverse solution to the EEG data at the selected frequency (Pascualmarqui 97). The power localized in each voxel of the inverse solution was log and z-transformed relative to age-appropriate normative distributions of voxel power at each frequency and depicted on slices obtained from the Probabilistic MRI atlas (Evans '94), color-coded for statistical significance (Valdessosa '97).

RESULTS: Our sample included 130 children with attention problems on whom we had both pre- and post-stimulant treatment evaluations. Three different patterns of QEEG relative power frequency abnormality were present. Other QEEG abnormalities were also quite prevalent including decreased alpha mean frequency, frontal hypercoherence, and/or posterior asymmetry with these features contributing greatly in distinguishing these children from the normal population. Across our sample, 85% of the ADHD and ADD children showed either an alpha or a theta relative power excess with 10% showing a beta excess. There was a positive relationship

between QEEG profile type and long-term treatment response to stimulant therapy. Behavioral improvement was seen in 75% of children with beta excess, in 66.7% of the children with an alpha excess, and in 58.2% of children with a theta excess. Further, 16.4% of the theta excess children and 3.7% of the alpha excess children showed increased behavioral problems after treatment with stimulants. A cluster analysis was run on our population of ADHD/ADD and children with learning disorders. This cluster analysis resulted in five clusters, two of which contained 96% of the ADHD/ADD children, with the children with learning disorders evenly distributed across the five clusters. The two clusters containing the ADHD/ADD children showed alpha and theta excess respectively, with the remaining three clusters associated with delta excess, delta plus theta excess, and frequency distribution within normal limits. Note, that while our cluster definition highlights the frequency abnormality, coherence, asymmetry, and mean frequency QEEG features also varied across the five clusters. LORETA z-score images will be shown of the two major clusters found in the ADHD/ADD children separately for the 11 Hz (alpha) and 5.4 Hz (theta) frequency. The LORETA image of the alpha excess cluster at 11 Hz shows primarily cortical abnormalities that are maximal and appear to originate in right parietal cortical regions. The LORETA image of the theta excess cluster at 5.4 Hz shows primarily temporal cortical and hippocampal abnormalities. LORETA images at the 5.4 Hz band for the alpha cluster and at the 11 Hz band for the theta cluster were within normal limits. LORETA z-score images will be shown for a stimulant responder and non-responder for cluster 1 (alpha excess), and for cluster 2 (theta excess) prior to and after long-term stimulant treatment. A positive treatment response was associated with decreased abnormality and a negative treatment response with increased abnormality within these LORETA images.

CONCLUSIONS: (1) In our sample of ADHD/ADD children over 95% showed a neurophysiological abnormality that involved either an alpha or theta excess in a vast majority. Decreased alpha mean frequency, frontal hypercoherence and posterior asymmetry were often present. (2) ADHD/ADD children with an alpha or beta excess were more likely to show a favorable response and less likely to show a negative response to stimulants than were those ADHD/ADD children with a theta excess. (3) ADHD/ADD children form a more homogenous QEEG population than do children with learning disorders. ADHD/ADD children fell into two QEEG clusters (alpha and theta excess), whereas,

the LD children were evenly distributed across five clusters (alpha, theta, delta, delta plus theta excess, or normal). (4) LORETA images indicate that the ADHD/ADD alpha cluster showed evidence of abnormality which originates in parietal cortical regions. The ADHD/ADD theta cluster abnormality appeared to originate in hippocampal and temporal cortical regions. (5) Positive response to stimulants results in a normalization of the LORETA abnormalities. A negative response to stimulants can be associated with increased LORETA abnormality.

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Chabot, Robert (presenter) Prichep, Leslie S., Ph.D.(1,2), Robert Chabot, Ph.D.,(1) and E. Roy John, Ph.D. (1,2)QEEG based treatment response prediction in OCD, dementia, and crack cocaine substance use disorder. 1. New York University Medical Center, Brain Research Laboratories, Dept. Psychiatry, New York, New York. 2. Nathan S. Kline Institute for Psychiatric Research, Orangeburg, New York.

Distinctive profiles of quantitative EEG (QEEG) abnormalities have been reported in many psychiatric disorders. The sensitivity and specificity of QEEG features has also been demonstrated through the documentation of electrophysiological heterogeneity within clinically homogeneous diagnostic categories. In all studies, QEEG features were extracted from 2 minutes of

eyes closed resting, artifact-free EEG recorded from 19 regions, referenced to linked ears. All features were Z transformed relative to age appropriate normative values. Only a selected subset of extracted features were submitted to the discriminant and cluster analyses. Using cluster analysis, subtypes were identified within several populations with DSM-III-R diagnoses including Obsessive Compulsive Disorder (OCD), Cocaine Dependence, and Dementia. In each of these disorders, subtype membership was found to be significantly related to subsequent treatment outcome and/or evolution of the disorder. In most instances, subtype was independent of clinical/demographic features and uniquely related to the electrophysiological characteristics. Knowledge of the pathophysiological profiles related to treatment responsiveness may have predictive value across of range of neuropsychiatric disorders.

Connor, Georgia K., M.A. and Ken H. Tachiki, Ph.D. Neurofeedback and pro-Z supplement.

Nutritional deficiencies are a very common occurrence today. Reduced availability of essential nutrients due to production of food products from lands exhausted after years of use, compounded by poor dietary habits of children, contribute to reduced availability of essential nutrients. The current estimate of deficiency of zinc in diets is 68%. A study of elderly Europeans living at home reported that 87% were deficient in zinc. Pro-Z, a nutritional supplement containing a biologically activated form of zinc, was reported to be an effective clinical treatment for Type II diabetes. Experimental findings indicate the clinical benefits resulting from: a) improved intestinal transport of zinc, b) cellular utilization of insulin, and c) cellular metabolism of glucose. When Pro-Z was taken as a nutritional supplement, an unexpected and marked calming effect on the hyperactivity of patients enrolled for neurofeedback therapy was observed. We report here a retrospective comparison of 4 clinical cases of patients treated for ten sessions of neurofeedback while concomitantly also receiving daily oral doses of Pro-Z. A statistically significant improvement was noted between PRE and POST assessments of hyperactivity, headache and stomachache pain, attention problems and frustration for both treatment groups (with Pro-Z, all $p<0.01$; without Pro-Z, all $p< 0.04$). However, a comparison of the POST 10 neurofeedback session groups showed that Pro-Z supplementation resulted in a greater improvement in scores for pain of headaches and stomachaches ($p<0.001$); and although not statistically significant, lower mean values of hyperactivity (0.62 +/- 0.75 vs.

1.4+/- 0.75; mean +/- SD). The POST scores of the two groups for attention difficulties (1.0 vs. 1.25) and frustration (1.0 vs. .98) were similar. Based on these observations, a study was initiated to investigate the clinical benefits of Pro-Z supplementation. The results of this single blind, placebo-controlled study will be reported. The calming benefit observed with Pro-Z supplementation will be discussed relative to neurofeedback training.

Cowan, Jonathan , Ph.D. The INALL Protocol: Data From a Case Series.

The INALL Protocol for EEG Neurofeedback is a particular type of wideband suppression that inhibits the idling rhythms of the frontal lobe Executive Attention Network. It is derived from the research of Dr. Barry Sterman, in which he showed that inhibition of alpha and theta rhythms signified cortical activation in peak performers such as B2 bomber pilots. I will review prior research data which indicates that rhythmic alpha and theta actually represents an idling rhythm. The QEEGs from one ADD client before and after training on this protocol will be reviewed. Comparisons between the eyes closed resting QEEG and Thatcher's database will be presented, but more emphasis will be placed on the dynamic changes in EEG with changes in cognitive demands. I will also present the results of a pilot test of the INALL protocol using the Peak Achievement Trainer at a local high school. The football coaches picked four participants for the study—two quarterbacks and two players who admitted having trouble following the plays. The latter two were also identified as special education students due to learning disabilities. I tested them with the visual TOVA prior to beginning training and then after completing training with the IN ALL protocol. Due to some missed sessions that could not be made up before the end of school, the number of sessions varied from 5 (two students), to 7 (one student), to 9 (one student). Individual sessions lasted from 20 to 40 minutes each. After 1-2 sessions in which they worked with concentrating on visual displays and sounds, we spent one session focusing on sensing the hamstring muscles, which are very important for fast starting in football. The last 3-5 sessions were spent in performing practices of passing and receiving skills that I modified to allow them to monitor their EEG with the SensorBand except at times when they moved too quickly to get good records. We also used other players to try to distract them as they focused on the plays. The TOVAs for three of the four players were initially abnormal, in that at least one scale had an abnormally low standard score. After training,

none of the TOVA scores was abnormal. In fact, the lowest standard score (average norm set to 100) was a 97. All four of the TOVAs were significantly improved. The average standard score change was 10.5, better than 2/3 of a standard deviation. To my knowledge, these are the most rapid changes in TOVAs ever reported consistently over a small group. The two learning disabled students reported that after the first or second session they were better able to focus in class and their performance had improved. All four students reported an improvement in their weightlifting. Reports ranged from increased effort and interest in lifting to increasing the number of repetitions and the amount of weight.

Crago, Robert, Ph.D. Abnormal QEEG'S in chronic fatigue syndrome patients.

Approximately 20 patients with a medical diagnosis of chronic fatigue syndrome were evaluated using QEEG with comparison to Thatcher's reference data base. The majority of the patient's demonstrated dominant patterns of diffuse alpha with frontal intrusion and often slowed alpha. Some demonstrated dominant theta patterns. This data will be presented with discussion about etiology, differential diagnosis, and treatment. References to other research with similar results will be discussed.

Cull, John G. (presenter)Kenneth Blum 1, 2, David E. Comings 3,, Bruce W. Kovacks 4, 5 John G. Cull 1, 6. A Novel Multiple Additive Associations (MAA) Technique for the Identification of Genes in Reward Deficiency Syndrome (RDS): Diagnosis and Treatment Implications.

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Following the original association by Blum et al. of the dopamine D2 receptor gene polymorphisms (Taq 1 A1 Allele) and severe alcoholism, numerous additional studies have confirmed the association with other impulsive-addictive-compulsive disorders. This includes substance use disorders, smoking behaviors, food bingeing, attention deficit disorders, pathological gambling, pathological violence, and other related behaviors. Common underlying genetic mechanisms account for the expression of these behaviors. These behaviors are complex and polygenic and require more than one gene to express the related phenotype. Impairments of the neurotransmitters in the meso-limbic system either via genetic or environmental mechanisms lead to a brain reward deficiency syndrome. While not all of these disorders have the same genetic anomalies, through a novel polygenic analytical technique, the MAA Technique, we have been able to map specific genetic anomalies to the various RDS related behaviors. We have evaluated over 40 polymorphic genes having differential associations that allow the differential diagnosis of the predisposition or proclivity to these behaviors. For example we examined the polymorphisms at 28 different genes affecting neurotransmitters (including serotonin, opioid peptides, GABA, dopamine, and norepinephrine) and observed through the use of regression analysis and the MAA Technique that 17 genes have an additive effect on the risk of pathological gambling and accounted for 26.6 % of the variance (p 2 x 10-12). Of 29 genes studied in 336 subjects with Tourette Syndrome, 20 were shown to progressively and additively increase the percentage of the variance accounting for the ADHD score, to a maximum of 13.63% (p< 3.0 x 10-11). In contrast in terms of percent body fat we found the dopamine DRD2 A1 allele accounted for as much as 45.9% of the variance (Chi Square = 43.47, df = 1, p< 0.0001) while the dopamine transporter and the dopamine beta hydroxylase genes were not significant. In terms of genotyping subjects for a number of these reward pathway genes, two independent studies revealed differential responses to various medications. Bromocryptine, a D2 agonist, prevented relapse in carriers of the DRD2 A1 allele as compared to the DRD2 A2 carriers. Chromium picolinate, known to change body composition, produced a significant reduction of body fat only in carriers of the DRD2 A1. These studies suggest that genotyping could lead to a more targeted therapeutic approach with greater preventive outcomes. Through the use of non-invasive buccal swab techniques we are developing DNA based tests which will allow differential diagnoses for numerous polygenic disorders including: ADHD (20 genes), aggression and hostility (3 genes), autism (7 genes), conduct disorder (9 genes), eating disorders (6 genes) generalized anxiety disorder (29 genes), learning disabilities (9 genes), nicotine addiction (7 genes), obsessive compulsive disorder (29 genes), oppositional defiant disorder (20 genes), pathological gambling (18 genes), pathological violence (3 genes), posttraumatic stress disorder (3 genes), premenstrual syndrome (PMS) or premenstrual dysphoric disorder (PMDD)(15 genes), schizoid/avoidant personality

disorder (3 genes), substance use disorders(SUDs) (29 genes), tics (12 genes), Tourette disorder (7 genes)7. Key aspects of the MAA Technique include ability to identify the genes involved and to weigh their relative importance and to guide therapeutic interventions, both pharmacological and electrophysiological (including neuronal regulation).

deBeus, Mary, Ph.D. To Q or Not to Q: Use of a Fibromyalgia Case Study in the Discussion of the Relative Merits of QEEG-Based and Behavior-Based Protocols.

This is a case study of a 54 year old, white female presenting with fibromyalgia and various other chronic health problems. In addition to presentation of client history, treatment protocol, pre- and post- MMPI-2 results, and statistical comparison of pre- and post- QEEGs, the relative merits and utility of QEEG-based and behavior-based protocols will be discussed. Initial treatment focused on abnormalities indicated by QEEG results. This led to exacerbation of symptoms. Use of the Othmer protocol resulted in improved symptoms, including reduction of everyday muscle and joint pain, increased cognitive ability, increased level of energy, and better sleep. After completion of at least 30 sessions, a follow-up QEEG showed little to no change in spite of reported improvements. Alpha-theta sessions were started to address psychological factors possibly contributing to fibromyalgia symptoms and to reduce central and frontal beta. Although minimal psychological "issues" emerged, the client experienced an escalation of various physical symptoms that led to re-examination by medical specialists and alteration of prescription medication, which may have been related to the script used during alpha-theta sessions. Although alpha-theta did not appear to directly improve fibromyalgia symptoms, a repeat QEEG did show reduction of central and frontal beta. Repeated measures t tests will be used to compare pre- and post-MMPI-2 results. Repeated measures t tests will also be used to compare QEEG done prior to treatment (and used for initial treatment planning), after completion of Othmer protocol, and after alpha-theta sessions.

deBeus,Mary, Ph.D. Implications for Neurofeedback of a QEEG Study with the Wisconsin Card Sorting Test .

The Wisconsin Card Sorting Test (WCST) is a test of ability to abstract and to use environmental cues to formulate rules for behavior. QEEG was used in this study to describe cognitive processing during performance of this test. Beyond the finding that significant cognitive

functioning is not limited to the frontal lobes during this task, this study has implications for neurofeedback. These include the need for expansion of QEEG assessment to include cognitive measures, need for development of QEEG databases using standard measures, such as neuropsychological tests, and describing underlying mechanisms for behavior-based protocols. Data were used from normal, right-handed subjects. ERP components were statistically analyzed, and significant EEG activity was found in non-frontal areas as well as frontal areas using ANOVAs, post hoc independent t tests, and backward stepwise multiple regression. Topographic maps showed marked bilateral posterior activity followed by left parieto-temporal focus during the post-stimulus condition (after presentation of a card to be matched). Information was then passed to frontal areas. After "right"/"wrong" feedback, prominent activity originated in left and central frontal regions, spread to bilateral posterior regions, and "terminated" in right parieto-temporal regions. This system may explain why some protocols using frontal/central and central/posterior bipolar sites and others using tempo-parietal sites may have success not only with improving cognitive functioning, but also with behavior modulation. They may not only strengthen pathways necessary for efficient cognitive processing, but also for producing behavior appropriate to environmental conditions. The field of neurotherapy may be furthered by studying QEEG during standardized tasks. Information from normals can be used to model desired functioning, with treatment planning focused toward such model functioning. Also, normative databases using such cognitive functioning models may give a better indication of what pathways need to be strengthened or weakened for desired outcomes. This type of treatment planning may be a step beyond using relative power or coherence patterns to isolate "problem" areas, but it may better reflect "real-world" functioning.

deBeus, Roger, M.S. The Effects of Music Training on the QEEG of Preschool Children.

It has been proposed that exposure to music, and hence music training, may excite and enhance the cortical firing patterns used in spatial-temporal reasoning. For example, recent literature has stated that music training enhances performance of temporal-spatial reasoning in college students. However, there have been conflicting results and very few have explored the effects of music training on the QEEG. Literature focusing on QEEG and music training generally covers two areas: comparing musicians to non-

musicians and music training as an experimental condition. QEEG studies identifying regions of the brain associated with the benefits of music training have been limited in number. This line of research, done primarily with children, has produced different results depending on teaching strategies and length of instruction. The purpose of this study was to integrate a standardized music curriculum and to determine how cognitive processing would be affected by this training as evidenced by the QEEG recordings. Methods: A total of 20 preschool children, 10 girls and 10 boys (ages 3 to 5)participated in the study. The children were recruited with parents' permission from a Child Development Center associated with a local university. Each child was brain mapped between 9:00 A.M. and 2:00 P.M. via an Electro-Cap while performing three conditions. First, they stared at a smiley face to measure the eyes open condition. Next, they listened to a Mozart piano sonata through earphones placed over their head. Finally, they performed the Object Assembly subtest from the Wechsler Preschool and Primary Scale of Intelligence - Revised (Wechsler, 1989). Then the participants were randomly placed into a music training group or control group (no music training). The music training group received approximately ten weeks of instruction while the control group received regular classroom instruction. The music instruction included singing, playing instruments, moving, listening, and creating taught by a state certified music teacher. A group of four nationally known early childhood educators reviewed the music lessons and agreed they were typical early childhood music activities. At the end of the music training each child from both groups were brain mapped again as stated above. QEEG data was collected with the NeuroScan SCAN System (Version 4.0).The Analog to Digital rate was set to 500Hz. Data was collected in the DC mode with DC correction of 70%. High and low pass filter settings were set at 30 and 1.0, respectively. The gain was set at 1000x and the 60 Hz notch filter was off per recommendations of the manufacturer. The sampling rate was 256 Hz. Impedance was kept below 3.0 kohms and balanced across all channels within plus or minus 3.0 kohms. Impedance was measured at the beginning and at the end of data collection as a control measure. QEEG editing was performed blind as to group membership (music training or control). Each child's edited segments were averaged together to obtain an average for each task. Then a grand-mean for each group was calculated from the individual means. In addition, a coherence file was created for each child's task and group average. After the average group means for each task and condition were created the data was imported into

a statistical program to analyze the data. The data was broken down into seven bandwidths from 1 Hz to 30 Hz (i.e., Delta, Theta, Alpha, Beta1, Beta2, Beta3, and Beta4). Preliminary Findings: Power and coherence will be analyzed separately for each condition (Listening to Mozart and Object Assembly). Power will be analyzed with a repeated measures MANOVA. The repeated measures factor will be the pre and post brain wave measurement. The within-subjects factors will be electrodes (21 sites), bandwidths (7), and two conditions. The between-subjects factors will be the two levels of instruction. The dependent measures will be the mean amplitudes of the seven bandwidths. Post hoc comparisons will be performed whenever main effects are found to be significant. Finally, difference probability maps will be generated for each condition. Coherence values will be generated for each group (music training and control) and condition (Listening to Mozart and Object Assembly). Then a Wilcoxon Matched Pairs Test will be employed to measure differences between groups by electrodes and bandwidths. Finally, difference probability maps will be generated for each condition.

Deits, Frank. Filtering the EEG; A Matter of Compromise.

The purpose of the EEG filter is to select a specified range of frequencies for recording or feedback, while rejecting all others. The ideal filter would pass the selected band without attenuation, distortion, or time delay. Frequencies outside the selected band would be totally rejected. In other words, the output of the filter would perfectly represent the signal in the band of interest. Unfortunately, in the real world this is not possible. In fact real filters do not even come close and compromises must be made in selecting a filter for a particular use.

This paper will present the relevant characteristics of several of the common filters types used in current EEG instrumentation. It will be shown that no filter has a clear advantage for all uses. Variations in filter response can produce dramatically different data. Successful replication of research or clinical results is dependent upon the way in which the EEG signal is processed. Published research rarely provides sufficient information to understand the effect of the filter process on data.

Evans, James R, Ph.D. Abnormal QEEG Patterns Associated with Dissociation and Violence.

Violent behaviors have been found to be associated with evidence of brain damage/dysfunction in several studies. The frontal

lobes and right hemisphere are the specific cortical sites most often implicated. In examining QEEG records of 52 men convicted of violent crimes and/or having a history of violence, the author has found most abnormalities in these areas. However, the QEEG's of a subset of these men also reporting histories of dissociative type experiences were characterized by specific abnormalities. In six cases there was abnormally excessive relative power in the alpha frequency at frontal sites. These men either strongly denied awareness that they had engaged in specific violent behaviors or were aware they had, but perceived that they were controlled by an external force, e.g. the devil. This is discussed in terms of earlier reports of a correlation of hypnotizability (and by inference, self hypnosis) with excessive alpha power. In three cases paroxysmal delta waves were observed at site F8 (occasionally spreading to F4 and T4) in the raw EEG. In all three cases the men reported engaging in behaviors at times which had no apparent (to them) cause, with some being of a violent nature and occasionally accompanied by delusions. The possibility of this EEG abnormality being a marker for at least one type of intermittent explosive disorder is discussed. These findings, if replicated, appear to have special relevance to the application of neurofeedback in the prevention and treatment of some types of violence.

Graap, Ken , M.Ed. and David Freides, Ph.D. Regarding the Data Base for the Peniston Alpha-Theta EEG Biofeedback Protocol .

Five papers by Peniston and colleagues which form the basis of alpha-theta EEG biofeedback treatment for alcoholism and posttraumatic stress disorder are reviewed. As a result, we raise three questions: 1) Are the samples studied independent? 2) What was the clinical status of the participants prior to treatment? 3) What treatment did the participants actually receive? In seeking answers to these questions we aim to strengthen the data base for neurofeedback with specific procedural information so that claims of efficacy can be tested and accepted or rejected on an objective basis. We present a review and pose questions regarding some of the details of papers published by Peniston and colleagues (i.e., Peniston, 1986; Peniston and Kulkosky, 1989, 1990, 1991; & Peniston, Marrinan, Deming & Kulkosky, 1993) who first presented the results of biofeedback treatments for posttraumatic stress disorder (PTSD) and alcoholism. The questions concern the nature of the data, the characteristics of the participants and the strategy of treatment. We begin with brief reviews of these research reports.

Gunkelman, Jay, QEEGT. Electrophysiological Assessment of Frontal Lobe Function in ADD/ADHD with EEG/qEEG and EP.

In July 1997 Ernst Neidermeyer, M.D. published a brief theoretical article theorizing a disconnection syndrome in ADHD. This lack of frontal lobe inhibition/regulation would account for the hyperkinetic dyscontrol. He failed to detail the circuitry involved in this disconnect. I will attempt to detail this regulatory loop. Neidermeyer also locates areas responsible for more purely attentional control, and emotional regulation. Based on the esteemed reputation of the author, I retrospectively reviewed data where there was a pure clinical profile and with comorbidity. The cases I will present are representative of the profiles of this larger review. The first case is that of a purely attentionally disturbed client. The P-300 has a "dead" area from the time the response arrived cortically through to a point beyond the P-300's decay. This area was uninvolved in the entire P-300, start-to-finish. The same phenomenon is noted for a purely depressed patient, though with a different distribution, as predicted by the Neidermeyer article. A hyperactive patient with minimal attentional complaints had the premotor area involved as predicted too. The graphic correlation of the spectral plots of single Hz. topographic mapping and the P-300 plotting will be included. The rest of the presentation will be done showing the P-300 maps for these patients and displaying the premotor disconnection circuitry involving the basal ganglia, especially the Caudate (shown in SPECT and PET studies to have major perfusion changes in ADHD).

Gunkelman, Jay QEEGT. Lambda EEG activity.

Evaluating the brain under task, such as mental math or reading, adds significantly to the evaluation. Task dependent slowing reflects the strain from the stress of the task and the higher alpha to lower alpha ratio signals level of vigilance shifts (F Schober et al., neuropsychobiology 1995;31:98-112). Not all slowing represents the strain from a task, the slower frequency normal variants are not strain. There are normal variants, and the proper interpretation of qEEG requires knowledge of their appearance in the mapping. Lambda is one such normal variant, originally described by Y. Gastaut (1951), and Evans (1949). Lambda is extensively reviewed by Chartrain (1976). It is most prevalent in children, waning following puberty, eventually seen in only 36% of the 31-50 year age range (Tsai and Liu, 1965). There is a variant of lambda seen in 1-3 year olds associated with eye blinks as well

(Westmoreland and Sharbrough, 1975). Lambda may represent the occurrence of a singular visual evoked potential (VEP), as the location, morphology and periodicity would attest. This same waveform may be seen with eyes closed during visual imagery as "lambdoid" activity. The lambdoid activity would not be expected to have a retinal genesis, though the lateral geniculate of the thalamus is likely involved. Positive Occipital Sharp Transients of Sleep (POSTS) is yet another name for activity with lambda's same morphology, periodicity, polarity and distribution. The true singular nature of these various terms is discussed by Neidermeyer. The proper interpretation of lambda's mapped image will depend on the identification of lambda in the raw EEG. The discrimination between lambda and other slow activity based on the mapping is not possible. This differentiation will require visual discrimination of the raw waveform based on pattern recognition. Examples of the morphology and distribution of the waveforms as well as the mapping of these various presentations will be done. The implication of lambda for occipital electrode NF protocols will be discussed.

Hammond, D. Corydon, Ph.D. EEG Patterns Associated with High Hypnotizability: Practical Clinical Implications.

A research summary of the theta literature twenty years ago suggested that there were two types of theta: a drowsy theta, and a theta associated with highly focused attention and involved in complex problem solving, such as doing mental arithmetic. More recent research will be noted that has found a mid-frontal theta (just anterior to FZ and a few millimeters to the left of midline), centering on 6.5 Hz, that is associated with focused attention, is more commonly associated with extroversion, low anxiety, and low neuroticism. Neurofeedback practitioners are generally unfamiliar with the research literature on hypnosis and brainwave patterns. In fact, many neurofeedback practitioners have been exposed to myths and misunderstand hypnosis, falsely perceiving it as not promoting self-regulation. Hypnosis refers to a state of focused attention. Research finds that when initially entering hypnosis, there is a great deal of 40 Hz activity, followed by a shift to theta brainwaves, particularly in the frontal regions, in the range of 5.5 to 7.5 Hz--the middle point of which is also 6.5 Hz! High hypnotizable persons exhibit more theta (5.5-7.5 Hz) brainwaves than low hypnotizables, both in a waking state, sitting with their eyes closed, and while in hypnosis. Some literature also suggests that mental imagery, such as we use in both alpha-theta training and in hypnosis, may be particularly focused in this range at about 6-7 Hz. Given unique capacities associated with this range of theta activity, the routine use of theta inhibit programs should be questioned. High hypnotizables are found to manifest cognitive flexibility and very special capacities, including higher creativity and abilities to powerfully influence body processes (e.g., in asthma, GI disorders, hemophilia, wound healing), including the capacity to produce profound analgesic relief equivalent to or greater than that produced by morphine. The relevance of this literature to clinical practice and for increasing a person's self-hypnotic capacity will be discussed briefly. There will also be discussion of the beneficial use of positive suggestions during alpha- theta training. It is believed that persons utilizing clinical hypnosis can benefit from adding neurofeedback skills to their repertoire, and that clinicians utilizing neurofeedback (particularly with alpha-theta training) can benefit from learning more about utilizing hypnotic phenomena and enhancing their skillfulness in providing therapeutic suggestions and promoting imagery.

von Hilsheimer, George, Ph.D., F.R.S.H. The work of D.A. Quirk.

D.A. Quirk died on 3 December 1997. Psychology lost one of its most productive geniuses. Quirk was the first psychologist to have been given full charge of a psychiatric ward in North America. He responded to that challenge by treating the women using GSR biofeedback, discharging 128 of the 150 women in his care, 123 remained free of medicine and were still living independent lives 3 years after discharge. Quirk developed a visual test of partial seizure with complex symptomatology (PSCS) and with this tool saw PSCS frequently among felons. He first treated PSCS with Wolpe's RIT but subsequently (1966) with the author developed an automated desensitization he named SCARS (Stimulus Conditioned Anxiety Response Suppression). Quirk learned from Sterman the use of EEG biofeedback in 1970 and applied the technique to nearly 3000 individuals. He demonstrated a reduction of recidivism from 98% in common practice to as low as 15% in some studies, but never worse than 35% after applying EEG to felons demonstrating PSCS on his test. The author tracked his EEG work with radically different patients and confirmed the value of Quirk's Sterman protocol. Quirk obtained significantly better results using RIT compared to common practice; SCARS compared to RIT; and EEG compared to common penal or therapeutic practice

treating a range of ills from dystonic homosexuality, through pedophilia, arson, anxiety, rage, violence, and schizophrenia.

Ibric, Victoria L. , MD, PhD, Surinder Kaur, PhD, and Charles J. Davies. Various diagnostic cases treated with neurofeedback using Roshi/neurocybernetics - preliminary results.

Various diagnostic cases ranging from Attention Deficit Disorders, with or without Hyperactivity, Autism, Dyslexia, Sleep Disorders, different Chronic Pain Syndromes, Memory Impairment, or Anxiety/ Depression symptomatologies, have been treated on Neurocybernetics for different number of sessions, and switched to Roshi protocols. Roshi protocols have been designed according to the predominant symptom that needed correction at the time of the change from one type of instrumentation to the other. The progress of the Roshi training has been monitored, either concomitantly on the Neurocybernetics, or after a certain number of Roshi sessions, and checked by a subsequent Neurocybernetics session. In parallel, Roshi sessions (30 minutes in length) have also been recorded on the Amiga system for further analyses. At this time we would like to mention some important observations drown from the Roshi training: 1) the patients seem to be able to stay awake most of the time while on the training, and at the end, they feel energized; 2) the high energy level reported at the end of each session, is constantly kept for a week, at least; 3) the peak performance is accomplished in a record time (patients report feeling more centered, and detached and also they feel that the time expanded, being able to perform tasks in less time, than before Roshi); 4) the emotions, depression or anxiety may be controlled by working in the frontal areas, improving the interhemispheric communications, and achieving a controlled synchrony, with an increased neuronal efficiency. 5) Patients with high blood pressure, when treated on Roshi for beta enhancement, did not exhibit an increase of the blood pressure readings, as observed when treated with beta enhancement on the sensory motor area. The various protocols will be presented. Some side effects observed in certain complex cases, will also be discussed. Keywords: Neurofeedback, Neurocybernetics, Roshi, ADD, ADHD, Depression, Anxiety, Memory impairment, Sleep Disorders, Chronic Pain.

Ibric, Victoria L. , MD, PhD. Neurofeedback in major depression associated to addictions - a case study.

Depression has been treated for some time with Neurofeedback (NF) and different authors presented different modalities in terms of the electrodes localization, or enhanced or inhibited frequencies (see Othmers, Peniston, Rosenfeld,). The case I am presenting, is a 43 years old Caucasian female with familiar major depression and addictions. The causality of her major depression may also be routed in her early childhood experiences (she lost her father, when she was 12), or may be an expression of a complex PTSD developed later in life (when, her already detached and chronically depressed mother has been diagnosed with Alzheimer). She started to use drugs and alcohol as self medication. Her depression has been treated medically and with psychotherapy, since childhood, to no avail. From the EEG stand point, she did not exhibited the characteristic signature of depression (lower brain waves amplitude of all the frequencies or only low beta amplitude), rather than she had a low level of arousal, characterized by high amplitude of alpha and theta, great variability of all the BW frequencies, and narcoleptic behavior. She 's been committing a silent suicide, becoming bulimic, obese, isolated. She called the last 3 years of her life "THE DEAD YEARS". When she started the NF she had, as she stated, " nothing else to do and nothing to loose". Only in one month of beta training she completely wined herself off the medication (Lithium, Prozac and Synthroid) and also she did quit smoking, without even wishing to quit. Her emotional make up, from depressed switched to more anxious and angry. Adjustment, from C3-beta to C4-SMR has been needed. However, all along each session has been a battle for the patient to stay awake. Persistency was the key, for 40 sessions done as 2-3 sessions per week; thereafter, up to the session 60th, the NF has been done only once a week, and the gains where kept. Meantime, she started to exercise and lost 15 lbs in 2 months. The alpha inhibit in the left frontal area (Rosenfeld protocol) hasn't been successful, and the alpha-theta protocol (Peninston), threw her back in depression. All these sessions had been done on the Neurocybernetics. Post 60 sessions we started a new protocol on Roshi. The Beta-17 enhanced over the frontal area and light complex stimulation, lead to a better interhemispheric synchronization. The protocol will be presented. Only after one session on Roshi, the level of her energy increased and stayed steady high for a full week. She started to write her life story. The progression was remarkable, and at a rhythm of one session per week, a steady level of well being was observed. (Important note: during the Roshi training patient never fell asleep). No more drugs or alcohol, no more smoking, no more Depression. She started to live again!!! Keywords:

Neurofeedback, Major Depression, Addictions, PTSD, Neurocybernetics/Roshi protocols.

Isaacs, Julian, Ph.D. Alpha-theta feedback in groups; new equipment and findings.

The cost of neurofeedback conducted on a one-on-one basis has previously limited its applications. The present paper explores the development of an inexpensive method of delivering EEG feedback to groups, suggesting its use in group settings for neurological remediation, peak performance and for group alpha-theta feedback. A novel, prototype neurofeedback system was configured to supply simultaneous, individual, sound-only feedback to groups of twelve individuals. This system was used in 1996 and 1997 to supply alpha-theta EEG feedback to groups, led by Julian Isaacs and Patricia Fields, participating in five day workshops for psychospiritual development at Esalen Institute. Participants reported rewarding and growthful experiences during the course of their alpha-theta feedback sessions. EEG data was recorded for sessions and comparison of experiential content with EEG records suggests that prior experience of non-drug altered states is one important factor mediating the effectiveness of alpha-theta feedback as a state induction technique. It was found in the workshops that the group setting seems to potentiate the effect of alpha-theta feedback through a number of factors which will be reviewed in the presentation. Previous reports of sound-only feedback used for ADD remediation suggests that this approach may not be limited to alpha-theta applications and the possible uses of such a system for other applications will be outlined together with descriptions of the technical aspects of the system and results of the two workshops.

Isaacs, Julian, Ph.D. "EFT" - A novel psychological intervention adjunctive to neurofeedback.

Several neurofeedback practitioners have found a novel psychological intervention helpful in treating child clients and their experiences and case studies will be outlined in this presentation. The technique is known variously as "TFT" - "Thought Field Therapy" and "EFT" - "Emotional Freedom Technique". Although in need of controlled research to back its claims and elucidate its mechanisms of action, the technique merits attention from neurofeedback practitioners for several reasons. First, it certainly appears to be highly effective. Second, it is uniquely suitable for children because it does not require the introspective skills required for conventional psychotherapy. Third, it works quickly and in a

few minutes can effectively resolve negative emotions, even treating long term phobias. Fourth, it is very safe to use and at the most basic level is easy to learn, so that lay persons may use it safely and effectively. Fifth, it incorporates a conceptual schema and practical techniques to diagnose and treat self-destructive conflicts. As a result, it may prove helpful in treating oppositional and resistant, chronically "failure-prone" individuals. Finally, the technique may be of profound theoretical importance because it may illustrate the possibility of neurological effects being caused by interventions analogous to acupressure treatment. EFT involves tapping on acupuncture meridians. Some acupuncturists claim to successfully treat neurological conditions and uncontrolled, prima facie, evidence of effectiveness seems to exist. Diagrams of acupuncture meridians show meridians transversing the brain. EFT may therefore be hypothesized to work by the activation of acupuncture meridians traversing the brain which then modulate interactions between the hippocampus and amygdala. If this is so it may be possible to use EEG techniques to research responses to EFT. EFT may be an example of a previously unsuspected class of mechanisms whereby central neurological processes may be altered.

Isaacs, Julian, Ph.D. - Can we bring sight to the half blind?

The restoration of sight to the blind has a powerful archetypal significance in Christian cultures. If a technique to restore full sight to hemianoptic stroke patients could be developed this would likely gain wide positive attention for neurofeedback as a remedial modality. The presently reported case study suggests that a combination of light stimulation (LS) and neurofeedback (LS/NF) may possibly remediate the hemianopsia of stroke. Although sight has NOT yet (as of session 28) been restored to the patient, if successful, there may be some far reaching implications generated by the technique which make it important to communicate the essentials of the method as soon as possible to promote research and to prevent proprietary ownership and patenting of the method. It is recognised that this study represents a very early stage development of the technique, being work in progress, having many deficiencies even as a case study. The patient was a 72 year old man who on 11/29/97 suffered a right thalamic stroke, causing left hemianopsia, left hemiparesis and left sided neglect. On sight testing it was found that the left visual field was entirely non-functioning. Pre-treatment EEG evaluation consisted of a QEEG and a visual evoked potential (VEP) study which

showed abnormal responses in the central areas and in the right hemisphere, with positivity responses being largely restricted to the left hemisphere. The patient's wife reported him as showing cognitive impairments consistent with the results of a post-stroke, pre-treatment neuropsychological evaluation. A total of 28 NF sessions were conducted, of which 25 used LS. It was found that response to treatment was rapid. Other clinicians using the LS/NF combination in other applications have previously reported similar acceleration of remediation. A stable protocol was developed and suggestions for further development of the protocol will be presented. After the 22nd LS/NF session a partial QEEG and complete VEP were again performed. The VEP shows marked improvement over the pre-treatment VEP although it is not entirely normal. This subject was completely hemianoptic and treatment of partially hemianoptic individuals may be easier. The partial QEEG shows increases in beta content in right posterior areas previously showing subnormal beta profiles. A repeat QEEG is planned after session 40. The subject's ability to remain awake has improved markedly and his wife reports him as having improved greatly in cognitive capacities. A post treatment neuropsychological evaluation is planned after session 40. This case raises many questions concerning the use of LS with NF and regarding the development of an effective technique for restoring sight to stroke victims with hemianopsia which will be discussed during the presentation. It is hoped that members of the NF community will be encouraged to explore this area. A draft paper describing the case and outlining protocol concepts and considerations is available to individuals seriously interested in exploring this area.

Kaiser, David , Ph.D. Attentional synchrony: A novel method to index attention with qEEG.

Behavioral synchrony between individuals is well established (e.g., Bernieri, Reznick, & Rosenthal, 1988; Maxwell, Cook, & Burr, 1985). Attentional synchrony between individuals is also likely to exist, but this phenomenon has not been studied despite its potential significance. When an individual is presented with any lengthy event or stimulus, fluctuations in attention are commonly observed ("arousal jags," cf. Berlyne, 1971; McClelland, 1953). If a stimulus is presented to many individuals at a same time, attention and arousal fluctuations will occur in synchrony in as much as a stimulus can regulate each person's attentional state; which is considerably (Reeves et al., 1989; Jones & Fox, 1992). In the present study, the ability to index attentional synchrony between individuals was evaluated with qEEG.

Between- subject variance of successive alpha magnitude (8-12 Hz, 1 s epochs) was measured in 20 subjects during a series of short films and baseline conditions. Film content was rated on a 10-point scale by 32 different subjects. Boring films were expected to produce diverse processing responses as some subjects followed the storyline closely while others pondered various unrelated thoughts as the film progressed. Interesting films, on the other hand, were expected to induce comparable alpha amplitudes across subjects at any point in time as the temporal pattern of the story engaged and held most subjects' attention similarly. Eyes open baseline conditions were expected to resemble boring films. Parietal sites (P3, Pz, P4) were selected for analysis as these sites were sensitive to overall interest levels in a previous analysis.

As predicted, all three eyes open baselines (EO) produced large between-subject variances at Pz. Only one film, the least interesting of 21, were comparable to baseline values. Overall, between-subject variance at site Pz correlated negatively with interest ratings; $r = -.80$, $p<.01$. An analysis of interest fluctuations within films showed that between-subject variance tracked interest well, much better than epoch magnitude. The reliability and validity of this measure is obviously not yet established, but the results do suggest that attentional synchrony occurs, and occurs frequently (e.g., during every condition to varying degrees). In this light, Attention Deficit Disorder, in particular the symptoms of inattention and distractibility, might best be modeled in part as specific failures to achieve or sustain attentional synchrony with others. Such a model may provide novel approaches to assessment and treatment.

Lawson, Robert and Rogers, Randy. Relationship between depression severity and overall EEG abnormality.

E. Roy John predicted that symptom severity of psychiatric disorders will be proportional to a multivariate measure of EEG abnormality. This presentation will test John's prediction by comparing an MMPI2 depression measure and multivariate measures of EEG abnormality from the Nxlink EEG database which uses John's normative data and gives both referential and bipolar Z scores for overall whole head EEG.

Lubar, Joel F. Ph.D. More New QEEG data about ADHD and response to therapy.

When we train individuals with ADD/HD we measure a number of EEG variables over sessions such as changes in the microvolt values of the rewarded and inhibited frequencies and

changes of the percentages of these activities. We also measure reward/inhibit ratios and behavioral changes such as TOVA ratings and other outcome measures. Now we are beginning to explore the relationship of these to QEEG measures including coherence, phase and asymmetry using the Lexicor NRS-24 system and the Thatcher database with Hudspeth's NREP analysis program. We are beginning to look for patterns in these complex QEEG measures and EEG measures obtained during training. I will discuss this approach and pose a number of questions that need to be examined as we view examples of the findings we are obtaining.

McDonald, Tracy and Don Bars Ph.D. Evaluating the Prevalence of the Mu Rhythm in an Adolescent, Psychiatric Population.

This paper investigates the prevalence of the Mu rhythm and its relationship to various behavioral variables. Of the studies investigating the Mu rhythm very few have looked at Mu in terms of psychiatric disorders. This study is part of an ongoing investigation of the electrical activity of brain and its relationship to behavior. The participants were 329 male and female adolescent psychiatric patients with an average age of 13.28 (SD = 2.9). The patients were administered evoked potential (EP) studies and a quantitative electroencephalogram (EEG). The presence of Mu was determined by examining the Fast Fourier Transformation (FFT) eyes open record for a focus of electrical activity at the C3 and C4 electrodes in the alpha band. The percentage of the normal population with Mu was defined in terms of various archival studies. There was a significant statistical difference in the percentage of persons in an adolescent and child psychiatric population with Mu (56.84%) and the percentage seen in a normal samples (2.8%-21%) (z[3.9]=10.346,p>.001 and z[3.9]=52.716,p>.001). A Chi Square test showed that individuals with explosive behaviors had less Mu than would be expected by chance and those with ruminating behaviors had significantly more Mu than would be expected by chance. The visual evoked potential P 100 wave form from the checkerboard pattern/reversal paradigm was found to be significantly less intense in those who had Mu (F[1,327]=6.29, p=.0126). This study begins an investigation into the clinical understanding of Mu and its relationship to various psychiatric behaviors.

Montgomery, Penny S. Ph.D. Neurofeedback for the reduction of spastic paralysis in stroke.

A proven but little known neurofeedback procedure will be presented along with data from

five cases of spastic paralysis due to stroke where spasticity was relieved and movement restored. An early (1976) paper reporting the results of a case study by Barry Sterman and others inspired this exploration of an application of 12 to 15Hz activity over the sensorimotor cortex. Five cases from three separate practices around the country will be presented in which this procedure has resulted in reduction of spastic paralysis due to stroke. Suggestion for broader application of this procedure will be made

Moore, John Paul, B.A. Trudeau, D.L., MD. Alpha-Theta brainwave biofeedback is not specific to the production of theta/alpha crossover and visualizations. The Center for Addictions and Alternative Medicine Research and Minneapolis Veterans Affairs Medical Center, Minneapolis MN.

Introduction: Alpha -Theta biofeedback has been described as a promising treatment for addiction. Subjects are first taught deep relaxation by skin temperature biofeedback employing autogenic phrases. They then are instructed in brain wave biofeedback for alpha and theta waves. Theta increase and Alpha decrease are associated with a deeply relaxed state called "crossover" where hypnagogic imagery is more intense. We tested the hypothesis that other types of deep relaxation brain wave biofeedback would produce 1) the same amount of theta to alpha "crossover" and 2) the same amount of imagery.

Methods: Subjects from a residential substance abuse program were given one of three EEG biofeedback conditions in a blind fashion - either 1)suppression of 24-30HZ that is usually associated with muscle tension ("EMG") or 2) standard alpha-theta feedback as described by Peniston ("Alpha-Theta") or 3) alpha feedback alone ("Alpha Only"). Following the sessions, subjects completed questionnaires describing the visual imagery they experienced.

Findings:. EMG or Alpha Theta sessions had more percentage of time in Theta/Alpha crossover or in the ratio of theta amplitude to alpha amplitude averaged over session than alpha feedback alone. Although statistically significant, the differences were small. Subject self reports of imagery occurred with all three conditions and were not necessarily associated with crossover.

Discussion: Brain wave parameters of deeply relaxed states, namely theta amplitude greater than alpha amplitude, can be demonstrated without direct theta feedback. These findings support Taub's assertion that alpha/theta training is not specific or essential to achieving a state of relaxation and high suggestibility.

Ochs, Len, Ph.D. Variable dimensions important in the application of neuro-stimulation systems.

Discussed briefly will be 25 known discrete and continuous, stimulation and organismic variables and variable dimensions that influence the conduct and outcome of work with stimulation approaches (including "spontaneous" EEG feedback) in their application to central nervous system dysfunctions, which are all, in fact stimulation intake, processing, and integration dysfunctions.

Organismic variables: – Reactivity of the person and application site to matched stimulation vs. background noise stimulation, subjectively and objectively, globally and locally -- Sensitivity of the person and application site to matched stimulation vs. background noise stimulation, subjectively and objectively, globally and locally --Coherence responsiveness speed (kindling dispersion rate), influencing whether it is an easy problem or a hard one to treat -- Kind of CNS functioning problem(s), including onset rate, duration, location, and dispersion -- The medical systems status of the person, i.e., which other systems and subsystems are involved in the problem -- The subjective consequences of being on-target vs. off-target with any treatment approach -- Stimulation channel (eyes, ears, skin, vestibular, etc.) – Stimulation-Response latency, the organismic side -- The history of mental and physical dysfunction of the individual – The suddenness of the onset of the problem(s).

Stimulation variables, discrete and continuous: – Stimulation intensity, including duty cycle – Stimulation: cortically mediated or direct – Stimulation-Response latency, the equipment side, i.e., degree of matching – Synesthetic offset, e.g. Measuring EEG and stimulating with light vs. inductance – Stimulation input organ: using a light stimulus through eyes, or skin... -- Stimulation control site: one 10-20 site vs. another -- Stimulation duration at any application site -- Frequency of exposure -- Fidelity of stimulation response and degree of S-R matching (size of leading frequency) -- Stimulation frequency -- Stimulation frequency range -- Stimulation wave length in the EMF spectrum -- Leading frequency -- Rate of change of any of the above factors -- Total exposure (how much treatment the person has had)

Othmer, Siegfried , Ph.D., and David A. Kaiser, Ph.D. Ability to Maintain and Sustain Attentiveness and Impulsive Control with Neurofeedback.

The effect of sensorimotor (SMR) or beta neurofeedback on attentional processes was investigated using the Test of Variables of Attention (TOVA) for 231 children and adults with attentional problems (mean age 25.2y). The TOVA consists of target-poor and target-rich halves, further divided into quarters, in which the target or non-target stimulus appears infrequently, only twice out of every seven presentations, respectively. Responses during the first two quarters reflect the ability to maintain and sustain attentiveness, respectively, and responses during the final two quarters reflect the ability to maintain and sustain impulsive control, respectively. Subjects underwent an average of 30 SMR-beta training sessions. Overall, neurofeedback training resulted in significant improvement in attentiveness, impulse control, and response variability, p<.001. However this pattern of improvement was not consistent in each quarter nor half. Although impulse control improved for all quarters, attentiveness did not improve during the first quarter and showed the greatest improvement in the second quarter, the quarter in which sustaining attention is most required. Variability, on the other hand, showed no improvement during the target-poor half, and showed the greatest improvement in the final quarter. These findings suggest that different attentional processes occur or become prominent in each quarter of the TOVA test. Implications for protocol selection will be discussed.

John Putman: The effects of brief eyes open alpha brainwave training on the EEG's of 78 Army reservists.

Recently, psychologist Barry Sterman of the UCLA School of Medicine became involved in measuring the brainwave activity of high performance jet pilots engaged in a variety of tasks for the purpose of identifying the brainwave correlates of peak performance under different load conditions. The tests imposed on the subjects ranged from boring vigilance tasks to those of increasing complexity and potential overload. What Sterman found was that during a manageable periodic challenge the brainwaves exhibited, in parietal areas, a consistent cycling between resting state alpha (when in the attentive readiness state) and an alpha desynchronized, elevated low beta state when engaged in the response mode. They would then move back into the alpha state (referred to as Post Reinforcement Synchrony) (PSR) following withdrawal of the challenging stimuli. This resting state alpha proved necessary for the maintenance of optimum performance. As tasks became increasingly complex, the pilots required longer and longer periods of alpha synchrony before being able to respond to a new challenge. As the tasks came closer together in time, hence

allowing for no alpha respite, performances deteriorated. After dealing with these unstable situations for an extended period of time, the pilot's EEG began to exhibit excessive amounts of high theta activity -associated, in this case, with nonfunctionality and burnout. It is likely that those persons with adequate PRS are more resistant to the stress inducing effects of performance overload since their brains already possess the flexibility to move from one level of arousal to another leading to greater ease in dealing with situations that demand protracted periods of external vigilance. In addition, it may be that it is this flexibility that leads to a more efficient processing of stressful and even traumatic experiences. Those with the burnout profile (high amplitude theta, low alpha and high beta) are not able to navigate the full spectrum of consciousness and are thus less able to recover from stressful situations. In this paper, the effects of brief eyes-open alpha enhancement training on the EEG of 78 adults will be examined. EEG data was collected as part of a series of demonstration involving a mobile antistress neurolab intended for deployment in emergency situations. Changes in EEG amplitudes over the session were used as a measure of change in state. It was found that eyes open alpha enhancement training resulted in a substantial increases in activity in the feedback band (alpha) with marginal increases in low beta and decreases in theta. This is a quite different result one would expect from general "relaxation" training which is generally accomplished with eyes closed, yielding substantial increases in both alpha and theta. Since we were training with eyes open, additional mechanisms of control and arousal were being engaged resulting in a state unique to that of relaxation. Even so, nearly all of the subjects reported feelings of well being and alert serenity. It would seem that when engaged in this training, even for brief periods, the EEG moves in the direction opposite to that of Sterman's burnout profile which possibly results in an increased capacity for experiencing PRS. It would be of interest to demonstrate rigorously that the training could -if administered in a prophylactic manner - diminish fatigue, anxiety and poor performance in persons involved in high stress occupations that demand prolonged periods of external focus of attention under high load conditions. These may include air traffic controllers, pilots, emergency care providers, police, military personnel, etc.

Rubin, Yael, MA, Trudeau, David L., MD, Moore, John Paul, B.A., Herb Stockley MSW, Teri Dimond, MA. Residual Adult Attention Deficit Disorder and Stimulant Abuse in a Chronic Adult Male Treatment Program. The Center for Addictions and Alternative Medicine Research and Minneapolis Veterans Affairs Medical Center, Minneapolis MN.

Introduction: In the process of screening adult males in a residential treatment program for chronic substance use disorder, we were surprised to find a very high incidence of childhood attention deficit hyperactivity disorder (ADHD). Attention Deficit Disorder (ADHD) has been reported in high incidence in adolescent psychoactive substance abuse disorder (PSUD). Adolescents and children with ADHD have a higher incidence of PSUD as adults.

Methods: Adults from a residential treatment center completed a Wender Utah, a self administered questionnaire that is validated for childhood ADHD, and is a valuable instrument for making a retrospective diagnosis. All subjects also completed a self administered scalar rating of current inattention and hyperactivity/impulsivity symptoms based on DSMIV modified adult ADHD criteria. Detailed drug histories were obtained.

Findings: Fifty five percent of clients had Wender-Utah scores compatible with childhood ADHD. 14 of 54 subjects met at least 6 of 9 DSMIV ADHD criteria for either inattention or hyperactivity/impulsivity and 11 more nearly met these criteria (at least 4/9 of either or both sets) for a total of 25/54 or 46%. A relationship between childhood and adult symptoms ($r = .59$) was found. Childhood ADHD correlated with type of chemical use: childhood ADHD subjects were 1.83 to 3.92 times more likely to use crack cocaine ($p = .0112$) and 1.63 to 3.13 times more likely to use stimulants overall ($p = .0073$). Over all, whites who used stimulants used drugs other than crack 10/15 or 66% of the time, whereas blacks used crack cocaine 17/18 or 94% of the time.

Discussion: ADHD is a significant risk factor for both adolescent and adult PSUD. Our findings support a very high incidence of ADHD in an adult PSUD population that is characterized by chronicity, arrests and stimulant abuse. ADHD is a unrecognized but clinically significant comorbidity for adult PSUD, that may be linked to lower socioeconomic status and may predispose to treatment non responsivity, early dropout, staff discharge, and relapse. The treatment of ADHD with stimulants is contraindicated in the presence of stimulant PSUD. We are currently treating ADHD/PSUD adults with brain wave biofeedback, a non drug treatment, focusing on remediation of adult residual ADHD and QEEG demonstrated drug neurotoxicity.

Scott, William and David Kaiser. Augmenting Chemical Dependency Treatment with Neurofeedback Training.

Forty-three control subjects and 48 experimental subjects underwent treatment for chemical dependency in an inpatient residential facility. In addition to conventional therapies, experimental subjects also underwent 10 to 20 SMR-beta neurofeedback training sessions followed by 30 alpha-theta sessions during the first 45 days of treatment. For both groups the primary drugs of choice at intake were cocaine or methamphetamine, though most were polydrug abusers. Experimental subjects improved significantly on attentional and personality measures by the end of training whereas controls showed improvement on only psychopathic deviance and paranoia after the same number of days in the facility. Experimental subjects improved on the depression, hypochondriasis, psychopathic deviance, psychasthenia, hysteria, schizophrenia, and social introversion scales of the MMPI-2, p <.01. Similar personality changes were found for an alcoholic population (Peniston & Kulkosky, 1991). Seventy-one percent of experimental subjects remained in treatment for 12 weeks or longer, compared to 45% of controls, p<.01. By day 11 of treatment, which coincided with the end of SMR-beta training and start of alpha theta training, significantly more experimental subjects remained in treatment compared to controls, suggesting that the SMR-beta training itself may increase duration of stay in residential treatment facilities for this population. Although both groups included a number of individuals who briefly relapsed (i.e., less than 6 weeks), only 19% of experimental subjects fully relapsed compared to 42% of controls. An additional 23% of the experimental subjects left the facility prior to the study completion, ending treatment prematurely, whereas more than half of all control subjects (22 of 43) left the facility early. At least four follow-ups are planned at 6, 12, 18, and 24 months after study completion. Although further research is needed, the addition of both SMR-beta and alpha-theta neurofeedback training to conventional therapies appears to increase patient stay in a treatment facility, improve attention and personality factors, and increase the likelihood of permanent abstinence in substance abuse populations.

Siever, David Audio-Visual Stimulation as a Treatment for Chronic Pain.

Audio-visual stimulation (AVS) was studied as a treatment for chronic pain. The 15 participants suffered from multiple pain complaints with fibromyalgia sufferers being the majority. The DAVID series of AVS products (manufacture by Comptronic Devices Ltd.); were used. A baseline was measured for 1 month, then treatment was applied for 3 months. Daily diaries with visual analogue scales (VAS) were used to record pain ratings. The Beck Depression Inventory (BDI) was used to measure depression. Significant improvements in pain and depression were recorded. Methodological concerns are discussed. Preliminary results from a second study using a placebo condition are presented.

Siever, David and Michael Joyce. Audio/Visual Stimulation Program For Children With Attention Deficit Disorder and Reading Difficulties.

Disorders of ADD, ADHD, LD, anxiety, conduct disorder, and depression interfere with a student's ability to perform. These maladies have been reduced and/or eliminated as the child's arousal (brain) level is modulated. Controlling one's brain activity or level of arousal can be learned through various brain educating activities. Two of the most prominent educational modalities of brain enhancement are EEG neurofeedback (EEG) and audio-visual stimulation AVS). Audio-visual stimulation was the technology utilized in this investigation. This AVS investigation was implemented to substantiate and improve upon previous research of bringing about neuro-developmental growth and to demonstrate the simplicity and usefulness of providing low cost effective brain enhancing technology in a school setting. The results warrant serious consideration for utilizing AVS as a viable strategy to address reading, attention, learning, and general over-all academic, social/emotional growth and development of children.

Sterman, M. Barry, Ph.D. QEEG: What's Wrong with This Picture? School of Medicine, UCLA.

The QEEG has become a subject of increasing interest and increasing controversy in recent years. Issues significant to its validity and reliability have been overlooked in both its neurofeedback and medical applications. Some of the most relevant problems will be discussed. These include basic issues related to hardware and software design, signal interpretation, and statistical trivia, as well as physiological issues related to both trends and transients in EEG data and the variable of state. While some of these problems have seemingly easy solutions, others pose significant technical and conceptual challenges.

Tan, Gabriel Ph.D. The Alpha-theta Phenomenon, Hypnosis, Meditation, and Chinese Qigong: a Comparison. Houston VA Medical Center and Baylor College of Medicine.

The Alpha-theta protocol as developed by Peniston and Kulkosky has been applied to a variety of clinical populations including alcoholics, PTSD, and HIV with reportedly impressive results. Claims have been made which indicate the profound impact of this new treatment. Among the claims are: "normalization of personality", loss of desire for alcohol among chronic alcoholics, resolution of long-term PTSD problems which have not been amenable to conventional treatments, and changes in CD4 counts among HIV/AIDS patients. These claims are suggestive of basic internal alterations of one's neurophysiology and neurocircuitry not unsimilar to the profound insights and internal transformation in health status and personality sometimes reported by masters of meditation, hypnosis, and qigong. Supernatural feats have also been reported and observed by individuals in deep hypnotic trance state, and practitioners of Chinese Qigong. This paper will review the available literature in order to provide a critical comparison between these four phenomena in terms of their neurophysiology, method of "induction", claimed benefits and effectiveness, and potential risks and limitations. A subsequent goal is to provide answers to the following questions: 1. Is there a general thread linking these procedures? Are they simply different paths which lead to the same end points? 2. What are the pros and cons for each procedure and guidelines to be developed to suggest which procedure is most likely to be effective and under what conditions? 3. Are there situations where these procedures can be mutually facilitative and provided in combination for optimal results?

Thatcher, Robert W., Ph.D. New data on quantitative EEG and quantitative MRI findings in traumatic brain injury: implications for neurotherapy. Departments of Neurology and Radiology, University of South Florida College of Medicine, and the Bay Pines Foundation.

New methods of integrating QMRI with QEEG have provided fresh insights into the physiological and electrical consequences of traumatic brain injury. Increased amplitude of slow wave or delta frequency activity is correlated with white matter injury whereas reduced amplitude of alpha and beta frequencies is correlated with gray matter injury. Mild traumatic brain injury primarily involves gray matter injuries whereas moderate and severe traumatic injury includes white matter injury. A spatial gradient of gray matter and white matter injury stemming from

frontal and temporal cortex and extending to deep subcortical structures reflected in both the QEEG and the QMRI. Gray matter injury is also correlated with reduced short distance EEG coherence and increased long distance EEG coherence while white matter injury is correlated with decreased long distance EEG coherence. Reduced speed of information processing and reduced efficiency of information processing is reflected in the combined QEEG coherence measures and the QMRI measures. The integration of QEEG with QMRI is also helping to further our understanding of the 3-dimensional sources of electrical activity of the brain and may facilitate subcortical source localization procedures and eventually biofeedback of cortical and subcortical structures for the treatment of traumatic brain injury.

Thornton, Kirtley, Ph.D. Data on head injury and memory functioning from simultaneous recording of activation and QEEG.

Data on over 100 subjects were collected during a series of activation tasks. There were approximately 40 normals, 40 head injured and 20 children under the age of 14. Subjects verbalizations, an image of the subject and the EEG were simultaneously recorded to a hi 8 mm tape to ensure accuracy of data collection and for verifying responses. Nineteen activation conditions were employed with the subjects involving auditory and visual memory under immediate and delayed recall conditions. Other conditions employed included memory for where one puts objects, memory for intentions, association memory for names and faces, reading silently and out loud, problem solving (Raven's matrices, series D and E), hearing words, spelling, auditory and visual attention, multiplication tables, double digit internal spatial addition, sounding out nonsense words silently and out loud, subvocal verbalizations, visualization and autobiographical memory. During the development of the experiment, conditions were added or changed. Thus, not all conditions have all 100 subjects in them. All available qEEG parameters were measured (i.e. peak frequency, amplitude asymmetry, etc.) and the sampling rate was extended to 256 to allow analysis of the 32 to 64 hertz range. Results which are available to be presented will be presented. The main condition of auditory memory for passages has sufficient subjects at this point in time for presentation.

Toomim, Hershel, Sci.D. Intentional control of regional cerebral blood flow.

The use of regional brain blood flow (rCBF) as an intentionally controllable quantity