THURSDAY, OCTOBER 18, 2018

8:00AM-9:00AM – PLENARY SESSIONS

ROOM 1
Title: The Importance of Morphology and Montaging in EEG
Presenter(s): Tiffany Thompson, PhD, BCN, REEG-T, QEEG-D
Level: Intermediate

Abstract: Reading the raw EEG is an artform that is essential knowledge-base of any practitioner using EEG to assess and diagnose their patients' conditions. Spindles, triangular shapes, sinusoidal, monomorphic, and archiform waveforms are just a few telling morphological signs that are imperative in understanding what is really going on. Does the waveform wax and wane? Does it travel in spindles or bursts? Does it appear only a few times in the record? What if it is rhythmic? These temporal dynamics are also imperative in a proper assessment of the person. When looking at the raw waveform, you will learn more than what any QEEG, alone, can tell you.

Through exploring the more insidious forms of artifact (i.e. electricity, channel noise, mixed metals, etc.) to detecting less commonly seen morphological forms in the EEG (i.e. lambda, mu, OIRDA, beta spindles, etc.), this lecture will guide the clinician through some of the more advanced ways of interpreting EEG so that the QEEG does not mislead one into misdiagnosis.

We are privileged to have many analysis and diagnostic tools to help us dissect, spatially and temporally analyze, condense and summate the EEG into neat and tidy diagrams, but we fail our patients and our profession if we miss the devils in the details.

Finally, montages are necessary to understand the many ways in which we can assess and view the EEG. There is no best montage for all purposes. While linked ears can provide a global view, it is prone to contamination if there is a strong temporal finding or if there is contamination otherwise in the ear electrodes. Average and weighted average montages (such as the Laplacian and Hjorth montages), will highlight any local phenomena, and will uncover any significant temporal component, but will fail us to see global information. Bi-polar montages are excellent for displaying phase reversals, which are indispensable in issues of head injury and seizure focus.

ROOM 2
Title: The Non-Linear Brain: Investigating Neural Entrainment Using Missing Pulse Rhythms
Presenter(s): Charles Wasserman, BA; Yi Wei, MA; Erika Skoe, PhD; Heather Read, PhD; Edward Large, PhD
Level: Advanced

Abstract: Many rhythm perception experiments employ simple isochronous rhythms, in which synchronous neural or behavioral responses are observed (Bauer, Kreutz, & Herrmann, 2015; Repp, 2005a, 2005b). However, responses at the stimulus frequency do not allow one to distinguish whether synchrony occurs as a response to a common input, or as the result of an emergent population oscillation that entrains at a particular frequency. However, it is possible to create a rhythm with no spectral energy at the pulse frequency by manipulating the number of events that occur anti-phase

(180Â°) versus in-phase (0Â°) with the basic rhythmic cycle. Dynamical analysis predicts neural oscillation will emerge at such a “missing” pulse frequency (Large, 2010). Â¬Previous studies have shown that subjects tap along to complex rhythms at the missing pulse frequency (Large, Herrera, & Velasco, 2015) - a finding that supports the prediction, and responses at missing pulse frequencies have been seen in auditory brain areas using magnetoencephalography (MEG) (Tal et al., 2017).

Aims: This study aimed to investigate whether the sensorimotor system, as measured by 32-channel cortical EEG, would entrain to a complex rhythm at the pulse frequency even when the complex rhythm contained no spectral power at that frequency.

Methods: The experiment utilized four different rhythms of varying complexity (1 simple, 2 complex, and 1 random rhythm) created from 100ms tones with a 200 Hz fundamental frequency (F0). Offline the EEG was decomposed into the cortical-steady state response (SS-EP) and the subcortical frequency following response (FFR). Fast Fourier Transform (FFT) of the Hilbert envelope showed energy at the repetition frequency (2Hz) for the simple rhythm, but no spectral energy at the missing pulse frequency (2Hz) for the complex rhythms. EEG responses to these stimuli were examined for evidence of neural oscillations and power modulations at the missing pulse frequency predicted by dynamical analysis.

Results: We report evidence of responses in the EEG to the pulse frequency of missing pulse rhythms. We also note a differing topography of power at the pulse frequency across the scalp for the complex rhythms vs. the simple and random rhythms.

Conclusions: These data support the theory that rhythmic synchrony occurs as the result of an emergent population oscillation that entrains at this particular frequency. Additional analyses examined whether the FFR to the F0 is modulated by whether the stimuli are perceived as being on-beats or off-beats in the rhythmic context.

9:10AM-10:10AM – PLENARY SESSIONS

ROOM 1
Title: The Impact of Using Effective Connectivity Measures (Granger Causality) in Guiding Neurofeedback
Presenter(s): Robert Coben, PhD; Anne Stevens, PhD
Level: Intermediate

Abstract: Over the past several years, we have seen advancements in the ways we assess coherence and connectivity that provide great insights into brain functioning (Coben, Rezazadeh & Cannon, 2014). This understanding has led to approaching coherence in a multivariate fashion that enhances it's accuracy (Kus, Kaminshi & Blinowska, 2004). Multivariate autoregressive statistical tools have become critical to this endeavor. Such techniques enable us to measure effective connectivity in a source localized fashion such that we can image reciprocal causality and influence. This accuracy in depicting neural networks gets us closer to the real signals in the brain. This led to an enhancement in how we do neurofeedback training which now uses four sensors and trains coherence in a multivariate fashion (Coben et al., 2018). We have adopted a theory that states the more accurate our assessment of connectivity and the source of the activity then the more effective our attempts at neurofeedback may be. In this pilot study we evaluated the effects of basing our neurofeedback (multivariate coherence training) protocols on coherence measures as compared to multivariate autoregressive effective connectivity that uses sources to estimate reciprocal causality (see Friston, Moran & Seth, 2013). We sampled 45 subjects with

various presenting complaints and divded up into three groups. All subjects had their neurofeedback protocols developed based on QEEG methods. Group 1 was based on ICA and effective connectivity granger causuality, groups 2 and 3 were based on correlational coherence measures. We used two separate comparison groups, one served as a within groups and the other a between groups comparison. All subjects underwent between 12-15 neurofeedback sessions followed by another assessment period. Dependent measures includled EEG comparisons of power and graph theory metrics of effective connectivity. Clinical comparisons were also made based on rating of progress to measure their symptoms change over this period of time. Preliminary data analysis has shown that all groups show changes and gains from their neurofeedback training, but that the group that had their protocols based on effective connectivity measures showed greater clinical and EEG changes. The implications of these findings will be presented.

ROOM 2
Title: Brain Mapping (QEEG) Changes Before and After Medical Cannabis Administration and Potential Clinical Implications.
Presenter(s): J. Lucas Koberda, MD, PhD
Level: Intermediate

Abstract: There is a relatively little information available on the effect of medical cannabis on the brain electrical activity. Therefore, we are in the process of conducting the research on the response of brain electrical activity (EEG/QEEG) to medical cannabis in different medical conditions approved by the state of Florida for therapy with this medication. Since we have not received yet any research grant -only patients who were interested in the participation in this study were enrolled. Patients were evaluated at the neurological clinic in Tallahassee; FL. Twenty-one patients with variety of medical conditions including epilepsy, chronic pain, PTSD/anxiety, Parkinson's disease, multiple sclerosis, cancer were so far enrolled in this study. Before medical cannabis initiation the brain maps (EEG/QEEG) were collected as well as detail information on the patient level of pain, anxiety, and other clinical information. Patients were initiated with CBD or CBD/THC combination with dose adjustment until reaching a positive clinical response described as pain, seizures or anxiety reduction and/or sleep improvement. In Parkinson disease and Multiple Sclerosis patients-an improvement in ambulation is being evaluated. Repeated EEG/QEEG was completed after reaching a positive clinical response in order to compare to the initial recordings. So far seven patients completed second brain mapping session, but we are expecting to see results of more follow up testing in the near future. In general, patients with anxiety and chronic pain were recorded to have an elevated beta and/or high beta power on the brain mapping before medical cannabis treatment initiation. Preliminary results of follow up EEG/QEEG testing showed marked reduction of previously elevated beta power after a clinical response is reached. Also, mild increase in theta power was recorded in some patients after CBD and/or THC initiation. In addition, more interested patients are being recruited to this research. Hopefully, in the future once a research grant is secured more extensive study will be facilitated.

ROOM 3 – *ISNR FOUNDATIONS*
Title: Ethics in Neurofeedback
Presenter(s): Leslie Sherlin, PhD, CMPC, QEEGD, BCN, BCB
Level: Beginner

Abstract: Under the ISNR Professional Code of Conduct and Ethics members are responsible for ensuring that services are performed competently. For professionals who interact with clients, or who have access to confidential client information, technical competence may not suffice. This talk aims to provide attendees and introduction and overview of ethical considerations for the neurofeedback and biofeedback professional. Neurofeedback and biofeedback specific ethics training can be important even for providers who have previously worked in other mental health fields, because it demonstrates how the profession's ethical standards will be upheld through specific policies with this modality.

10:20AM-11:20AM – PLENARY SESSIONS

ROOM 1
Title: Trends in Scientific Research Reflect and Predict the Clinical Relevance of (EEG) Biomarkers.
Presenter(s): Andrè Keizer, PhD
Level: Intermediate

Abstract: QEEG-guided neurofeedback is based on interpreting abnormalities in the resting-state EEG in relationship with psychopathology. Setting up effective neurofeedback treatment protocols relies on the correct interpretation of individual QEEG profiles in relationship with the symptoms of the patient. Scientific studies have demonstrated associations between certain deviations in resting-state EEG and specific psychological disorders. The most well-known link is that of excess theta/beta ratio in relation with ADHD (e.g. Arns et al., 2012). Recent approval of the FDA for an ADHD diagnostic test based on excess theta/beta ratio illustrates that this 'EEG biomarker' is both meaningful and reliable1. Other markers for psychopathology include 'alpha asymmetry' for depression (Thibodeau et al., 2006) and excess beta power for anxiety and insomnia (Pavlenko et al., 2001; Perlis et al., 2001). However, a modern QEEG report will contain many different and detailed analyses of an individual EEG. Moreover, the number of analyses that can be performed on EEG data has been increasing rapidly. Interpreting the clinical relevance of these analyses for the treatment of an individual patient depends on the scientific studies demonstrating links between these measures and the symptoms of the patient. In the current presentation, the trends in QEEG research will be discussed and an attempt will be made to assess the relevance of different QEEG analyses for clinical purposes using a systematic analysis of the scientific literature. The main approach is to analyze the number of papers published on a particular search term (reflecting a certain EEG biomarker) per year. A secondary approach is to analyze the number of citations per year to seminal papers which describe a new EEG biomarker. Finally, comparisons with scientific literature in different fields may provide useful analogies. For example, the interpretation of an individual blood test for cancer relies on scientific research on the association between certain biomarkers (e.g certain proteins) and the presence of a tumor. How did scientific research on these 'tumor markers' evolve and eventually lead up to the use of tumor markers in clinical testing today, and what can this tell us about the current state-of-the-art and future clinical relevance of different EEG analyses? One hypothesis is that papers which demonstrate a promising new biomarker will show a continuous increase in citations per year when the biomarker can be replicated and when it is useful as a diagnostic tool in clinical practice. In contrast, when such a study cannot be replicated it may show an

initial increase of citations, but the number of citations per year will inevitably go down after this initial increase. In the latter case, it can be concluded that the biomarker is not useful in clinical practice. Analyzing trends in the scientific literature to predict clinical relevance of potential EEG biomarkers is novel and relevant approach which may have important implications for the scientific and clinical field of QEEG and neurofeedback.

ROOM 2
Title: Understanding the Mysterious 40 Hz. Brain System for Attention, Learning, and Feeling Good
Presenter(s): Jonathan Cowan, PhD; Estate Sokhadaze, PhD
Level: Intermediate

Abstract: Evidence from a wide variety of studies and authors supports a new synthesis of understanding regarding the 40 Hz. brain scanning system, and its role in attention, understanding, learning, and creating positive feelings as a reward for the effort. It is a basic foundation for the individual's survival, promoting their effective responses to new discoveries and situations. We have therefore named this brain system Neureka! (short for Neural Eureka!). This understanding builds upon Llinas' discovery of the "Event Binding Rhythm" (Llinas et al.,1998), which scans the cortical layers from front to back 40 times a second, and reports back to its origin, the centrally located nuclei in the thalamus, all of which we will review here.

These nuclei synthesize all this information and send out modified 40 Hz. scanning rhythms, which look for additional information to add to the understanding of a particular new event. This looping information exchange continues until the event is evaluated and a response is created.

Salient events are stored in short term memory, particularly in the prefrontal cortex (PFC). Short term memory is then converted to longer term memory, particularly if dopamine, norepinephrine, and/or other neuromodulators are released. There is evidence that both of these neuromodulators are released in the PFC, particularly near FPz. Dopamine also creates a variety of positive feelings when it is released there.

We will review several lines of evidence about the Neureka! brain system from fMRI and other scans (Knutson et al., 2003), and complement them with our EEG studies based on the Neureka! measurement, which selectively clarifies this particular 40 Hz. rhythm and separates it from the other 40 Hz. activity passing through more peripheral parts of the thalamus.

Results: These studies show that neurofeedback training of Neureka! enhances memory and happiness (for at least four months) and decreases depressed feelings. It also improves memory and attention measurements (Sokhadze & Daniels, 2016). Previous studies (Cowan et al.,, 2011, 2017; Rubik, 2011) demonstrate clear relationships between increases in Neureka! amplitude and love, happiness, satisfaction, gratitude, and appreciation. We will review studies where neurofeedback training using the Neureka! measure (Sokhadze, 2012) was used to improve behavioral symptoms in children with autism (Wang et al., 2016). Furthermore, the 40 Hz rhythm was used to distinguish the emotional reaction to drug and stress cues of substance abusers from those with comorbid PTSD (Sokhadze et al., 2009).

ROOM 3 – *ISNR FOUNDATIONS*
Title: Diversity in Neurofeedback
Presenter(s): Lexi Meinhold
Level: Beginner

Abstract: Diversity is not often considered when presenting or providing Neurofeedback interventions. A brain is a brain, each one unique yet with a common set of structures. Or so we think. In reality a potential client's cultural expectations and beliefs about their own brain, mind and body will deeply influence their response to Neurofeedback. In this workshop we will explore our own cultural beliefs and values as well as those of our clients. Learning about Cultural Neuroscience offers us a vehicle to review these issues.

11:30AM-12:30PM – INVITED SPEAKER

Title: The Effects and Mechanisms of Mindfulness Meditation, Cognitive Therapy and Mindfulness-based Cognitive Therapy for Chronic Low Back Pain
Presenter(s): Melissa Day, PhD
Level: Intermediate

Abstract: Chronic low back pain (CLBP) is a pervasive, costly, and highly disabling condition. Research has shown that CLBP is inadequately managed solely by biomedical approaches alone. Thus, current guidelines put forth by the Centers for Disease Control and Prevention in the US recommend non-pharmacological therapy as the first line approach to chronic pain management. In this context, there is evidence that Cognitive Therapy (CT) and mindfulness meditation (MM) programs are beneficial for a range of CLBP-related outcomes. Although not previously tested for CLBP management, evidence in other pain populations suggests that Mindfulness-Based Cognitive Therapy (MBCT) – which seamlessly integrates CT and MM techniques – might also be particularly well suited for improving pain, mood and function.

An expanding body of research is investigating the potential neuormodulatory function of these psychosocial pain treatments. Although scarce research has examined brain-state related changes in the context of CT and MBCT for pain, within MM, several studies in pain samples have used electroencephalogram (EEG) at pre- and post-treatment to test the possible role of brain activity changes in association with improved pain-related outcomes. Results found MM was associated with power increases primarily in the alpha band, and this increase in alpha was suggested to play a key role in the effects of MM on pain. It is not known however if this potential neuromodulatory pathway is unique to MM as delivered as an isolated technique, or if it might also play a role in other similarly efficacious treatments, such as CT and MBCT.

In this plenary session I will present data from a recently completed randomized controlled trial comparing MM versus CT versus MBCT within a CLBP sample. Treatment consisted of eight weekly, 2-hour group-delivered sessions. EEG brain state data was obtained at pre- and post-treatment, as was self-reported pain related outcome measures of pain interference, pain intensity, physical function and depression. I will present (1) the treatment-related changes in the self-reported outcomes, (2) an analysis of change in brain activity across the three treatments, and (3) how potential changes in brain state are associated with changes in the self-reported outcomes.

12:30PM-1:30PM – KEYNOTE SPEAKER

Title: Update on the Work Towards CPT Codes and Third-Party Reimbursement
Presenter(s): Mark Trullinger, BCN
Level: Intermediate

Abstract: ISNR, in partnership with AAPB and BCIA, have taken significant strides in the past few years toward pushing for insurance reimbursement. This presentation will provide a macro-level progress report on the CPT coding workgroup trying to modernize our codes, petitions for inclusion as a recognized organization for AMA activities for CPT coding and Relative-Value Unit (RVU) determinations, and national level efforts for insurance reimbursement.

FRIDAY, OCTOBER 19, 2018

8:00AM-9:00AM - PLENARY SESSIONS

ROOM 1
Title: Neurofeedback: An Effective Treatment for Symptoms of Post-traumatic Stress Disorder in Veterans
Presenter(s): Connie McReynolds, PhD
Level: Intermediate

Abstract: This presentation will discuss the positive therapeutic gains made with veterans whose primary treatment for PTSD was artifact corrected neurofeedback. The participants for the data analysis were randomly drawn from an archival database of veterans who had received neurofeedback training.

Individualized neurofeedback treatment was provided for 20 U.S. military veterans (16 males, 4 females) with an average age at the time of testing being 46 years old (Â±1 SD = 17.7). The self-reported primary diagnoses of these veterans included PTSD (65%), ADHD (15%), Major Depression (10%), Generalized Anxiety (5%), and Learning Disability (5%).

Assessments completed after both 20 and 40 half-hour sessions of treatment identified significant improvements for both auditory and visual attention using the IVA-2 and significant improvements in well-being based on the General Well-Being Scale (GWBS). To evaluate the clinical effects of treatment changes, significant improvements in well-being were defined as a change from a more impaired level of distress to less impaired using the assessment category labels. Changes in self-reports of well-being were assessed by comparing the initial scores on the GWBS with rating scores obtained after 40 sessions of treatment were completed using a paired sample t-test. In order to evaluate whether or not neurofeedback training improves auditory and visual attention, paired sample t-tests were computed comparing pretreatment IVA-2 AAQ and VAQ quotient test scores with each individual's IVA-2 test scores after completing 20 and then 40 sessions.

It was discovered that neurofeedback impacted individuals' overall auditory attention and IVA-2 global auditory test scores significantly improved after both 20 ($p < .007$, Cohen's $d = 0.5$) and 40 training sessions ($p < .0001$, Cohen's $d = 0.8$). Veterans were found to have significant enhancements in auditory vigilance ($p < .03$), processing speed ($p < .0009$) and focus ($p < .01$). The IVA-2 global measure of visual attention was also found to show significant improvements after 20 sessions ($p < .004$, Cohen's $d = 0.5$) and after 40 sessions ($p < .06$, Cohen's $d = 0.4$). Specific improvements in visual processing speed ($p < .04$) and focus ($p< .02$) were identified after 40 sessions. Ratings of well-being significantly improved after treatment ($p< .001$, Cohen's $d = 0.8$) with 84% of the veterans improving five points or more on the GWBS. Improvements in well-being were found to be significantly correlated with increases in veterans overall auditory attention ($r = .44$, $p < .03$) and auditory processing speed ($r = .57$, $p < .005$).

While the lack of a control group in this study limits the conclusion that neurofeedback was the primary causal factor for the observed improvement in wellbeing, the discovery that the global measure of AAQ and specifically discriminatory auditory response time (i.e., the auditory Speed scale) were significantly correlated with ratings of well-being after 40 sessions of neurofeedback, but not prior to training, lends support to the validity of neurofeedback being the key factor in the improvements observed in well-being.

ROOM 2
Title: Personalized EEG-Neurofeedback as a Treatment for ADHD
Presenter(s): Helene Brisebois, PhD; Caroline Dupont, MPs
Level: Intermediate

Abstract: Several neurophysiological subtypes based on electroencephalographic (EEG) biomarkers have been identified in attention deficit hyperactivity disorder (ADHD) (Johnstone, Gunkelman, & Lunt, 2005). However, most studies investigating the efficacy of neurofeedback (NFB) as a treatment for ADHD use uniform treatment protocols that are not taking into account individual EEG biomarkers (Arns, Ridder, Strehl, Breteler, & Coenen, 2009). A recent pilot study suggests that personalizing NFB protocols to individual EEG biomarkers of ADHD might lead to increased specificity and efficacy of treatment (Arns, Drinkenburg, & Kenemans, 2012). Hence, the objective of this presentation is to investigate the effects of personalized EEG-NFB as a treatment for ADHD. It will provide an overview of personalized EEG-neurofeedback protocols for ADHD and introduce results from a pilot project that aimed to integrate a neurofeedback clinic as part of the Service offering of the Office for Students with disabilities in a Canadian college. A hundred and eight college students with a diagnosis of ADHD received free personalized EEG-NFB two times a week over a period of four months. Half of the participants was randomly assigned to the experimental condition. The other half was put on a waiting list to serve as a control group and received treatment later. Resting state EEG signals were recorded to evaluate overall brain activity pre- and post- training, and to determine individual EEG-biomarkers for selection of personalized treatment protocol. ADHD behavioral symptoms were assessed pre- and post- training using the Conners' Adult ADHD Rating Scale (CAARS-S:L), the Integrated Visual and Auditory Continuous Performance Test (IVA-2) and assessment of executive functions. A significant change was observed in subjects trained in EEG-NFB, both in brain activation patterns and at the behavioral level. More specifically, normalization of targeted resting brain waves was observed in the experimental group. Results from this pilot project demonstrate the feasibility of personalizing NFB protocols to individual EEG biomarkers of ADHD and the efficacy of NFB as a treatment for ADHD. On a broader level, this presentation will allow for a better understanding of the impact of neurofeedback training on neural and behavioral correlates of ADHD.

ROOM 3 – *ISNR FOUNDATIONS*
Title: Infraslow Neurofeedback, Still a Maverick in the Field?
Presenter(s): Mark Smith, LCSW, BCN, QEEG-D
Level: Basic

Abstract: Infraslow frequencies have been studied in the behavioral literature for more than five decades. It has been a tool in the neurofeedback armamentum for over a decade. Only recently has it taken its place among the more studied forms of neurofeedback. This year a double blind, randomized, and placebo controlled study of Infraslow neurofeedback was published in Scientific Reports, a tier one journal. It's safe to say Infraslow Neurofeedback (ISF) has finally arrived. But it is still a relatively unknown form of neurofeedback compared to Zscore training for example. However, this powerfully transformative form of brain training is making inroads with clinicians and researchers. This presentation will help clinicians understand the unique history of Infraslow neurofeedback/research and why these frequencies and this form of training have remained hidden from more general recognition. Descriptions of the two forms of ISF training will be provided. We will discuss the clinical imperatives that drove protocol development and describe the current best practice. This unique brain training method targets the infraslow frequencies (< 0.1 Hertz) a distinct neurophysiological process that moves in stereotypical

spatiotemporal trajectories within cortex. Research suggests these slow oscillations determine the overall excitability of the cortex. ISF coordinates processes in the body with processes in the brain. For instance, heart and brain regions are coordinated at infraslow frequencies as are digestive tract and brain networks. In fact, shifts (or fluctuations) in these infraslow frequencies directly affect the brain's internal regulation of the autonomic nervous system, including our fight-flight-freeze stress response as well as our rest-and-digest state. With ISF neurofeedback the brain learns to optimize its ability to self-regulate, adjusting baseline levels of activity in various regions, facilitating improved communication within and between functional networks, and improving neurophysiolgical coordination. Two channel bipolar training remains the standard in ISF training promoting profound shifts in Autonomic Nervous System function within session. ISF sLORETA, the latest iteration of Infraslow training, provides clinicians with a sophisticated tool that allows intervention at the foundation of brain activation and communication utilizing deeper behavioral networks.

9:10AM-10:10AM – PLENARY SESSIONS

ROOM 1
Title: Tuning the Traumatized Brain: LORETA Z-score Neurofeedback and Heart Rate Variability Biofeedback for Chronic PTSD
Presenter(s): Ashlie Bell, PhD(c), LCSW, BCN
Level: Basic

Abstract: Introduction: Neuroimaging studies have identified numerous abnormalities within the default mode (DMN), salience (SN), and central executive (CEN) neural networks of those suffering from PTSD (Lanius, Frewen, Tursich, Jetly, & McKinnon, 2015). A systematic review of the literature revealed ten studies (n=213) that examined neurofeedback as a method for altering these neural patterns and alleviating PTSD symptoms (Foster & Thatcher, 2015; Gapen et al., 2016; Huang-Storms, Bodenhamer-Davis, Davis, & Dunn, 2007; Kluetsch et al., 2014; van der Kolk et al., 2016; Paret et al., 2014; Peniston & Kulkosky, 1991; Peniston, Marrinan, Deming, & Kulkosky, 1993; Pop-Jordanova & Zorcec, 2004; Smith, 2008). These studies demonstrated mostly medium to large improvements following a variety of NF training modalities. Low-resolution electromagnetic tomography analysis (LORETA) z-score neurofeedback (LZNF) is a newer modality that is believed to produce more targeted and efficient outcomes than traditional modalities; however, it has not been adequately examined for the treatment of PTSD. This study is the first to examine the effectiveness of this modality using a controlled, experimental design.

Method: The purpose of this research study was to examine the effects of LZNF training, as compared to heart rate variability biofeedback (HRVB) training, on PTSD symptoms, autonomic regulation, and brainwave activation patterns in adults with chronic PTSD. Twenty-four participants were alternately assigned to receive 15 sessions of either LZNF (n = 12) or HRVB (n = 12) training. HRVB was chosen as an active control condition due to the ability to closely match many conditions to the LZNF group (i.e. time with trainer, resting state, body-computer interface, similar audio/visual feedback, etc.) while providing an ethical alternative for this sensitive population. Psychophysiological measurements (i.e. 19-channel EEG and HRV) were recorded before, during, and after a single session of training as well as before and after 15 training sessions. Psychosocial questionnaires were completed during the pre- and post-intervention assessments.

Results: The data for this study is still being analyzed and thus results are not yet available; however, visual examination of the data and symptom reports suggest the results will be positive. The full results will be analyzed and ready to present before this ISNR conference. Paired and independent samples t-tests and Cohen's d effect sizes are being utilized to examine both within- and between-group changes after 1 and 15 sessions. Pre-post changes will be analyzed for: mean LORETA current source density (CSD) z scores of three neural networks (i.e. DMN, SN, and CEN); HRV metrics (i.e. standard deviation of NN intervals, root mean square of the successive difference, low frequency power); and, total scores on the PTSD Checklist for DMS-V and Beck Anxiety Inventory. I have hypothesized that LZNF will produce greater changes in LORETA CSD z scores and PTSD symptoms, while HRVB will produce greater changes in HRV metrics.

Conclusion: This study is expected to provide important, preliminary data regarding the effectiveness of both LZNF and HRVB training on PTSD symptoms and HRV, as well as their differential effects on each of the neural networks suspected to underlie PTSD symptomology.

ROOM 2
Title: The Human Compassion Circuit
Presenter(s): Larry Stevens, PhD
Level: Advanced

Abstract: Compassion has been one of the most cherished, acclaimed, practiced, and pursued of human virtues for literally thousands of years, and a foremost part of nearly all organized religions and spiritual quests. Despite its lofty and celebrated status, tragically there are far too many examples in human history of "the far enemy" of Compassion, Cruelty. For a species so enamored with this cherished human virtue, how are we so able to engage in cruel acts? Perhaps the answer, in part, to this critical social question lies in our neurological makeup; perhaps there are specialized structures in our brains that are hardwired for the experience of Compassion, and structures that are similarly hardwired for our expression of Cruelty.

This presentation reports on a recent literature review, analysis, and integration by the author of a growing body of compassion research, detailed in his chapter entitled, "The Brain that Longs to Care for Others: The Current Neuroscience of Compassion" in his soon-to-be-released academic textbook, The Neuroscience of Empathy, Compassion, and Self-Compassion (Elsevier/Academic Press, June 2018). This review suggests that such hardwired circuits do indeed exist in each of our brains. A followup research investigation by the author was designed to begin the answer to the question above and to more clearly and with greater certainty identify these circuits.

This presentation will thus clarify the temporal and spatial characteristics of a neurological circuit in the human brain identified with the experience of Compassion. The hypothesis of the reported research investigation is that participants will respond to careworthy and to blameworthy compassion scenarios with a specified differential, sequential (temporal) spatial circuit involving (1st) an affective amygdala (AMG), anterior insular cortex (AIC), and anterior cingulate cortex (ACC) sub-circuit, then (2nd) motor intentional mirroring structures in the Mirror Neuron System of the premotor cortex (PMC) and inferior parietal lobe (IPL), then (3rd) cognitive regulatory sub-circuits in the dorsolateral prefrontal cortex (dlPFC), ventrolateral PFC (vlPFC), dorsomedial PFC (dmPFC), and posterior temporal cortex (PTC), and then (4th), and simultaneous with the PFC sub-circuits above, self-other differentiation Theory of Mind (ToM) sub-circuits in the bilateral temporal parietal junction (TPJ), precuneus (PCun), and dmPFC. These

temporal and spatial pathways are identified by continuous electroencephalograph (EEG) recordings and during subsequent power spectral and LORETA neuroimaging analyses following the participant's experiencing of specific, visually-presented compassion scenarios. Exciting Neurotherapy, TMS, Meditation, and Psychotherapy protocols are explored as ways of increasing Compassion in human beings, perhaps even as alternatives to one of the cruelest of compassion "far enemies", torture.

ROOM 3 – *ISNR FOUNDATIONS*
Title: Use of EEG and Neurofeedback for Therapists/Psychotherapy
Presenter(s): Tiffany Thompson, PhD, BCN, REEG-T, QEEG-D
Level: Basic

Abstract: Neurotherapy and psychotherapy are inextricably linked. The physiological manifestation of the condition seen in the EEG, the quantitative EEG, and in the body is often present in the mind and the emotions, emerging as various complexes, psychopathologies, and forms of repression, suppression, and denial. Put another way, the psychological manifestations of a condition, as seen in a client's symptomology, behavior, state of mind, and presentation, can be linked to physical findings.

Both the psyche and the brain (spirit and matter) are, themselves, made of opposites that move and change dynamically in a balancing act. In the electroencephalogram we see the brain offer compensatory mechanisms to counter unnatural imbalances (e.g., an individual with an anxiety disorder will show excessively high amplitude beta, countered by a deficiency in theta). In Jungian psychology, the tension of the opposites is the correlate (e.g., an individual with an egocentric persona suffering from an inferiority complex). In neuroscience, we see the brain as a complex adaptive system under the processes of chaos and order, creating emergent phenomena—in Jungian psychology we see the psyche as a complex adaptive system under the processes of chaos and order, creating emergent phenomena in processes of synchronicity leading to individuation.

The exploration to unfold in this talk is the linking of Freud and Jung's respective models of the psyche with both electroencephalographic phenomena and neuroscientific findings, as they relate to neuroanatomy and connectonomics (the branch of neuroscience dealing with the network structures of the brain, in total called the "connectome"). The hypothesis then stands, that the id and the collective unconscious are associated with autonomic subcortical brain functions and early neurological connections, as well as the slow wave form of delta (1-4 Hz). Jung's personal unconscious and Freud's preconscious are linked to theta (4-8 Hz) and the neural structures responsible for the generation of these wave forms. The processes of active imagination and meditation are tied to the role of alpha (9-12 Hz), and the ego and its trappings are linked to beta (13-40 Hz) and its cortical processes. Lastly, the appearance of gamma indicates an integrated state, similar to individuation. Within this dance is the thread of duality and unity, as well as order and chaos; each set of necessary poles encapsulates both the tension of the opposites as well as the fundamental physics behind the wiring and firing of the brain.

10:20AM-11:20AM – PLENARY SESSIONS

ROOM 1
Title: Gender Differences in Quantitative EEG Volumetric Analysis Shortly After Sport Concussion Injury in High School Athletes
Presenter(s): Harry Kerasidis, MD; P. David Ims, MA; Stacie Rector, ATC

Level: Intermediate

Abstract: We have previously reported changes in sLORETA quantitative analysis shortly after acute sport related concussion injury in high school athletes, which persist after clinical recovery. (Kerasidis et al 2018) We have also reported the effects of neurofeedback on these changes during the acute recovery period (Ims et al 2018)

Studies have identified gender differences in the incidence, severity and recovery time from sport concussion injury, all increased in females (Cantu 2010, Hamson-Utley 2013, Miyashita, 2016, Mollayeva, 2018, Tanveer, 2017). The objective of this investigation is to explore gender differences in volumetric QEEG analysis after sport concussion injury in high school athletes.

Methods: Standard electroencephalograms (EEGs) were analyzed in 40 high school athletes (20 males) shortly after concussion injury using sLORETA imaging compared to a normative database (NYU/BrainDx). Peak Z-score variation (PZV), and %volume of grey matter activity that fell outside Z= -2.5 to 2.5 (PIGMV for increased activity, PRGMV for reduced) were calculated for each of 5 EEG frequency bands.

Results: PZV was increased in the Delta/Theta/Alpha, in both genders with no statistical gender difference (M/F averages: 3.82/3.16, 2.73/2.72, 2.52/2.72, respectively, $p > .05$), Beta in females not males, Beta-Gamma in males and females which was significantly increased in females (M/F averages: 1.75/2.88, 3.64/5.02 respectively, $p<.01$). PZV was decreased in Beta in males not females (M/F averages: -2.83/-2.18, $p< .05$) there was a significant difference in reduced beta-gamma activity (M/F averages: -1.11/-.49, $p=.01$).

Greater than 1% grey matter volume of PIGMV was seen in Delta/Theta/Alpha/Beta and Beta-Gamma activity with no gender difference (M/F averages: 20.94/11.71, 5.87/7.38, 5.62/7.93, 4.09/9.22 $p>.05$). There was a significant difference in PIGMV in Beta-Gamma (M/F averages: 31.94/60.04, $p=.01$). Greater than 1% PRGMV in Alpha/Beta in both genders and Theta activity in females not males.

Conclusions: Slower frequency (Delta, Theta, and Alpha) abnormal variations show no statistical gender differences. In the faster frequency bands (Beta and Beta-Gamma), females demonstrate a larger variation from the norm and larger percent grey matter volume affected by increased Beta and Beta-Gamma activity. Males, not females exhibit a deficiency in Beta activity after concussion. Further research to correlate these electrophysiologic changes with symptom severity and recovery time is needed.

ROOM 2
Title: Social, Spiritual, Psychological, and Physiological Predictors of Well-being of Military Veterans: A Pilot Study of a Viable, Holistic, and Predictive Model of Well-being
Presenter(s): Manuel Halter, PhD
Level: Intermediate

Abstract: Military leaders are striving to identify and implement innovative and necessary solutions to enhance or optimize military members' well-being, with the ultimate goal of improving the short and long-term well-being of warriors and their families. This study tested the viability of a holistic model of well-being that was developed as a screening instrument. A secondary goal is to mitigate the

detrimental effects of the high operational tempo, and the extreme pressures faced by active duty military veteran community. Therefore, to be adequate the model had to be predictive of well-being to serve as such a base-lining and monitoring tool. This new model involves a holistic, systems approach, integrating four key life domains that were hypothesized to impact overall well-being: human, psychological, social, and spiritual performance. These domains are interconnected and work together via situational, dispositional, and intentional variables to produce well-being, or the lack thereof (Howell, Kern, & Lyubomirsky, 2007). To test the viability and utility of this model, a stepwise multiple regression analysis was conducted on archival data of 117 military veterans. Based on the literature of, and the shared nomological network between, well-being (e.g., Howell et al., 2007), PsyCap (e.g., Avey, 2014; Lorenz, Beer, Pütz, & Heinitz, 2016), social isolation or connectedness (e.g., Kent, Hawthorne, Kjaer, Manniche, that & Albert, 2015), spiritual intelligence (e.g., Faraji, & Begzadeh, 2017), psychological and cognitive performance (e.g., Del Brutto, Mera, Del Brutto, Maestre, Gardener, Zambrano, & Wright, 2015; Lathan, Spira, Chen, Bleiberg, Vice,Tsao, & Spira, 2013), as well as heart rate variability (HRV) (e.g., Fatisson, Oswald, & Lalonde, 2016) and quantitative electroencephalogram (qEEG) metrics (e.g., Thatcher, North, Biver, & Zhou, 2017), it was hypothesized that human performance (Brain Function Index or BFI [qEEG] and SDNN [HRV]), psychological performance (DASS-21 composite score), social performance (Friendship Scale composite score), and spiritual performance (SISRI-24 composite score) would significantly predict well-being (Psychological Capital or PsyCap composite score). This set of predictors is hypothesized to account for a significant proportion of the well-being or PsyCap variance (i.e., CPC-12 composite scores). (PsyCap). Furthermore, each predictor is hypothesized to explain a unique and significant proportion of the PsyCap variance. The expected results would suggest that the positive core construct of PsyCap can be predicted using self-report measures addressing each domain, combined with functional measures (i.e., BFI and SDNN), and cognitive performance assessment outcome measures (i.e., Defense Automated Neuropsychological Assessment (DANA). Moreover, such findings would support a viable model of well-being, which military leaders can use to baseline and monitor its members.

ROOM 3
Title: Altered States NeuroMeditation: Current Approaches, Preliminary Findings, & Future Applications
Presenter(s): Jeff Tarrant, PhD
Level: Basic

Abstract: Using neurofeedback and other technologies to achieve altered states of consciousness has its roots in the early development of the field of neurofeedback. In fact, some of the initial neurofeedback protocols were designed to replicate many of the effects commonly experienced during a meditative state (Crane, 2007; Trudeau, 2016). Having observed that the practice of meditation often led to an increase in alpha power or increased theta activity crossing over alpha, these two approaches became the foundation of Deep States NeuroMeditation protocols, essentially attempting to facilitate elements of an altered state (Tarrant, 2017).

This work and these protocols are powerful and have been associated with impressive results with difficult clinical populations including alcoholics and those suffering with PTSD. Recent explorations into the study of consciousness has led to some new approaches and protocols for assisting clients into achieving altered states for the purposes of psychological and emotional healing.

This presentation will present a new and novel approach to achieving altered states with neurofeedback by replicating brain-based research on psychedelic therapies. Current research with psilocybin, LSD,

DMT, and other psychedelics have all shown tremendous potential in treating a wide range of mental health disorders. It is believed that these impacts are due, at least in part, to the way they alter perception and the dysfunctional creation of a self-identity (Carhart-Harris, et al., 2012). Based on this emerging field, certain brain patterns and brain regions have revealed themselves as important in these transformative experiences. By targeting these brain patterns through neurofeedback, in conjunction with additional strategies, we may be on the cusp of a brand new approach to the use of neurofeedback. In this presentation, we will share preliminary research showing how these altered states can be facilitated using neurofeedback. We will explore approaches, indications and contraindications as well as a variety of adjunctive aids, including vibroacoustics, evocative music, and visual entrainment.

11:30AM-12:30PM – INVITED SPEAKER

Title: Integrating Mindfulness with Bio and Neurofeedback
Presenter(s): Inna Khazan, PhD
Level: Intermediate

Abstract: Bio and neurofeedback are powerful treatment modalities shown to be effective at alleviating numerous psychophysiological conditions. Biofeedback provides a way to work with challenging conditions in cases for which other interventions have been unsuccessful, such as chronic pain, anxiety, headaches, and trauma. At the same time, bio/neurofeedback treatment itself can stall, leaving the client and the therapist feeling frustrated and unsure of how to proceed. These challenges include situations when the client is highly anxious about his/her physiological symptoms, feels pressure to "do things right," becomes easily overwhelmed with emotional stimuli, or is simply too distracted to attend to the computer screen for more than a few minutes at a time. Oftentimes, these challenges are due to the clients' unhelpful efforts to control the fundamentally uncontrollable aspects of their internal experience.

Mindfulness-based approach to bio/neurofeedback can help people experience change through mindful, non-judgmental awareness and acceptance, providing the therapist and the client a way to work with what gets in the way of biofeedback success. In this talk, participants will learn how to apply mindfulness-based skills to their biofeedback practice in order to help their clients reap the benefits of biofeedback without getting stuck in unproductive attempts to control their internal experience.

12:30PM-1:30PM – KEYNOTE SPEAKER

Title: Comprehensive Assessment and Outpatient Treatment of Addiction using Neurofeedback and a Functional Medicine Approach
Presenter(s): Susan K. Blank, MD
Level: Intermediate

Abstract: The most common type of addiction treatment in the United States today is based on the Minnesota Model. This style of treatment is relying on 12 Step principles and was developed over 60 years ago. Despite a tremendous amount of research and new evidenced based practices very few treatment centers incorporate innovations like Neurofeedback.

In this session, we will look at and review several cases studies from The Atlanta Healing Center that illustrate important advances in treatment of the chronic brain disease of addiction. We will focus on the importance of making the proper diagnosis, medication assisted recovery, evaluating co-occurring psychiatric, cognitive and pain conditions; assessing the hormonal and nutritional status of patients and providing treatment modalities like neurofeedback. Education of the family and patient is important and connecting with recovery support essential for the patient to have the best possible outcome in the management of this potentially life-threatening disease.

Saturday, October 20, 2018

8:00AM-9:00AM – PLENARY SESSIONS

ROOM 1
Title: Cognitive and Psychophysiological Test Operations as Assessment Tool for Neurofeedback Clinicians: A Pilot Study on its Preliminary Normative Data and Validity
Presenter(s): Thomas Feiner, BCN; Maria Juan, Msc; Ruben Perez, MSc
Level: Basic

Abstract: Neurofeedback is a paradigm in which individuals are trained to modulate their Electroencephalogramm (EEG) by providing them feedback about the targeted EEG component to treat syptoms and disorders associated to the neuronal condition. Neurofeedback shows effects on both the alleviation of symptoms and also changes in cognitive performance as an appreciated side effect or as bringing up the desired/expected ability like improved continous attention, focus and impulse control. For example, training the alpha band frequency has been associated with improved attentional control and working memory. Investigating attentional control is typically done with tasks such as the Stroop task, in which a color word is shown in a font color that is different (incongruent) than what the word represents and the participant is asked to name only the font color. Test have shown that there is often a remarkable decrease in response time (delay) and an increase of accuracy from pre to post Neurofeedback sessions. In general the Stroop test could be used to mark objectively success of Neurofeedback over time. The problem is that that clinicians complain about the time which is spent to administer the Stroop test, which makes it interesting for research but not for clinical praxis.

The purpose of this study was to obtain normative data of a battery of informatized tests from the software Cognitive And Psychophysiological Test Operations (CAPITO) and its comparation with classical neuropsychological tests in order to assure construct validity with the goal to create a test which is suitable for use by primary care medical staff, psychologists and neuropsychologists, since it can be administered in just 10 minutes.

We administered a battery of informatized tests (stroop, simple reaction time, sustained attention, shifting attention) to 120 subjects who are cognitively normal and range in age from 18 to 65 years, of whom 26 randomly-selected subjects also scored in classical tests in order to check battery validity (confidence level of 90%, sampling margin of error 15%). In the case of subjects receiving both modalities (informatized and classical testing) the order of application was balanced, in order to avoid application order bias. Statistics of each test scores were calculated and comparisons between informatized and classical tests were conducted.
Results: Normative data were collected for CAPITO battery and positive correlations with classical tests were found. No effects were found for age and sex in either test. Educational level impacted the Stroop test variables but not the other tests.

ROOM 2
Title: Training Blood Flow: nHEG Utilization for Specific QEEG Phenotypes in ASD
Presenter(s): Adrian Van Deusen, HND; David Cantor, PhD, MS. QEEG-D, BCN
Level: Intermediate

Abstract: The spectrum of autistic disorders is among the most heterogeneous, both in regards to electrophysiology and to metabolism. Specific to brain electrophysiology, research points to multiple noted outlying quantitative EEG features; consistent with the heterogeneity of the symptoms of this disorder. That variation of noted phenomenon has led to various EEG Neurofeedback training strategies over the past two decades. Many of these strategies have undergone clinical research and, while encouraging, have presented similarly heterogeneous outcomes. It is still an active discussion with regards to which symptom features of ASD are specific to which neurofeedback protocols . Furthermore, protocols that address frontal pole delta or fronto-temporal and temporal beta in low functioning patients are challenging as these features are often confounded by muscle artifact and eye movement during training. In this presentation, we propose an alternative Neurofeedback training protocol that can be used to improve particularly the frontal and temporal region dysfunctions that play a role in regulating attention and response control, and that is near-impervious to the contamination of eye movement or muscle tension. One of the systemic dysregularities noted in the ASD population is a variety of metabolic imbalances which we argue can be presented as diffuse, low absolute power measures spanning 2 or more frequency bands in the qEEG. The specific physiological mechanism for this phenotypic pattern is not yet well understood but one rationale is that as a result of underlying metabolic dysregulation, oxygen perfusion is reduced resulting in reduced cell energy and subsequent low power. With this supposition, the authors have been using a nHEG (Toomim) training protocol since 2011. We have selected from 50 of the qualifying clinical nHEG training cases run in 2016 and 2017. The multicase study reveals significant improvement in the qEEG features from baseline to subsequent evaluations following approximately 10 hours of treatment. These results are compared to a protocol of neurofeedback therapy that trains to increase absolute power by rewarding EEG absolute power parameters alone.

9:10AM-10:10AM – PLENARY SESSIONS

ROOM 1
Title: Applied Innovation in Clinical Practice- Let's Go Beyond Neurofeedback
Presenter(s): Amy Serin, PhD
Level: Intermediate

Abstract: Many neurofeedback practitioners utilize multiple modalities in practice to enhance the effects of neurofeedback. Adjunct therapies such as counseling, transcranial direct current stimulation (tCDS), heart-rate variability training, and biofeedback, among others, to improve patient outcomes. Two methodologies, bi-lateral alternating stimulation in tactile form (BLAST) and cranial electrical stimulation (CES) also show promise in altering electrical activity in key networks associated with stress (Serin, Hageman, & Kade, 2018; Feusner, Madsen, Moody, Bohon, Hembacher, Bookheimer & Cystritsky, 2012) and can be used in conjunction with traditional neurofeedback. However, many clinicians do not have a model for how to apply these modalities in practice, nor have they reviewed the emerging data on the modalities. Beta EEG rhythm has been found to correlate to high situational and personal anxiety (Pavlenko et al., 2009) and BLAST has been found to significantly reduce beta activity, subjective distress and physiological body sensations in response to thinking about a stressful event (Serin, Hageman & Kade, 2018) by possibly de-potentiating amygdala activity (Harper et al., 2009) which is responsible activating the body's stress response (Ehrlich et al., 2009). The use of CES may result in cortical deactivation, may alter brain activity in the default mode network (DMN), and may create significant changes in intrinsic connectivity networks (Feusner et al., 2013). The body of literature is growing with regard to these two methodologies, and clinicians can utilize them in conjunction with traditional

neurofeedback to achieve specific outcomes in treatment with patients with anxiety, insomnia, depression, and varied diagnoses. A review of clinical data, biometric data, EEG findings, and other research will be presented, along with guidelines for clinical use of the modalities and a system and structure for incorporation into clinical practice. Discussion of how to combine these modalities will also be summarized to advance the field of applied neurofeedback.

ROOM 2
Title: Multivariate Coherence Training for Developmental Trauma
Presenter(s): Robert Coben, PhD; Clark Thompson, MA; Anne Stevens, PhD
Level: Intermediate

Abstract: Developmental trauma is a major public health concern that has generated increased interest from researchers over the past few decades. The Adverse Childhood Experiences (ACE) study revealed correlational relationships between traumatic childhood experiences and an array of outcomes after several years, which included depression, substance abuse, domestic violence, suicide attempts, and various medical conditions (Felitti, Anda, Nordenberg, Williamson, Spitz, Edwards, & Marks, 1998). Common domains of impairment observed by children exposed to developmental trauma are multifaceted, consisting of self-concept, attachment, behavioral regulation, affect regulation, dissociation, and biology (Cook, Spinazzola, Ford, Lanktree, Blaustein, Cloitre, & Mallah, 2017). Neuroimaging studies of this population have revealed structural changes in the brain, such as reduced development of the hippocampus, amygdala, corpus callosum, and left neocortex (Teicher, Andersen, Polcari, Anderson, Navalta, & Kim, 2003). Overall, there are a paucity of neurofeedback studies on developmental trauma. A small handful of projects have focused on power training (van der Kolk et al., 2016), some of which have been QEEG based (Huang-Storms, Bodenhammer-Davis, Davis, & Dunn, 2006).

We are conducting a study on participants with a history of developmental trauma who underwent neurofeedback training. We hypothesize that subjects who undergo neurofeedback training will show significantly decreased levels of mood and trauma related symptoms compared to controls. Based on the findings of Armes and Coben (2017), we hypothesize that changes in connectivity will be related to success in neurofeedback and reduction of symptoms. Our study consists of 40 participants who were randomly assigned to a 4-channel multivariate coherence training group or a control group who received an alternative treatment with no neurofeedback training. Dependent variables included the Beck Depression Inventory-II, Beck Anxiety Inventory, Trauma Symptom Inventory-II, as well as power and graph theory connectivity metrics based on qEEG findings. These measures were all administered at time 1 and time 2 with an intervening period of neurofeedback training. Preliminary findings show enhancements in coherence metrics are associated with decreased depression, anxiety, and trauma related symptoms.

10:20AM-11:20AM – PLENARY SESSIONS

ROOM 1
Title: Tandem 3D Neuroimaging in Mild Traumatic Brain Injury: Providing a Neuroholistic Perspective in Clinical and Forensic Settings
Presenter(s): David Cantor, PhD, MS; Richard Batson, ND, ABAAHP; Michael Seyffert, MD, MS
Level: Intermediate

Abstract: Form and function are critical approaches to the analysis and evaluation of the brain. Routine structural neuroimaging (CT and MRI) is routinely unremarkable in mild traumatic brain injury, often making objective proof of brain injury illusive. In the absence of abnormal findings on routine CT or MRI scans, structural changes following mild traumatic brain injury are best appreciated by quantitative volumetric 3D MRI. Volumetric MRI imaging allows for quantification of regional brain structure volume in order to identify cumulative atrophy following TBI. Volumetric MRI has been well-validated in the medical literature with 119 systematic reviews supporting its use in a wide variety of conditions and is therefore arguably one of the strongest evidence-based methods in radiology.

Positron Emission Tomography (PET) is a nuclear medicine imaging technique which can be used to measure brain glucose metabolism. Under physiological conditions, glucose metabolism is tightly connected to neuronal activity. Disruptions in neuronal activity associated with disease, including traumatic brain injury, are often reflected in alterations of glucose metabolism. Fluorodeoxyglucose (FDG) PET is currently the most accurate in-vivo method for measuring regional brain metabolism in both health and disease states. FDG-PET can provide complimentary information to both structural imaging and electrophysiological methods for examining the brain.

Standardized Low Resolution Electromagnetic Tomography (sLORETA) is a well-established, qEEG derived, electrophysiological method which provides 3D images of cortical current density. While sLORETA has been found to be independently helpful in the evaluation of mild TBI, including coup contrecoup injuries, abnormal findings on LORETA are closely related to changes in cerebral blood flow as well as glucose metabolism.

Neuropsychological test performance, while purported to provide objective evidence of functional status following TBI, is often compromised by concerns of malingering or secondary gains. In addition, exaggerated values may result from high anxiety frustrations during test taking, further invalidating neuropsychological findings. In such cases, supportive objective evidence from structural and functional neuroimaging can play a decisive role in substantiating brain injury in both clinical and forensic contexts. More specifically, structural and functional neuroimaging modalities which are now norm referenced to age and other demographic factors are ideal can now be used to evidence important information in the diagnosis and treatment of brain injury in a complementary fashion to neuropsychological testing.

This presentation will outline an innovative application of quantitative, 3D structural and functional neuroimaging techniques which can provide convergent validity establishing the presence of brain abnormalities following head injury. More specifically, we present the tandem application of volumetric 3D MRI, FDG-PET imaging, and volumetric sLORETA, thus providing a “neuro-holistic” perspective of brain changes resultant from traumatic brain injury. The tandem application of the specific 3-D neuroimaging methodologies outlined in this presentation is one of the first models of an integrated, neuro-holistic brain imaging method which offers a cutting-edge technique to better understand the long-term anatomical, physiological, cognitive and behavioral sequelae of traumatic brain injury. This presentation will demonstrate how this method can be readily implemented into a multi-disciplinary clinical practice.

ROOM 2
Title: The Effect of Infra Slow Frequency Neurofeedback on Quantitative Electroencephalogram and Autonomic Nervous System Function in Adults with Anxiety and Related Diseases
Presenter(s): Karlien Balt, MSc; Mark Smith, MSW; Peet Du Toit, PhD; Priyesh Bipath, PhD
Level: Intermediate

Abstract: Background: Over the last decade it has been observed in clinical practice that Infra Slow Frequency (ISF) training shifts clients in physiological state during training. Peripheral body temperature, pupil size and breathing rate are a few examples of autonomic nervous system (ANS) responses regularly observed during ISF neurofeedback training.

ISF electroencephalographic (EEG) biofeedback focusses on the low energy signals produced by the brain. This includes frequencies of less than 0.1 Hz (Smith, Collura, Ferrera, & de Vries, 2014). Evidence suggests that these slow oscillations play a role in synchronizing faster activity and modulates cortical excitability (Bazhenov & Timofeev, 2006). The origins of these slow oscillations are not yet well understood but studies have indicated the involvement of the thalamus and other subcortical structures (Larincz, Geall, Ba, Crunelli, & Hughes, 2009).
The ANS is an important role player in maintaining sympathetic-parasympathetic and cardiovascular homeostasis. It includes vagal cholinergic and sympathetic noradrenergic nerves that supply the heart and sympathetic noradrenergic nerves that enmesh arterioles. Therefore clinicians and researchers have long sought valid, non-invasive, quantitative means to identify patho-physiologically relevant abnormalities of these systems (Goldstein, Bentho, Park, & Sharabi, 2011).

Heart Rate Variability (HRV) is one of the most well-known means of measurement. There is increasing research pointing to the clinical application of HRV in training and exercise due to its apparent result in strengthening sympathetic-parasympathetic balance (Peper E, 2007). Achieving an increased HRV while doing ISF training should be a good indicator of firstly reaching clients Optimum Frequency (OF) and secondly achieving a sympathetic-parasympathetic balance (Collura, 2014) (Camp, Remus, Kalburgi, Porterfield, & Johnson, 2012)

This study hypothesizes that ISF training has a measurable physiological effect on an individual by measuring certain autonomic functions viz. HRV, muscle tension, skin temperature, skin conductance, heart rate, respiration rate and blood pressure. Also, to demonstrate how ISF training impacts the resting state EEG.

Methods:Thirty adults between the ages of 18 and 55 with primarily anxiety will receive a Quantitative Electroencephalogram (QEEG) to get a baseline before training. The participants will then receive ISF neurofeedback training for 10 sessions while continuous monitoring of ANS changes will be done to determine if there are measurable changes. After 10 sessions we will repeat a QEEG to determine what changes occurred. The same process will be completed for a control group. The control group will receive one channel power training where Theta and Hibeta activity will be inhibited at 3-7Hz and 22-30 Hz respectively and Lobeta 12-15 Hz activity enhanced at the C4 location on the head.

Anticipated results: Preliminary results and a pilot study conducted show significant changes that have been observed in participants trained in ISF neurofeedback, both in the activation patterns when looking at the QEEG and the autonomic functions that were measured. No significant changes have been seen thus far in the control group.

Conclusion: The study will possibly demonstrate that autonomic functions are affected by ISF neurofeedback training and that changes occur in the resting state EEG of participants trained.

11:30AM-12:30PM – INVITED SPEAKER

Title: The Central Brain Mechanisms of Pain and the Neuromodulation Techniques for Addressing It
Presenter(s): Dirk DeRidder, MD, PhD
Level: Intermediate

Abstract: Although chronic pain is one of the most important medical problems facing society, there has been limited progress in the development of novel therapies for this condition. The key to more successful pain treatment is to understand the mechanisms that generate and maintain chronic pain. Anatomically there exist at least two ascending pain input pathways and 1 descending pain inhibitory pathway. One input pathway encodes the painfulness, whereas the other pathway encodes the suffering or emotional pain associated with the painful stimulus. The pain inhibitory pathway probably encodes the percentage of the time the pain is dominantly present during the day. The anatomical pathways can be visualized using functional MRI meta-analyses, and LORETA EEG further shows that chronic pain is an imbalance between the ascending and descending pain inhibitory pathways. This is indeed confirmed both by activity, functional and effective connectivity EEG analyses.

Non-pharmacological treatment for chronic pain using spinal cord stimulation normalizes this imbalance, supporting the concept that pain is truly a balance disorder between pain input and pain suppression in the brain, and causally related to this imbalance. Pain thus is not merely the result of more pain input via the spinal cord or brainstem.

This imbalance mechanism might be universal in view of the pathophysiological analogy between pain, tinnitus, Parkinson's disease, major depression, also known as thalamocortical dysrhythmia. Furthermore, thalamocortical dysrhythmia and and reward-deficiency syndrome (obesity, addiction, ADHD and personality disorders) may be two sides of the same coin as suggested by EEG source analyzed conjunction analyses between thalamocortical dysrhythmia and reward deficiency syndromes. As such, this new conceptualization of pain, Parkinson, tinnitus, depression, addiction, ADHD, OCD and personality disorders as imbalances in the brain paves the way for neuromodulation techniques such as transcranial electrical stimulation and infraslow neurofeedback to normalize this imbalance.

12:30PM-1:30PM – KEYNOTE SPEAKER

Title: Is Addiction a Brain Disease? And Does it Matter?
Presenter(s): Marc Lewis, PhD
Level: Intermediate

Abstract: Over the past 20 to 30 years, medical authorities have come to define and explain addiction as a brain disease. However, the domination of the disease model skews the science of addiction, diverts attention from key social-psychological factors, and results in potentially harmful trends in policy and clinical practice. In this talk I review the distortions and omissions of the classic brain disease model and point to problems in the treatment philosophy derived from it. I then outline an alternative model of addiction based on principles of learning and development. This model views addiction as an

entrenched habit for regulating emotional needs, learned through the repeated pursuit of highly-motivating but short-lived rewards. Developmental-learning models of addiction help explain individual differences in vulnerability (and recovery) based on early emotional difficulties and current psychological and social resources.