**Theoretical and Clinical Considerations in**

**Advanced EEG Biofeedback Methodologies**

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 24 Hours of Learning (accredited CEs for BCIA recertification)

8AM – 9:30AM Pacific Time

**Course Syllabus**

ABSTRACT:

 EEG Biofeedback has greatly expanded over the past 10 years. As a result, the list of treatment options can seem overwhelming. Amidst the clamor of competing ideologies, manufacturers and treatment modalities, it is the responsibility of the advanced EEG biofeedback clinician to create a treatment approach that is effective and engaging for the trainee/patient/client. This class moves beyond the introduction to basic EEG feedback modalities and equipment, and into an overview of the state of the art of EEG, and the subsequent options and complex treatment decisions that are necessary in operating competently in the modern neurofeedback climate.

READING:

Suggested Reading (beyond what is available within the course):

* Thatcher, R. (2012). Handbook of QEEG and EEG Biofeedback. ANI Publishing
* Collura, T. (2013). Technical Foundations of Neurofeedback. Routledge Publishing <http://www.amazon.com/Technical-Foundations-Neurofeedback-Routledge-Neurotherapy/dp/041589901X> $130
* Arns, Gunkelman, Olbrich, Sander, and Hegerl. (2010). EEG Vigilance and Phenotypes in Neuropsychiatry: Implications for Intervention.  In R. Coben & J. Evans (Eds.), *Neuromodulation and neurofeedback: Techniques and applications.* Elsevier (included in your reading materials).

9 objectives for this course:

1. To understand the brain mechanisms that we are effecting when performing neurotherapy so the clinician can make right protocol choices.
2. To understand how to read EEG records based upon montages so the clinician can make the correct protocol decisions.
3. The therapist will gain a deeper knowledge to more sophisticated neurotherapy protocols and uses to improve therapeutic outcome.
4. The therapist will learn about Brodmann areas to better assess functional issues of his or her client.
5. The therapist will learn about cortical and subcortical networks to better assess functional issues of his or her client.
6. JTFA and FFT analysis of wave forms are important to the understanding of the EEG patterns. The clinician will gain a deeper understanding of these and thus be able to perform better analyses.
7. The clinician will learn historical and therapeutic bases for coherence and symmetry training to provide confidence in utilizing these protocols.
8. The clinician will learn historical and therapeutic bases for z-score training to provide confidence in utilizing these protocols
9. The clinician will learn historical and therapeutic bases for LORETA training to provide confidence in utilizing these protocols

**WEBINAR 1 February 4, 2021: 1.5 hours**

**Introductions**

**Recap of Basics**

Kerson

This section will recap important concepts from earlier learning, including gross neuroanatomy and physiology, operant conditioning and historical aspects as well as stress models that are relevant to advanced clinical and theoretical concepts. It will then look at prediction and how the brain relies on predictive measures to make sense of its world.

**WEBINAR 2 February 11, 2021: 1.5 hours**

**Reward Styling**

LeMay

This section will discuss the major concepts of rewarding and shaping behavior through the neurofeedback session. The concept of tapering the reward style that fits best to the client’s needs and the protocol’s designed will be demonstrated. The purpose of each rewarding style will be reviewed.

**WEBINAR 3 February 18, 2021: 1.5 hours**

**Montages, Reference Placements, Derivations and Protocol Decisions**

Kerson

Neurofeedback protocol determination is an important clinical step and is largely based upon objective assessments. 19-channel EEG, the predominant objective measure, is generally recorded with a referential linked-ear montage, but once recorded can easily be “remontaged” to view the EEG events from a different perspective. Thus montages are a key factor. Taking a step back from the brain map and observing EEG events in the record better leads to understanding the what, why and where EEG events occurred in the cortex. This is crucial to making the right protocol choices. This section looks at EEG phenomena from multiple montage perspectives.

**WEBINAR 4 March 4, 2021: 1.5 hours
Brodmann Areas**

Kerson

At the turn of the 20th century, Korbinian Brodmann developed a map of the cortical areas of the brain based upon cellular cytoarchitecture at autopsy. This system, in which he named 52 areas, is based upon the premise that similar cell structure must mean that same-grouped cells performed a single group of functions. Current brain imaging devices prove the Brodmann system to be very accurate and this system is still in use today. This section will provide foundational knowledge for the clinician to better plan neurotherapeutic treatment based upon knowledge of function at cortical locations.

**WEBINAR 5 March 18, 2021: 1.5 hours**

**Networks**

Kerson

Recently, cortical and subcortical network locations and functions have been explored extensively. This section discusses graph theory, how it relates to the brain’s networks and the 7 most important networks. Knowledge of them will greatly impact neurotherapeutic protocol decisions.

**WEBINAR 6 April 1, 2021: 1.5 hours**

**Section 6: Coherence and Symmetry**

Kerson & LeMay

It is assumed homologous sites should behave similarly during specific tasks. Symmetry is the measure of exactness of EEG behaviors between them and is based upon the assumption that brain behaviors are not entirely left- or right-brained. Coherence is a measure of the morphological relationship between two waveforms. It has its base in waveform physics and illustrates the influence of biology on physics quite eloquently. It is also the historical base from which Z-score training and later forms of connectivity training were developed. The strengths and weaknesses of some coherence based training models will be discussed. The instructors will discuss the theoretical and historical perspectives of both neurofeedback modalities.

**WEBINAR 7 April 15, 2021: 1.5 hours**

**Phase and Phase Lag**

LeMay

Groups of neurons engage and disengage in relationship to one another. The nature of that engagement and disengagement can be seen in phase relationships. Phase Lag is one of the phase relationships that will be discussed as it relates to clinical presentation and treatment planning. Behavioral shaping and reward strategies to address phase relationship issues will be demonstrated and discussed.

**WEBINAR 8 April 29, 2021: 1.5 hours**

**Joint Time Frequency Analysis (JTFA) and Wavelets**

Kerson & LeMay

In neurofeedback, the most common analytic tool for EEG is the Fourier Transform. FFT is a time-domain algorithm. However, JTFA is a method that uses both time and frequency of a domain at the same time and can also be used with EEG. This offers certain advantages and disadvantages to the clinician in shaping the EEG and therefore behavior. In this segment wavelet analysis will also be discussed.

**WEBINAR 9 May 13, 2021: 1.5 hours**

**Z-Score Training**

LeMay

Gaussian distributions have a long history in statistics. Z score training takes advantage of the mathematic properties of Gaussian distributions and applies them to the behavior found in the EEG. The strengths and weaknesses of this approach, along with reward styling considerations will be discussed.

**WEBINAR 10 May 27, 2021: 1.5 hours**

**Low Resolution Electromagnetic Tomographic Analysis (LORETA)**

LeMay & Kerson

LORETA neurofeedback is a more recent development in EEG biofeedback. In the past several years it has mostly been used for diagnostic purposes, but more recent advances in computer processing have made it possible to use it as a training paradigm, both with and without z-score enhancements. In this section, we will discuss how this guides EEG biofeedback at the surface. And how it can be turned into a solid reward/shaping process for therapy.