Applied Psychophysiology

The use of biological feedback to improve human functioning

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Director, Widener Biofeedback Center
Clinical Associate Professor

Psychophysiology

Psychophysiology (from Greek ψυχή, "breath, life, soul"; φύσις, "nature, origin"; and -λογία, -logia) the branch of psychology that is concerned with the physiological bases of psychological processes.

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Psychophysiology looks at the way psychological activities produce physiological responses.

Applied psychophysiology involves making therapeutic interventions of various kinds which work primarily with the physiology to alter functioning and mood.

Applied Psychophysiology

• Introducing the cognitive self to the physiological self
  - The executive female
  - The yoga instructor
• Training and coaching
  - Yum and yuck
  - This and that

Biofeedback

Biofeedback is a process that enables an individual to learn how to change physiological activity for the purposes of improving health and performance. Precise instruments measure physiological activity such as brainwaves, heart function, breathing, muscle activity, and skin temperature. These instruments rapidly and accurately “feed back” information to the user. The presentation of this information—often in conjunction with changes in thinking, emotions, and behavior—supports desired physiological changes. Over time, these changes can endure without continued use of an instrument.
Correlates of ANS/CNS with biofeedback modalities

- Skeletal muscle tension: SEMG (surface electromyography)
- Peripheral blood flow: Thermal feedback
- Sweat gland activity (eccrine): GSR/SCL (Galvanic Skin Response)
- Breathing patterns: Strain gauge
- Cardiovascular System: HRV (Heart Rate Variability)
- The Brain’s electrical functioning: EEG

One of the early researchers, Elmer Green of the Menninger Clinic in Kansas, used biofeedback instruments to study Eastern yogis. He discovered that certain yogis could control their internal states merely through meditation and thought.

<table>
<thead>
<tr>
<th>Psyche</th>
<th>Physiology</th>
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<tbody>
<tr>
<td>mind</td>
<td>body</td>
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</table>
The Psychophysiological Principle

"Every change in the physiological state is accompanied by an appropriate change in the mental-emotional state, conscious or unconscious, and conversely, every change in the mental-emotional state, conscious or unconscious, is accompanied by an appropriate change in the physiological state."

Elmer Green

The 45 minute session

- Review of homework
- Didactic – learning about mind-body dynamics
- Training
- Next session preview
- Leave 5 minutes for wrap-up (scheduling, payment, etc.)

Treatment Plan - Do with Everyone

- Initial Eval
- Testing – PSP
- ANS Overview
- Physical
  - Nutritional Guidelines – Cellular Respiration
  - Breathing is the Bridge - Respiration bff
  - Cardio-pulmonary system – HRV bff
- Cognitive
  - Alter perceptions
  - Support
- Behavioral
  - Keep a Sabbath
  - Play, Leisure
  - Environmental Engineering
Initial Psychological Evaluation

Psychophysiology Orientation

- PP - onset - symptoms - severity
  - What was happening in patient’s life at the time of onset
- Current stressors
- Life-style
  - Exercise
  - Sleep patterns
  - Diet
- Support network
  - Trust, self-disclosure

The PSP

Psychophysiological Stress Profile

- Effective use of the PSP as a treatment guide and prognostic index

- Biofeedback and Psychophysiology: Exploring and integrating the mind and body
The Standard PSP

Basic design: Baseline, Stressor, Recovery

- Baseline: Research baselines, Clinical baselines
- Performance challenge: Mental Stressor, Recovery
  - Performance anxiety, perfectionism, drive, social anxiety
- Emotional challenge: Imagery, Recovery
  - What they say, how they say it, how do they “react”
- Anticipatory challenge: Existential stress
- Self-directed Rest & Recovery
  - End with 4 minutes of relaxing music; ask client to sit back and relax

Psychological states & the Soma

- Patterns and what they tell us
  - Skeleto-muscular
  - Vascular
  - Cardio-vascular and respiratory
  - Somatic anxiety
  - Brain under arousal & over arousal (not covered in this teleconference)

Analysis of the PSP

1. Reactivity
2. Recovery
3. Patterns: EMG, Thermal, GSR
The Art & Science of Profiling
Patterns, Personality And Profiling

• BioBehavioral aspects of psychophysiology
• Hunches
• Incorporating other information
• Interactive Investigation

Treatment
Applied psychophysiology

1. Feedback vs. monitoring
2. Criteria training
   • EMG: balance and appropriate activation
   • Thermal: 90°F and above
   • GSR: centering oneself mentally; emotional self-soothing skills
   • EEG: normalization

EMG (Electromyograph)

Skeletal muscles activate by contraction. The physiological bases for activation involves some of the following motivations:
• preparation for movement,
• movement itself,
• protective guarding, and
• communication.
EMG Patterns Guards & Gladiators

- Fighters & Protectors
  - Active - Shoulders
- Passive Bitters - Jaw
- Body Armor - guarded - diffuse

Case Study - EMG

Nature/Nurture and EMG activation
- 110% ers: driven, perfectionist
- Anger issues
- Abuse issues

Right Shoulder tensing during Anticipation Challenge

46 year old female diagnosed with TMJ
Peripheral Blood Flow - Thermal

- An indirect measurement of visceral muscle constriction
- Occurs as part of sympathetic arousal

Thermal Patterns

- Hypervigilent
- Fear
- Perpetual worry
- Perfectionism, Persistence, Pressure
- “constricted” personality
Case Study - Thermal

- Nature-Nurture Issues
  - First-born
  - Abuse in childhood - especially sexual abuse
    - Patient forms a "coat of armor" and a hypervigilent stance
  - PTSD

Vasoconstriction following Performance Challenge-poor recovery

32 year old female diagnosed with TMJ and neck pain
Alcoholic father

Treatment Plan - Do with This Patient

?
GSR (Galvanic Skin Response)

- Sweat gland activity
- Used in the lie detector
- Measures emotional stress

GSR Pattern:

- Anxious
- Ruminating
- Weak self-soothing mechanisms
- Trust issues
- Emotionally Sensitive

Case Study - GSR

- Nature/Nurture Issues
  - family history ETOH/Drugs
  - hindered development of self-soothing capacity - inadequate childhood relationship with primary caretaker
  - Existential angst
Reactive GSR following a motor vehicle accident resulting in death of a friend

21 year old female diagnosed with PTSD after a motor vehicle accident in which her passenger friend died

High and reactive GSR levels seen in this phobic patient

54 year old female diagnosed with fibromyalgia and IBS

Treatment Plan - Do with This Patient

?
Specific disorders
Some general guidelines

Angela McGrady, Ph.D.
HPP = the Hypertension Predictive profile

- Hypertension can be lowered through biofeedback training if the patient has a certain profile
- High levels of frontalis EMG
- Low peripheral temperature (vasoconstriction)
- High heart rate
- High Plasma Renin Activity (PRA)


Case Study - daily chronic headaches

- The Psychophysiological Stress Profile (PSP)
  - Starting EMG = 17.7μV (L) and 9.3μV (R)
  - Starting peripheral temp = 77.5°F
  - Starting GSR = 16.5 μmhos
**Case Study - sleep disorder**

- Night Terrors since childhood
- Family: mother – hx of depression/anxiety – “she’s caused all of us a lot of pain.”

**Case Study - sleep disorder**

- Treated from May 19 – Sept. 8, 2009 for 14 sessions
- Sleep study recommended
- Ended treatment because of significant reduction in night terror (both in number and severity)

> “After a six week course of biofeedback, Ms. Hxxx had a three week period with no episodes, however, over last week she had one episode nightly.”

Psychophysiological psychotherapy and beyond

Widener Partnership Charter School (WPCS)
Self-Regulation Training Program

**Case Study - seizure disorder**

- Dx’d Primary Generalized Epilepsy
- Onset age 3
- Age 8 started EEG biofeedback and seizure free x 6 years
- Spring 2009 (age 14): seizure activity started again
- 3 months of weekly SMR biofeedback 7/13/09-8/6/09
- Email from mother on 10/2/09

> “Just wanted to touch base with you to let you know that Sxxxx hasn’t had any seizures for maybe two months now! so Hooray for that, and thank you for getting him off to a good start this summer. He is seeing Eric once a week now.”
EEG Patterns

EEG markers: correlates for psychopathology

- Cz alpha enhance during EC s/b at least 20%
- O1 theta/beta ratio s/b > 2.0
- F4/P3: if <1.3
- Fz: hi beta/beta s/b = .45-.55
- Abuse/trauma
- Family hx of addiction
- R/O depression
- If >.6 may = hyperactive cingulate (behaviorally compulsive, inflexible, perseverative)
- If < .4 may = hypo of cingulate (behaviorally passive)

Arousal
Sleep studies - chronic overarousal
Depression - chronic underarousal

Altered States
Self-Regulation
Mediator's mind

Medical
Pain Disorders
Cancer
Fertility

Peak Performance
Optimal functioning

Arousal Control
Sensory Motor Strip Conditioning
Sleep > Seizure > Hyperkinesis

Joel Lubar, Margaret Shouse
Applications – Autism

Wanda Wyrwicz
Barry Stermann
Margaret Ayers
Applications – Seizure & Sleep Disorders

Neal Miller
Somnatic Conditioning of the CNS
SMR (11-15Hz)

"...one is puzzled by several conclusions being expressed today by individuals. These are:

1) that there is no evidence that EEG operant conditioning affects physiological substrates, and
2) that application of this modality to the treatment of epilepsy should still be considered as 'experimental'.

Physiological Correlates of Sensorimotor Rhythm Operant Conditioning

"...SMR activity...leads to an attenuation of the conduction of somatosensory information to the cortex"

Altered States

Deep relaxation & deep meditative states

Anna Wise
Barbara Brown
Elmer Green
Dale Walters
Eugene Peniston
Joe Kamiya

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Efficacy Studies

- Efficacious
  - Anxiety
  - ADHD
  - Chronic Pain
  - Epilepsy
  - Headache – Adult
  - Hypertension
  - Rheumatoid Disease
  - TMD

- Probably Efficacious
  - Alcoholism/Substance Abuse
  - Arthritis
  - Diabetes
  - Headache – Pediatric
  - Insomnia
  - TBI

Evidence-Based Practice in Biofeedback and Neurofeedback (2008) by Carolyn Yacza, PhD and Deb Montgomery, PhD

Question, Concerns, Comments
**STRESS: SYMPTOMS & STRATEGIES FOR COPING**

**Surviving**

- **Symptoms**
  - Increase in adrenaline released
  - Increases in muscle tension, blood sugar (sugar cravings), blood pressure
  - Short, shallow breathing; cold hands
  - Decreased sex drive; digestive system suppressed
  - Suppression of the immune system (more frequent illness)

- **Remedies**
  - **PF**: Life-style changes (exercise, improved diet)
  - **EF**: Relaxation training, **Biofeedback**

**COGNITIVE**

- Hypervigilence, apprehensive expectations
- Feeling anxious, a sense of urgency
- Hyperattentiveness > distractibility
- Decrease in higher level cognitions > confusion

- **PF**: Altered perceptions, Psychotherapy (RET, CBT, SIT)
- **EF**: Alter emotional and cognitive responses (affiliation, emotional support)

**BEHAVIORAL**

- Fight Response > irritability, impatience, anger
- Flight Response > isolation, avoidance, withdrawal

- **PF**: Alter nature of the stressor
  - assertiveness training, time management
- **EF**: Counteract the stress response
  - leisure, play, environmental engineering

Problem-Focused (PF) approaches work by changing the stressor
Emotional-Focused (EF) approaches work by tolerating the stressor

**STRESSORS**

- Environment
- Life Events
- Personality
Name ________________________________ Date ______________

**STRESS RESPONSE INDEX**

Please indicate how much these symptoms have bothered you in the past 2 weeks

0 = This symptom rarely or never occurs.
1 = This symptom occurs occasionally.
2 = This symptom occurs quite often.
3 = This symptom occurs all the time or nearly all the time.

<table>
<thead>
<tr>
<th><strong>Physiological Symptoms</strong></th>
<th>Sub-Total</th>
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<tbody>
<tr>
<td><em>racing or pounding heart</em></td>
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<tr>
<td><em>rapid breathing with short, shallow breaths</em></td>
<td></td>
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<tr>
<td><em>cold sweaty palms</em></td>
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<tr>
<td><em>butterflies in stomach or indigestion</em></td>
<td></td>
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<tr>
<td><em>gastrointestinal problems (i.e., constipation, diarrhea)</em></td>
<td></td>
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<tr>
<td><em>dry mouth</em></td>
<td></td>
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<tr>
<td><em>high blood pressure</em></td>
<td></td>
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<tr>
<td><em>muscle spasms or twitches</em></td>
<td></td>
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<tr>
<td><em>headaches</em></td>
<td></td>
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<tr>
<td><em>shoulder pain</em></td>
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<tr>
<td><em>more frequent colds or the flu</em></td>
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<tr>
<td><em>chronic fatigue, exhaustion</em></td>
<td></td>
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<tr>
<td><em>poor appetite or eating too much</em></td>
<td></td>
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<tr>
<td><em>skin rash</em></td>
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<thead>
<tr>
<th><strong>Emotional Symptoms</strong></th>
<th>Sub-Total</th>
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<tbody>
<tr>
<td><em>difficulty concentrating</em></td>
<td></td>
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<tr>
<td><em>feelings of being overwhelmed</em></td>
<td></td>
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<tr>
<td><em>feeling keyed up</em></td>
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<tr>
<td><em>feelings things are out of control</em></td>
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<tr>
<td><em>feelings of being sad, down in the dumps</em></td>
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<tr>
<td><em>forgetfulness</em></td>
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<tr>
<td><em>racing thoughts</em></td>
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<tr>
<td><em>restlessness</em></td>
<td></td>
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<tr>
<td><em>mood swings</em></td>
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<tr>
<td><em>apathy (an &quot;I don't care&quot; attitude)</em></td>
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<tr>
<td><em>inability to enjoy the things you used to enjoy</em></td>
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<tr>
<td><em>feeling you want to isolate yourself socially</em></td>
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<tr>
<td><em>feeling oversensitive to others</em></td>
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<thead>
<tr>
<th><strong>Behaviors</strong></th>
<th>Sub-Total</th>
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<tbody>
<tr>
<td><em>excessive worrying</em></td>
<td></td>
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<tr>
<td><em>overeating</em></td>
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<td><em>excessive use of alcohol</em></td>
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<tr>
<td><em>nightmares</em></td>
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<tr>
<td><em>insomnia</em></td>
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<tr>
<td><em>nail biting</em></td>
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<td><em>angry outbursts</em></td>
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<tr>
<td><em>crying too often</em></td>
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<tr>
<td><em>increase in sick days</em></td>
<td></td>
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<tr>
<td><em>unable to move from one task to another with ease</em></td>
<td></td>
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<tr>
<td><em>being excessively negative and critical</em></td>
<td></td>
</tr>
<tr>
<td><em>unable to relax or play</em></td>
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**Index Total________**
Psychophysiological Stress Profile

EMG SITE 1 __________________________ EMG SITE 2 __________________________

THERMAL __________________________ EDG (GSR) __________________________
  non-dominant hand                  dominant hand

T1,2,3                           **Baseline**
  Notes: ____________________________

T4,5                           **Performance Stressor**
  Notes: ____________________________
  Serial 7's (500 493 486 479 472 465 458 451 444 437 430 423 416 409
  402 395 388 381 374 367 360 353 346 339 332 325 318 311 304 297)

T6,7                           **Recovery**
  Notes: ____________________________
  Tell them to "relax"

T8,9                           **Emotional Stressor**
  Notes: ____________________________
  Recall an upsetting experience

T10,11                         **Recovery**
  Notes: ____________________________
  Tell to "relax"

T12,13                         **Anticipatory anxiety**
  Notes: ____________________________
  Tell client "I'm going to do something that you might find uncomfortable and you can stop if it become too. I'd like you to close your eyes and keep them closed until I tell you to open them."

T14                           **Startle Response**
  Notes: ____________________________
  Clap hands close to the client

T15-20                         **Recovery**
  Notes: ____________________________
  Tell them to sit back and do whatever they can do to relax deeply. Put on relaxation music.

INTERPRETIVE IMPRESSIONS:
  ____________________________________________________________
  ____________________________________________________________
Your **Psychophysiological Stress Profile Report**  
Functional testing of the Autonomic Nervous System

**PSYCHOPHYSIOLOGICAL STRESS PROFILE ASSESSMENT**

**NAME:** ________________________________  **DATE:** ______________

**ABOUT THIS TEST:**

The PSP subjects a patient to a number of challenges that most people find stressful. Each challenge is followed by a recovery period. Both the challenges and the recovery periods run for 2 minutes. The test is started with a 3-minute baseline period.

**THE STRESS CHALLENGES:**

1) **Performance Challenge:** This challenge involves doing a difficult task. It provides a good measure of performance stress. It can also provide a measure of psychosocial stress since many people worry about appearing "stupid" to the therapist as they struggle to complete the task.

2) **Emotional Challenge:** This challenge involves having to recount, as vividly as possible, a recent stressful event.

3) **Anticipation Challenge:** This challenge involves an indirect measure of anticipatory anxiety and correlates with high need for control, trust issues and hypervigilence about the future. The Anticipation Challenge ends with a loud noise which is meant to measure your startle response.

Recovery periods are spaced between each stressor and for an extended period at the end of the test.
**SURFACE ELECTROMYOGRAPH (SEMG)**

Muscular Tension and Holding (higher measurements indicate more muscular tension)

Your muscle tension levels were measured. Excessive tension drains energy and can lead to such problems as tension headaches, TMJ, muscle spasm and muscle weakness.

Placement: trapezius muscles

**Your Test Results:**

---

**Normative Data for EMG activity for the muscle(s) tested are:**

EMG1&2: mean: ≈ 2.2µV

mild tension 4.8µV moderate tension= 7.4µV radical tension= 10.0µV
**Thermal**

Vascular Constriction/Peripheral Blood Flow (lower temperatures indicate more stress)

Blood flow measurements are very responsive to stress and relaxation. By watching the rise and fall of your finger temperature, you will become aware of internal feelings associated with stress and relaxation. Constricting blood flow can cause problems with the immune system, delay healing, migraine headaches and is involved in some types of high-blood pressure. Extreme vasoconstriction is often seen with high levels of prolonged stress.

Placement: non-dominant hand temperature

**Your Test Results:**

<table>
<thead>
<tr>
<th>Normative Data for Thermal activity is:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>93-95°=very relaxed</td>
<td></td>
</tr>
<tr>
<td>90-93°=normal</td>
<td></td>
</tr>
<tr>
<td>86-90°=tense</td>
<td></td>
</tr>
<tr>
<td>below 85°=stressed</td>
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</table>

*BioNeurofeedback Treatment Center*
*(610) 660-0443*
Galvanic Skin Response

Sweat Gland Activity (higher measurements indicate more stress)

**SCL is also referred to as GSR:** The sweat gland activity on our hands is highly sensitive to our emotions and thoughts. This measurement will help you identify significant emotional and cognitive stressors. High levels of sweat are often seen with various types of anxiety especially when it is more mentally and emotionally based.

Placement: dominant hand conductance

**Your Test Results:**

<table>
<thead>
<tr>
<th>Normative Date for GSR activity is:</th>
<th>&lt;5μmhos = relaxed</th>
<th>5-10μmhos = slightly activated</th>
<th>10-20μmhos = agitated</th>
</tr>
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<tbody>
<tr>
<td>&gt;20 is usually an indication of an high levels of cognitive and emotional tension</td>
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</table>

Caveat: a very low GSR with little reactivity can be an indication of emotional numbing and learned helplessness

*BioNeurofeedback Treatment Center*

(610) 660-0443
RECOMMENDATIONS

Based on your test results, your biofeedback therapist will review the recommendations and plan of action that will best help you regain vitality, health and balance. There is space below for you to make additional notes based on your discussion with your therapist.

If you have any questions, please give us a call.
Heart Rate Variability Biofeedback Training

Respiration plays a central role in the both physical and emotional energy. Rapid breathing (hyperventilation) often accompanies a tense or stressful moment. We “blows off” carbon dioxide (CO₂) too quickly and this lowered level of CO₂ is called “hypocapnia.” Hypocapnia induces cerebral vasoconstriction and hypoxia and increases sympathetic nervous system (SNS) arousal and later causes rapid fatigue. The symptoms of hypocapnia include:

1) **Cardiovascular** -- palpitations, tachycardia, precordial pain, cutaneous vasoconstriction.
2) **Neurological** -- Central: dizziness, disturbance of consciousness and vision. Peripheral: paraesthesiae, tetany.
3) **Respiratory** -- shortness of breath, wheezing, chest tightness.
4) **Gastrointestinal** -- globus, dysphagia, epigastric pain, aerophagy.
5) **Musculoskeletal** -- muscle pain, tremors, tetany.
6) **Psychic** -- tension, anxiety.
7) **General** -- fatigue, weakness, exhaustion, sleep disturbance, nightmares.

**HRV biofeedback sessions**

Your training will include four components:

1. **Breath retraining:** Using a “strain” gauge, you will learn to use the primary breathing muscle, the diaphragm. The diaphragm is located at the base of the lungs. As we inhale, the diaphragm should drop down and push your abdomen out. Diaphragmatic breathing is sometimes referred to as deep abdominal breathing.

2. **Paced breathing:** Paced diaphragmatic breathing restores synchrony between the respiratory and cardiovascular systems. Paced breathing produces a pattern called the “Respiratory Sinus Arrhythmia” (or RSA), in which low frequency (LF) rhythms prevail in heart function, at a frequency of about 0.1 Hz, or 6 cycles per minute. The heart rate gently increases with each in-breath, and decreases with each out-breath, at a rate of about six cycles of breathing and heart rate change per minute. This RSA pattern produces greater homeostasis in the autonomic nervous system, reducing stress.
3. Achieving Resonant Frequency: Building the “meditator's peak” at about 0.1 Hz (low frequency range). Ordinary breath produces three heart rate frequencies referred to as VLF (very low frequency), LF (low frequency), and HF (high frequency).

4. Home training and integration into your life: several times a day, you should develop the habit of engaging in several minutes of paced breathing. You can run the program free for 30 days as a trial version. After that, the program can be bought for only USD $19.95. To purchase, run EZ-AIR and select the "Buy EZ-AIR" option in the File menu of the software.

- Go to [www.bfe.org](http://www.bfe.org)
- Go to the bottom of the page and click [download](http://download.ez-air.com)
- Set the program to the specification given to you by your biofeedback trainer

Regular practice is important for the first 6 weeks of your training. After that, you will benefit greatly by developing the ability to utilize your new breathing patterns whenever stress hits, and quickly manage it.
BioNeurofeedback Treatment Center

Initial EEG Evaluation

Name: ______________________ Date: _______ Data collection time: ______________

Medications at time of test: ________________________________

<table>
<thead>
<tr>
<th></th>
<th>delta</th>
<th>theta</th>
<th>alpha</th>
<th>SMR</th>
<th>beta</th>
<th>highbeta</th>
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<tbody>
<tr>
<td>.5-3 Hz</td>
<td>4-7 Hz</td>
<td>8-12 Hz</td>
<td>12-15 Hz</td>
<td>15-18 Hz</td>
<td>21-25 Hz</td>
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<tr>
<td>EO</td>
<td>Cz</td>
<td>Fz</td>
<td>F3</td>
<td>F4</td>
<td>O1</td>
<td>EC</td>
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<td></td>
<td>Read[RS]</td>
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<td></td>
<td></td>
<td></td>
<td>Listen[LS]</td>
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</tbody>
</table>

Save data to disk. Use format a:XXCCPP where XX=name initials, CC=condition and PP=Placement

Criteria Met for CADD: Yes______ No ______ Uncertain ______

Criteria Met for alpha subtype ADD Yes______ No ______ Uncertain ______

Criteria Met for depression indicator Yes______ No ______ Uncertain ______

Criteria Met for hyperactive cingulate Yes______ No ______ Uncertain ______

Criteria Met for low self-soothing capacity Yes______ No ______ Uncertain ______

Test Impressions/Interpretations:
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Recommended protocol(s):
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

SNR JN Vol 5, #4, 2001 (nb-my bandwidths differ slightly)
Patient's Name __________________________

Nasion to Inion: _____ cm (half = _____)
Fossa to Fossa: _____ cm (half = _____)
### Client's Name

______________________________

### BioNeurofeedback Treatment & Training Center

Celeste De Bease, PhD, BCIA-EEG

- Bala Cynwyd, Pennsylvania
- (610) 660-0443
- www.BioNeurofeedback.com

### Problems

<table>
<thead>
<tr>
<th>Year</th>
<th>Protocol Goal</th>
<th>Date</th>
<th>#</th>
<th>Site</th>
<th>Inhibit(μV)</th>
<th>Inhibit-T</th>
<th>Result(μV)</th>
<th>Score%</th>
<th>Reward(μV)</th>
<th>Reward-T</th>
<th>Result(μV)</th>
<th>Score%</th>
<th>Ratio</th>
<th>Points</th>
<th>Time</th>
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1. protocol goal-Ex: focusing; calming; sleeping; relaxing, seizure control, peak performance, etc.
2. enter bandwidth
3. enter training threshold
4. enter mean amplitude at completion of session

**Notes:**

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Bala Cynwyd, Pennsylvania
(610) 660-0443