Psychophysiology Today

Breathing for better health

Vol. 7 - Issue 1/2010

ISSNR: 1999-9879

Biofeedback Foundation of Europe

TABLE OF CONTENT

ISSNR: 1999-9879

FROM THE EDITOR

Volcanic power can bring people together!

This could be the header for a nice newspaper article written last April during our outstanding BFE meeting in Rome. Everyone enjoyed this special meeting in spring in Rome. The weather was fantastic and the evening light during our cultural tours was breathtaking warm and orange and soft. It was topped by the gala event in the Villa Borghese, overlooking the ancient part of Rome with live music of Italian songs.

The meeting brought new aspects and ideas. The Italians biofeedback society was nurtured and is now expanding as the clinicians and researchers recognized the importance of applied psychophysiology.
By holding the meeting in a hotel, we time to interact: a friendly and familiar feeling that is fabric of the BFE meeting. The illuminated sky was probably caused by the eruption of the volcano with the inexpressible name Eyjafjallajökull. The conference ended with the awareness that that people couldn't go home as expected and I, as the organizer, was a bit worried about complaints and problems that could arise due to these circumstances.

However it was different – it seemed that our group was not only in different in what they were doing but also in their living philosophy. I want to take this opportunity to thank everyone for the patience and friendliness they demonstrated. The BFE organized a bus to the Netherlands, picking up people from Rome and bringing them home with several stop over's. Other people used the disaster of the volcano eruption as a opportunity to extend their stay and joined those who couldn't leave. We formed groups that were just enjoying themselves in Rome and forged friendships and created social support. The crisis was transformed into new opportunities of growth.
Personally, I was lucky that my flight on Monday evening was one of the first regular flights; however, some people suffered financial loss as they could not return to go back to work. Nevertheless, this meeting will always be remembered and many more people will come to the BFE meetings thanks to the volcano, pizza, light and Rome☺ \
This edition of our annual journal offers interesting articles, from the faculty who will hold workshops at our upcoming meeting in Munich, in February 22- 26, 2011 at the "Technische Hochschule München "
We are looking forward to welcome Paul Swingle, Peter Litchfield and JoAnne Dahl as new presenters at our conference and we are very much delighted that the German Society for Biofeedback and Psychophysiology will also offer different presentations and workshops during the conference.
We hope that the e-journal continues to be useful and look forward to your submissions.

Monika Fuhs - Editor in Chief

P.S: If you are interested in viewing some pictures of our past meeting- here is a link you can use:
http://picasaweb.google.de/106361436312644838158/BFERome2010?authkey=Gv1sRgCOqElMSo3Zju9AE&feat=directlink#

back

PRESIDENTAL NOTE

The BFE annual meeting is an interdisciplinary biofeedback conference to nurture communication and education between specialists from different disciplines. Experts from neurofeedback, biofeedback as well as somatic awareness disciplines come together to share and learn. They recognize that specific physiological signals are always part of the whole. The dynamic physiological changes that are observed during biofeedback monitoring and training confirms Elmer and Alice Green's psychophysiological principal (Green et al., 1970): „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." The biofeedback confirms that a person is a system in which every part is affected by every other part.

In a broader perspective, biofeedback training is not separate from diet, exercise and social factors. These all interact together. This interaction can easily be observed when monitoring and training respiration patterns and is reflected in colloquial phrases such as "a sigh of relief," "inspired", "expired" or "a gasp of fresh air." Respiratory changes affect every physiological system and vice versa. For example, hyperventilation can evoke abnormal EEG patterns in people with epilepsy or trigger seizures, while sequential incomplete exhalation for just 30 seconds will induce feelings of anxiety and lightheadedness in most healthy people (Peper & MacHose, 1993). However, the effects induced by changes in respiration are also modulated by other factors such as blood sugar levels. If a person has a low blood sugar levels, then hyperventilation will rapidly decrease the mean EEG frequency to four Hz, however if the blood sugar level is high the mean EEG frequency does not decrease (Peper et, 2009).
These examples illustrate the necessity of being open to broader perspectives to enhance clinical and education success. The upcoming 2011 BFE meeting is a forum that offers a broad range of basic and applied psychophysiology and biofeedback workshops and presentation. These presentations and exchanges allow the undocumented be documented, the unseen be seen, the unfelt be felt, and the dysfunctional be functional.

I look forward to seeing you at the Munich 2011 meeting.

Erik Peper, Ph.D.

Green, E., Green, A., & Walters, D. (1970). Voluntary control of internal states: Psychological and physiological. Journal of Transpersonal Psychology, 1, 1-26.
Peper, E., Harvey, R., Takabayashi, N., & Hughes, P. (2009). How to do clinical biofeedback in psychosomatic medicine: An illustrative brief therapy example for self-regulation. Japanese Journal of Biofeedback Research. 36 (2), 1-16.
Peper, E. and MacHose, M. (1993). Symptom prescription: Induc¬ing anxiety by 70% exhalation. Biofeedback and Self-Regulation. 18 (3), 133-139.

back

CapnoLearning: Respiratory Fitness and Acid-Base Regulation

Peter M. Litchfield, Ph.D.,
Behavioral Physiology Institute, Santa Fe, New Mexico, USA
Contact: p.litchfield@bp.edu

CapnoLearning® is about learning breathing behaviors that facilitate optimal respiration and its associated regulation of acid-base physiology. CapnoLearning involves the use of a capnometer (or capnograph) which provides real-time information about carbon dioxide (CO_2) retention in the alveoli of the lungs for evaluating learned breathing behaviors that serve respiratory chemistry. Clients discover how they have learned to breathe, how their breathing affects them, and how to effectively self-regulate breathing behavior based on learning rather than prescriptive exercise. CapnoLearning includes the application of principles of phenomenological exploration, behavioral analysis, behavior modification, biofeedback, awareness training, and cognitive learning.

Few people, lay or professional, know that (1) breathing directly regulates body chemistry, including pH, electrolyte balance, blood flow, hemoglobin chemistry, and kidney function, and that (2) breathing is a behavior subject to the same principles of learning as any other behavior, including the role of motivation, reinforcement, emotion, attention, perception, and memory. Bringing together these two simple facts means integrating the biological and behavioral sciences in profoundly practical ways relevant to the lives of millions who have unwittingly learned breathing behaviors that compromise respiration and acid-base balance.

Breathing is behavior, and as a behavior it serves multiple objectives. Although, respiration is obviously and unquestionably the fundamental objective, breathing is required for basic physiological functions and everyday activities such as talking, laughing, coughing and the like. It is indicated in relaxation, yoga, and meditation. It is utilized as defensive behavior for triggering emotions (e.g., anger), for dissociating from trauma, for reducing fear (avoidance learning), and for achieving secondary gain (operant learning). None of these considerations, however, may necessarily be associated with healthy respiratory chemistry, and unfortunately, quite often to the contrary. CapnoLearning is about learning breathing behavior that serves respiratory physiology and its associated acid-base regulation, that is, respiratory fitness.

Respiration

Respiration can be broken up conceptually into three phases: external, internal, and cellular respiration. External respiration is about the mechanics of breathing, moving gases (air) in and out of the lungs. Internal respiration is about ensuring the transport of oxygen in the blood from the lungs to tissue cells, and then the transport of metabolic CO_2 from tissue cells to the lungs for both its excretion and its reallocation to systemic circulation for acid-base regulation. Cellular respiration is the utilization of oxygen in mitochondria for the synthesis of adenosine triphosphate (ATP), molecules that cells ultimately break down for their energy.

Basic to external respiration is the subject of gas exchange. Gases are measured by virtue of the pressures that they exert. When gases are mixed, e.g., air, they each contribute to a total pressure. Each gas contributes a partial pressure (p). Total atmospheric air pressure at sea level, at 15 degrees Celsius and 0% humidity, is 760 mmHg (millimeters of mercury). At sea level partial pressure oxygen, written pO_2, is 159 mmHg(20.93%), and partial pressure carbon dioxide, written pCO_2, is 0.3 mmHg

back

ISSNR: 1999-9879

(less than 0.04%). Most of the gas exchange, O2 and CO2, takes place in the fundamental alveolar-capillary unit, the alveolus. There are about 300 million alveoli in the lungs, surrounded by about 280 billion pulmonary capillaries. Capnography is about measurement of average alveolar pCO2, which is observed and measured in the final phase of exhalation, when gases are presumably 100 percent alveolar (not mixed with anatomical dead space gases); this measurement is known as End Tidal CO2, or ETCO2, or pCO2 at the "end of the tides of air," that is, when the "tide is out."

The **Henderson-Hasselbalch (H-H) equation** is central to understanding internal respiration, which describes pH regulation in extracellular fluids: pH = [$HCO3^-$] ÷ pCO2 (in its simplified conceptual format), wherein pCO2 is regulated by breathing, and bicarbonate concentration [$HCO3^-$] is regulated by the kidneys. These fluids include blood plasma, interstitial (fluids that surround tissue cells), lymph, and cerebrospinal fluids. Changes in the numerator of the equation, bicarbonate concentration, are generally slow (8 hours to 5 days), whereas changes in the denominator, partial pressure carbon dioxide (pCO2), are immediate. This makes breathing behavior the central player in moment-to-moment acid-base regulation. Arterial levels of pCO2, known as PaCO2, remain between 35 and 45 mmHG to keep plasma pH within its normal range (7.35 to 7.45 mmHg). In normal healthy lungs, when perfusion (blood) and ventilation (air) are matched, alveolar pCO2 (and hence, ETCO2) is approximately equivalent to PaCO2.

Balancing the Henderson-Hasselbalch (H-H) equation is achieved through the presence of receptor sites in (1) the brainstem that are sensitive to interstitial pH and pCO2, and (2) the arterial system (aorta and carotid arteries) that are sensitive to plasma pH and pCO2. Changes in pH and pCO2 in both locations together drive the respiratory centers in the brainstem, along with partial pressure oxygen (pO2) changes detected also at arterial receptor sites. If pH is too low (< 7.35 mmHg), or too high (>7.45 mmHg), PaCO2 is reduced or increased by altering breathing rate and depth (minute volume). Brainstem reflex-regulated breathing, under normal circumstances, maintains alveolar pCO2 at 35 to 45 mmHg, wherein rapid diffusion from alveolus to pulmonary capillary provides for almost immediate equilibration, thus ensuring a PaCO2 equalling approximately the same value.

Actual quantities of carbon dioxide generated by the body vary considerably based on metabolism, e.g., meditation vs. exercise, although the PaCO2 values required for maintaining acid-base balance remain the same. At rest, for example, only about 15 percent of the CO2 arriving in the lungs is actually excreted; the balance is reallocated to systemic circulation. Capnograph instrumentation does not indicate how much CO2 is being exhaled, rather it indicates the alveolar pCO2 being maintained, and thus the approximate PaCO2.

Behavioral hypocapnia

The H-H equation from a medical perspective describes changes of pH of involved parameters and their regulation by physiological regulation. When bicarbonate concentration [$HCO3^-$] drops as a result of metabolic acidosis, e.g., lactic acidosis during anaerobic exercise, breathing is considered to be a reflexive compensatory response that contributes to restoration of acid-base balance. When pCO2 is too low, extracellular pH rises with resulting **respiratory alkalosis**, a condition medically defined as **hypocapnia**. When pCO2 is too high, extracellular pH falls resulting in **respiratory acidosis**, a condition medically defined as **hypercapnia**. The medical perspective offers up organic explanations that may give rise to these conditions. Integrating behavioral psychology with the H-H equation, however, sets the stage for examining these conditions from a learning perspective, where the denominator of the equation may be directly regulated by powerful reinforcement of operant breathing behaviors that compromise acid-base balance. Thus, the equation might be rewritten as follows: **acid-base regulation (pH) = physiology [$HCO3^-$] ÷ behavior (breathing for PCO2 changes)**. The implications are impressive.

back

Learned **overbreathing** behavior results in **behavioral hypocapnia**, where breathing rate and depth are mismatched. Its consequence is an increased level of pH, or respiratory alkalosis, which may have profound immediate and long-term effects that may trigger, exacerbate, and/or cause a wide variety of emotional (anxiety, anger), cognitive (attention, learning), behavioral (public speaking, test taking), and physical (pain, asthma) changes that may seriously impact health and performance (Fried, 1987; Laffey & Kavanagh, 2002). Practically speaking, behavioral hypocapnia is defined as ETCO2 measured to be below 35 mmHg brought about by learned breathing patterns: 30-35 mmHg is mild to moderate, 25-30 mmHg is serious, and 20-25 mmHg is severe hypocapnia. Behavioral hypocapnia reduces respiratory fitness and disturbs acid-base chemistry as follows:

- Hypocapnia increases red blood cell alkalinity and reduces red cell CO2 levels, thereby increasing hemoglobin's affinity for oxygen (Bohr Effect).1 The consequence is "unfriendly" hemoglobin: oxygen saturation rises (HbO2) but oxygen distribution to tissues is compromised. Note that the uninformed practitioner may mistakenly interpret higher saturation readings taken with an oximeter as a sign of improved respiration. The same red blood cell physiology also restricts the amount of nitric oxide (a potent vasodilator) released by hemoglobin, resulting in significant vasoconstriction, even ischemia. These two factors together may significantly reduce reduction of oxygen and glucose to cells that require them.

- Hypocapnia increases plasma alkalinity, thereby triggering significant electrolyte changes. Calcium ions migrate into muscles in exchange for hydrogen ions, resulting in their immediate constriction, e.g., arteries, gut, and bronchioles. Vasoconstriction can lower cerebral and coronary blood flow/volume by up to 50 percent in a matter of seconds. Bronchiole constriction increases airway resistance and may trigger asthma symptoms or precipitate an attack. Gut constriction may result in nausea and cramping, as in the case of altitude sickness. Calcium-magnesium imbalance in skeletal muscles may increase the likelihood of spasm and fatigue. Sodium and potassium ions in interstitial fluids migrate into cells in exchange for hydrogen ions resulting in sodium and potassium deficiencies.

- Chronic hypocapnia orchestrates yet different physiological changes. The kidney requires CO2 for the reabsorption of both bicarbonate and sodium ions, as well as for generating new bicarbonates lost in the urine as a result of buffering acids generated by protein breakdown (e.g., phosphoric acid). The resulting bicarbonate and sodium deficiencies may include some of the same effects as those identified with chronic stress, e.g., fatigue. Other effects include: elevated platelet level, aggregation, and "adhering" propensity; antioxidant depletion as a result of excitotoxin production (e.g., glutamate); and systemic inflammation.

- Hypocapnia may set the stage for intracellular lactic acidosis (e.g., in neurons) by significant reductions in oxygen supply and increased cellular metabolism resulting from the influx of sodium and potassium.

Here are some of the symptoms and deficits triggered, exacerbated, caused, or perpetuated by hypocapnia:

- RESPIRATION: shortness of breath, breathlessness, bronchial constriction and spasm, airway resistance, reduced lung compliance, asthma symptoms; CHEST: tightness, pressure, and pain;
- PERIPHERAL CHANGES: trembling, twitching, shivering, sweatiness, coldness, tingling, and numbness;
- HEART: palpitations, increased rate, angina symptoms, arrhythmias, nonspecific pain, ECG abnormalities;
- EMOTION: anxiety, anger, panic, apprehension, worry, crying, low mood, frustration, performance anxiety, phobia, generalized anxiety;

back

- STRESS: tenseness, acute fatigue, chronic fatigue, effort syndrome weakness, headache, burnout;
- SENSES: blurred vision, dry mouth, sound seems distant, reduced pain threshold;
- CONSCIOUSNESS: dizziness, loss of balance, fainting, black-out, confusion, disorientation, disconnectedness, hallucinations, traumatic memories, self-esteem, personality shifts;
- COGNITION: attention deficit, inability to think, poor memory, learning deficits;
- MUSCLES: tetany, hyperreflexia, spasm, weakness, fatigue, pain; ABDOMEN: nausea, cramping, and bloatedness;
- MOVEMENT: coordination, reaction time, balance;
- VASCULAR: hypertension, migraine, digital artery spasm, ischemia;
- BLOOD: red blood cell rigidity, thrombosis;
- SLEEP: apnea;
- PERFORMANCE: endurance, altitude sickness.

Breathing behavior

The above symptoms and deficits, mediated by learned breathing behaviors that disturb basic acid-base chemistry, typically go "unexplained" or are mistakenly attributed to other unrelated causes, e.g., stress. In this context of thinking, these effects become **behavioral consequences**, rather than unexplained clinical symptoms and performance deficits. Most forms of breathing training, however, do not explicitly address the alignment of external with internal respiration, but rather focus on the mechanics of breathing, usually in the service of reducing sympathetic arousal or changing states of consciousness, e.g., relaxation, meditation, yoga. Unfortunately, however, it is usually implicitly assumed that the specific breathing mechanics embedded in these practices (e.g., breathing more deeply and more slowly) necessarily pave the way to optimal respiration. This is a profound misunderstanding (of the underlying mechanisms?).

Respiratory fitness is vital to health and performance, and must be regulated despite the breathing acrobatics of talking, emotional encounters, and professional challenges. As a result of very specific learning, dictated by specific learning circumstances, breathing may "change on a dime" as a function of where (s)he is, who (s)he is with, and what (s)he may be doing, thinking, and feeling. Respiratory fitness needs to be in place regardless of whether or not one is relaxed or stressed, excited or bored, active or inactive, working or playing, focused or distracted.

"Good respiration requires neither relaxation nor a specific mechanical prescription, save one: the varied melodies of breathing mechanics must ultimately play the music of balanced chemistry" (Litchfield & Tsuda, 2006).

To insist on slow breathing and relaxation, for example, may be not only unrealistic, but may also be counterproductive.

CapnoLearning

CapnoLearning is about the application of traditional learning theory to breathing behavior. Applied behavioral analysis and behavior modification are thus central considerations. Behavioral detective work is essential, which means pinpointing the history of learned breathing behavior along with the factors that may be sustaining it. If overbreathing is a reinforced operant behavior, **simply teaching clients the "right" mechanics may be both irrelevant and misleading**. Practicing "good" mechanics may mean to nothing more than repetitive exercises that attest to one's skills to consciously manipulate breathing behavior, which often may in itself be a problem. If learning history is overlooked, training will fail. The governing factors will continue to govern.

Basic learning considerations include classical conditioning, operant conditioning, two factor-learning,

back

avoidance learning, state-dependent learning, cognitive learning, and biofeedback. Operant conditioning includes concepts such as: operant response (e.g., breathing rapidly), positive reinforcement (e.g., feeling in control), negative reinforcement (e.g., fear reduction), and discriminative stimulus (e.g., sense of breathlessness). Discriminative stimuli (SD) trigger operant behaviors based on reinforcement contingencies, e.g., "feeling challenged by an authority figure" may serve as an SD for accessory muscle (chest) breathing, an operant response positively reinforced by "feeling in control."

Basic classical conditioning concepts, as applied to breathing behavior, include the (CS) conditioned stimulus (e.g., the experience of small breaths) and the (CR) conditioned response (e.g., fear), i.e., small breaths elicit fear. Both kinds of learning may be state-dependent which means that they may only be triggered in specific states, e.g., when hypocapnic. In fact, chronic hypocapnia may become the gateway into a different personality, a different sense of self, thus making it a form of "chemical" dependency.

Operant and classical conditioning invariably work together, and comprise what is known as two-factor learning. Classically conditioned responses provide both the motivation and reinforcement for the operant behaviors. For example, classically conditioned fear of the transition time between breaths (a conditioned stimulus) provides motivation for aborting the exhale (an operant response), which is then reinforced by fear reduction (a negative reinforcement). The transition time serves both as a conditioned stimulus AND as a discriminative stimulus. These principles, as applied to breathing behavior, are illustrated in the case described below.

Case history

For several years a physiotherapist, previously an Olympic athlete, was frequently (weekly) unable to go to work, finding herself "without enough oxygen" (breathlessness) usually immediately after having eaten breakfast. Her consultations with the medical profession had led nowhere, only to psychiatric medications. Based on her own interpretation of the symptoms, she was certain that underbreathing was her problem. Her solution was to implement relaxation and breathing techniques she had previously learned about from books and colleagues.

Her EtCO2 levels were observed with an educational capnograph (the CapnoTrainer®, manufactured by Better Physiology Ltd) at rest as well as when challenged with specific tasks and emotions. There was no evidence of overbreathing, or hypocapnia. Nevertheless, based on her responses on the Breathing Interview Checklist (Litchfield) and the ensuing interview, it was decided to introduce guided intentional overbreathing where symptoms, emotions, and memories could be explored as her EtCO2 values slowly diminished. After about a minute of increasing the depth of breathing while slowing the rate, her EtCO2 dropped to about 28 mmHg, where upon she immediately exclaimed that "this is exactly what happens to me, and now I won't be able to get out of it for the rest of the day!" When it was pointed out that the procedure was identical to that which she had described as her own solution to the symptoms, she was flabbergasted when she could also see for herself that her solution to the problem was its cause!

When she was asked to reinstate her previous pattern of eucapnic (normal pCO2) breathing, she failed to be able to do so. She was then coached for recovery, which included the following elements: diaphragmatic breathing (to make breathing easy), passive exhale (to eliminate intention), allowing for more transition time between the exhale and the inhale (to extinguish fear), **systematically minimizing the size of the breath** (the desired operant), and thoughts about happy events (to change the state). Within about four minutes her pCO2 levels normalized and she felt relaxed and relieved. As these instructions were not consistent with her belief system, she expressed her incredulity about the success of taking smaller breaths over and over again. Guided overbreathing was introduced a second time, and once again she was trapped in her vicious circle pattern and was unable to reinstate eucapnic breathing. After four or five occasions, however, with pCO2 biofeedback she quickly learned (1) how

back

to intentionally create a hypocapnic state by overbreathing (negative practice), and then (2) how to intentionally restore optimal respiration pCO2(35 -40 mmHg) while experiencing hypocapnia. She was no longer victim to her own learned vicious circle breathing behavior.

Eating and breathing behaviors had become decoupled as a result of being in a hurry to finish breakfast, with the result of disturbed respiration and the associated hypocapnic symptoms, e.g., breathlessness. Besides not being aware of the origin of the problem, nor of the behavior she had learned as a consequence, both her interpretation (e.g., not getting enough O2) of her symptoms (e.g., breathlessness) and her solution (e.g., big breaths) to their amelioration were faulty. Thus, her first step to resolving her vicious circle breathing pattern was cognitive: to learn a new belief system about breathing based on the facts, to interpret her own breathing experience in a new way, and to replace her old hypocapnic self-talk, “I can’t get enough oxygen,” with new self-talk, “my body knows what to do.” These new cognitive behaviors are best learned through awareness training during the interval between exhalation and inhalation, where and when the brainstem reflexes can be identified and experienced2. Allowing for the reflex, and feeling it in action, builds a sense of confidence, an important new positive reinforcement for learning new breathing behaviors.

The second step was to identify the (operantly) learned breathing behaviors (e.g., taking deep breaths) that steered her into hypocapnia, the specific discriminative stimuli (e.g., feeling in a hurry while eating) that triggered these behaviors, the classically conditioned stimuli (small breaths) that triggered the emotions (e.g., fear) that motivated the behaviors, and the reinforcements that maintained the behaviors (e.g., fear reduction). Her learning was based on pCO2 biofeedback where she learned about the effects of breathing patterns on her physiology and psychology.

The third step was to extinguish the conditioned fear response (the CR) to small breaths (the CS), thereby removing the negative reinforcement for bigger breaths (fear reduction). The fourth step was to learn new breathing behaviors (e.g., taking small breaths) triggered by introducing new discriminative stimuli (e.g., early-on symptoms of hypocapnia), and new conditioned stimuli (e.g., also early-on hypocapnic symptoms) that provided new sources of motivation and reinforcement (e.g., instant relief) for the new behavior. All of these learning considerations were specific to the client and became embedded in her own physiology, a part of who she is; they were not generic prescriptive exercises simply imposed on a learned faulty breathing pattern.

Efficacy

Does CapnoLearning work? In regard to efficacy, four separate questions emerge: (1) Have changes in respiratory chemistry been clearly demonstrated to regulate the appearance and disappearance of physical and mental symptoms and deficits? Yes. The answers abound in pulmonary and acid-base physiology textbooks everywhere (e.g., Levitsky, 2007). (2) Are the behavioral techniques utilized for assessing behavior, extinguishing behaviors, and learning new behaviors supported by the research literature? Yes. The answers abound in behavioral psychology textbooks everywhere (e.g., Miltenberger, 2008). (3) Are these same behavioral techniques successful when applied to breathing behavior? Yes (e.g., Ley, 2001). And, (4) does restoring good respiration in clients with compromised respiration ameliorate specific symptoms and deficits? The answer is always, “it depends.” It depends on how compromised respiration may be playing a role in a specific client’s presenting complaints. And thus, learning new breathing behaviors may not help, help a little, help some of the time, help a lot, or eliminate the problem altogether.

Millions of people, worldwide, teach and learn about breathing, but unfortunately, little of what is practiced is rooted in the textbook sciences of pulmonary physiology (e.g., Levitsky, 2007), acid-base physiology (e.g., Thomson, Adams, & Cowan, 1997), behavioral analysis (e.g., Leslie 2005), behavior modification (e.g., Kazdin, 2001), cognitive learning (Freeman, 2005), biofeedback (e.g., Schwartz & Andrasik, 2003), and the psychology of respiration (e.g., Fried, 1987, 1993). Unfortunately, misinformation,

back

misconceptions, pseudoscience prescriptions, and ignorance about breathing and how it effects respiration have predominated with little attention, if any, paid to these immensely rich literatures and their relevance to breathing behavior. Failure to directly address breathing as learned behavior, and how it regulates fundamental body chemistry, means leaving out the most fundamental, practical, and profound factors that account for (1) the far-reaching effects of maladaptive breathing habits, as well as for (2) the surprising benefits of learning breathing behaviors that optimize respiration. CapnoLearning represents an effort to address this opportunity.

Endnotes

[1]The Bohr Effect is descriptive of how (1) the presence of carbon dioxide in red blood cells and (2) the pH of blood cell cytosol, alter the affinity of hemoglobin for oxygen as depicted in the oxyhemoglobin (hemoglobin that is carrying oxygen) dissociation curve. This S-shaped curve specifies the relationship between PO2 and hemoglobin oxygen saturation (SaO2), wherein as PO2 drops so too does SaO2. Decreased levels of carbon dioxide and increased levels of pH (higher alkalinity), as a result of hypocapnia, increase hemoglobin's affinity for oxygen, thus moving the dissociation curve to the left and thus requiring yet lower levels of PO2 for the release of oxygen.

[2]The brainstem reflex referred to here is the dorsal respiratory groups (DRG), a respiratory medullary center located in the nucleus of the tractus solitarius (NTS), which consists mostly of inspiratory neurons. The center is the principal regulator of diaphragmatic activity. This reflex can be directly experienced, with practice, as "air hunger" during the interval immediately preceding inhalation.

References

Freeman, Arthur (Editor-in-Chief). (2005). Encyclopedia of Cognitive Behavior Therapy. New York: Plenum.

Fried, R. (1987). The hyperventilation syndrome: Research and clinical treatment. Baltimore: John Hopkins University Press.

Fried, R. (1999).Breathe well, be well. New York: John Wiley & Sons.

Fried, R. & Grimaldi, J. (1993). The Psychology and Physiology of Breathing in Behavioral Medicine, Clinical Psychology, and Psychiatry. New York: Plenum Press.

Kazdin, Alan E. (2001). Behavior Modification in Applied Settings (Counseling) (6th edition). Belmont: Wadsworth Publishing Co.

Laffey, J.G. & Kavanagh, B.P. (2002). Hypocapnia. New England Journal of Medicine, 347(1), 43-53.

Leslie, Julian C. (2005). Principles of Behavioural Analysis. New York: Psychology Press.

Ley, R. (Ed.). (2001). Respiratory psychophysiology and the modification of breathing behavior. Behavior Modification, Special Issue, 25(4), 491-666.

Levitzky, M. G. (2007).Pulmonary Physiology (7th edition). New York: McGraw Hill.

Litchfield, Peter M. & Tsuda, Akira (2006). Good breathing, bad breathing. L'Esprit D'aujourdhui, 8(1), 47-57. (In Japanese, long version in English available at www.bp.edu.)

Miltenberger, R. G. (2008). Behavior Modification: Principles and Procedures. Pacific Grove CA: Brooks/Cole.

Schwartz, Mark S. & Andrasik, Frank (Eds.). (2003). Biofeedback: A Practitioner's Guide. New York: Guilford Press.

Thomson, W. S. T., Adams, J. F. & Cowan, R. A. (1997). Clinical Acid-Base Balance. New York: Oxford University Press.

back

Originally published in California Biofeedback, summer 2003, Vol. 19, No. 2, pp 5-9

Potentiating Neurotherapy: Techniques for Stimulating the EEG

Paul G. Swingle, Ph.D.
R. Psych. Vancouver, BC, Canada
Contact: pswingle@swingleandassociates.com

Reprint with Permission from California Biofeedback

Since concentrating on neurotherapy as my primary therapeutic tool, my research has focused on developing techniques for increasing the efficiency and accelerating the process of modifying brain functioning. Many neurotherapists do provide clients with various adjunctive self-administered treatments to facilitate the therapeutic process. These "add ons" include relaxation exercises, self-hypnosis, energy psychology routines, life style modification recommendations, subliminal affirmation devices, cranial microamperage stimulators, audiovisual stimulators and therapeutic harmonics. The reason for prescribing these procedures, of course, is because they are believed to potentiate the therapeutic process.

I have been particularly interested in the use of therapeutic harmonics and I have been doing research in this area for almost 20 years. One such harmonic (Alert) is a blend of several carrier frequencies providing a 10Hz overriding frequency that is imbedded in a filtered pink noise at between –15 and –25 dB(C). The effect of the Alert harmonic is that it suppresses EEG theta (3-7 Hz) amplitude (Swingle, 1996) and has been found to markedly accelerate the neurotherapeutic treatment of Common Attention Deficit Disorder (CADD) (Swingle, 2001). The Alert harmonic has been used by thousands of clients and is marketed by several companies. The data on this harmonic are very consistent. The suppressing effect is about the same with males and females (provided the sound pressure levels are presented at gender specific levels — see Swingle, 1992), but differs with age. For clients over 18 the suppression of theta amplitude is about 30% whereas for young children the suppression is about 15%.

It is not surprising that sound influences brain activity and further research has identified a number of harmonic blends that have specific effects on the EEG such as reducing beta amplitude or increasing theta amplitude and thus can be very useful as adjunctive treatments for sleep or anxiety difficulties. Harmonics have also been developed to enhance the Sensory Motor Rhythm (SMR) and slower frequencies, suppress high frequencies (28-40Hz) and to speed up alpha.

When working with subtle energy such as subliminal harmonics, it is important to prepare the stimuli so that they are within the effective range. In the case of sound, the effective range is very specific and narrow (techniques for preparing such materials are described in Swingle, 1992). If the sound is too close to supraliminal levels the information is not processed. This "gray zone" is found not only with sound but with other modalities as well (Gary Swartz, personal communication, reported this gray zone with olfaction). This suggests two independent processing systems for information above and below perceptual thresholds and importantly, an energy level zone in which the information is not processed efficiently in either system. The second finding suggesting that subtle energy may be processed differently from more potent stimulation is that identical stimuli produce different effects supraliminally versus subliminally. For example, when presented at 15dB(C) below ambient, a 10 Hz harmonic increases heart rate whereas a 25 Hz harmonic at the same intensity reduces heart rate, which is the opposite of what one would expect with supraliminal presentation of these same frequencies (Ohatrian et al, 1960, Swingle, 1993).

back

The adjunctive treatment procedures described above are static in the sense that they are applied to have a specific effect on autonomic and/or central nervous system functioning. The Alert harmonic, for example, is prescribed for home use by a CADD child because at intake it has been determined that this stimulation will reduce theta amplitude for this person.

My research into braindriving technologies was stimulated by a long acquaintance with Len Ochs. As many readers know, Dr. Ochs was one of the pioneers in the development of stimulated EEG treatment procedures. Dr. Ochs demonstrated that making supraliminal light stimulation (Light Emitting Diodes (LEDs) mounted on eyeglass frames) contingent on EEG activity could be an effective neurotherapeutic treatment for a variety of disorders. At this same time I was heavily into research on subliminal energy treatment procedures as adjuncts to neurotherapy. Interestingly, Len Ochs discovered at about this same time that the energy from the LEDs (with the lights completely blocked) was a more powerful treatment than when the lights were seen by the client! Given the theta suppressing effect of the Alert harmonic it seemed logical to use that harmonic to modify brainwave amplitudes by making the sound contingent on EEG events in a manner similar to that introduced by Len Ochs.

At the present time, there are two products for delivering harmonics contingent on EEG or other biofeedback events. One is a software product and the second is a stand-alone unit that will deliver stimuli contingent on biofeedback events. The software product is called Braindriver and is a program used in the Brainmaster EEG system. The second product is the Braindriver Cascade, which is used with any EEG feedback system. This unit can deliver sound, or other stimuli, contingent on many quantitative and qualitative EEG events. The unit can be used with any biofeedback instrument with sound feedback capability but the present paper will be limited to the EEG.

It would perhaps be useful at this point to offer a few examples of stimulating or braindriving the EEG. The most straightforward example is a child with CADD in which the only remarkable feature of the QUICKQ (more about this below) is high amplitude theta activity over the sensory motor cortex (location Cz). The usual treatment for this condition is theta inhibit, beta enhance neurofeedback over location Cz. The number of sessions required to treat this disorder using "conventional" neurofeedback is between 40 and 80 (Lubar, 1991). One can reliably and permanently remediate this simplest form of ADD in 15 to 20 sessions using braindriving technology (Swingle, 2001). In between one third and one half of the neurotherapy sessions braindriving is included. When theta amplitude is below the training threshold the game icons move and the child hears the reward tone. When the theta amplitude goes above the training threshold then the game icons stop moving, the child does not hear the reward tone but the braindriverr theta suppressing harmonic (in this case, Alert) is presented which suppresses theta amplitude.

A more complicated example is in the treatment of seizure disorders. Again, the conventional treatment for epilepsy is to enhance the amplitude and/or frequency of SMR operant responses over the sensory motor cortex (locations C3, Cz, C4). One should also set an inhibit on theta because if theta amplitude increases when the SMR amplitude increases, there is a likelihood that seizure activity will remain unchanged or become worse even though SMR amplitude is increasing (Lubar and Bahler, 1976). Using braindriving technology one can cascade the units so the theta-suppressing harmonic is presented when theta amplitude increases above threshold and the SMR-enhancing harmonic is presented when SMR amplitude drops below threshold. The braindriving technology can be used alone (i.e., no visual feedback) or with visual feedback displays. In most cases, braindriving is not used exclusively in the treatment of any condition but is combined with conventional neurofeedback. This is a practical clinical decision since the method of researching this technology has been to add it to the neurotherapy and observe the changes in the EEG and determine if the enhancements are sustained in the ongoing neurotherapy treatment sessions. We have been systematically increasing the percentage of sessions in which braindriving technology is used. There have been cases in which braindriving has been used exclusively but these have been cases in which there were circumstances mitigating conventional neurotherapy. One of these cases will be discussed in detail later in this article.

back

In keeping with the philosophy of rapid and efficient neurotherapeutic treatment, I have developed a rapid intake brain assessment – the QUICKQ (a summary procedure sheet is appended). This rapid intake assessment requires about 6.5 minutes of recording at 5 brain sites (O1, Cz, F3, Fz, F4). At locations Cz, O1, F3 and F4 three brainwave bands are recorded: Theta (3-7Hz), Alpha (8-12Hz) and Beta (16-25Hz). At Cz and O1 we measure Eyes Open (EO) and Eyes Closed (EC) and also we test the harmonics to be used in the braindriver to verify that they affect brainwave amplitude as expected. At the frontal locations all recordings are EC. The appended procedure sheet for the QUICKQ describes the assessment procedure and suggested clinical probes based on the acquired data. It should be noted that the QUICKQ is not used in cases where a full nineteen-site brain map is warranted. The following cases all proceeded from the QUICKQ in which, aside from identifying areas for treatment, the effectiveness of the harmonic sounds for modifying brainwave activity had been established.

Case RG

This young woman was under treatment for a severe anxiety disorder that manifested in eating difficulties and poor immune functioning as evidenced by incessant colds and flues. Of several areas requiring treatment, one prominent brainwave feature was a markedly deficient theta/beta ratio at location O1. Her ratio was .54 whereas normative would be around 2.00. The neurotherapeutic treatment for this condition is to enhance theta amplitude and/or decrease beta amplitude at location O1. Generally, one does not commence treatment with these brainwave bands nor at that exact location but gradually approach the training bandwidths and locations starting in areas and with bands that are easier for the client to master. However, this is beyond the scope of this paper; suffice it to say that the following example of braindriving occurred at the time when the client was ready for theta amplitude enhancement. In keeping with the strategy stated above of approaching the treatment frequency with more manageable (for the client) frequencies, we started with braindriving alpha (8-12Hz). The potentiating harmonic for alpha amplitude enhancement is 6 to 8 cycles per minute that is presented to the client anytime alpha amplitude drops below the training threshold. The baseline alpha amplitude was 3.2 microvolts (uV) that increased to 8.4 uV after 20 minutes of braindriving. Consistent with what one finds with alpha/theta neurofeedback training, when alpha amplitude increases theta tends to increase as well. In this case the theta amplitude increased by 15.4% (from 5.2 to 6.0 uV) that resulted in an increase in the theta/beta ratio of 14.3%.

Case KL

KL is a man in his 50s who was under treatment for posttraumatic diffuse body pain and severe sleep quality difficulties. His initial ratio of theta to SMR (13-15Hz) was 4.40 whereas a normative range is below about 2.50. At the session to be reported here, his starting theta/SMR ratio was 3.29. The braindriving protocol was to present the Alert theta-suppressing harmonic when theta amplitude exceeded the training threshold and to present the SMR enhancing harmonic when the amplitude of the SMR dropped below the training threshold. Baseline measurements at the start of the session indicated a theta amplitude of 5.6 uV and SMR amplitude of 1.7 uV. At the end of the session the theta amplitude remained unchanged at 5.6 uV but the amplitude of the SMR had increased to 4.0 uV for a ratio of 1.40. It is unusual to have changes this large but this case nicely shows that even with driving techniques the brain "knows what it needs", a concept most neurotherapists embrace, in that theta remained unchanged while SMR increased even though both were driven. KL reported a marked improvement in the diffuse body pain at the next session.

Case TP

This little girl was under treatment for a serious learning disorder. One of the things we noticed in her QUICKQ was that the anterior cingulate gryus was hyperactive. Her ratio of hibeta (28-40Hz) to beta was .88 at intake whereas normative is .55 to .65. Hyperactivity of this structure is related to obsessive/compulsive forms of behavior including stereotypy of thought, problems "letting go" of thoughts, stubbornness, and of particular concern in situations of learning disorders, often resistance to accepting different approaches to learning.

back

Braindriving with young children usually is integrated into conventional biofeedback procedures because braindriving alone is rather boring. One simply sits there while the computer delivers sound stimuli about thirty percent of the time. As described above, braindriving can be integrated into conventional biofeedback with visual icon displays. In this case when the icons were not moving the braindriving sound stimuli were presented. This particular session with TP was rather late in treatment. Her hibeta/beta ratio was down to .59 at the start of this session. The suppressing harmonic was 24.5Hz and the feedback game display was Pacman. The braindriving harmonic was presented, on average, 30% of the time. TP's end session hibeta/beta ratio had dropped to .53 that is well within normative range.

CASE GR

One of the most exciting applications of braindriving is with clients who have limited capacity for volitional biofeedback. Although it is an axiom of neurotherapy that the brain learns even if the client is not paying attention nonetheless neurofeedback is compromised when the client has such limited capacities. Such clients include the more severe autistic spectrum disordered, psychotic, and brain injured. We have used braindriving with such clients many of whom have become capable of fully cooperative volitional neurofeedback. Braindriving protocols for such clients include suppression of hibeta and beta amplitude over the anterior cingulate gryus with autistic spectrum disordered children with a "hot midline", so-called "squash" protocols that suppress the amplitude of all frequencies from 2 to 25Hz for developmentally delayed and severe FAS children, and slow frequency suppress and "speed-up" alpha protocols for stroke clients.

GR spent the first 45 minutes of his first appointment screaming and thrashing on my office floor despite heroic efforts of his parents. Fortunately, one of my staff members is a most talented young woman who works magic with these seemingly unapproachable children. She was able to habituate GR to tolerate electrodes on his head and to remain relatively quiet for a few minutes at a time watching videos of animated cartoons. This habituation took several sessions after which we started the braindriving protocols and obtained a QUICKQ. The braindriving protocols included suppression of hibeta and beta over the frontal midline (Fz), "squash" over the frontal (F3 and F4) and central (Cz) areas, and suppression of theta amplitude over the occiput (O1 and O2) as well as centrally and frontally. There have been some remarkable changes in GR. He converses in sentences, albeit awkward and clipped, interacts with peers and, importantly, is capable of volitional neurofeedback where we are now addressing the anomalies found in his full 19 site QEEG. We started with the QUICKQ after GR was able to tolerate a single electrode and this miniQ guided our braindriving protocols. Once GR was able to tolerate the full cap we preceded to the full QEEG which is guiding his current treatment.

The above cases give examples of the use of braindriving in different clinical situations. I will end this section with a few other examples of braindriving under different conditions. Dr. Ochs told me that he found that he only needed a few seconds of his treatment to be clinically effective. In fact, he maintained that the effects could be mitigated if treatment continued beyond a few seconds! With braindriving as well we often find that the major effect occurs within the first few minutes and that prolonged treatment (20 to 30 minutes) yields little further gain. The following data are from a session with a severely traumatized woman in which the purpose of the session was to increase theta amplitude in the back of the brain (location O1). Her theta amplitude was 3.6 when she started. The data for the first 20 seconds of treatment indicated that the theta amplitude increased, at five-second intervals, as follows: 4.1, 4.6, 5.8, and 8.1. Thus, after 20 seconds of braindriving her theta amplitude increased from 3.6 to 8.1 uV. After an additional 20 minutes her theta amplitude increased to 10.1 uV indicating that the amplitude had increased 125% in twenty seconds and an additional 24.7% after an additional 20 minutes.

Braindriving can also be combined with other treatment procedures as well. The following data were obtained from a session in which Roshi 2 was being used. In this case the Roshi leads were on the frontal lobes (F3 and F4) and the Roshi stimulation was magnetic goggles. The purpose of Roshi is to reduce total brainwave amplitude but one might also want to enhance theta amplitude in conjunction

back

with Roshi suppression of other brainwave frequencies. This is a case of a man in his 40s who was under treatment for anxiety, depression and sleep disturbance. In addition to the Roshi treatment, theta in the back of the brain (O1) was brain driven to either increase, or at least not decreases, the theta amplitude so as not to exacerbate the sleep problem. The end session data indicated that alpha had decreased by 22.4%; beta by 17.5% but theta had increased by 10.5%. The theta/beta ratio at the start of the session was 1.00 and had increased to 1.34 by session end.

The final example is from a session in which the client, a woman in her 50s, had a braindriving session when she was heavily medicated with paroxetine (Paxil) and risperidone (Risperdal). At the start of the session her theta, alpha and beta amplitudes were 3.1, 2.9, and 8.2, respectively. At the end of the 30 minute session the amplitudes were 3.0, 2.9 and 8.3, respectively. Thus, braindriving appeared to be ineffective under this condition, a situation often encountered, in my experience, with conventional neurofeedback with heavily medicated clients.

In summary, braindriving has been found to be an extremely effective method for increasing the efficiency of neurotherapy. Combined with the very rapid and efficient QUICKQ intake procedure, neurotherapy can be a remarkably cost effective treatment option for a very wide range of disorders. Braindriving is simply applied learning theory in which stimuli with known and measurable effects on the central nervous system are made contingent upon a response, following a classical conditioning paradigm. This classical conditioning protocol can be combined with the operant conditioning properties of neurofeedback. One nice feature of the Braindriver Cascade, for example, is that it can also be used to reinforce an operant, in addition to presenting stimuli in classical conditioning format. For example, the instrument can be programmed so that if the child produces a SMR response every few seconds, an electric train can be kept moving for a few seconds even though the SMR response is a brief operant. As described above, a second Braindryvr can be programmed to classically present the theta suppression harmonic whenever theta amplitude goes above the training threshold and this can be completely independent of the ongoing operant reinforcement of the SMR. In my opinion, this combination of volitional and non-volitional procedures is going to dramatically accelerate the development of neurotherapy as a primary treatment option for many disorders.

References

Lubar, J. F. (1991). Discourse on the development of EEG diagnostics and biofeedback treatment for attention-deficit/hyperactivity disorders. Biofeedback and Self-Regulation, 16, 201-225.

Lubar, J.F. and Bahler, W.W. (1976). Behavioral management of epileptic seizures following biofeedback training of the sensorimotor rhythm. Biofeedback and Self-Regulation, 1, 77-104.

Ohatrian, G.E., Peterson, M.C. and Lazarre, J.A. (1960). Responses from clicks from the human brain: Some depth electrographic observations. Electroencephalography and Clinical Neurophysiology, 12, 479-489.

Swingle, P.G. (1992). Subliminal Treatment Procedures: A Clinician's Guide. Sarasota, FL: Professional Resource Press.

Swingle, P.G. (1993). Subliminal Facilitation. Invited Workshop. International Conference on Transcultural Psychiatry, Montreal, Quebec.

Swingle, P.G. (1996). Subthreshold 10-Hz sound suppresses EEG theta: Clinical application for the potentiation of neurotherapeutic treatment of ADD/ADHD. Journal of Neurotherapy, 2, 15-22.

Swingle, P.G. (2001). Parameters associated with rapid treatment of Common ADD (CADD). Journal of Neurotherapy, 5, 73-84.

back

Appendix Technical Notes

1. Ear ground and reference
2. Epoch length 15 seconds, shorter if necessary
3. Recording @ Cz is usually one continuous run of 10 epochs
4. Recording @ O1, F4 and F3 are usually in one interrupted run changing electrode position as necessary by pausing data collection
5. Recording @ Fz is usually one interrupted run changing filters by pausing data collection
6. Cognitive challenge is either reading or counting
7. "Alert" is theta suppressing harmonic
8. Data are mean amplitudes unless artefacts indicate the use of medians
9. Band amplitudes calculated as square root of single Hz components squared
10. Unremarkable ranges, listed below, are normative guidelines, specific ranges may vary somewhat based on equipment , environmental conditions and certainly age of client.
11. The QUICKQ is not appropriate for assessment of stroke, seizure disorders, traumatic brain injury. QUICKQ is often appropriate for first assessment of autistic spectrum, brain dysfunction to determine initial treatment protocols to be followed by full QEEG

SWINGLE 5-POINT QUICKQ

(RECORD: 3-7Hz; 8-12Hz; 16-25Hz)

EPOCH	@Cz	@O1	@F4	@F3	@Fz	
1	EO	EO	EC	EC	EC	
2	EO	EO	EC	EC	EC	(RECORD: 2Hz; 28-40;
3	EC	EC	EC	EC	EC	16-25Hz)
4	EO	EO			EC	
5	(READ				EC	
6	OR				EC	
7	COUNT)				EC	(RECORD: 8-9Hz;
8	EO		(EO = EYES OPEN)		EC	11-12Hz; 10Hz)
9	"ALERT"		(EC = EYES CLOSED)		EC	
10	"ALERT"				EC	

Unremarkable clinical ranges

1. @CZ: mean theta/beta <2.2; alpha increase ec >30%; theta/beta ratio cognitive challenge <2.2 but no marked difference from mean and beta increase <20%; sum of all mean amplitudes, total power, (TP) <60.0
2. @O1: EO and EC theta/beta > 2.00; alpha increase CC >50%
3. @F4 and F3: F4 = f3 in all bands, theta/beta ratios <2.00; theta/alpha ratio 1.25 - 1.75; TP = and <60.
4. @fz: 2Hz <8.5; 28-40/beta .45 - .55; 28-40 & beta <15.0; 8-9/11-12 <1.30

Clinical Implications of Remarkable Ranges

The following clinical probes should be considered as suggestions for developing a behavioral profile of the client. Remarkable ranges do not validate a clinical diagnosis. Similar remarkable patterns can be associated with different clinical profiles. For example, developmental delay, fetal alcohol syndrome and some autistic spectrum profiles can have very similar remarkable eeg patterns. It is important to keep in mind, therefore, that the remarkable ranges indicate behavioral inefficiencies and not necessarily clinical diagnoses. Unique remarkable patterns are associated with some specific conditions, such as common attention deficit disorder (cadd) (item 1 under cz, with no other remarkable ranges).

back

Thus it is the treatment specificity afforded by identifying remarkable ranges rather than diagnostic labelling that makes the QUICKQ a valuable rapid intake procedure. The following suggested clinical probes are not exhaustive. The experienced clinician will identify many patterns associated with specific client complaints.

@Cz

1. Mean theta/beta >2.2 and under cogni-tive challenge > 2.2, probe for CADD
2. Mean theta/beta <2.2, under cognitive challenge >2.2, probe for add and/or problem with poor reading comprehension/retention
3. Mean theta/beta > 3.00, probe for ad(h)d
4. Limited or negative ec alpha increase, probe for visual processing (memory)problem. If also negative @o1, probe for traumatic stress
5. "Alert" theta suppression (relative to mean) if > 5% prescribe for home use
6. TP >>60.0, probe for developmental delay, autistic spectrum behavior, marked cognitive deficits

@O1

1. Theta/beta eo <2.00, probe for poor stress tolerance, "racing" thoughts, anxiety. If<<2.00, probe for addictive behavior, gad,and stress precipitated depression
2. If theta/beta EC <EO probe for sleep disturbance particularly sleep onset insomnia.If both ec and eo about = and <1.50 also probe sleep disturbance
3. If alpha ec increase minimal or negative and also at cz, probe for traumatic stress
4. Theta/beta >3.00, probe for cognitive inefficiencies. Also found in some asperger's patterns

@F4 and F3

1. Theta/beta >2.2, probe for cognitive inefficiencies
2. Theta/alpha <1.25, probe for frontal alpha add - problems with organization, sequencing, sustained focus. If theta/alpha <.80, also probe for fibromyalgia and sleep disturbance
3. F4 beta >20% of F3 beta and/or F4 theta/beta <20% of F3 theta/beta, probe for depression particularly in adults also probe for impulse control problems in children
4. F4 theta/beta >30% f3 theta/beta, probe for emotional volatility or conversely restricted emotional range
5. Tp>>60.0, probe for developmental delays, autism spectrum disorders, memory/cognitive deficits in adults
6. F4 beta>20% of f3 beta and f4 theta >20% of f3 theta probe for fibromyalgia/ chronic fatigue, particularly when o1 theta/beta <1.50 @fz

1. Delta (2Hz) >9.0, probe for cognitive deficits
2. 28-40hz/beta < .45, probe for excessive passiveness
3. 28-40hz/beta > .55, probe for stubborn behavior, obsessive/compulsive behavior; perseveration in autistic spectrum behaviors; assume hot midline (anterior cingulate gryus) in treatment of autistic spectrum behaviors
4. Implications of ratios in 2 and 3 above apply only if sum of amplitudes of 28-40hz & beta <15. If latter summated amplitudes >15, but 28-40/beta is within normative range, probe for fretting and assume hot midline in treatment of autistic spectrum behaviors
5. 8-9/11-12 >1.50, probe for cognitive inefficiency, age related deficits in memory and cognitive processing.
6. 8-9/11-12 >>1.50, probe for developmental delay, marked cognitive deficits, sleep disorder

Paul G. Swingle, Ph.D. wasprofessor of psychology at the University of Ottawa from 1972 to 1997 prior to moving to Vancouver. As fellow of the Canadian Psychological Association, Dr. Swingle was lecturer in psychiatry at Harvard Medical School from 1991 to 1998 and during the same time period was Associate Attending Psychologist at McLean Hospital (Boston) where he also was head of the Clinical Psychophysiology Service. Dr. Swingle was Chairman of the Faculty of Child Psychology at the University of Ottawa from 1972 to 1977 and Clinical Supervisor from 1987 to 1997. He is a registered psychologist in British Columbia and is certified in Biofeedback and Neurotherapy.

back

Pesticides May Raise Kids' Risk of ADHD

Study Shows Food Is Likely Source of Pesticide Exposure Linked to ADHD

D.J. DeNoon
WebMD Health News
Reviewed by Laura J. Martin, MD

May 17, 2010 -- Relatively low-level exposure to common pesticides - probably from residues on foods - doubles kids' risk of ADHD, Harvard researchers find.

The findings come from a nationally representative sample of 1,139 U.S. kids aged 8 to 15 who were tested for ADHD (attention deficit hyperactivity disorder) and had urine samples tested for signs of exposure to various organophosphate pesticides such as malathion. Kids with higher-than-average levels of pesticide metabolites were about twice as likely to have ADHD as kids with undetectable levels of pesticide metabolites, find Marc C. Weisskopf, PhD, ScD, associate professor of environmental health and epidemiology at Harvard School of Public Health, and colleagues.

„This raises concerns that ubiquitous pesticides may be contributing to the national burden of ADHD, which already is quite high," Weisskopf tells WebMD. It's not just kids who live on farms or otherwise get extremely frequent or high-dose exposure to pesticides. The metabolites detected in the Weisskopf study indicate that these kids have ongoing, low-level exposure to pesticides at levels that may affect their development.

„What I think is so important is this is not a select group of people with unusually high pesticide exposure," Weisskopf says. „This is a general population sample. If this link with ADHD is proved true, there is a big chunk of people this is going to be relevant for."
Weisskopf notes that his study is designed to detect a possible risk but is not able to prove that one thing caused another. For example, the data could be taken to mean that kids with ADHD somehow behave in ways that increases their exposure to pesticides. While that appears counterintuitive, further studies are needed to test whether pesticides truly contribute to ADHD.

Organic Foods: To Buy or Not to Buy

Pesticide Exposure from Common Foods
Alarmingly, the Weisskopf study complements an earlier study by Virginia A. Rauh, ScD, MSW, and professor of family health at Columbia University's Mailman School of Public Health and co-deputy director of the Columbia Center for Children's Environmental Health.

In their 2006 study, Rauh and colleagues found that kids with the most exposure to a household organophosphate pesticide had significantly delayed mental and motor development. These effects increased over time. And kids who were exposed while still in their mothers' wombs were more likely than other kids to have ADHD.

„We were quite sure the exposure came from residential pesticide use and from food," Rauh tells WebMD. „What happens is a whole variety of commonly used foods are sprayed routinely with organophosphates to eliminate pests. That is where the food residue comes from."

back

Unlike cigarette smoke, a health-harming pollutant that one can do much to avoid, pesticides are hard to avoid. They're everywhere -- even in foods we generally consider healthy.

„Here is a situation where the average consumer isn't buying the wrong kind of food or breathing the wrong kind of air. There is not a whole lot the average person can do," Rauh says. „And that is where we need the EPA [Environmental Protection Agency] to take a good look at all these studies and see if the risk warrants dropping the safety limit for these chemicals and tightening their regulation."

Pesticide Exposure from Common Foods continued...

According to tests by the consumer organization Environmental Working Group (EWG), seven fruits are among the foods most contaminated with organophosphate pesticides:

- peaches
- strawberries
- apples
- domestic blueberries
- nectarines
- cherries
- imported grapes

The EWG also found high pesticide levels in five vegetables:

- celery
- sweet bell peppers
- spinach
- kale
- collard greens
- potatoes

The good news is that EWG found 15 fruits and vegetables to be relatively low in pesticide residues:

- onions
- avocado
- sweet corn (frozen)
- pineapples
- mango
- sweet peas (frozen)
- asparagus
- kiwi fruit
- cabbage
- eggplant
- domestic cantaloupe
- watermelon
- grapefruit
- sweet potatoes
- honeydew melon

Weisskopf and colleagues report their findings in the May 17 online issue of Pediatrics.

back

Living beyond your Pain: Using Acceptance & Commitment Therapy (ACT) to Ease Chronic Pain

A summary by C. Ruf

JoAnne Dahl uses the basic premises of acceptance commitment therapy (ACT)* with chronic pain to accept that pain is a normal part of human life. Thus, we cannot aim at getting rid of pain for good. In ACT suffering and pain are seen as two separate states of being. Suffering is seen as the struggle with difficult emotions, thoughts, unwelcome memories and sensations. Additionally to the pain itself, people keep on ruminating about it and identify with their suffering which causes only more suffering. It becomes obvious that the first step to ridding yourself of your suffering is to accept your pain.

Her book offers advice to people who become more and more hopelessness because they have tried treatments that did not work Mrs. Dahl answers that it is necessary for people to know that they are not alone in feeling frustrated with their pain management treatment. One of the reasons, why people feel hopelessness in our society is that they expect a pain-free life.

Mrs. Dahl emphasizes that feeling hopeless about unsuccessful attempts to get rid of pain sends us important messages: first, it is the attempt to get rid of the pain that is hopeless, not the individual. Second, it is self-evident that struggling in a hopeless battle rather than putting your energy in what you love to do is depressing. Third and most important, the reason why we want pain out of the way is to be able to live the life we want to live. In order to reclaim our lives it is important to take the feeling of hopelessness seriously.

Concerning the question how you can best reconcile physical and mental pain that seems to fuel each other JoAnne Dahl emphasizes that the only way to avoid pain is to avoid living because these two belong inevitably together. It is self-evident that no one wants to be afflicted with illness or to suffer of a broken heart. But if you want to live your life you need to take some risks. She explains that ACT is not going to help you to avoid pain but to ask you to shift the way you deal with your personal experiences. The acceptance of the present state is in Mrs. Dahl's view the first step towards reducing suffering and living a valued life.

Another important aspect of ACT is the term "values illness". This term describes a state when you have pushed aside your valued life because you are focusing on reducing the pain. In this way we are struggling against ourselves – a struggle that we can't win which may lead us to depression. Joanne Dahl wants to draw particular attention to the fact that one reason why we get into this fix is the cultural myth – like she calls it – that claims that *a good life is a painless life*. People should abandon this thought.

Mrs. Dahl came to her unusual approach by learning to live richly with pain. She realized that feelings of hopelessness are ubiquitous: not only among clients but also among the physicians, psychologists, vocational advisors and even insurance companies. Part of the reason is that Western medicine does not work that well on chronic pain. To deal with chronic pain, ACT suggests to accept the pain that cannot be fixed and use one's resources to get back to life. Suffering is caused more by the struggle than by the pain itself. Pain may be something that we can't control but suffering can be very much controlled in her view.

back

For clients to maintain their progress and not return to their habits, she suggests that practice is most important. Only constant practice can make the ACT skills part of your life. All the obstacles that want

to pull you off course can be seen as sign that you are on the right path because if you have rested at home these obstacles haven't shown up. JoAnne Dahl advices to start looking actively for these obstacles because they strengthen your skills. You should look with compassion and curiosity for thoughts and feelings that want to pull you off the course and accept them as a part of you.

In most cases we are creatures of habits and tend to fall into old patterns. In JoAnne Dahl's opinion it is the best to accept this and examine it as a learning process that will help you get back on the track. Her final advice is to choose our lives continuously hundreds of times a day.

"ACT is a therapy approach that uses acceptance and mindfulness processes and commitment and behavior change processes to produce greater psychological flexibility." (Hayes & Stroshal P13: 2004). ACT is considered to be part of the third wave of therapies, with their focus on acceptance, values, mindfulness and cognitive defusion seen uniquely poised to assist with the many problems that are inherent in the experience of pain, including all of the difficult psychological content that often accompanies it.

The main differences in ACT is that the functional analysis in ACT describes, the triggers and functions of the chains of pain behavior as well as the functions of pain and the fears of pain in a much wider context for each individual. (Dahl, Wilson, Luciano & Hayes 2005). Another difference in this ACT model of chronic Pain as well as functional analysis is the treatment of the client's language. ACT technology does this by defusion exercises and observing thoughts as thoughts. The aim of the ACT model in pain is creating flexibility around the client's stuckness in pain and building a repertoire toward valued life directions. (Dahl, Wilson, Luciano & Hayes 2005)

Note: JoAnne Dahl will be offering a workshop at the upcoming BFE Meeting in Munich 2011

Our Break tip for computer workers

In Memoriam of Prof.Dr.Dr.med. Michael Mück-Weymann

Some people spend a lifetime devoted to science, technological advances, and quest for knowledge to improve the lives of others. Today, science pays homage to a man who devoted his whole self to science, even in the last moments of a fatal disease: the German physician, researcher, psychotherapist and professor Michael Mück-Weymann. He recently died leaving an incredible contribution to science. We want to thank him for the more than 160 scientific publications, and more than 380 scientific presentations at international congresses.
Michael Mück-Weymann practised clinical activities at various hospitals, for example at the psychosomatic clinic of the University of Erlangen and of Dresden. He was head of the department of psychophysiology and preventive medicine at the University Clinic Dresden. At the hospitals Neustadt/Aisch and Bad Windsheim Mück-Weymann he worked as head doctor in the field of psychosomatics and behavioral medicine.

Additionally, he was nominated as a lecturer in the fields of applied physiology, psychosomatics and psychotherapy at the University of Erlangen-Nürnberg. Furthermore he was engaged in scientific collaboration and teaching at diverse German Universities.

In the remaining time, Michael Mück-Weymann worked freelance as psychotherapist and furthermore as supervisory therapist for the German Society of Biofeedback (DGBFB).

When it comes to his research, many different areas were examined from philosophy to medicine, from psychology to human biology. In general, Michael Mück-Weymann's clinical and scientific interest is expressed in his work in psycho-cardiology, in particular the interaction between heart physiology and depression, and heart biofeedback. Other fields of interest were somatoform and autonomic dysfunction, psychopharmacology, biofeedback and relaxation therapy (AT, PRM & FE), psychosocial health (especially prevention, burnout), stress medicine, philosophical aspects of medicine, non-invasive functional measurements of perfusions of the skin as well as brain and peripheral vessels.

His research involved also the use of certain medical devices. He tried to assess the quality of affordable devices for measurement of heart rate variability (HRV) to evaluate, if they were sufficient to detect abnormalities in high risk patients and athletes and to compare Laser Fluxometry Doppler (LDF) with photoplethysmography (PPG).

In a study published in April 2003, Mück-Weymann assessed the level of correlation of the time domain variables between a reference "golden standard" and less expensive devices. He quoted that the latter to be sufficient to permit initial screening by family doctors, and self-administration by high-risk athletes and patients.

In his study about Laser Fluxometry Doppler (LDF) and photoplethysmography (PPG) Mück-Weymann was able to show that experimental data obtained with PPG and LDF were not equivalent and that one has to be cautious regarding comparing and interpreting results obtained with these two different methods. LDF or PPG are frequently used as non-invasive tool to assess skin blood flow. They are both thought of as to be suitable and interchangeable methods for the detection of sympathetically activated vaso-constrictive episodes that can be provoked by voluntary deep inspiration (DI), the so-called inspiratory gasp response (IGR).

Furthermore, Michael Mück-Weymann was interested in the effects of sertraline, an antidepressant of the selective serotonin reuptake inhibitor class (SSRI) and lorazepam, a high potency benzodiazepine drug.
In an article published in July 2003, he evaluated the cognitive and autonomic effects of sertraline.

back

He showed that sertraline caused a significant reduction of heart rate and SCL ($P<0.05$), whereas HRV and SCR did not change. Cognitive functions such as flicker fusion frequency, memory, choice reaction time and psychomotor performance were not influenced by sertraline but slow and fast beta power density in the qEEG increased. Cognitive and psychomotor performances were not altered in healthy humans receiving multiple dosing with sertraline. The observed decreases in heart rate and SCL may thus be due to a sympathic-inhibitory effect of sertraline.

Another study concerning psychopharmacological effects was published in June 2007: Mück Weyman here analyzed the effects of non-sedative doses of Lorazepam on cutaneous responses to aversive stimuli and subjective mood. He showed that Lorazepam may attenuate SCRs to aversive stimuli without affecting vigilance or subjective mood. Thus attenuation of autonomic responses to aversive stimuli may not be specific for the observed anxiolytic effect.

Mück-Weymann's studies also addressed the influence of rescue service personnel's shift work to psycho-physiological parameters. The aim of the investigation was to gather information about the interaction between psycho-physiological parameters and how these were influenced by shifting of work load. The investigations included measurements of blood pressure, heart rate variability, and salivary cortisol.
In this study a lowered feeling of well-being was associated with a pronounced decrease of salivary cortisol ($r = 0.538$; $p < 0.05$), as well as lower blood pressure values ($r = 0.547$; $p < 0.05$), and a lower LF/HF quotient ($r = 0.836$; $p < 0.01$), indicating lower sympathetic and/or increased parasympathetic activation. After three night shifts, lower sympathetic activation seemed to negatively affect the well-being.

Far more pages would be necessary to portray Michael Mück-Weymann's life's work with all its facets, so this can only be a brief outline. Michael Mück-Weymann will certainly be remembered as a man of science who made a great contribution to more than one field of scientific research.

In: Japanese Journal of Biofeedback Research, 37(1), 2010, 19-28.

back

Surface Electromyographic Biofeedback to Optimize Performance in Daily Life: Improving Physical Fitness and Health at the Worksite

E. Peper[1], A. Booiman[2], M. Tallard[3] and N. Takabayashi [4]
[1] San Francisco State University, San Francisco, USA
[2] Mensendieck Remedial Therapy, Wormer, The Netherlands
[3] The Turning Point: Cognitive and Educational Solutions, LLC, Brick, New Jersey, USA
[4] Institute for Holistic and Integrative Medicine, Kobe, Japan
Contact: epeper@sfsu.edu

Muscle pain is the primary cause of discomfort for more than 30% of patients who visit their primary physicians with severe pain. These pains are often caused by dysponesis which is unaware misdirected muscle efforts not necessary for task performances. It can consist of 1) excessively tightening muscles that are used for the task performance, 2) tightening muscles not necessary for the task performance (inappropriate co-contractions), 3) not relaxing muscles after the task has been completed, or 4) not relaxing muscles momentarily during task performance to allow for ongoing regeneration (surface electromyograhic gaps/micro-breaks).These chronic covert muscle tensions are a significant co-factor in the etiology, maintenance and progression of many disorders such as headaches, backaches, joint pain, repetitive strain injuries, myalgias, etc. Dysponesis can be identified with surface electromyographic (SEMG) feedback.

The benefits of using SEMG to reduce dysponesis through awareness and training are illustrated by two clinical case examples: 1) to improve health at work when packing apples and 2) to enhance performance while working out in the gym on an elliptical exercise machine.

As documented by the SEMG recorded from the upper trapezius and/or forearm flexors, the reduction of misdirected muscle efforts decreased the neck and shoulder pains at work and at home and enhanced performance on an elliptical exercise machine. SEMG is a useful clinical tool to assess, monitor, provide feedback to the therapist and client, document muscle dysponesis, and teach clients awareness and voluntary control to reduce their dysponesis and improve health.

Keywords: Surface electromyography (SEMG), Dysponesis, Posture, Pain, Performance, Repetitive strain injury (RSI)

back

****

In: Japanese Journal of Biofeedback Research. 36 (2), 2009, 1-16.

How to do Clinical Biofeedback in Psychosomatic Medicine: an Illustrative Brief Therapy Example for Self-Regulation

E. Peper[1], R. Harvey[1], N. Takabayashi[2] and P. Hughes[3]
[1] San Francisco State University, San Francisco, California U.S.A.
[2] Institute for Holistic and Integrative Medicine, Kobe, Japan
[3] Our Lady of the Lakes University, San Antonio, Texas U.S.A.
Contact: epeper@sfsu.edu

Biofeedback interventions, based on the psychophysiological principle that thoughts, emotions, and body interact, affecting each other, have been shown to be powerful clinical tools for use in psychosomatic medicine settings and primary care settings where 75% of patients may present with symptoms of unknown causes. This paper describes both overt and covert factors supporting successful biofeedback training. Highlighted biofeedback approaches addressed are: a) dynamic uses of the stress profiling; b) reframing the patients' experiences as a result of normal or even excessive biological reactions; and, c) details of cardio-respiratory feedback practices. The clinical example is illustrated by the description of a two session intervention for a 20 year old woman to reduce symptoms of chronic anxiety and crying. This case illustrates that clinical biofeedback is more than just attaching sensors or having the person mechanically practice some prescribed behavior.

Keywords: Biofeedback, Hypertension, Anxiety, Clinical practice, Respiration

****

In: The Behavior Analyst Today. 6(3), 2005, 191-202.

Behavior Analysis of Epilepsy: Conditioning Mechanisms, Behavior Technology and the Contribution of ACT

J. Dahl and T. Lundgren
Department of Psychology, Uppsala University, Uppsala Sweden
Contact: jo_anne.dahl@comhem.se; tobiaslundgren455@hotmail.com

The conditioning mechanisms involved in the epileptic seizure behavior along with subsequent effective behavioral treatment have been known for more than a half a century. The behavior technology of seizure control provides low-cost, drug free treatment alternative for individual already suffering from seizures and the stigmatization of epilepsy. Despite this substantial amount of research, behavior therapy for seizures is not available to most people. This aim of this paper is to present the history of the behavior analysis and therapy developed in the last century. In addition to the established behavioral technology, a third wave contextual behavior therapy, Acceptance and Commitment therapy is shown in a recent study to contribute to new dimensions of treatment. Whereas, previous behavioral treatment regimens have aimed at seizure control, ACT aims at creating psychological flexibility around all of the experiential avoidance patterns associated with epilepsy and builds repertoire towards the individuals valued life. A treatment model that includes both the behavioral analysis and seizure control techniques along with ACT components: acceptance, defusion skills, mindfulness, and committed action in valued direction may have greater success than behavioral treatments alone. While behavioral control strategies may be used for preventing, predicting and actually interrupting seizure behavior, acceptance-based skills are used for creating flexibility around "resistance" to having seizures. While more research is needed, this combination represents a viable alternative and or compliment to drug and surgical therapy.

back

Keywords: Epilepsy, applied behavior analysis, Acceptance and Commitment Therapy, third wave contextual behavior therapy

****

In: Deutsche Medizinische Wochenschrift. 2009 Dec; 134 (51-52):2601-6.

Music and Health--What Kind of Music is Helpful for Whom? What Music not?

H.J. Trappe
Medizinische Universitätsklinik II (Schwerpunkte Kardiologie und Angiologie), Ruhr-Universität Bochum.
Source: http://www.ncbi.nlm.nih.gov/pubmed/20013543
Contact: hans-joachim.trappe@ruhr-uni-bochum.de

It is well known that music not only may improve quality of life (QoL) but also have different effects on heart rate (HR) and its variability (HRV). Music emphasis and rhythmic phrases are tracked consistently by physiological variables. Autonomic responses are synchronized with music, which might therefore convey emotions through autonomic arousal during crescendos or rhythmic phrases.

A greater modulation of HR, HRV and modulations in cardiac autonomic nerve activity was revealed with a greater effect for music performance than music perception. Reactions to music are considered subjective, but studies suggested that cardiorespiratory variables are influenced under different circumstances. It has been shown that relaxing music decreases significantly the level of anxiety in a preoperative setting to a greater extent than orally administered midazolam ($p < 0,001$).

Higher effectiveness and absence of apparent adverse effects make preoperative relaxing music a useful alternative to midazolam for premedication. In addition, there is sufficient practical evidence of stress reduction to suggest that a proposed regimen of listening to music while resting in bed after open heart surgery. Music intervention should be offered as an integral part of the multimodal regime administered to the patients that have undergone cardiovascular surgery. It is a supportive source that increases relaxation. Music is also effective in under conditions and music can be utilized as an effective intervention for patients with depressive symptoms, geriatrics and in pain, intensive care or palliative medicine.

However, careful selected music that incorporates a patient‘s own preferences may offer an effective method to reduce anxiety and to improve quality of life. The most benefit on health is visible in classic music, meditation music whereas heavy metal music or technosounds are even ineffective or dangerous and will lead to stress and/or life threatening arrhythmias. There are many composers most effectively to improve QoL, particularly Bach, Mozart and Italian composers are „ideal".

back

****

In: Behavioral and Brain Functions. 2010, Feb 2; 6:9.

Neurofeedback and Biofeedback with 37 Migraineurs A Clinical Outcome Study

D.A. Stokes and M.S. Lappin
The Better Brain Center, Inc, 2121 Eisenhower Ave Suite 604 Alexandria, VA 22314, USA.
Source: http://www.ncbi.nlm.nih.gov/pubmed/20205867
Contact: DStokes@neuronew.com

Traditional peripheral biofeedback has grade A evidence for effectively treating migraines. Two newer forms of neurobiofeedback, EEG biofeedback and hemoencephalography biofeedback were combined with thermal handwarming biofeedback to treat 37 migraineurs in a clinical outpatient setting. 37 migraine patients underwent an average of 40 neurofeedback sessions combined with thermal biofeedback in an outpatient biofeedback clinic. All patients were on at least one type of medication for migraine; preventive, abortive or rescue. Patients kept daily headache diaries a minimum of two weeks prior to treatment and throughout treatment showing symptom frequency, severity, duration and medications used. Treatments were conducted an average of three times weekly over an average span of 6 months. Headache diaries were examined after treatment and a formal interview was conducted. After an average of 14.5 months following treatment, a formal interview was conducted in order to ascertain duration of treatment effects.

Of the 37 migraine patients treated, 26 patients or 70% experienced at least a 50% reduction in the frequency of their headaches which was sustained on average 14.5 months after treatments were discontinued. All combined neuro and biofeedback interventions were effective in reducing the frequency of migraines with clients using medication resulting in a more favorable outcome (70% experiencing at least a 50% reduction in headaches) than just medications alone (50% experience a 50% reduction) and that the effect size of our study involving three different types of biofeedback for migraine (1.09) was more robust than effect size of combined studies on thermal biofeedback alone for migraine (.5). These non-invasive interventions may show promise for treating treatment-refractory migraine and for preventing the progression from episodic to chronic migraine.

****

In: Physical Therapy. 1994 Jun; 74(6):534-43; discussion 544-7.

Efficacy of Electromyographic Biofeedback Compared with Conventional Physical Therapy for Upper-extremity Function in Patients Following Stroke: a Research Overview and Meta-analysis.

J. Moreland and M.A. Thomson
St. Joseph's Hospital, Hamilton, Ontario, Canada
Source: http://www.ncbi.nlm.nih.gov/pubmed/81972400

The purpose of this study was to examine the efficacy of electromyographic biofeedback compared with conventional physical therapy for improving upper-extremity function in patients following a stroke. A literature search was done for the years 1976 to 1992. The selection criteria included single-blinded randomized control trials. Study quality was assessed for nine criteria. For functional (disability index or stage of recovery) and impairment outcomes, meta-analyses were performed on odds ratios for improvement

back

versus no improvement. Mann-Whitney U-Test probability values were combined across studies.

Six studies were selected, and outcome data were obtained for five studies. The common odds ratio was 2.2 for function and 1.1 for impairments in favor of biofeedback. The estimate of the number needed to treat to prevent a nonresponder was 11 for function and 22 for impairments. None of the meta-analyses were statistically significant. The results do not conclusively indicate superiority of either form of therapy. Although there is a chance of Type II error, the estimated size of the effect is small. Given this estimate of little or no difference, therapists need to consider cost, ease of application, and patient preference when selecting these therapies.

****

In: Applied Psychophysiology and Biofeedback. 2010 Apr 23. Epub ahead of print

Respiratory Sinus Arrhythmia Feedback in a Stressed Population Exposed to a Brief Stressor Demonstrated by Quantitative EEG and sLORETA

L. Sherlin, F. Muench and S. Wyckoff
Nova Tech EEG, Inc., 8503 E. Keats Ave, Mesa, AZ, 85209, USA,
Source: http://www.ncbi.nlm.nih.gov/pubmed/20414803
Contact: lesliesherlin@mac.com

Previous investigations of electroencephalograms during relaxation have identified increases in slow wave band power, correlations between increased levels of alpha activity with lower levels of anxiety, and autonomic changes characterized by otherwise documented decreased sympathetic activity.

This study was carried out to determine the overall changes in quantitative electroencephalographic activity and the current source as a result of an acute session of respiratory sinus arrhythmia (RSA) biofeedback in a population of subjects experiencing stress.

This study‘s findings provide physiological evidence of RSA feedback effect and suggest that RSA training may decrease arousal by promoting an increase of alpha band frequencies and decrease in beta frequencies overall and in areas critical to the regulation of stress. It was of interest that novices could achieve these objective alterations in EEG activity after minimal training and intervention periods considering that the previous literature on EEG and meditative states involve experienced meditators or participants who had been given extensive training. Additionally, these effects were present immediately following the training suggesting that the intervention may have effects beyond the actual practice.

****

In: Clinical Autonomic Research 2003 April; 13(2):99-102.

Agreement of two Different Methods for Measurement of Heart Rate Variability

M. Radespiel-Tröger, C. Mahlke, T. Gottschalk, M. Mück-Weymann
Dept. of Medical Informatics, Biometry, and Epidemiology, Friedrich-Alexander-University, Erlangen-Nürnberg, Waldstrasse 6, 91054 Erlangen, Germany.
Source: http://www.ncbi.nlm.nih.gov/pubmed/12720094
Contact: radespmn@imbe.imed.uni-erlangen.de

The widespread use of affordable devices with sufficient precision for measurement of heart rate varia-

back

bility (HRV) might lead to early detection of abnormalities in a large number of high-risk patients and

athletes. The purpose of this study was to determine the limits of agreement of two devices for measuring HRV parameters differing in price and assumed precision.

36 healthy subjects (22 men and 14 women) with a mean age of 27.4 (SD 11.1) years were included. The two devices used for comparison were PowerLab with Chart software as the reference golden standard, and Polar Transmitter/Advantage with Precision Performance software, respectively. Measurements included the following heart rate variability parameters: heart rate, range of R-R-interval duration, SDNN, rMSSD, total Power, VLF power, LF power, and HF power. Measurements were taken during metronomic respiration over a total period of 3 minutes. Statistical analysis was performed according to Bland and Altman and by means of Scatterplots and Spearman correlation coefficients. Good agreement was found for heart rate (95 % CI of limits of agreement: -0.7-0.6 bpm; r = 0.999), range of duration of R-R-intervals (95 % CI: -18.9-17.0 ms; r = 0.997), rMSSD (95 % CI: -1.5-2.5 ms; r = 0.999), and SDNN (95 % CI: -3.0-3.1 ms; r = 0.997). Correlation of measurements was high for the variables total Power, VLF power, LF power, and HF power. Analysis of method agreement for frequency domain variables was statistically not feasible. The level of agreement for the analyzed time domain variables between the reference golden standard and the inexpensive device is sufficient to permit initial screening by family doctors, and self-administration by high-risk patients and athletes.

****

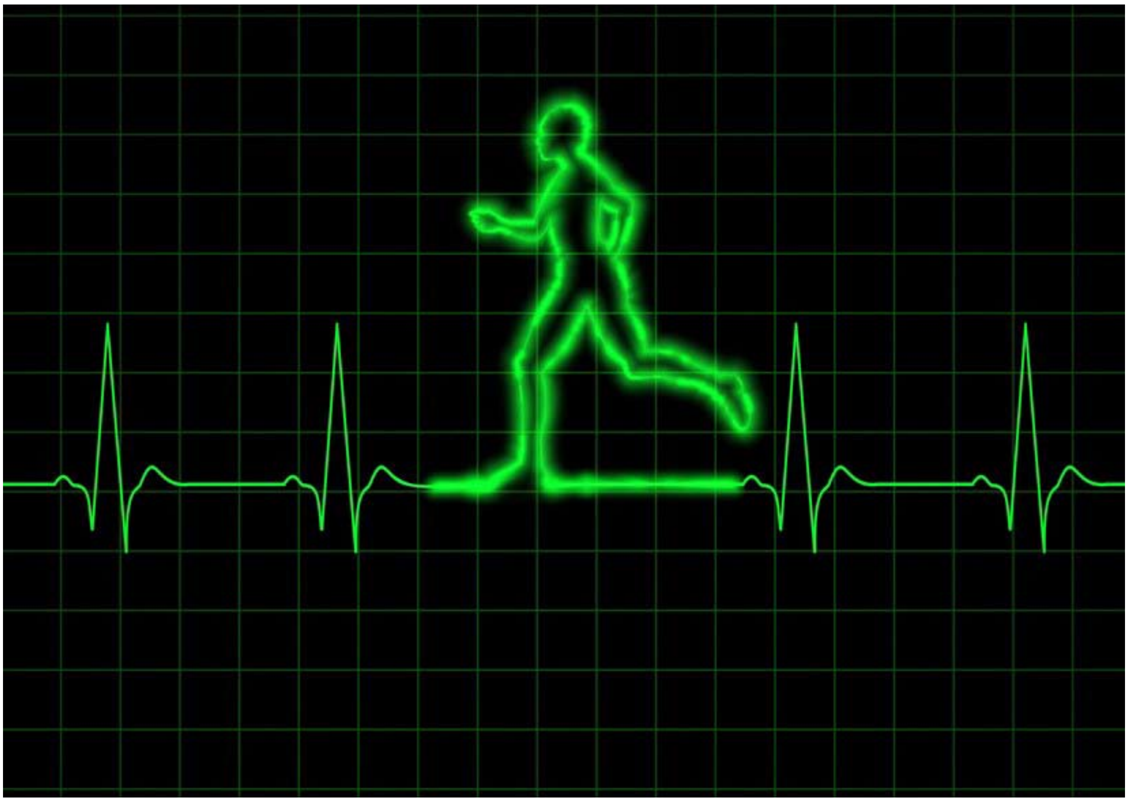
In: Applied Psychophysiolgy and Biofeedback. 2010, May 5. Epub ahead of print

Biofeedback of Heart Rate Variability and Related Physiology: A Critical Review

A.L. Wheat and K.T. Larkin
Psychology Department, West Virginia University, 53 Campus Drive, 1124 Life Sciences Building, Morgantown, WV, 26506-6040, USA,
Source: http://www.ncbi.nlm.nih.gov/pubmed/20443135
Contact: Amanda.wheat@mail.wvu.edu

Low heart rate variability (HRV) characterizes several medical and psychological diseases. HRV biofeedback is a newly developed approach that may have some use for treating the array of disorders in which HRV is relatively low. This review critically appraises evidence for the effectiveness of HRV and related biofeedback across 14 studies in improving (1) HRV and baroreflex outcomes and (2) clinical outcomes. Results revealed that HRV biofeedback consistently effectuates acute improvements during biofeedback practice, whereas the presence of short-term and long-term carry-over effects is less clear. Some evidence suggests HRV biofeedback may result in long-term carry-over effects on baroreflex gain, which is an area most promising for future investigations. On the other hand, concerning clinical outcomes, there is ample evidence attesting to efficacy of HRV biofeedback. However, because clinical and physiological outcomes do not improve concurrently in all cases, the mechanism by which HRV biofeedback results in salutary effects in unclear. Considerations for the field in addressing shortcomings of the reviewed studies and advancing understanding of the way in which HRV biofeedback may improve physiological and clinical outcomes are offered in light of the reviewed evidence.

back



****

In: Computational Intelligence and Neuroscience. 2010:267671. Epub 2010 Mar 11.

Music Composition from the Brain Signal: Representing the Mental State by Music

D. Wu, C. Li, Y. Yin, C. Zhou, D. Yao
Key Laboratory for NeuroInformation of Ministry of Education, School of Life Science and Technology, University of Electronic Science and Technology of China, Chengdu 610054, China.
Source: http://www.ncbi.nlm.nih.gov/pubmed/20300580

This paper proposes a method to translate human EEG into music, so as to represent mental state by music. The arousal levels of the brain mental state and music emotion are implicitly used as the bridge between the mind world and the music. The arousal level of the brain is based on the EEG features extracted mainly by wavelet analysis, and the music arousal level is related to the musical parameters such as pitch, tempo, rhythm, and tonality. While composing, some music principles (harmonics and structure) were taken into consideration. With EEGs during various sleep stages as an example, the music generated from them had different patterns of pitch, rhythm, and tonality. 35 volunteers listened to the music pieces, and significant difference in music arousal levels was found. It implied that different mental states may be identified by the corresponding music, and so the music from EEG may be a potential tool for EEG monitoring, biofeedback therapy, and so forth.

back

****

In: Tijdschrift voor Psychiatrie. 2010; 52(1):41-50.

Neurofeedback and Attention Deficit Hyperactivity Disorder: What is it and is it Working?

J. van As, J.W. Hummelen, J.K. Buitelaar
Source: http://www.ncbi.nlm.nih.gov/pubmed/20054796
Contact: jvas@centrummaliebaan.nl

Neurofeedback is a method of treatment that is being used increasingly in the Netherlands, particularly in psychological practices. Many psychiatric and somatic symptoms are currently being treated with the help of neurofeedback. In particular, neurofeedback is being used more and more to treat attention deficit hyperactivity disorder (ADHD). Despite its growing popularity, Neurofeedback is still a relatively unknown treatment method in psychiatric practices. To investigate the scientific evidence for treating ADHD with neurofeedback. We searched the literature for reports on controlled trials that investigated the effectiveness of neurofeedback on ADHD. Six controlled trials were located. The studies reported that neurofeedback had a positive effect on ADHD, but all the studies were marred by methodological shortcomings. On the basis of currently available research results, no firm conclusion can be drawn about the effectiveness of treating ADHD by means of neurofeedback. In view of the fact that neurofeedback is being used more and more as a method of treatment, there is an urgent need for scientific research in this field to be well planned and carefully executed.

****

In: Journal for vascular diseases. 1998 Nov; 27(4):220-3

Rhythmical Changes of the Cutaneous Blood Flow in the Forehead Region under the Condition of Hypnoid Relaxation

M. Mück-Weymann, K. Tritt, O.P. Hornstein, T. Mösler, P. Joraschky
Department of Psychotherapy and Psychosomatic Medicine, Dresden University of Technology, Germany.
Source: http://www.ncbi.nlm.nih.gov/pubmed/9859741

A characteristic and stable blood flow rhythm can be detected for the skin of the forehead and ear lobes with frequencies of approx. 0.15 Hz (9/min), which were primarily not related to the respiratory rhythm. The perfusion of the skin in the forehead region was investigated non-invasively with laser Doppler fluxmetry in ten healthy subjects before and during Hypnoid Relaxation (HyR). The HyR-state was induced by suggesting formulas regarding to the well known Autgeneous Training. RESULTS: In all test subjects rhythmical fluctuations of bloodflow with a frequency of approx. 0.15 Hz could be observed both, before and during HyR. We found that the amplitude of these fluctuations clearly (> 20% from individual baseline) increased in five of ten test subjects under the condition of HyR. Furthermore, in three of ten cases the spontaneous respiration under HyR adjusted to the frequency of the described bloodflow rhythm, which exists both, before and during HyR. These phenomena suggest an individually stabil and autonomous rhythm which is effected by alterations in the level of conciousness and which may be caused by the close linkage between the nerval structures for control of respiratory and circulatory systems. May be, this autonomic rhythm could be used as a trigger for breathing therapies or as a parameter for the impact of relaxation techniques on hemodynamics, e.g. in complementary therapy of vascular diseases like systemic sclerosis.

back

****

In: Applied Psychophysiology and Biofeedback. 2009, 34(1):1-6. Epub 2008 Dec 2.

Changes in pCO2, Symptoms, and Lung Function of Asthma Patients during Capnometry-assisted Breathing Training

J. Ritz (a), A.E. Meuret (b), F.H. Wilhelm (b) and W.T. Roth (c)
(a) Department of Psychology, Southern Methodist University, 6424 Hilltop Lane, Dallas, TX 75205, USA
(b) University of Basel, Basel, Switzerland
(c) Stanford University School of Medicine and the VA Palo Alto Health Care System, Stanford, USA
Source: http://www.ncbi.nlm.nih.gov/pubmed/19048369
Contact: tritz@smu.edu

In a recent pilot study with asthma patients we demonstrated beneficial outcomes of a breathing training using capnometry biofeedback and paced breathing assistance to increase pCO2 levels and reduce hyperventilation. Here we explored the time course changes in pCO2, respiration rate, symptoms and lung function across treatment weeks, in order to determine how long training needs to continue. We analyzed in eight asthma patients whether gains in pCO2 and reductions in respiration rate achieved in home exercises with paced breathing tapes followed a linear trend across the 4-week treatment period. We also explored the extent to which gains at home were manifest in weekly training sessions in the clinic, in terms of improvement in symptoms and spirometric lung function. The increases in pCO2 and respiration rate were linear across treatment weeks for home exercises. Similar increases were seen for in-session measurements, together with gradual decreases in symptoms from week to week. Basal lung function remained stable throughout treatment. With our current protocol of paced breathing and capnometry-assisted biofeedback at least 4 weeks are needed to achieve a normalization of pCO2 levels and reduction in symptoms in asthma patients.
Keywords: Asthma, Hyperventilation, pCO2, Biofeedback, Asthma symptoms

back

BCIA Promotes International Certification

Fred Shaffer, PhD, BCB & Don Moss, PhD, BCB

BCIA is working hard to promote international certification. In March 2010, we changed our name to the Biofeedback Certification International Alliance (BCIA) to emphasize our international mission, created an international task force, and added an international section to our new website at www.bcia.org. We have made considerable progress in promoting courses at regionally-accredited universities, distance learning and distance mentoring, and in providing online access to continuing education and testing.

University Courses: We are proud that Monika Fuhs at Sigmund Freud University of Vienna now offers biofeedback and neurofeedback courses based on the BCIA blueprints. We are equally proud of the first BCIA-accredited neurofeedback curriculum offered entirely in French at the Institut de Neurofeedback du Quebec by Drs. Vincent Paquette and Johanne Levesque. Both universities have chosen student completion of BCIA certification as a program objective.

Distance Education: We are excited by the distance education programs that teach didactic coursework based on our Blueprint of Knowledge. There are three distance-based didactic programs for General Biofeedback, two for Neurofeedback, and one for Pelvic Muscle Dysfunction Biofeedback.

Distance Mentoring: Distance mentoring has nearly eliminated the challenge of finding a qualified professional to supervise the learning of personal self-regulation and clinical skills. Many of our mentors successfully use internet-based technologies like Skype ® and Go To Meeting ® to demonstrate and directly observe skills like electrode placement and identification of artifact.

Online Continuing Education: In September 2009, the BCIA Board launched affordable online continuing education in collaboration with the Association for Applied Psychophysiology and Biofeedback (AAPB) and the International Society for Neurofeedback and Research (ISNR). We selected important articles from Biofeedback, Applied Psychophysiology and Biofeedback, and the Journal of Neurotherapy that are available online and then developed brief online tests that cover their main learning objectives.

Online Testing: BCIA has successfully delivered online exams for all three certification programs since 2009 to applicants in countries as diverse as Canada, Mexico, the Netherlands, and South Africa. Secure online testing has benefited both our American and international colleagues by eliminating their travel costs, making it easier to arrange for exam proctoring, and significantly reducing their special exam fee. In fact, the first official exam outside of the US and Canada took place in Amsterdam on September 27, 2010 and was very well attended! We hope this will be the first of many more to come.

Conclusion: We are impressed by the potential for international growth in General Biofeedback, Neurofeedback, and Pelvic Muscle Dysfunction Biofeedback. BCIA certification can help promote this development by providing an international standard for didactic education and training in these areas. We are encouraged by the number of international universities that have developed courses based on our Blueprints and that expect their graduates to demonstrate their competence by achieving BCIA certification, so that they will be "More than qualified – BCIA Board Certified!" Visit our table at the 2011 BFE Meeting in Munich.

For further information please contact: info@bcia.org

back

42nd Annual AAPB Meeting

For further information please contact
aapb@resourcenter.com
or visit www.aapb.org

back

15th Annual BFE Meeting

This meeting will be generously co-sponsored by the University of Applied Sciences München

HOCHSCHULE FÜR ANGEWANDTE WISSENSCHAFTEN · FH MÜNCHEN

back

ISSNR: 1999-9879

GUIDELINES FOR SUBMISSIONS TO Psychophysiology Today

Psychophysiology Today is published and distributed by the Biofeedback Foundation of Europe as an e-magazine.
Items for inclusion in Psychophysiology today should be forwarded to editor@bfe.org
Articles should be of general interest to the Biofeedback community.
The general interest of the BFE is to offer educational, informative and, where possible, factually based articles and information.
All articles are reviewed by our editorial team, the editors reserve the right to accept or reject any material and to make editorial and copy changes as deemed necessary.
Feature articles should not exceed 2,500 words; department articles 700 words; and letters to the editor 250 words. Manuscripts should be submitted electronically, preferably Microsoft Word. PDF files and scanned documents cannot be accepted.
If your files are too large for sending electronically please submit on a CD to the address below.
For the authors section submit a biographical sketch (30 words) and photo of the author. Graphics and photos may be embedded in Word files to indicate position only. Please include the original, high- resolution graphic files with your submission -- at least 266 dpi at final print size. GIF or TIFF preferred for graphs and JPEG for photos.

BFE is not responsible for the loss or return of unsolicited articles.

Articles in this issue reflect the opinions of the authors, and do not reflect the policies or official guidelines of BFE unless stated otherwise.

back