In 1875, Richard Caton identified what may have been the first evidence of slow cortical potentials in an article titled “The Electric Currents of the Brain,” in the British Medical Journal. He stated “The cortex’s Direct Current (DC) baseline waxes negative whenever it is more active. Gradients of 150-200 uV/mm are noted.” He later noted, “When any part of the gray matter is in a state of functional activity, its electric current usually exhibits negative variation.” Some later researchers suggested that this signaled the discovery of the “steady potential” or the DC potential of the brain, though others have noted the possibility of equipment-based artifacts in his recordings (Niedermeyer, 1999).

During the period from the late 1800s through the early 1900s, research into brain electrical activity turned toward observations of electrical stimulation and spontaneous electrical activity in animal studies. As technology improved, the ability of researchers to identify EEG rhythms also improved. Hans Berger, famous for his description of alpha blocking with cognitive activity, made this observation partly because of his use of more sensitive equipment (Niedermeyer, 1999).

Subsequent research into the electrical characteristics of the human brain became primarily focused on phasic phenomena from AC recordings. This trend continues today with the current practice of EEG biofeedback or neurofeedback also focusing primarily on training AC frequencies,

This is a report indicating SCP changes averaged from 65 - 8-second trials. A simple image on the computer screen (not shown), a floating ball, represents the direction of the SCP signal. An arrow and a tone indicate to the participant which direction to try to direct the image. An up arrow with a higher tone means to make the ball float up and a down arrow with a lower tone means to make the ball float down. Trial conditions alternate in a semi-random pattern. Responses are averaged and the negativity condition (float up) is represented by the blue line and the positivity condition (float down) is represented by the red line. A successful series is shown, on average, by movement in the desired direction.
Global Solutions

EEG - EMG - HR/BVP - General Physiology

The Infiniti System is the culmination of 30 years of innovation and leadership in biofeedback and psychophysiology, incorporating the latest advances in electronic hardware and PC software architecture. Its power and versatility enable the system to be customized to any practice and for any budget. From one to forty channels, we offer a system that meets your data acquisition and biofeedback requirements - with the assurance of reliable signal accuracy and infinite flexibility.

CALL 1-800-361-3651
FOR BIOGRAPH INFINITI WORKSHOP INFORMATION

Thought Technology Ltd.
2180 Belgrave Avenue Montreal, QC, H4A 2L8, Canada
Tel: 1-800-361-3651 • 514-489-6251 Fax: 514-489-6255
http://www.thoughttechnology.com

MAR734-00
**From the President**

Urban myths and biofeedback:

Is there a match?

Let’s take a look at neurofeedback. Many distinguished speakers at our conference appear to be contributing to a growing myth about neurofeedback: Neurofeedback somehow permanently changes behavior in a way never seen in other kinds of learning, even laboratory operant conditioning research. Really? Wow, this is great stuff! So if I learn how to do it ‘right,’ I can pretty much promise that the problem will be cured, eh? That’s a lot more satisfying than plain old psychotherapy, or cognitive therapy, or structured cognitive retraining. Right?

Let’s step back for a moment. First of all, there are lots of solid studies from a variety of laboratories showing both rapid learning (even one-trial conditioning) and permanently changed behaviors. In particular, look at a series of diverse studies started in the 1930s, now referred to as the ‘taboo’ experiments. Today we might call them one-trial phobias. They share in common the conditioning of arousal states, and the linking of salient stimuli with immediate feedback.

Another source of relatively permanent learning comes from re-instatement-of-extinction studies, where over-learning is likely to reinstate previously learned behaviors. And of course, Skinner’s astounding studies on intermittent reinforcement showed that a gradual weakening of reinforcement opportunities actually increases the resistance to extinction. Errorless discrimination studies in education show clearly a permanent change in behavior, using gradual shaping procedures and the ability to modify the difficulty of the task based on current performance.

**From the Editor**

Welcome to 2006. I’m glad to say that 2005 was a great year for the BSC. We had an outstanding conference (read about it on page 14). Our membership is growing and becoming more diverse in its professional applications. In 2006, we’re reaching out to our neighboring states and offering membership to practitioners in Nevada, Oregon and Washington. And we hope to reach out to people who have been practicing biofeedback in California, but who have unfortunately not participated in the Society. If you know of anyone, please let him or her know about us.

Dr. Barton’s article on his use of the galvanic skin response modality is inspiring. This is one of my favorite modalities and one that helps lend validation to the field in general, just simply because it’s use can stimulate profound psychophysiological changes. John Anderson’s article about short-term potentiation and event-related potentials is thought provoking. It inspires thought about new and innovative ways to train the brain, always of interest to our neurotherapists readers.

Jan Markle’s “It’s Your Turn” highlights a very important question – are we walking our talk? In addition to improving our own wellbeing, this is the best form of marketing for our field. There’s nothing worse that an uptight, stressed-out biofeedback practitioner. I liken that to an MD with nicotine on his breath. Let this installment be inspiration to us all.

I’m not going to solicit anything here; I’ll leave that up to the marketing department (do we even have a marketing department?). I would, however like to offer fond wishes for a wonderful, fruitful year for you and for your biofeedback practice.

Cynthia Kerson, MA
Only one biofeedback provider delivers such a breadth of professional training programs and equipment. Stens offers professionally run biofeedback and EEG certification programs, as well as application workshops in Incontinence, Chronic Pain/HRV/sEMG and Stress Management. You’ll learn with the most experienced teachers and train with the most sophisticated equipment. Our courses meet all the didactic requirements for BCIA. It’s easy to see why there’s only one clear choice when it comes to biofeedback.

**5-Day Professional Biofeedback Certificate Program**

<table>
<thead>
<tr>
<th>Location</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denver, CO</td>
<td>April 23–27, 2005</td>
</tr>
<tr>
<td>New York/New Jersey</td>
<td>May 14–18, 2005</td>
</tr>
<tr>
<td>San Francisco, CA</td>
<td>June 25–29, 2005</td>
</tr>
<tr>
<td>Chicago, IL</td>
<td>July 16-20, 2005</td>
</tr>
<tr>
<td>Anaheim, CA</td>
<td>Aug. 6–10, 2005</td>
</tr>
<tr>
<td>San Francisco, CA</td>
<td>Sept. 24-28, 2005</td>
</tr>
<tr>
<td>Austin, TX</td>
<td>Oct. 22-26, 2005</td>
</tr>
</tbody>
</table>

**4-Day Professional EEG Certificate Program**

<table>
<thead>
<tr>
<th>Location</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York/New Jersey</td>
<td>May 19–22, 2005</td>
</tr>
<tr>
<td>Chicago, IL</td>
<td>July 21-24, 2005</td>
</tr>
<tr>
<td>Anaheim, CA</td>
<td>Aug. 11–14, 2005</td>
</tr>
<tr>
<td>Austin, TX</td>
<td>Oct. 27-30, 2005</td>
</tr>
<tr>
<td>Ft. Lauderdale, FL</td>
<td>Nov. 17-20, 2005</td>
</tr>
</tbody>
</table>

**Application Workshops**

- 4-day Incontinence: (April)
- 2-day Advanced Biofeedback (Pain, HRV, sEMG): (June, Dec)
- 2-day Stress Management: (September)
- 1-day Freeze Framer: (Dec)

CEs for APA, CNA, BBS. Stens Corp. is approved by the APA to offer CE for psychologists and maintains responsibility for the program.
A Current Case of Hypertension

William G. Barton, MBA, MA, Ph.D.

www.biobill.org or e-mail: biobill@pacbell.net

I first entered the mental health field in 1972 and obtained my Masters in clinical psychology while working on the “locked unit” of Walnut Creek Hospital. I was hired without any experience but the staff liked my height and strength! I was soon looking for a niche to make a better living than two dollars an hour and “health education” via the deliverance of clinical biofeedback was an attractive avenue for me as I had come from and experimental psychology background at Hamilton College in New York. At Gladman Memorial Hospital, I met Dr. Arthur Gladman who rapidly became my mentor and who was largely responsible for “bringing” biofeedback to the Bay Area from his experiences with Elmer Green at the Menninger Clinic in Topeka, Kansas. I became a pioneer of group biofeedback at his hospital and augmented my income in those days before becoming licensed with this tool and technique. Today, biofeedback applications amount to some 40% to 50% of my practice. I seem to always have at least four or five clients working on hypertension control and a number of patients with panic disorder, phobia, chronic pain, TMJ, anxiety disorder, and insomnia where the biofeedback and self-regulation provide specific skill training helpful to the individual. I come from a Humanistic and Existential orientation and embrace Jungian ideas but often work behaviorally with specific goals to treatment with the biofeedback. The following is an example of an ongoing case involving anxiety and hypertension.

G.P. on her first visit had an initial blood pressure of 160/90 and at the end of the session was 160/82. She is a fifty-year-old retired professional that has been in psychoanalysis intensively for over fourteen years. She became aware of her hypertension four years ago and had concomitant panic attack episodes and rampant anxiety. Increasingly she had tachycardia and very irregular heartbeats. Her anxiety and physical symptoms along with elevated blood pressure had gotten markedly worse as she worked on and approached termination with her analyst. Her medication regimen that was begun four years ago included Valium, Toprol, Inderal, Claritin, and Pindolol. She knew very little about biofeedback but was referred to me by her internist. I suggested to her that she suspend any judgement about the biofeedback training and its potential efficacy for four or five sessions to see how it goes. I felt that I would know by then if this held promise for her. I have been using the Bio Integrator system for fifteen years or so.

At her third session her initial reading was 170/90, and she was clearly quite anxious. Her exit blood pressure was 150/86, and she and I were both hopeful and optimistic. By the fifth session she was reporting considerable compliance with daily home practice consisting of fifteen to twenty minutes of replicating her training in the office, albeit without any feedback but using my auditory program “Relax to Relax” which incorporates soothing music, ocean sounds, and Autogenic suggestion. Let me turn to some general statements about hypertension and then show GP’s results.

Physicians occasionally make referrals for biofeedback therapy and training for individuals that want help in specific skills training to reduce blood pressure. Referrals seem to be generated by the insistence of the patient for something more than control through drugs. Many of these people benefit from learning skills of self-regulation of the mind/body reactions to stressors, anxiety, and tension, often referred to as “fight or flight” responses that take a physical toll over time. Many of the more “high risk” referrals are people who have had a stroke or cardiac episode. Some of these individuals could be classified as “Type A” personality types that can begin practicing and implementing specific behavioral changes in their lifestyles for additional benefits to the self-regulation or biofeedback training.

What is Hypertension?

Hypertension is a complex disease that is characterized by chronic sustained elevations in systolic blood pressure (SBP) and or diastolic blood pressure (DBP). The American Heart Association states that nearly 1 in 3 adults in the United States has high blood pressure. This is a staggering number of people and nearly 1/3 of this group is undiagnosed and are unaware that they have it. High blood pressure is the major risk factor for the incidence of stroke, heart attack, heart failure, and kidney failure. Sustained elevated blood pressure correlates with a shortened life span. Amazingly, 90 to 95% of all cases of hypertension are of “unknown origin.” This type of hypertension is sometimes called “essential,” “primary,” or “idiopathic.”

What are the Numbers of Hypertension and Its Categories?

Greater than or equal to 140 mmHg. systolic
Greater than or equal to 90 mmHg. diastolic
Normal = less than 120 mmhg. systolic and less than 80 mmHg. diastolic
Pre-hypertensive: 120 to 129 mmHg. systolic and 80 to 89 mmHg. diastolic

High Blood Pressure:
Stage I: 140 to 159 systolic or 90 to 99 diastolic
Stage II: 160 or higher systolic or 100 or higher diastolic

Continued on page 6
### Hypertension

*Continued from page 5*

### How Blood Pressure is Measured

Blood pressure is measured with a sphygmomanometer and is usually taken from the left arm and taken while the individual is sitting. The device is a cuff that is placed around the biceps area of the arm. The cuff is inflated with a small hand pump that contains a meter that reads pressure in millimeters of mercury (mmHg.) and that has a valve to allow the release of the pressure. The cuff is inflated usually to a level about 20 mmHg. above the systolic level. This pressure closes the brachial artery that runs down the arm. As opening the valve slowly backs off the pressure, the first pulse of blood that comes through can be heard by a stethoscope or can be heard by an electronic pick-up sensor. This is the systolic blood pressure and is an indicator of how hard the heart organ is contracting to get blood through the arterial system. As the valve is opened more, the beat to beat pulses of blood is heard all the way down to a point that it is now longer heard. This level where there is no longer resistance is the diastolic blood pressure. There are a wide variety of blood pressure units on the market. There are units that are battery powered and can read blood pressure from the wrist and others that can read it from the finger. These instruments are easy to use but are notorious for giving quite variable readings. There are easy to use instruments available with built in stethoscopes that can be self-applied on the biceps and that provide quite reliable blood pressure readings.

### Biofeedback and Self-Regulation Training

It is important to emphasize that the biofeedback training is an important adjunct to an individual’s medical treatment and is not meant to replace medical treatment. For an individual taking any variety of medications to “control” hypertension, it is often possible that their physician may chose to reduce medication as one gains self regulation skills and makes positive life-style changes that are contributing to lowered blood pressure. Physicians and cardiologists are generally quite conservative and slow to reduce medication! Usually within three or four biofeedback sessions, it is very apparent whether biofeedback training will be useful in helping an individual control and modify his or her hypertensive reactions to stress and anxiety. We all have fluctuations in blood pressure throughout the day and certainly elevations with exercise, and emotional interactions, and work stress are common. One of the hallmarks of hypertension, however, is the inability or slowness to recover to a “safe” blood pressure after a stressor. It is not unusual to see significant drops in blood pressure from mastering biofeedback techniques. Within a session as much as a twenty to thirty point drop in blood pressure can be typical.

The training proceeds as follows. I take a blood pressure reading “pre” and “post” biofeedback training. Depending on the individual, in the first or second session data will be taken on several physiological modalities. Recording may include hand and foot temperature, the muscle tension of key muscle groups (eg.trapezius and frontalis), basal skin resistance (eccrine sweat gland activity, also called BSR and formerly GSR) as recorded off of the fingers or palm surface of the hand, respiration activity and heart rate variability. Brain wave training may also be useful to help train pathways toward a mentally quiet state or meditative state. The patient trains in a relaxed, semi-reclining position and is guided by the therapist (often with the use of Autogenic Training and Progressive Relaxation) and by the physiological feedback via tones or video screen feedback into a deeply relaxed state. This state, broadly speaking, consists of learning peripheral vasodilation (warm hands and warm feet), slowing of heart rate coupled with relaxed slow diaphragmatic breathing, low muscle tension, low “arousal” as evidenced by less sweat activity in the hands, and a quiet mind. The state can be learned and mastered with practice. As the patient gains some skill, I like to practice “interval” training during a session. After relaxing for five or six minutes, I may pause the training.

---

<table>
<thead>
<tr>
<th>Date</th>
<th>PRE</th>
<th>POST</th>
<th>Date</th>
<th>PRE</th>
<th>POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/03/05</td>
<td>162 / 88</td>
<td>162 / 82</td>
<td>3/28/05</td>
<td>132 / 90</td>
<td>122 / 84</td>
</tr>
<tr>
<td>1/10/05</td>
<td>150 / 92</td>
<td>138 / 86</td>
<td>4/04/05</td>
<td>Didn’t want</td>
<td>130 / 88</td>
</tr>
<tr>
<td>1/19/05</td>
<td>170 / 90</td>
<td>150 / 86</td>
<td>4/18/05</td>
<td>132 / 86</td>
<td>118 / 78</td>
</tr>
<tr>
<td>1/24/05</td>
<td>152 / 90</td>
<td>146 / 84</td>
<td>4/25/05*</td>
<td>132 / 82</td>
<td>118 / 78</td>
</tr>
<tr>
<td>2/07/05</td>
<td>144 / 92</td>
<td>132 / 88</td>
<td>5/02/05**</td>
<td>130 / 86</td>
<td>120 / 80</td>
</tr>
<tr>
<td>2/14/05</td>
<td>138 / 86</td>
<td>130 / 84</td>
<td>5/16/05</td>
<td>124 / 84</td>
<td>118 / 78</td>
</tr>
<tr>
<td>2/21/05</td>
<td>144 / 100</td>
<td>130 / 84</td>
<td>5/23/05</td>
<td>138 / 92</td>
<td>122 / 82</td>
</tr>
<tr>
<td>2/28/05</td>
<td>138 / 98</td>
<td>122 / 82</td>
<td>6/06/05</td>
<td>128 / 84</td>
<td>118 / 80</td>
</tr>
<tr>
<td>3/07/05</td>
<td>138 / 88</td>
<td>118 / 82</td>
<td>6/13/05</td>
<td>126 / 84</td>
<td>116 / 74</td>
</tr>
<tr>
<td>3/09/05</td>
<td>136 / 86</td>
<td>No take</td>
<td>6/27/05</td>
<td>124 / 84</td>
<td>112 / 80</td>
</tr>
<tr>
<td>3/14/05</td>
<td>150 / 98</td>
<td>130 / 88</td>
<td>7/11/05</td>
<td>124 / 90</td>
<td>118 / 80</td>
</tr>
<tr>
<td>3/21/05</td>
<td>132 / 94</td>
<td>118 / 84</td>
<td>7/25/05</td>
<td>130 / 86</td>
<td>122 / 82</td>
</tr>
</tbody>
</table>

* Discontinued Inderol, Beta Blocker
** Reduced Toprol by ½ the dose, 25 mg. down to 12.5 mg
*** Discontinued Toprol
and “reactivate” or stress the patient by discussing current issues in their lives, followed by another interval of relaxation. I may do this three or four times in a session. Post blood pressure readings are taken at the conclusion of the last relaxation interval. As a person gains mastery and skill of reducing blood pressure in the office, the next challenge is to begin to integrate these skills into one’s day to day life activities. Integration can be promoted initially by practicing the biofeedback skills daily for a set time interval of fifteen minutes. With further mastery an individual can gradually shift from having a specific meditative-type or biofeedback “time out” to more integrated “micro” breaks that include deliberate, conscious shifts to one’s physiology throughout the day designed to lower and regulate blood pressure and curtail “fight or flight” behavioral patterns. I often provide home training devices for more specific learning along with audio support.

GP has been a pleasure to work with and has really applied herself to learning biofeedback skills. She works each session initially with some heart rate variability and then moves into eyes closed training where her focus is on increasing peripheral blood flow to hands and feet, increased BSR (drier hands with emotional quieting), increased percent alpha, and lowered EMG frontalis (less muscle tension). As she goes eyes closed she initially is fed back frontalis with the goal of getting under one microvolt. Generally she gets there in four of five minutes. She receives a lower pitch tone as she achieves greater relaxation. I typically finish the training with six or seven minutes of alpha feedback. She gets a “reward” tone anytime her alpha is above a particular threshold. She goes away from nearly every session feeling a bit more confident in her self-regulation skills and her ability to reduce her blood pressure. Here is a summary of her pre and post blood pressure readings during the sessions. Her sessions were at the same time each week. She intends to periodically “check-in” for booster sessions. I have been using the biofeedback tool for over thirty years and find it very helpful in giving a person a sense of “control” back in their lives. They become and active participant in health maintenance. If my practice were solely biofeedback based, I would burn out and be bored by it. I am not at all! Also, I am not asking patients to do something that I have not practiced myself. It has been a great tool for me and I maintain my own skill levels via micro self-regulation breaks throughout the day. A clinician is really not ready to use biofeedback with patients until they have mastered self regulation skills for themselves and until the technology is no longer a distraction away from client centered therapy. A basic level of competence in biofeedback is achieved by practitioners whom have gained certification from the Biofeedback Certification Institute of America located in Wheat Ridge, Colorado. I am a Senior Fellow of the B.C.I.A. which likely means I am old and competent!

The following depicts the patient’s progress over time on her basal skin resistance. This measure is one of my favorites as it is a window into a person’s emotions. Higher skin resistance (drier hands) generally indicates less anxiety, less vigilance, greater calmness, and greater sense of security, confidence, and safety. Medications such as anxiolytics certainly effect the readings and can cloud the picture (artificially induce drier hands). Despite titrating out some of the Beta Blockers, the patient shows tremendous progress.
From the President  
Continued from page 3

All of these studies could make magical claims that something special was happening. Please, no more magical talk about neurofeedback. Educate the true believers to go back to basic learning theory, OK? That’s what neurofeedback is really about.

Another myth is that biofeedback is dying. Certainly, BSC is concerned that California’s Worker’s Comp administrators are revising their standards. This is just a political issue, and has nothing to do with the veracity of its applications. At least 3 generations of health care professionals from all over the world are actively involved in expanding biofeedback and neurofeedback opportunities. Please visit our website for updates on this issue.

BSC is constantly busting another misbelief. It is the belief that BSC has less to offer than AAPB or SSNR or APA, etc. We had a great convention, with more opportunity to get together with speakers, share extended discussions and stay up late partying with old colleagues and new members. Smaller is better, at least in a focused interest group.

In the tradition of past BSC presidents, I encourage you to continue your participation in BSC. Did you know, for example, that there is a new kind of biofeedback for eating disorders? That thermal imaging can be used as a feedback device? That slow potentials measure both EEG activity and gastric motility? To paraphrase Einstein, the truth is in the signals. We just need to separate the signal from the noise, including the noise about miraculous claims of permanent learning by evangelical speakers.

Best regards,
Bob Grove, lordnelson@sprynet.com

The New York Times OP-ED Monday, September 19, 2005

37th Annual Meeting
April 6 – 9, 2006
Hilton Portland and Executive Tower
Portland, Oregon

Keynote/Invited Speakers
Gail Adler, MD, PhD  
Division of Endocrinology, Diabetes and Hypertension  
Brigham and Women’s Hospital

Mario Beauregard, PhD  
University of Montreal

Diane Newman  
University of Pennsylvania Health System

Jamie Pineda, PhD  
University of California, San Diego

Steve Porges, PhD and Sue Carter, PhD  
University of Illinois at Chicago

David Spiegel, MD  
Stanford University

Robert Stern, PhD  
Penn State University

Steven Wolf, PhD  
Emory University School of Medicine

For Additional Information, please visit the AAPB website at www.AAPB.org
Southern California Regional Meeting
Pasadena Library, Pasadena
May 6, 2006
Coordinator: Victoria Ibric
Tentative Line-Up: Siegfried Othmer, Barry Sterman, Hershel Toomim, Bill Hudspeth, Kris Sharp, Jack Johnstone

Northern California Regional Meeting
Marin Biofeedback, San Rafael
June 3, 2006
Coordinators: Cynthia Kerson and Teresa Corrigan
Tentative Line-Up: Richard Gevirtz, Cynthia Kerson, Erik Peper

2006 Annual Conference
“Evidence-Based Mind/Body Medicine”
Berkeley Double Tree at the Berkeley Marina
November 2-5, 2006

Check the website for updates
www.biofeedbackcalifornia.org
Slow Cortical Potentials
Continued from page 1

generally in the range of 1 to 60 Hz.

The study of slow cortical potentials continued in the area of physiology and animal research but recently there has been increased interest in observing slow cortical potential values in the human EEG and correlating them with cognitive activity, sensory processing and motor activity. Slow cortical potentials (SCP) are distinguished from short latency, event related potentials (ERP) of up to 500 ms. SCPs reflect cortical processes that require more than one second to complete and are associated with more global, task-related activities. Such changes occur in task specific areas of the cortex and can be displayed using topographic maps. Areas of activation show surface negative potential changes (Altenmuller & Gerloff, 1999).

Operant conditioning of slow cortical potential changes is more recent area of study. One reason for increased interest in the training of SCPs is the excellent work done by Nils Birbaumer and his colleagues at the University of Tubingen in Germany, demonstrating that SCPs can be operantly conditioned with positive up polarity for a variety of disorders. The recent availability of DC-coupled amplifiers for EEG recording has also contributed to this interest (Altenmuller & Gerloff, 1999).

According to Niedermeyer & da Silva (1999), the term “DC” can mean several things. DC means direct current, which is a current without oscillations. From an electrophysiological perspective “DC shifts” are ultra slow potentials, below the typical EEG and are generally around 0.1-0.2 cycles per second, though they may extend up to 1 cycle per second (delta traditionally begins at .5 cycles per second). So SCPs are not true direct current, though their oscillations are so slow that they are “DC like” phenomena.

DC also refers to “direct coupling” (Niedermeyer, 1999) and is a description of a type of amplifier that does not use capacitors between the stages of amplification and that uses an infinite time constant to provide for optimal DC recording. Until recently this has been quite difficult to achieve for EEG recording. Most conventional EEG amplifiers use capacitors that reject DC voltages and also employ a finite time constant in a range that also interferes with access to DC phenomena.

An approximation of DC information can be obtained from an alternating current amplifier through the use of a rectifier, or by extending the time constant to approximately 10 seconds (Kotchoubey, et al., 1999). A thorough discussion of amplifier characteristics is beyond the scope of this article. Several excellent chapters relating to this subject can be found in “Electroencephalography” (1999).

The source and nature of slow cortical potentials (SCPs) is in some dispute. Prevailing theory holds that negative SCPs result from synchronous postsynaptic potentials in the apical dendrites of cortical pyramidal cells. Others hold that SCPs are supported and produced by glial cells within the cortex. It appears that pyramidal neurons may be the source of these potentials and that the glial system is the “sink” in electrical terms (U. Strehl, 2005, personal communication). Increased neuronal activity is associated with an increased outflow of potassium ions leading to increased extra-cellular potassium concentrations. Glial cells depolarize in the presence of increased extra-cellular potassium concentrations, resulting in intra and extra-cellular current flows that are similar to typical neuronal synaptic transmissions (Speckmann & Elger, 1999). Since glial cells are widely interconnected and have extensive processes, it appears likely that the glial system, in response to neuronal activity, produces the current flows that produce SCP values recorded from the scalp.

Despite some discussion regarding the source of slow cortical poten-

Top graph represents slow cortical potentials from a two channel sintered Ag/AgCl Cz electrode with left and right mastoid references for channel 1 and 2 respectively. X-axis time scale is approximately 38 seconds. Y-axis scale is +/- 35 Uv with negative polarity up - the common practice for SCP recording. The next two graphs represent “raw” EEG from channels 1 and 2 from the same recording electrode, with the same x-axis time scale and +/- 15 Uv y-scale with positive up polarity. The two spectral displays reflect a segment of the same data with a 2 second epoch and 1/4-second refresh. Note the slow amplitude fluctuations of the SCP signal.
tial activity, it is clear that scalp SCPs represent the excitability potential of the cortex. SCP negativity is associated with increased cortical excitability. High cortical negativity has been correlated with a greater likelihood of seizures (Speckmann et al., 1984) and migraines (Sinitchkin, et al., 2000) in susceptible individuals.

SCP positivity is associated with increased cortical inhibition. Higher than expected positive potentials have been noted in children with elevated blood lead levels (PbB) (Otto and Reiter, 1984) and a lack of self-regulation skills of SCP compared with controls was found in children with ADHD (Heinrich, et al., 2004). Slow cortical potentials have also been used to monitor the depth of anesthesia during surgical procedures (Sebel, et al., 1997) because it appears to be an excellent indicator of level of arousal.

Recent studies have used SCPs to evaluate a variety of task-oriented responses. Birbaumer and colleagues have trained SCP to reduce seizures (Kotchoubey, et al., 1997, 1999, 2001, 2002; Daum, et al., 1993) and other groups have applied SCP feedback training to improve ADHD (Heinrich, et al., 2004: Strehl, U., 2004 personal communication) and schizophrenia (Schneider, et al., 1992).

SCP feedback training appears to be an approach that targets general characteristics of arousal using a single measure, as compared to other types of EEG training that often reward increases and/or decreases in certain combinations of frequencies to accomplish changes in arousal. SCP feedback may provide a less complex approach to training neuronal activity in the clinical setting; one that might also provide greater accessibility in the form of clinician supervised home training devices. Most research to date has been conducted using the Cz electrode site. However, at least one investigation involved training left hemisphere language sites. This approach demonstrated improved word processing results following the negativity training condition and a decline in results following the positivity condition (Pulvermuller, 2000). It would be interesting to study the effects of slow cortical potential training at other electrode sites.

There have been some efforts to identify slow cortical potential values using multiple electrodes in a quantitative EEG assessment paradigm. Basile and colleagues (2004) used four, 32-channel DC coupled amplifiers to identify differences in slow cortical potential responses in schizophrenic patients compared with normal controls. They found significant variations in response patterns, with normal controls showing fairly simply organized positivity and negativity patterns while schizophrenic patients showed much more complex, fragmented patterns of activation and inhibition.

At present there are only a few clinically available DC-coupled amplifiers capable of accurately identifying slow cortical potential activity. An Internet search yielded several devices clearly aimed at the research institution market with correspondingly high prices as well as a couple of other devices with prices within the reach of a clinical practice. A new 32-channel DC-coupled data acquisition device for quantitative EEG assessments has also recently been released.

One potential attraction of using a DC amplifier is the capability of monitoring and/or training both slow cortical potentials and typical EEG frequencies. This is because DC amplifiers are optimized for SCP but also have the capacity to record faster frequencies as well. This is particularly true for amplifiers with higher analog-to-digital (AD) conversion rates because this allows them to record AC potentials without exceeding amplifier capabilities, which can be a problem in an amplifier without capacitors at the input stages. Higher A (analog) to D (digital) conversion rates allow newer DC amplifiers to process EEG at a much lower voltage while retaining a high degree of accuracy.

The training of slow cortical potential shifts is a fairly new endeavor. Much remains to be learned about the effects of training both the positivity and negativity conditions at various electrode sites for individuals with a variety of presenting concerns and specific neurophysiological characteristics. Some recent, brief clinical experiences by this author suggest that training SCPs using new, more accurate amplifiers may result in more pronounced changes occurring more quickly. This occurred on several occasions, even when using previously well tested protocols alternating 8 to 10 second trials of both the positivity and negativity conditions. Thus, it will be important to develop protocols with more specificity and flexibility to meet the needs of non-homogeneous client populations that also take into account changes in equipment and software characteristics that may affect the rate of skill acquisition and subsequent outcomes.

The author would like to thank Ute Strehl of the University of Tubingen in Germany, David Sever of Mind Alive, LTD in Canada, and Erwin Hartsuiker of Mind Media BV in the Netherlans for technical assistance in preparing this article.

References:
Slow Cortical Potentials

Continued from page 11


Your Turn: BSC Members Speak

Jan R. Markle, MA, BCIAC

“What relaxation technique do you practice regularly (really) to manage your own stress? How often do you use it and why do you prefer it?”

Bill Barton, PhD, Clinical Psychologist, San Francisco:
Many times a day I release face tension to the .5 microvolt level and increase blood flow to the souls of my feet, along with paying attention to breathing ... long slow exhales to decompress with micro relaxations.

James E. de Jarnette, PhD, MA, PhD, Neuro-Psychoanalyst, Beverly Hills:
For over thirty years now, I have used meditation on a daily basis as a stress-buster as well as a spiritual path. In the early days of biofeedback, and to some extent now, biofeedback has been used as a type of high-tech adjunct to psycho-spiritual growth. I have used neurofeedback as an aid to meditation and spiritual growth. It is really quite good. But for me, on a regular daily basis, good old fashioned meditation works best. Doing it an hour in the morning and then before bed at night has helped make my life WONDERFUL, i.e. full of wonder.

David Devine, PhD, Center for Behavioral Medicine, San Jose:
I use Andrew Weil’s “Relaxation Breath” once daily for 5-10 minutes, sometimes twice if I am feeling particularly stressed. I like it because it provides a focus for my agitated mind and is very calming. I usually precede it with a 1-2 minute body scan. It can also be done for just a few minutes, if that’s the only time you have.

Tom Sorensen, PsyD, Sorensen Psychological Services, Westlake:
Since I am ADD I regularly, 3-5 days per week, use the Paradise unit to train at 16 Hz for 24 minutes. At the same time, I set the heart rhythm sound on that unit so that I breathe at 7 breaths per minute. I also use the Resperate about 3 times per week for 15 minutes, normally breathing at about 6 breaths per minute. I find either of the above very relaxing, sort of like a good massage. I choose the brain wave training for myself because I can do it while doing other things, even while washing the dishes!

Katherine Gibney, Point Richmond:
Being a practitioner, I realize that often it’s what I do, rather than what I train, that is the strongest influence. I frequently get comments on how calm I am. The first way in which I relax is to make sure that I’m breathing effortlessly and diaphragmatically throughout the day. If I observe tension in my breathing, I exhale fully, imagining that my breath is flowing down my arms and legs and out my fingers and toes—a streaming exercise that I teach to most clients. When I’ve endured a particularly long or stressful day, I focus on diaphragmatic breathing or do some Autogenic Training before sleep.

I also routinely meditate and exercise. I meditate at least once daily for at least 15 minutes. When my schedule allows, I meditate twice daily for a half hour to an hour each. I generally take a short walk in mid-day and try to get out more on weekends. I have recumbent bicycle that I ride for approximately 15 minutes in the morning and for a half an hour 3 to 4 times a week at the end of the day. I combine this with stretching and lifting weights to strengthen my upper body and neutralize the effects of computer work.

Steve Wall, MA, BCIAC, Director Bio Research Institute, Cotati:
I do a few things. I train 4-5 days a week in an eyes-closed mode to reduce temporalis EMG activity to a very low level. My goal in the EMG training is to recruit and maintain a deep parasympathetic response. I also periodically do neuro training for low alpha and finally, I walk a couple of miles, 6-7 days a week.

Jeanne Charbonneau, Grass Valley:
While studying w/ Eric Pepper at SF State in 1985 I learned Autogenic Training. Since then, I use Autogenic Training when I cannot sleep—that is, if I wake up in the middle of the night and/or have difficulty settling down to fall asleep. It works! (I usually just use the phrases of heaviness and warmth.) Recently, I have re-started using Autogenic Training with clients with great success and find that it appeals to people of all ages.

In recent years, I began a form of meditation in which the focus is on the body—simply sensing the area just above the belly button and following that with a very basic body scan, just sensing the body. It is not necessarily a stress reduction technique but I do find that when under a lot of stress this is a daily reminder to bring the focus back to the body and usually to what is more real.

Important Notice about CEUs

Continuing Education Units (CEUs) are no longer required for BSC Certification. The Board has suspended the certification process, recommending BCIA Certification instead (www.bcia.org). For those already certified, BSC can update your last certificate. Please contact the Executive Director for details at (415) 485-1345.
"Reliability and low cost through better engineering."

$1995*
C2 Plus 6 Channel

$3195*
C2 Plus 12 Channel

Up to 4 Channels of EEG.
- Multi-site Target/Inhibit.
- Alpha-Theta. (Temp, too)
- Magnitude & Percent Power.

Multisite EEG protocols:
- Coherence
- Symmetry
- Comodulation
- Co-contra
- Pelvic Floor Training

Simple RSA

Dynamic HRV Training (VLF, LF, HF)
Simple RSA Exercises using HR alone.

Cardio-Respiratory Synchrony
Exercises
(i.e., HR & Respiration)

*Many kinds of Feedback, including Picture-fill Game

• 16 bit A/D conversion and high sampling rates mean clear clean signals.
• Automatic IMPEDENCE TESTING means false ‘signals’ are eliminated.

We believe it was one of the more enriching BSC conferences from over the past few years.

The 2005 BSC conference, held in the Crowne Plaza in Irvine last November, had a wonderful mix of neurofeedback and biofeedback clinical and research-related talks and courses. We had many of our dignified members speak about the projects they were working on during the year. Dr. Bhat, Dr. Toomim, Dr. Peper, Dr. Othmer, Dr. Grove, Dr. Sideroff, Dr. Ibric, Dr. Linden, Dr. Gevirtz, Jay Gunkelman, Kris Sharp and Dr. Criswell, among others shared the latest within their scopes of expertise. This included everything from chair somatics to the neurosubstrates of consciousness to prevention techniques for heart disease.

In addition to the luxury of learning from our prestigious members, we had the honor of hearing from others outside our membership. These guests included Dr. Sherman talking about incontinence, Dr. Katz on Ericksonian hypnosis, Dr. Litchfield on Capnometry and breathing, Dr. Waller on his neurological model of relationships and Carolyn Yucha discussing issues of efficacy in biofeedback research.

Last year we also inaugurated the teaching and nursing panels. These were popular to those interested in learning more about the application of biofeedback for nursing and teaching professionals. We plan to continue with these panels this year.

And of course, we are always grateful for the presence of our vendors, EEG Info, Better Physiology, Electro Medical Products, Stens Corporation, BioComp Research Institute, J&J Engineering, BMI and HeartMath.

We believe it was one of the more enriching BSC conferences from over the past few years. At this conference, Bob Grove took over the presidency from Jim DeJarnette and Victoria Ibric was named President-Elect.

The 2006 conference will be held at the Berkeley Double Tree Hotel at the Berkeley Marina. Its title, “Evidence-Based Mind/Body Medicine” should give you an idea of what we have in mind. In addition to the dynamic learning opportunities we have in store, we’re also planning a dinner cruise around the beautiful San Francisco Bay as our Saturday Night festivity, an event that should not be missed. We hope you’ll join us.

2005 BSC Conference News
Biofeedback Society of California
Invites You to Join!!

New to the area of biofeedback or been away for a while? Consider joining the Biofeedback Society of California. At $95 per year for full membership, how can you miss? Outstanding conferences, informative newsletters, Web site member listing, and networking with others are just part of what you will receive.

MEMBERSHIP BENEFITS INCLUDE:
BSC’s outstanding tri-annual publication California Biofeedback • Discounts at the Annual Conference and regional meetings/seminars • Listing on the BSC member Web site member page • Networking with others in a multi-professional organization • Liaison with state and national associations • Continuing education credit for biofeedback practitioners and other professions • Monitoring of state legislation related to biofeedback • Providing policy recommendations • Professional support with insurance and managed care • Eligibility to participate on a committee of the Society, and • An opportunity to promote the field of biofeedback through a combined effort.

For information about the society, and for a membership application, visit our Web site at www.biofeedbackcalifornia.org.

Brain imaging studies tell us **ADD, ADHD, depression, memory loss** and other important clinical conditions are related to poor blood perfusion of the frontal and prefrontal cortex. Now you can directly observe and train these areas without the **muscle and eye movement** artifacts that interfere with conventional EEG readings.

**HEG NEUROFEEDBACK**
**HEMOENCEPHALOGRAPHY (HEG)**

**SIMPLE FOR YOU * SIMPLE FOR YOUR CLIENT * EASILY LEARNED**
**FEWER SESSIONS * HIGHER EFFICIENCY**

**TRAIN BRAIN FITNESS * BRAIN BLOOD FLOW * A NEW NEUROFEEDBACK MODALITY**
**IT’S LIKE HAVING A PORTABLE SPECT SCAN IN YOUR OFFICE**

HEG DIRECTLY TRAINS BLOOD PERFUSION!

**BIOCOMP 2010 INCLUDES:**

- HEG, EEG, EMG, ScrEdR, TEMP, and 15 more of the best conventional modalities

**LEARN ABOUT THE EXCITING OPPORTUNITIES IN BRAIN HEG TRAINING**

**consult:** Hershel Toomim Sc.D.  **BIOCOMP RESEARCH INSTITUTE**

6542 HAYES DRIVE, LOS ANGELES, CA 90048, (800) 246-3526, FAX (323) 930-8505, EMAIL hershel@biocompresearch.org