



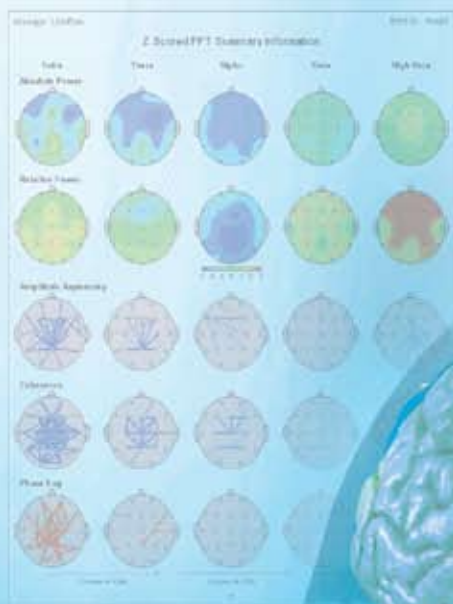
# NEURO CONNECTIONS



Fall 2013

## Newsletter

A joint newsletter from the  ISNR  
& the  ANP Neurofeedback Division



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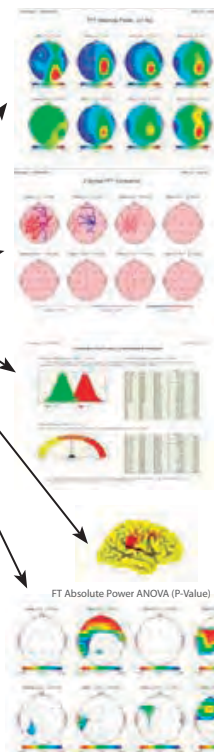
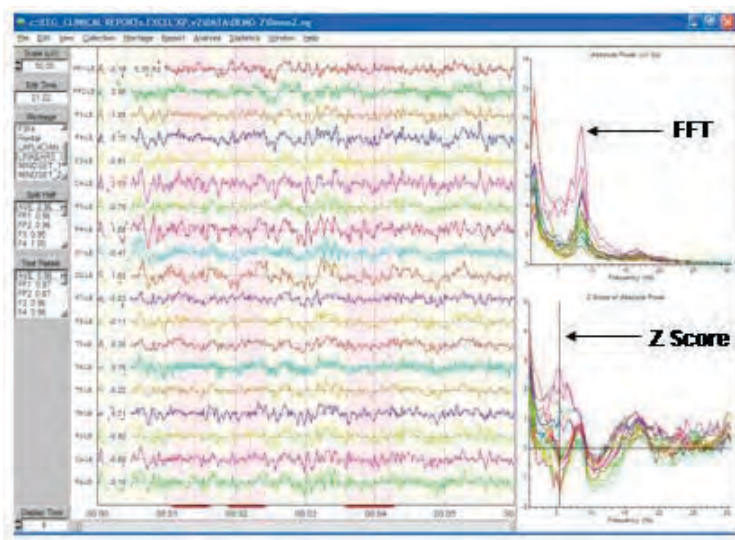




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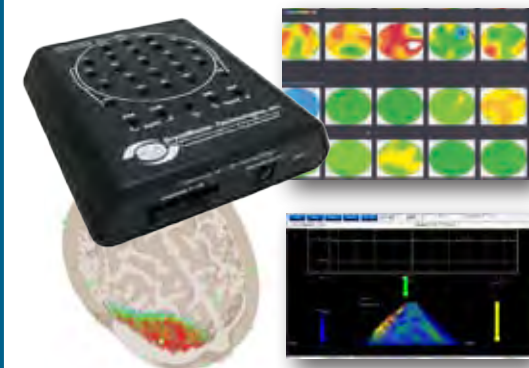
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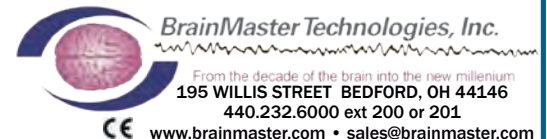
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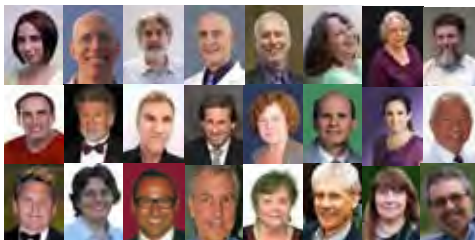


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## Online Supplement



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Infra-Low Frequencies and Astrocytes *David Kaiser, PhD*

Slow Cortical Potentials Neurofeedback *Sarah N. Wyckoff, PhD*

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## Letter from ISNR President

"The King is dead, long live the King!" This ancient chant was meant to be a sign of continuity and stability at the time of passing of the monarch. The lineage was already set, although the old king had passed away, the citizens knew that a new king had already stepped into his place.

Well, I hope that this ancient saying applies to the pending transitions of our journal. I am writing this letter well in advance of its publication so I cannot say at this moment what all of the final details will be. I can tell you that the Board of Directors and I have been working hard to find and create a good alternative to what had become a less than desirable situation. To remind you briefly of the history, the *Journal of Neurotherapy* began as a self-published journal, intended to provide a means of publishing research and case studies in the new field of neurotherapy. We were a new science and established journals were by and large unwilling to accept our articles. After a period of time, Haworth was contracted with to publish the journal. During this time the Board of editors and reviewers became more diverse and reputable and the journal began to gain more attention. Unfortunately, Haworth found it necessary to get out of the publishing business and was purchased by Taylor & Francis. T&F gained full ownership and copyright for the Journal and ISNR became the "sponsor" of the journal but no longer held any ownership rights.

The various editors and the ISNR Board continually sought to improve the quality of the journal and diligently tried to gain PubMed indexing. We had hoped that T&F would facilitate this process, but they proved to be less than helpful in their approach. The journal found itself in a Catch 22. We could not attract the level of quality research articles we needed to gain indexing because we were not indexed. Martijn Arns and I dedicated ourselves for two full years to begging, cajoling, and arm twisting many, many authors to submit some excellent research in order to make a push for indexing but in the end we were not successful.

Our contract with T&F was up for renewal so it was time for a decision. We felt that they had not really contributed to our efforts, they were very expensive, and we did not even own the journal that we were paying them to publish. We decided not to renew the contract and to seek alternatives. Hopefully you have seen the email blast that announced the changes to the journal several months ago. We are planning on publishing a new journal named *NeuroRegulation* through the generosity of Mount Mercy University in Cedar Rapids, Iowa. Because the University is contributing much of the labor, we believe that we will be able to provide an on-line, open access journal of high quality, with the same interesting and informative research and applications as JNT, and without the need to charge authors a fee for publication. This means that clini-

cians and researchers in clinical or small university settings where resources are few can still have a pathway to full peer-reviewed publication, and our members who depend on the journal to keep them informed of new technologies, methods, and discoveries can continue to have easy access to this information.

At the same time we are hoping to be able to provide an occasional "Special Issue" published through the Frontiers in...series. This publishing group is one of the most highly regarded publishers in neuroscience and publishes a wide variety of research in neuroscience. These issues will likely delineate a specific topic or method and invite research from the top researchers and practitioners involved to submit articles and findings. It is our hope that this will enable us to expose more of the scientific community to the effectiveness and power of neurofeedback and applied neuroscience. Frontiers journals are already Medline indexed and have a significant impact factor so this will allow us to increase our footprint without the huge expense and challenge of producing a full volume of a journal.

I think that this will be a great step forward for the Society and for the field. We will be able to continue to inform and educate our members, and reach out



Randall Lyle, PhD

### ISNR Mission Statement

To promote excellence in clinical practice, educational applications, and research in applied neuroscience in order to better understand and enhance brain function. Our objectives are:

- Improve lives through neurofeedback and other brain regulation modalities
- Encourage understanding of brain physiology and its impact on behavior
- Promote scientific research and peer-reviewed publications
- Provide information resources for the public and professionals
- Develop clinical and ethical guidelines for the practice of applied neuroscience

### AAPB Neurofeedback Division Mission Statement

To improve human welfare through the pursuit of its goals. The specific goals are:

- The encouragement and improvement of scientific research and clinical applications of EEG technology and neurofeedback.
- The promotion of high standards of professional practice, peer review, ethics, and education in neurofeedback.
- The promotion of neurofeedback and the dissemination of information to the public about neurofeedback.
- The division is organized for the purpose of carrying on educational and scientific objectives and is not to be operated for profit.

to the larger scientific community. However, the problem of quality research and case studies remains. One of the primary problems for the *Journal of Neurotherapy* was always a lack of content. We never had sufficient submissions. This was the single greatest reason why we could never accomplish our goal of Medline indexing. *NeuroRegulation* will not be the journal we all want it to be if we do not have authors submitting high quality research, case studies, theoretical proposals, and integrated care models. The journal was always dependent on you and that has not changed. I want to encourage you in the strongest manner possible to support your new journal. Make submissions! You might be surprised at how wonderful it feels to find yourself published!

Randall Lyle, PhD 

## Letter from ISNR Executive Director

### The BRAIN Initiative Hopes to Unlock Mysteries of the Human Mind

In April 2013, the Obama administration announced its plan for a decade-long scientific effort to examine the workings of the human brain and to build a comprehensive map of its activity. For ISNR members, the BRAIN Initiative—short for *Brain Research through Advancing Innovative Neurotechnologies*—will be an effort to revolutionize our understanding of the human mind and to uncover new ways to treat, prevent, and cure brain disorders like Alzheimer's disease, schizophrenia, autism, epilepsy,



Cindy A. Yablonski, MBA

and traumatic brain injury. The project will launch with approximately \$100 million in funding and include federal agencies, private foundations, and teams of neuroscientists and nanoscientists in a concerted effort to advance our knowledge of the brain's billions of neurons.

### What could be some of the benefits of the BRAIN Initiative?

The BRAIN Initiative hopes to generate revolutionary new tools that will measure the brain activities in thousands to millions of neurons in order to produce a



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general theory of the brain. An interdisciplinary network of scientists and engineers will work on the BRAIN Initiative in order to make new, powerful prosthetics, treatments for devastating brain disorders, improved educational strategies, and smart technologies that mimic the brain's extraordinary abilities. For ISNR members, the hope is for the BRAIN Initiative to provide adjunct methods—in addition to brain training and neurofeedback—for patient evaluation and treatment.

### Who else is doing brain research now?

In June 2012, the journal *Neuron* included the work of six leading scientists that proposed pursuing a number of new approaches for mapping the brain. The proposal envisions using synthetic DNA as a storage mechanism for brain activity. The BRAIN Initiative is also markedly different from a

recently announced European project that will invest 1 billion euros in a Swiss-led effort to build a silicon-based “brain.” The project seeks to construct a supercomputer simulation using the best research about the inner workings of the brain.

### Think about it.

Sure, the BRAIN Initiative is politically motivated and there are many disagreements about its goal, objectives and overall budget requirements. But what is exciting and what the BRAIN Initiative gets right is the need for a major scientific effort. Similar to the space race or the Human Genome Project, the BRAIN Initiative is singularly dedicated to exploring one of the most exciting frontiers in science. The effort will focus primarily on technologies and tools that should help ISNR members with diagnosis and

treatment, as opposed to data-generating experiments. The benefits from this initiative could be a view of the brain that goes beyond anatomy to the very function, and eventually to new ways of healing disorders. And that seem like a worthwhile endeavor.

### To learn more about the BRAIN Initiative, visit these web sites:

For NIH summary on the BRAIN Initiative see: <http://www.nih.gov/science/brain/index.htm>.

For an info-graphic that highlights major elements of the BRAIN Initiative see <http://www.whitehouse.gov//info-graphics/brain-initiative>.

I value your input, your ideas, and your suggestions. You can reach me at [cyablonski@isnr.org](mailto:cyablonski@isnr.org).

Cindy A. Yablonski, MBA 



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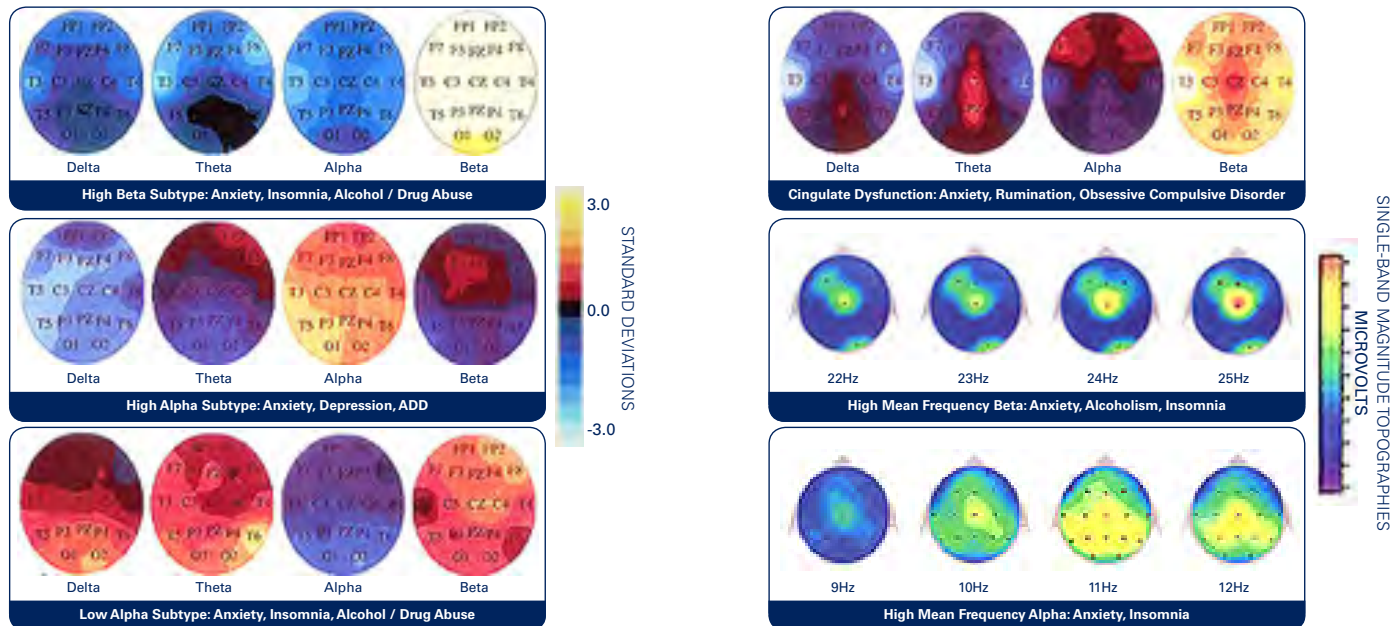




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03) Neuroguide - R. Thatcher Normative Database <i>A) Eyes Closed Linked Ears Z-scores // Eyes Closed LaPlacian Z-Scores B) Eyes Open Linked Ears Z-Scores // Eyes Open LaPlacian Z-Scores</i>	\$70.00/each
04) Neurorep - W. Hudspeth QEEG Analysis System <i>A) Eyes Closed - Weighted Average, Z-scores, Magnitude, % Power, LaPlacian, Average Spectrum, coherence, connectivity B) Eyes Open - Weighted Average, Z-scores, Magnitude, % Power, LaPlacian, Average Spectrum, coherence, connectivity</i>	\$70.00/each
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## Letter from ISNR Editor

### Hello Fellow ISNRers,

This fall edition is focused on the issue of slow frequency training in the area of SCP, ISF, and ILF. Not too many years ago, the idea of training at low, slow frequencies was greeted with a lot of skepticism and fear. Yes, fear that such training would create serious side effects from which the client might not be able to recover. Of course, coherence training was also greeted with similar views. So we have come a long way. The case studies and techniques in these articles will be helpful to your understanding and to your clients. Do read David Kaiser's article and I almost say read it first. It has caused me to rethink my questioning the type of training depicted in this edition. As usual he gives us the most carefully thought out reasons and opens up the training of the brain and its operation to our further scrutiny.

Sarah Wyckoff gives her experiences in SCP training and heart-brain connections. She gives information on the use of SCP for disorders such as epilepsy, migraine, ADHD, substance abuse, depression, and anxiety. Very informative.

Edith Schneider's article gives us a very comprehensive review of the work with SCP and looks at the issue of networks being affected by SCP.

Siegfried Othmer looks at the optimization procedure in ILF training. As always, Dr. Othmer gives us a historical and clinical discussion of the procedure that he and his wife originated only a few years ago.

Mark Smith gives us more insight into ISF training and addresses the issue of how does a small, recurrent amplitude change effect changes in the brain.

Also, look at the recurring article called Neurofeedback Around the World. This report gives information on neurotherapy in Australia. Some of your friends will pop up in the article so read and enjoy.

Have a wonderful fall and hope to see you at ISNR.

Merlyn Hurd, PhD,  
BCN Senior Fellow



Merlyn Hurd, PhD

## Letter from AAPB NFB Division President



Richard Soutar, PhD

Recently, the American Academy of Pediatrics raised neurofeedback (NFB) to a Level 1 intervention for ADHD on their website [www.practicewise.com](http://www.practicewise.com). It was listed as biofeedback but the citations were all from NFB research. This could be a bigger deal than the long sought after NIH study that is supposed to catapult us into acceptance by the scientific community. Interestingly, a large percentage of medical practices have never been researched using controlled group designs and one leading investigator has found that 60% of medical research is deeply flawed. So maybe the bar is not as high as we thought, but just located in a different place.

People use what seems to work, and most do not read research articles. Many physicians I have spoken with have said doctors tend to use what other big clinics use, such as the Mayo Clinic. Word gets around. Our field seems to be growing and everyone is starting to get in on the act. It seems like there is a

new internet site every week touting NFB or new equipment. There are several groups charging very large fees for their services, but this is business. Look at the outrageous fees some hospitals charge for services. The list serves are buzzing with outrage over exotic fees and primitive NFB protocols; perhaps there is some jealousy there as well, because most of us are clinicians and not entrepreneurs. Many of these groups are only using the early SMR protocols etc., which actually tend to be quite safe, and this of course aggravates progressives even more. There are some complaints about abuses, but the level

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of “iatrogenic effects,” if we really want to use a medical term, is pretty minimal compared to how many die from approved medical procedures. The FDA does not take us very seriously after 30 years of minimal trouble.

The criticism and condemnation in our field among ourselves is far more abusive emotionally than anything being leveled at us from the outside. We are happily demonizing each other for not using the latest or most sophisticated, albeit minimally researched, technology we can develop and sell. I have spoken with some of these other vendors who do not show up at meetings, and they generally provide the same response. They are alienated by the atmosphere at the meetings and on the list serves. They see us as narrow-minded, excessively critical, and self-abusive. They don’t want their businesses or their clients associated with this atmosphere. They also see how vendors well-established in the community are likely to take unfair advantage of their status and attempt to limit the products and markets of new players. We, on the other hand, tend to look down on these newcomers as adventurers, price gougers, unsophisticated barbarians, and even dangerous evildoers. We want to put up the barbed wire on this Wild West scenario.

Totaled together, however, these groups far outstrip the combined membership of ISNR and AAPB. We are already outnumbered and we could find ourselves sidelined as the field advances in the marketplace without us. So perhaps we, the meeting and certification people, should consider changing our strategy. Perhaps we should lower the bar a bit, reach out and get to know these other groups, and invite them to play. Once we all get to know each other, we might be able to manage some agreement—some call it compromise. We might also be able to educate them on how much more exciting and effective our new technologies and methods are, compared to what they have been using, and how they can benefit from them, unless you are a fearful and jealous vendor protecting your shrinking turf. At least we would all be talking together and working to expand and improve our field. I suspect that fear, status concerns, and greed will make this a very difficult step to take. For most people, it is much easier and more exciting to rant, gossip and finger point. Isn’t that why reality TV and cable news is so popular?

*Richard Soutar, PhD, BCN* 

## Letter from AAPB Executive Director



### Staying Connected!

Everyone is on social media these days, and AAPB is no different! AAPB is working now to develop an active social media presence. Why? There are more reasons that can be listed in this message, but here are a few:


1. Our tendency has been to isolate ourselves and tout the benefits of biofeedback and neurofeedback among ourselves. The old “preaching to the choir” syndrome.
2. Since social media has become so active, we believe that harnessing that energy and becoming a functioning part of that community will enhance the communications sphere among the AAPB membership, the overall applied psychophysiology community, prospective clients, other healthcare providers, those interested in optimal performance, and a wide variety of social media participants.
3. Societal resistance to social media has lessened to the point where more non-traditional users are now getting involved.
4. It’s the wave of the future and we cannot sit on the sidelines. Doing so would risk being left behind.

So, what will be different from what we already have? AAPB has a Facebook page and a Twitter account now. The answer is that we will be pushing relevant information out and reaching out to audiences that we don’t currently have. Some of the audiences are mentioned above, like potential clients, the healthcare community, and those who could benefit from optimal performance techniques, to name a few. The universe is vast and social media offers an opportunity for us to be recognized as THE source for relevant information about biofeedback and neurofeedback and their benefits.

For this effort to be successful, it needs to be a group effort. Here are a few ways that you can help:

1. Post a quick note on the AAPB Tweet site when you learn about a new publication, article, or research findings of interest to the field.
2. Submit stories, articles, or information that will keep the Facebook account fresh and interesting.
3. Volunteer to be on an AAPB committee that helps to review the content or to answer any questions that come to the Twitter or Facebook accounts that are within your specialty area.

We believe that society is becoming disenchanted with conventional remedies that carry with them exhausting lists of side effects. We offer a modality that is receiving attention and evidentiary support as an effective alternative. We also believe that social media is a great way to reach the masses and are taking steps to harness that energy for the good of our community and society as a whole.

*David L. Stumph, IOM, CAE* 

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## Letter from AAPB Editor



*Roger Riss, PsyD*

Welcome to the fall 2013 issue of *NeuroConnections*. The focus of this issue might be summarized in the question “What’s happening below 0.5 Hz?” Historically, Neurofeedback practitioners, particularly in the United States, have employed frequency-based training, with emphasis on the traditional 1-30 Hz EEG frequency bands, while instrument manufacturers have optimized their equipment to that focus with AC amplifier designs which treated EEG signal below 0.5 Hz as potential source of artifact, to be excluded from feedback training via high pass filtering.

The 1990’s gave rise to a complimentary, primarily European, neurofeedback method focusing on modulation of DC baseline shifts (slow cortical potentials) associated with discrete cued episodes of cortical activation and deactivation, respectively, rather than modulation of periodic, oscillatory EEG signal over time.

Within the past decade a gradual blurring of the boundaries between these two, theoretically and technically distinct approaches to neuromodulation has arisen, as clinicians, guided primarily by careful observation of patient response, began to shift training to increasingly slow reward frequencies, and began to report robust patient response to infra low reward frequencies proximate to DC. This pioneering clinical work, initially arising from the Othmer group, and expanded upon by later developments of Smith and Collura, has not been without controversy. Consistent with past advances in our field, clinical reports of efficacy preceded supporting controlled research. Moreover, as experts in EEG signal analysis have highlighted in the past (see Stoller, 2010), questions remain about what components of the EEG signal are most salient to successful patient response when training in the infra-low/intra-slow frequency range. Unfettered by these unanswered questions and controversies, the ranks of clinicians reporting favourable patient response to infra-low/intra-slow frequency training techniques continues to grow, compelling continued clinical discussion and scientific scrutiny.

Within the current issue, David Kaiser keynotes our discussion by exploring the scientific rationale for attention to infra-low frequency bands, highlighting the ubiquitous presence of slow frequency rhythms in key biological modulatory processes. He goes on to postulate that, if faster frequency neurofeedback impacts neuronal regulation, feedback training in ultra radian and infra low ranges has the potential to modulate underappreciated glial and astrocytic regulatory systems.

Following an historical timeline, the issue unfolds with dis-



cussions of *Slow Cortical Potential* (SCP) training by Sarah Wyckoff and Edith Schneider, from theoretical and clinical viewpoints, respectively. Next, Siegfried Othmer contributes a historical retrospective of the emergence of *Infra-low frequency* (ILF) training methods which his group pioneered, while European researcher and clinician Mieke Weidemann comments on similarities and differences between the SCP and ILF techniques. Mark Smith and Jackie deVries bring the issue to a close with lively reviews of the evolution and current status of the *Infra-slow frequency* (ISF) training methods which reflect a further evolution of the field.

Readers whose interest is piqued by the current issue might wish to visit the NeuroConnections web page and re-read a number of related papers which have appeared in past issues, below. We hope that you enjoy the issue as much as we have enjoyed its preparation.

Roger H. Riss, PsyD 

#### Reading list

Collura, T.F. Practicing with multi-channel EEG, DC, and slow cortical potentials. *NeuroConnections* (Winter 2009).

Othmer, S. & Othmer, S. Introduction to infra-low frequency training, *NeuroConnections* (Spring 2010).

Stoller, Lincoln. Making sense of infra-low frequency neurofeedback *NeuroConnections* (Summer 2010).


Strehl, U. (2009). Slow cortical potentials neurofeedback. *Journal of Neurotherapy*, 13(2) 117.

## Neurofeedback Around the World



John Davis, PhD

*This edition's update is courtesy of Nerida Saunders.*


In Australia, several neurofeedback practitioners report the following developments. In Queensland, on Australia's eastern coast, **Michelle Aniftos** has added qEEG and ERP assessment methods to her well-established practice, and continues to host university practicum students, one of whom, **Catherine Pascoe** is investigating neurofeedback for children with ADHD. A little farther south along the coast, **Nerida Saunders**, in northeastern New South Wales, is investigating working memory training and tDCS with PTSD and mild cognitive impairment. Farther down the east coast in Sydney, **Noel Thompson** is conducting EEG signal analysis research, and collaborating with **Bill Scott** to develop new EEG analysis methods. Also in Sydney, the Service for the Treatment and Rehabilitation of Torture and Trauma Survivors (STARTS) neurofeedback is provided to clients, and studies are starting with **Richard Bryant** and **Belinda Liddell** at the University of New South Wales, on EEG, fMRI, and emotional regulation in individuals with PTSD. STARTS, **Graham Jamieson**, and **Harley Macnamara** at the University of New England have also conducted a study on alpha enhancement. **Alan Snyder** and **Andrew Kemp** in Sydney are using neurofeedback together with heart rate variability training. At the University of Wollongong, a little farther south from Sydney, researchers at the Brain and Behavior Institute are examining EEG biomarkers and neurofeedback. In Adelaide, down and around on the southern shore, **Richard Clark** is investigating the efficacy of neurofeedback in dyslexia. 

## Virginia White, Lifelong Advocate for Healing

Virginia White, RN, LIMPH, MS, EdS, CPC, BCIA Fellow, passed away on January 18, 2013. Virginia's life was centered on helping others, professionally and personally. She was a pioneer in biofeedback and neurofeedback as well as her development of the Behavioral Service Unit for Mary Lanning Hospital in Hastings, Nebraska.

In the 1980s, Virginia studied biofeedback at the Menniger Foundation with Elmer and Alyce Green, then studied with Dr. Joel Lubar in Knoxville, Tennessee. She then bought biofeedback equipment and began to practice on family and friends.

From 1991 until her death, Virginia owned and operated her own business, Professional Counseling Associates, Biofeedback and Behavioral Therapy Clinic in Hastings, Nebraska. Over the past 20 years, Virginia trained and supervised many clinicians utilizing biofeedback and neurofeedback. She received the Lifetime Achievement Award from the Nebraska Biofeedback Society.

Virginia was special in her commitment to helping people heal and in her intuitiveness in guiding them toward this path. Her spirit continues in all who knew her, worked with her, and received services from her. 



## Infra-Low Frequencies and Astrocytes

David Kaiser, PhD

Infra-low frequencies (ILF) correspond to rhythms with periods lasting from many seconds to many hours. An ILF of 0.1 Hz corresponds to a 10-second period, a frequency associated with blood flow and cortical network dynamics. The number of papers on this and similar frequencies in brain activity is burgeoning. However, for this article I will focus on the very slow ILF, those in the mHz range ( $<0.001$  Hz).

An ILF of 1 mHz, for instance, corresponds to a 17-minute rhythm, 0.18 mHz to a 90-minute cycle, and 0.14 mHz to 2 hours. The latter two periods encompass the range of our Basic-Rest-Activity-Cycle, how we tend to rest and work in two-hour increments across the day (Kleitman, 1982; Rossi & Kleitman, 1992). This cycle exists in our behavior because it is the brain's time-based management (or cycle) of cortical excitability and plasticity, an adaptive response to the challenges of life. Our cycle of cortical excitability and plasticity, followed by inactivity and energy restoration, is clearly observed in our sleep cycles. Ev-

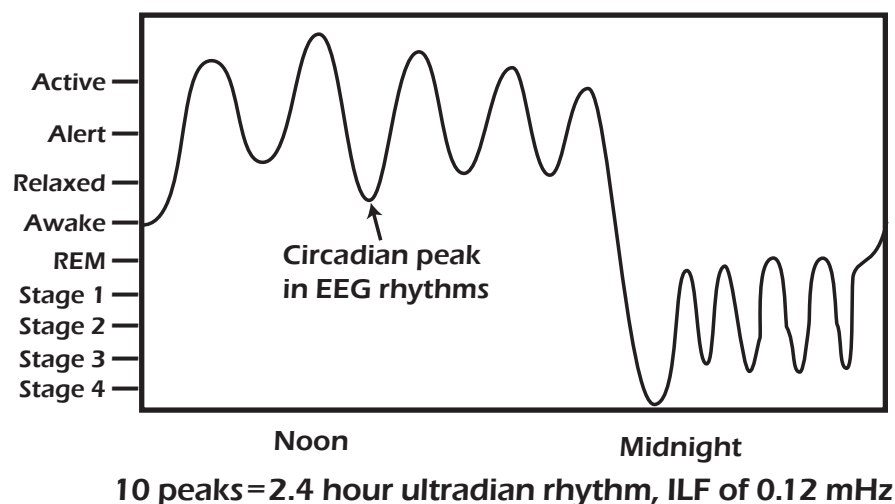
ery 90 minutes or so, we shift from non-REM to REM sleep, from restorative, non-responsive cortical activity to periods of excitability and plasticity, rapid eye movement (REM) sleep, when the day's learning is consolidated (Ribeiro et al 2008; Rossi & Lippincott, 1992). Our cycles are also apparent during the day in our EEG: all frequencies fluctuate in magnitude about every 2 hours (see Figure 1), riding a wave of excitability and rest at an ILF near 0.1 mHz (Kaiser & Serman, 1994; Chapotot et al., 2000).

Circadian rhythms, those which peak and trough once a day, correspond to an ILF of 0.0112 mHz, a slow but very common frequency observed in biological cells. Most mammalian cells and tissues express circadian rhythms (Yoo et al., 2004; Kowalska and Brown, 2007). Circadian rhythms are regulated by clock genes in most species and are life's response to cycles of light and darkness. Even under free-running conditions, these rhythms are remarkably stable in duration, though not in phase, as we use the sun's light to entrain our daily

rhythm. Our brain reveals a circadian peak for EEG rhythms in the early afternoon, poking above the ultradian peaks, as shown in Figure 2.

Ultradian rhythms, those lasting from many seconds to a few hours, are not an evolutionary adaptation to the earth's rotation but rather a response to metabolic challenges. A waxing and waning of the brain's energy state is adaptive, and common to homeodynamic systems, those maintaining homeostasis in an energetically-variable environment. It is adaptive to run fast (be more active) periodically throughout the day, even if the cost is being slower or less active occasionally. Ultradian rhythms are present in every aspect of biology, from algae to house flies to humans. Ultradian rhythms are observed in our daily behavior and in the brain. Our brain is autorhythmic and demonstrates amazing stability over a vast array of rhythms spanning multiple time frames ranging from a few milliseconds to several minutes and hours (Hughes et al., 2012). We observe ultradians in blood flow, in oxygenation, in neuronal firing rates, in brainwave activity, in sleep arousals, and even for epileptic seizures (Aladjalova, 1957; Leopold et al 2003; Staba et al, 2002, Steriade et al., 1993). Ultradian rhythms correspond to infra-low frequencies, those below 0.1 Hz (and usually those of interest are well below 0.1 Hz), down at the milli-Hz (mHz) range. (In addition to circadian and ultradian rhythms, we also have infradian rhythms, those which occur once a week, once a month, once a season, once a year, or once every 17 years, such as ovulation, hibernation, or migration—very low ILFs indeed!)

What is responsible for the very slow ILF signal ( $<0.001$  Hz) we record from the scalp? What in the brain is cycling so



**Figure 1:** Ultradian rhythms reflecting the brain's time-based cycle of cortical excitability and plasticity



slowly, as slow as our 2-hour daily rhythm of rest and activity, for instance? Generation of infra-slow frequency waveforms may involve multiple intracranial structures and mechanisms, notably glial cells and the blood-brain barrier (Vanhatalo et al., 2003). Infra-low frequencies between 0.1 and 1 Hz correspond to the default mode cycles, brief periods of activity and rest, a weaving on and off of our default mode, and the task-positive networks. Fluctuations in the 0.01–0.1 Hz range in EEG activity are relevant to cognitive task performance (Monto et al., 2008), as they reflect network dynamics, competition among the default mode, central executive, and the salience networks, but we find even slower rhythms in the brain. The thalamus consistently shows oscillations at < 0.1 Hz in animal research (Hughes et al., 2011) and nuclei in the dorsal thalamus express rhythms as slow as 0.005 Hz in vitro (Lorincz et al., 2009). Many neurotherapists are interested in even slower ILFs than 5 mHz as they find therapeutic effect from training ILFs in the range from 1 to 0.1 mHz. What in the brain cycles this slowly?

The answer may be glia. Astrocytes are known to modulate cortical slow oscillations and may be responsible for very slow ILFs (Fellin et al., 2009). For instance, thalamic astrocytes generate spontaneous and often highly rhythmic intracellular calcium oscillations as slow as 0.003 Hz (Parri & Crunelli 2001). Astrocytes are a very common glial cell. The term “glia” is the Greek word for glue, reflecting the early neuroscientists’ debate over its role in the nervous system. The original view was that glia served as passive cohesive support for the neuronal system. Glia—and astrocytes in particular—are now recognized as active participants in brain function. Glia interact with neurons at the synapse and at the axon; astrocytes assist synaptogenesis and plasticity, and oligodendrocytes, another form of glia, speed information exchange between neurons by insulating axons.

Humans are glial brains, to our better-

ment. Glia take up the most space of any element of our brain, as much as 90% of our cortex, 80% of the cortex of our genetic relative the chimpanzee, 60% of rodents, and 20% of fruit flies (Laming et al., 1998). Across species, astrocytes increase in prevalence proportionally with the complexity of the brain. The astrocyte-neuron ratio is 1:25 in the leech, 1 in 6 for the roundworm, 1 in 3 for rats and mice, and approximately 3 astrocytes to 2 neurons in the human, with 7 to 1 in the neocortex (Oberheim et al., 2009). The size and complexity of astrocytes has also increased in larger-brain species; for instance, astrocytes in humans are 2.6 times larger with 10 times as many processes, and they signal 10 times faster than those of rodents. The human astrocytic network complexity and diversity permitted the increased functional competence of our brain, compared to other mammals and even other primates (Oberheim et al., 2009). The evolution of the astrocyte-neuron partnership is likely the source of our species success on earth. Intelligence is connected to the proportion of glia one possesses. Foreexample, Einstein’s brain had much higher glia/neuron

ratios than other men his age, in the left parietal lobe (Brodmann area 39), an area involved in symbol representation and calculation, and the additional energetic support provided by so many glia likely produced his mental excellence (Diamond et al., 1985).

Neurons and glia interact dynamically to process information and organize behavior. Astrocytes play a critical role in plasticity. The synapse is not just an interaction of two neurons, but rather is typically an interplay between neurons and their astrocytes (i.e., Tripartite synapse model; Kang et al. 1998; Araque et al. 1999; Carmignoto 2000). Astrocytes release neurotransmitters in response to synaptic activity, and in so doing provide a feedback loop on synaptic transmission. Astrocytes are able to modulate and integrate the activity of adjacent neurons by releasing neurotransmitters (Parpura et al. 1994; Bezzi et al. 1998; Innocenti et al. 2000). Astrocytes release neurotrophic signals that promote neuron survival (Banker, 1980). In fact, in vivo astrocyte survival is necessary for cortical neuron survival (Wagner et al., 2006).

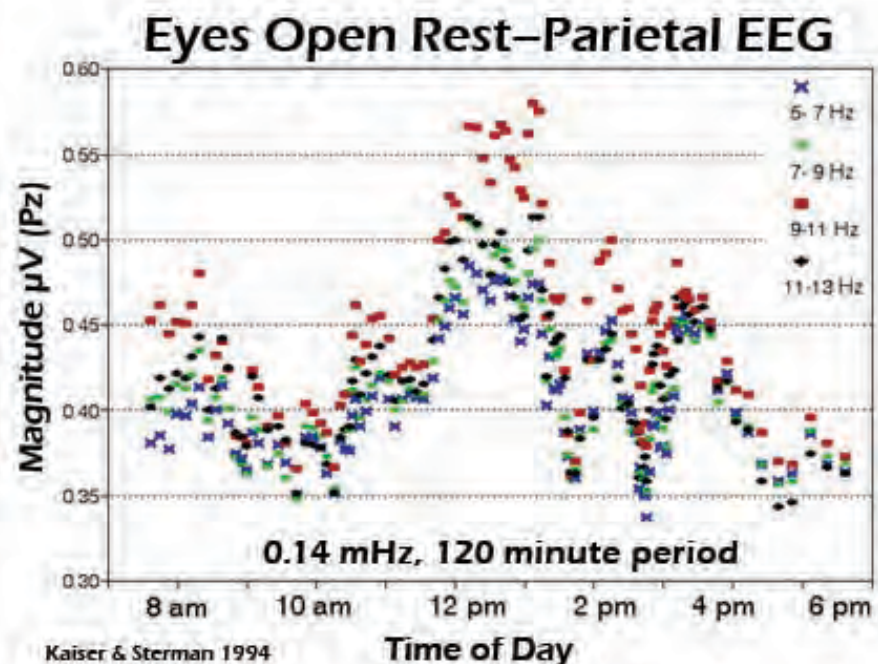


Figure 2: A circadian peak for EEG rhythms occurs in the early afternoon

Astrocytes might promote neuron survival simply by inducing neurons to form synapses. When cultured with astrocytes, the synaptic activity of retinal ganglion cells increases by nearly 100-fold over ganglion cells cultured without (Barres 2008). Astrocytes also release both vasoconstrictors and vasodilators into capillaries via “foot processes” (Zonta et al., 2003; Metea and Newman, 2006; Gordon et al., 2007), controlling local blood and oxygen flow.

Astrocytes produce long-term fluctuations in ATP release (energy), synaptic plasticity, as well as glutamate and calcium availability, jointly constituting a multi-faceted capability of regulating cortical excitability and plasticity (Fellin et al., 2007). Astrocytes possess many of the same molecules of the neuronal synaptic machinery and are able to influence synaptic strengthening and depression. The rate of synaptic plasticity adjustments by astrocytes is an ILF, occurring only slowly and coordinating slowly through calcium waves. Astrocytic net-

works intercommunicate with neuronal networks and process information on this slower time-scale, 0.1 to 0.001 Hz. This regulation of cortical synapses via calcium waves is observed as slow cortical oscillations in the EEG (Lorincz et al 2009) and allow synchronized activation of neuronal ensembles (Poskanzer & Yuste, 2011) which help segregate and coordinate cortical networks (Halassa and Haydon, 2010). Astrocyte networks influence an even slower arousal cycle, the sleep-waking cycle. They control sleep pressure accumulation in part by inhibiting awake-state-promoting cholinergic neurons in the basal forebrain (Halassa et al, 2009; 2010). Hence, through a variety of mechanisms, astrocytes are integral to brain function.

Astrocytes release ATP and it is this release of ATP that provides the tone for faster neural operations, based on energy availability (Parri and Crunelli, 2002, 2001; Parri et al., 2001). The ATP release cycle may be responsible for the slow ILF (mHz) recorded at the scalp, as

the ultradian rhythms in EEG. In other words, the ILF signal below 0.1 Hz that we measure at the scalp is likely caused by astrocytic spatio-temporal dynamics. No other system in the brain appears to regularly activate in this time frame. Some believe that astrocyte activity may contribute to conscious modulation of brain rhythms in neurofeedback (Pereira & Furlan, 2010). The next task will be to prove that by altering ILF signals via neurofeedback or magnetic stimulation, we alter astrocyte-neuronal dynamics. We may impact astrocyte functionality and address basic energy cycle issues in health and sleep using ILF training.


*David A Kaiser MFA PhD has a 25-year history in EEG and neurotherapy research. He currently works in Southern California with EEG Info and other practitioners.*


References are available in the supplement at: <http://isnr.org/neurofeedback-info/neuroconnections-newsletters.cfm>.

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## Slow Cortical Potentials Neurofeedback

Sarah N. Wyckoff, PhD

Neurofeedback therapy has emerged as a non-pharmacological treatment option for the management of medical and psychiatric conditions. For nearly half a century, research in applied psychophysiology has focused on identifying the electrophysiological basis for neurofeedback interventions and treatment efficacy for individuals with intractable epilepsy and attention-deficit/hyperactivity disorder (ADHD). Within this research, two methods of neurofeedback have emerged including frequency-based neurofeedback and slow cortical potential (SCP) neurofeedback. Frequency-based applications use operant conditioning paradigms to train an individual to self-regulate oscillatory activity within the traditional EEG frequency bands (e.g., delta, theta, alpha, and beta). Treatment selection is guided by established research-based protocols (e.g., SMR training for epilepsy and theta/beta training for ADHD), qEEG analyses, and/or normative database comparisons. SCP-feedback applications use operant conditioning paradigms to train an individual to self-regulate event-related slow wave shifts (positive and negative) that are embedded in oscillatory activity.

This form of neurofeedback is indicated for conditions characterized by impaired regulation of cortical excitation thresholds and deviations in contingent negative variation (CNV).

Despite differences in their approach, a recent meta-analysis of EEG operant conditioning paradigms for the treatment of epilepsy indicated that both neurofeedback methods contributed to a significant reduction in weekly seizure rates (Tan et al., 2009). A meta-analysis of neurofeedback for the treatment of ADHD indicated that both methods contributed to large treatment effect sizes for the reduction of impulsivity and inattention and a medium effect size for the reduction of hyperactivity (Arns, de Ridder, Strehl, Breteler, & Coenen, 2009). Successful treatment outcomes for these disorder populations encouraged researchers and clinicians to investigate the scientific basis for using SCP-feedback in a broader range of conditions including migraine, depression, anxiety, substance abuse, and schizophrenia. This article will provide a brief discussion of the basic mechanisms and rationale for SCP-feedback, specific training goals and technical requirements,

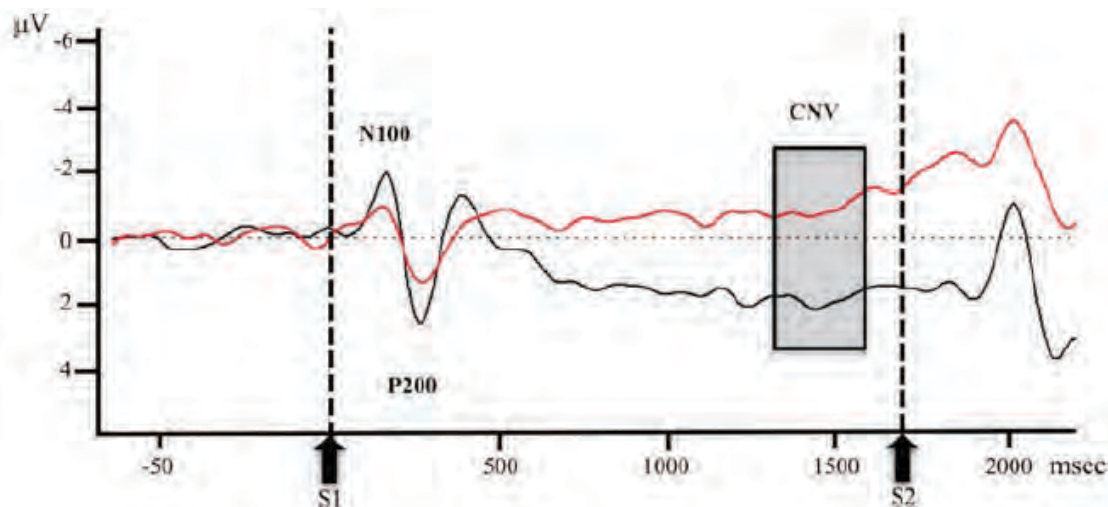
and therapeutic applications. Finally, a review of SCP-feedback related research findings will be provided.

### What are the mechanisms and rationale for SCP-Feedback?

SCPs are very slow electrical shifts in brain activity that cycle below the 0.01 Hz range and last from 300ms to several seconds. These shifts change periodically from being electrically positive to negative and reflect the threshold regulation mechanisms of attention and cortical activation and inhibition (Rockstroh, Elbert, Lutzenberger, & Birbaumer, 1990). Negative shifts reflect the provision of attentional resources and facilitate the initiation of goal directed behavior which can be observed in enhanced reaction time, stimulus detection, and short-term memory during the negative shift phase (Birbaumer, Elbert, Canavan, & Rockstroh, 1990), while positive shifts reflect the disfacilitation of excitation thresholds and inhibition, i.e. avoidance of premature activation or “false starts.”

SCP-feedback focuses on the self-regulation of these negative and positive shifts and has been shown to be therapeutic

*Continued on page 25*



**Figure 1:** the contingent negative variation (CNV).





## Training for Self-Regulation of Slow Cortical Potentials in Clinical Practice

Dr. med. Edith Schneider

When I started with slow cortical potential (SCP)-training six years ago, I had a hard time understanding what these potentials really were and how they differed from frequencies. Nevertheless I decided to do this type of neurofeedback-training because it was developed in Tübingen and I simply knew that anything that Niels Birbaumer and Ute Strehl stood behind couldn't be bad.

So I began, and soon I realized that the standard approach which was described in the studies couldn't be applied to all of my patients. Therefore, in the course of the following years I stayed with the basic idea, but I began to adapt the protocol to the individual needs of my patients.

At first I only treated children with ADHD and ADD. Soon, I found out that the training was very helpful for children with autism spectrum disorder. At times, I found the changes with them even more profound and amazing than with the ADHD population. Children with learning disabilities and mental retardation followed, showing good results in a short time. What's more, as I collected follow-up data from my patients, I learned that results were long-lasting after training had ended and even improved with time. So, out of curiosity, I kept asking children to come back in for an assessment after six months and a year to see if they could still successfully do the training. and I found that they could still do it after a year and longer.

In the beginning, my work with adults was restricted to patients with either stroke or traumatic head injuries, since this is a client population I have been treating for many years. Then one day, the mother of a child I was treating

mentioned that she was convinced that she had ADHD as well, and wanted to train herself. Since ADHD was her least problem, I was a bit cautious, but decided to give it a try. This woman had been severely abused as a child and had developed a deeply mistrusting personality, was easily angered, and often explosive.

After a year of training, her psychotherapist approached me and asked if I was willing to treat another one of her patients after watching the positive changes the training had caused. This was the point when I started working with abused

many apparently different conditions that can be improved by SCP training. For a long time, I couldn't understand how one treatment could be effective for such different problems.

Then, I found out about the default mode network and started reading about the connection between slow cortical potentials and the network functions. As Raichle has pointed out in his article on SCPs, fMRI and consciousness, the slow cortical potentials are controlling the network functions. He likens them to an orchestra conductor who makes sure that

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*Training to self-regulate slow cortical potentials enables people to direct more energy resources to the task at hand.*

---

women with PTSD. Patients with anxiety disorders and depression followed, and most of them experienced great changes for the better. All of them were also with a psychotherapist or psychiatrist, so I felt comfortable doing the training with them, and I always kept close contact with the other therapists.

In the course of my work with the children, I noticed that many of them showed great improvements in sports, a lot of the boys play "fussball" and often they remarked on how much better they were getting at scoring goals. Occasionally, parents wanted to train as well, and found out that they were improving in everyday life and on the job, even though they were performing quite acceptably before.

Many times I kept telling myself not to become too enthusiastic about SCP training and not to think of it as a silver bullet. But I am still amazed at the

all the different parts of the brain and all the different networks cooperate in an orderly fashion to ensure that the brain can effectively deal with the demands of the inner and outer environment (He & Raichle, 2009).

The slow cortical potentials arise wherever neurons are active and they correspond closely to the BOLD signal, so they are found there where the brain is working. They govern consciousness, attention, and perception. The phase of the slow potentials influences the rise and fall of the amplitude envelopes of all other frequencies, so all other oscillations are nested in the rise and fall of the slow cortical potentials.

To me, this means that by training the self-regulation of the slow cortical potentials, one influences all other frequencies as well. With the proper software to analyze this, it can be shown that

training SCPs results, for instance, in a lowering of the theta/beta ratio and in other improvements as well.

Training to self-regulate slow cortical potentials enables people to direct more energy resources to the task at hand. This has been shown lately during a large study done by Gevensleben and described by Wangler et al. in 2011. Here, they showed that only slow cortical potential training resulted in an improvement in the contingent negative variation, whereas frequency training did not have this effect (Wangler et al. 2011).

People who train SCPs learn in the course of time to consciously “turn on” their brain when they have to perform. Their performance becomes more effective and faster, as we can measure by the shortening of the latency of the P 300 wave.

To me, the most important outcome of the training seems to be a better control over network functions. Samantha Broyd et al. describe in their article Default-mode brain dysfunction in mental disorders: A systematic review that many

problems are related to faulty network functions (Broyd et al., 2009). In the case of ADHD this seems to be a problem of switching cleanly between the default mode and the attention network, causing people to be distracted easily and not being able to perform goal-oriented behavior for an extended period of time. Once they learn self-regulation of the slow potentials, by being required during the training to switch back and forth continually, they can pay attention for a longer period of time, finish the task at hand, organize themselves better, and accomplish more.

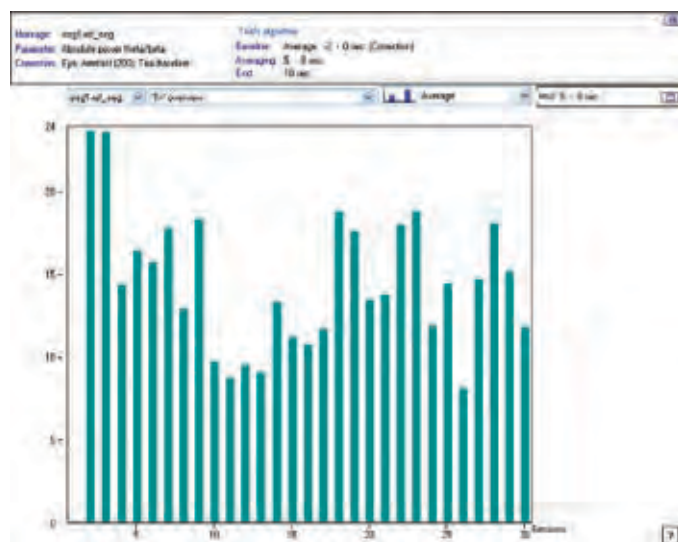
The work of Broyd et al. has helped me to understand why slow cortical potential training is so effective with such a large number of different problems. The training improves the interplay of the different networks. The brain, being a homeostatic system, can then organize itself better and carry out necessary corrections.

I would like to give a few examples of the results of slow cortical potential training with different patients:

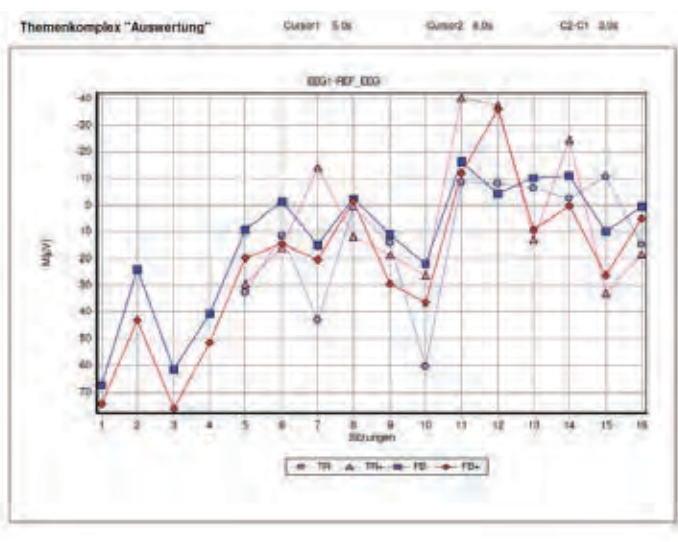
**Case 1: Linda was a nine-year-old girl, a “dreamer-type” ADD child** when she came to see me in 2011. She was convinced that she was stupid. Her mother, who sat with her over her homework for hours every day, was at her wit’s end. Linda didn’t have time to spend with her friends, because homework took so long. Her little sister was developing some maladaptive behaviors in order to get at least a little bit of attention.

Linda came to the practice and tried out the training. She improved quickly. After three months, she became faster in doing her homework and began getting better grades at school. There was a great reduction in her theta/Beta ratio (Figure 1). She became more open and talkative and was proud of her achievements in school. Still, the training was often quite tiring for her, but she kept up her motivation until the summer break.

The first 13 sessions show constant improvement. Session 14 took place just before summer vacation, and Linda was with her thoughts already by the beach.



**Figure 1:** Improved theta/beta ratio with SCP training in a 9-year-old girl with ADD.



**Figure 2:** Progression of training over 16 sessions in a 9-year-old autistic child. In order for a session to be successful, the blue mark (dark blue square for the feedback condition, light blue circle for the transfer condition) should be situated above the red marks (dark red = feedback, light red = transfer). He did quite well during the first four sessions when he had only the feedback condition, that is, he saw the feedback object all the time. As of session 5, transfer trials were added which require him to imagine the feedback object and he learns only at the very end of the trial whether or not he was successful. He has made continual improvements; after 16 sessions he was still not able to achieve negativity, but he did quite well on the differentiation.



When she returned from summer break (session 15), she was still doing well. However, she had decided to repeat the third grade in order to catch up on subject matter she had missed the year before; things in school were easy and she let up a bit on her work. Then came the time change, and as of November she didn't show very good results. (This is a phenomenon I have been observing for six years now. In advent, the children's performance deteriorates and it picks up again after Christmas is over.) Linda did not perform well before Christmas. After we talked about the difficulties she promised that after Christmas she would do her best again and her results so far are promising.

We plan to continue the training for a couple of months and then have a break for at least a year. She will come back next summer to see if she needs booster sessions to help her make the change to a different school.

**Case 2: Andy is a nine-year-old autistic child, born prematurely.** He had bad

infections right after birth, developed hydrocephalus and received a shunt which became repeatedly infected. He receives special education, but doesn't have an individualized education plan, as this is not usual in German special-education facilities; although he does have a classroom aide.

When he started training he had a very short attention span, insisted on certain rituals, and would talk incessantly if he wanted something. We started training slow potentials, but without using artifact correction for the eyes because he would not cooperate with having electrodes put on his face. He trained with muscle artifact correction only. The first three sessions couldn't be evaluated because of excessive artifacts, but he soon adapted to the training situation and produced good results.

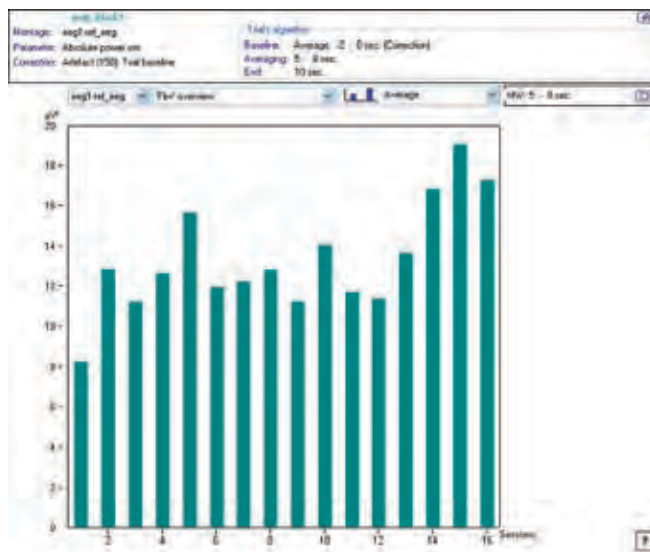
Since he lives several hundred miles away, he and his mother came for several days every few months and he had two sessions per day. He improved very quickly. His mother reported after the

training block in September that he was starting to play in his room by himself, and that the teacher had noticed an improvement in his attention-span. In the beginning, he would only sit still for a total of 40 trials at eight seconds each. By the end of the first training block, we would sit for 100 trials, which is a training period of twenty minutes.

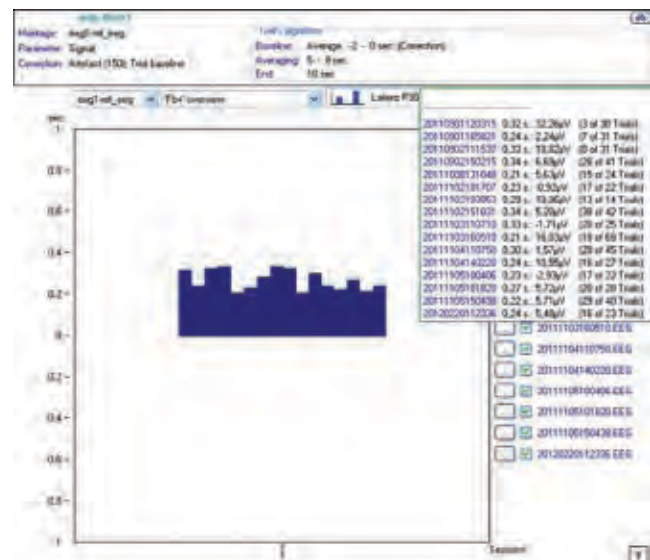
He returned for another block in November and did very well again, as can be seen in Figure 2 (page 20).

There had been an increase in the absolute power of SMR, which was reflected in more quiet and thoughtful behavior (see Figure 3). The performance in February wasn't so great. He came down with a bad cold and had to return home. Andy will be back for another block during his next break from school. His mother has a training video that she can play on the computer at home. Most of the time, Andy cooperates and watches the video for eight minutes. He receives tokens for cooperation at home.

Figure 4 shows that the processing



**Figure 3:** Improved SMR relative power with SCP training in a 9-year-old autistic boy. Shown are the mean values of SMR power for 16 sessions.



**Figure 4:** Decrease in P300 latencies with SCP training in a 9-year-old autistic boy. P 300 is an evoked potential that gives information on the processing speed of the brain. His mother reported that he could now build with his Lego blocks all by himself, that writing on the keyboard of his computer was getting much faster, and that his aide in school noticed an overall improvement in his behavior.

# *Jonathan E. Walker, M.D.*



- Board Certified Neurologist
- Board Certified Electroencephalographer
- President of the Neurofeedback Division of AAPB
- President of the American Board of QEEG Technology
- Pioneer in the field of neurotherapy research and treatment, he has used neurofeedback in his medical practice for over 20 years

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speed of his brain has improved. When looking at the latency of his P 300 evoked potential, one can see that the latencies are getting shorter and are remaining so as time passes.

**Case 3: Mr. X was an adult in his sixties with untreated ADHD.** He suffered from insomnia, moodiness, impulsivity, and was close to ruining his marriage by this behavior. He was still working but had difficulties at his job, because he felt that his efforts weren't being appreciated.

He learned how to differentiate between negatvation and positivation well, within the first few training sessions (Figure 5). As his sleep improved with training, so did his mood in the mornings, and he was less irritable at work (Figure 6).

He continued the training with the video at home and kept getting better. His mood improved greatly and he was

able to have talks with his wife without flying into a rage. He had finally decided to see a psychotherapist who was able to help him sort out his feelings. He had refused to discuss his problems in the years before. Now he is able to admit that she helped him greatly. I assume that the neurofeedback helped to stabilize his personality enough that he was able to embark on psychotherapy.

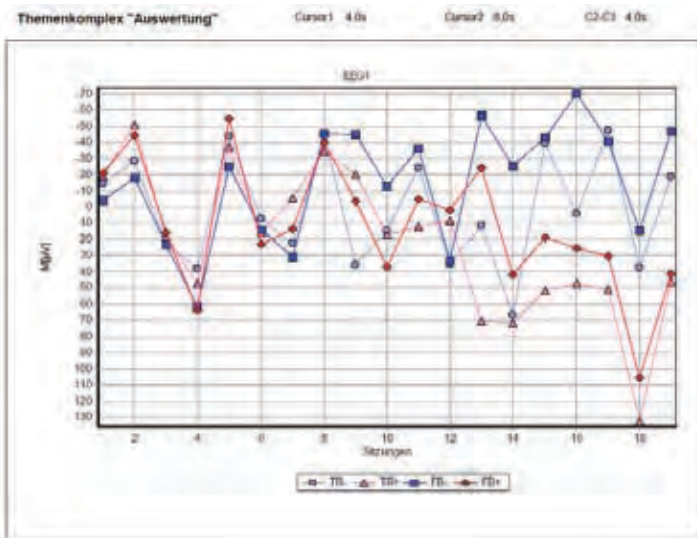
These results of three very different patients show that the training of the self-control of slow cortical potentials is a very powerful neurofeedback method which yields good and lasting outcomes in a variety of conditions, most likely because it addresses very basic network functions which, when ameliorated, allow the brain to regain homeostasis.

*Dr. med. Schneider completed her Bachelor of Arts in Education, University of Nebraska, Kearney Campus, earning her*

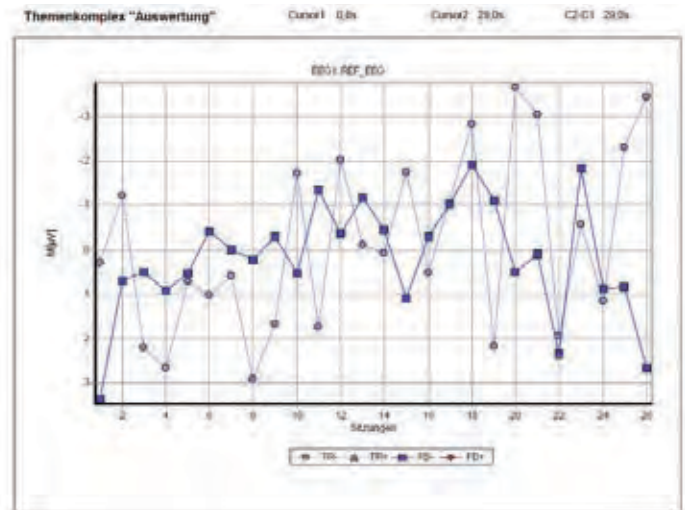
*Nebraska Teaching Certificate in 1974. She served as Program Coordinator for Beatrice State Developmental Center in Beatrice, Nebraska, 1976–1978. After returning to Germany she served as a faculty member with the School for Occupational Therapy, Berufsfortbildungswerk des DGB in Stuttgart 1978–1986. She completed Medical Studies at the Eberhard-Karls-Universität in Tübingen, Approbation als medical doctor, 1994–2005, practicing biofeedback and neurofeedback in her own practice since 2006. She is a certified biofeedback and neurofeedback therapist (Deutsche Gesellschaft für Biofeedback e.v.) and co-authored: Haus et al. Praxisbuch Biofeedback und Neurofeedback, Springer 2013.*

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SUPPLEMENT

References are available in the supplement at: <http://isnr.org/neurofeedback-info/neuroconnections-newsletters.cfm>.



**Figure 5:** 60-year-old male with untreated ADHD. The patient was able to differentiate between negatvation (dark blue squares are the feedback condition, light blue circles the transfer condition) and positivation (dark red diamonds show the feedback condition and the light red triangles show the transfer condition). In order to differentiate successfully, the patient should be able to produce negativity which signifies that he is able to allocate resources in order to process information or to prepare for action (Bereitschaftspotenzial). The positivation shows that the allocation of resources has stopped, allowing either for a consumption of the resources, or for storing/retrieving or updating memory contents (Elbert 1990). As he became more proficient, the differentiation became more pronounced, so that by session 19 he was performing very well.



**Figure 6:** Improved SMR relative power with SCP training in adult ADHD. The dark blue squares show his SMR-scores when he is in the feedback condition, that is, when he sees the feedback object. The light blue circles show the scores during the transfer condition when he has to imagine the feedback object. During the transfer condition the patient doesn't get any immediate feedback. It is only at the end of the trial (which lasts 30 seconds) that he receives a reward in shape of a sun if he was successful. Interestingly enough, he reported to really sleep well starting with session 18 when his feedback scores dropped but the transfer scores continued upwards.



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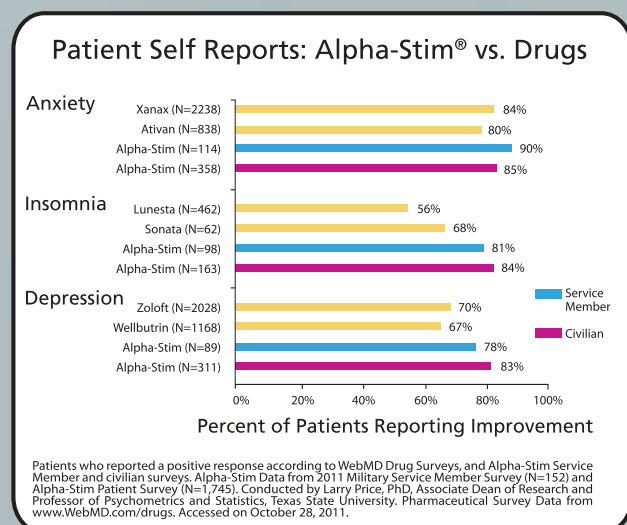
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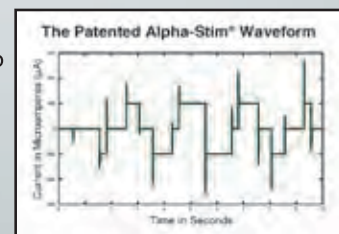
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## Slow Cortical Potentials Neurofeedback Continued from page 18

tic for disorders with impaired excitation thresholds. For example, negative SCP shifts were observed to increase during hyperventilation tasks (Rockstroh, 1990) commonly used to induce paroxysmal EEG activity. In individuals with epilepsy, negative SCP shifts precede and persist during ictal discharges, while positive SCP shifts develop following seizure termination (Ikeda et al., 1997). Signal “negativation” represents neural activation, increasing the firing probabilities of the underlying cortical areas. “Positivation” represents an inhibition, decreasing the firing probabilities of a cortical area. Based on these findings, epilepsy was conceptualized as a problem in restraining the hyperactivation of neurons in which increased cortical negativity reduces an individual’s threshold for paroxysmal activity. Thus, training epileptic patients to regulate or suppress negative SCPs was hypothesized to attenuate epileptic discharges, leading to reductions in seizure frequency.

A well-researched negative SCP is the contingent negative variation (CNV) (Figure 1, p. 18), an event-related potential representing anticipation and/or atten-

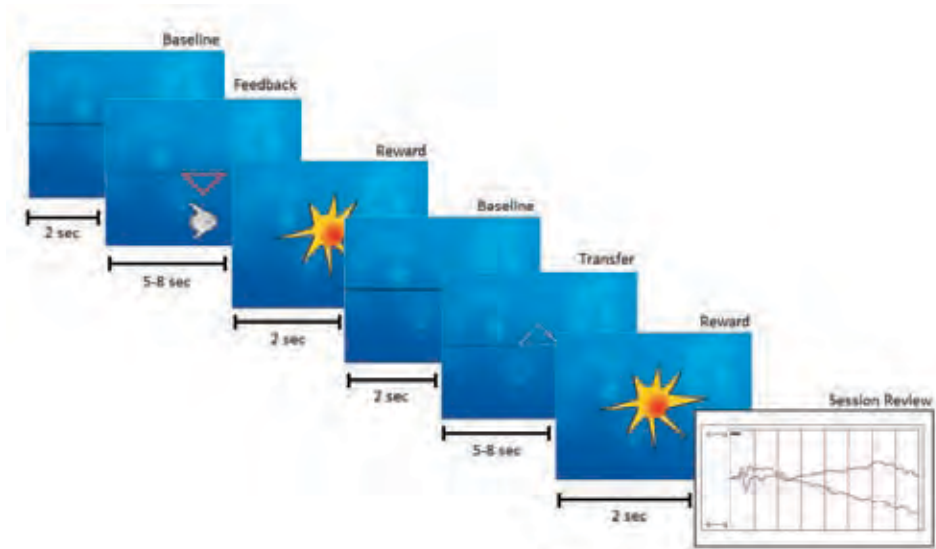
tion and motor preparation in reaction to a warning stimulus preceding a cued response trial (Walter, 1964). The CNV is a slow negative potential that develops over the central sites and increases with the amount of “cognitive energy” in anticipation of task performance. For individuals with ADHD, decreased CNV amplitudes have been observed for both children (Banaschewski et al., 2004; Banaschewski, Tbias, & Brandeis, 2003; Hennighausen, Schulte-Körne, Warnke, & Remschmidt, 2000; Perchet, Revol, Fournieret, Mauguière, & Garcia-Larrea, 2001; Sartory, Heine, Müller, & Elvermann-Hallner, 2002; van Leeuwen et al., 1998) and adults (Dhar, Been, Minderaa, & Althaus, 2010; Mayer, Wyckoff, Schulz, & Strehl, 2012; Weate et al., 1993) with the disorder compared to healthy controls. These findings support the cognitive energetic model of ADHD, which asserts that disorder-specific dysfunctions are determined by computational processes and state factors such as effort, arousal, and activation (Sergeant, 2000).

### What are the Training Goals and Technical Requirements?

During SCP-feedback, individuals learn voluntary regulation of surface-negative

and surface-positive SCP shifts over the sensorimotor cortex. In addition to the active electrode positioned at Cz, reference and ground electrodes, as well as two to four electrodes are needed to record and correct for vertical and/or horizontal eye movements. Proper “real-time” electro-oculography (EOG) correction methods are essential for successful training, as the eye acts as a dipole producing significant artifact in the SCP signal range. Skin resistance is maintained in the 5-10 Hz range, while the time constant and sampling rate are set to 10 seconds and 128 Hz, respectively.

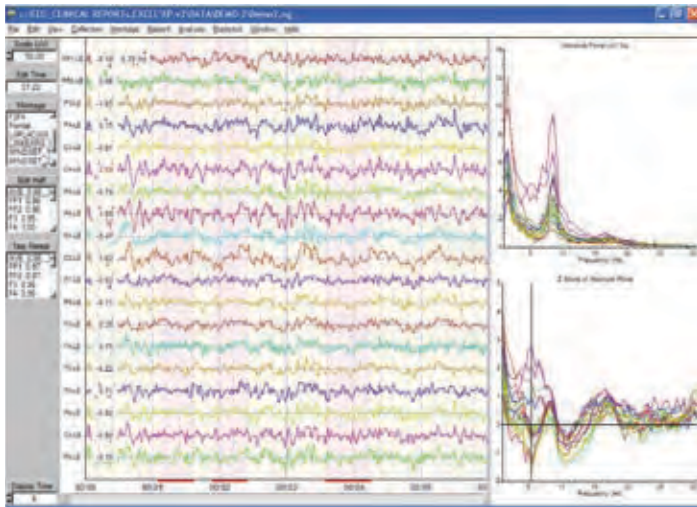
SCP neurofeedback utilizes discontinuous, trial-based feedback, typically consisting of three phases: a baseline phase (2sec), an active phase (5–8sec), and a reinforcement phase (2sec, Figure 2). During the active phase, participants are cued by a graphic symbol to activate (produce a negative shift) or deactivate (produce a positive shift) their brain activity. For example, an upward or downward arrow may direct the participant to move the feedback object (e.g., plane, ball, fish) in the cued direction or to produce an object color change (e.g., from white to red, white to blue). During “feedback trials” the participant is able to see the degree of movement or color change, reflecting the degree of the SCP activity relative to the baseline phase. During “transfer trials” the participant receives no visual feedback while attempting to produce a cortical shift in order to promote generalization of self-regulation skills. During the reinforcement phase, participants receive a visual “reward” stimulus if the cued brain state was met during the preceding feedback or transfer trial (e.g., a sunburst, smiley face, points). The training goal is to learn to regulate SCP activity in cued direction. Training software independently averages positive and negative trials for both feedback and transfer trials. During the session review, the participant is able to view the differentiation between the cued trials, success rates, and averaged trial amplitude (Figure 1, p. 18). This feedback serves as



**Figure 2:** SCP neurofeedback consisting of three phases: a baseline phase (2sec), an active phase (5–8sec), and a reinforcement phase (2sec)

# 1 to 19 Channel NeuroGuide Neurofeedback

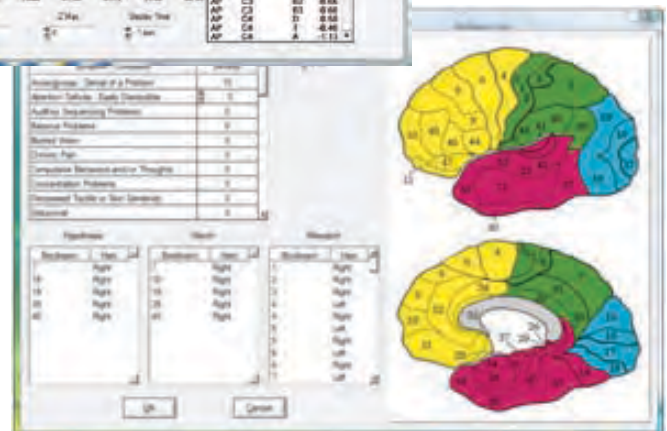
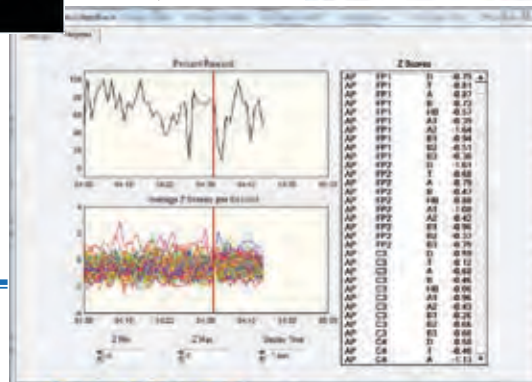
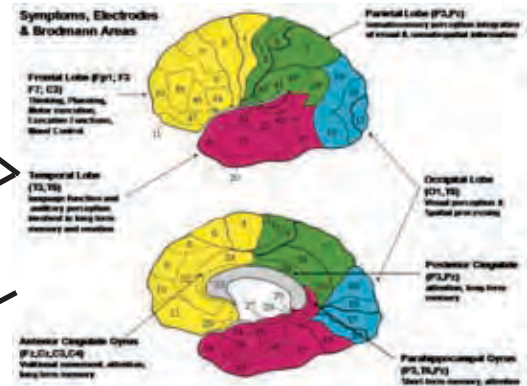
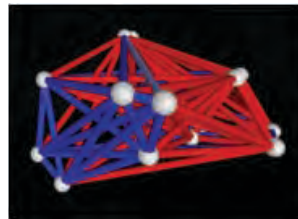
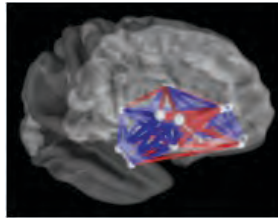
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a secondary reward, as well as an opportunity for the participant to modify their training strategies.

In contrast to the variety of frequency-based neurofeedback protocols, SCP-feedback utilizes a fairly standardized protocol. SCP-feedback protocols vary with regard to the training equipment used; the number and order of trials; the number and density of treatment sessions; and the addition of behavioral therapy components. In ADHD research, positive and negative trials range from 70 to 160 per session and are randomized (typically, 50/50). Sessions contain two to four “runs” (20–40 +/- trials) that utilize mixed or segregated blocks of feedback and transfer trials. The density of treatment ranges from one to two sessions a week to five double sessions per week (25–30 total). The greatest variation in SCP-feedback protocols are related to the addition of behavioral therapy components. For example, some studies implemented token systems, parental involvement, practice logs, and exercises to transfer skills to daily life situations (such as use of visual cue cards and practice DVDs before homework or exams). For a complete review of ADHD-specific protocol details, see Mayer, Wyckoff, and Strehl (2012).

### **What are the therapeutic applications research findings?**

#### **Epilepsy**

Two multicenter studies have shown that patients with epilepsy were able to learn self-regulation of SCPs leading to a decreased incidence of seizures (Rockstroh et al., 1993; Kotchoubey et al., 2001). Rockstroh and colleagues investigated the use of SCP-feedback in twenty-five patients with drug-refractory epilepsies. At one-year follow up, 18 patients continued to monitor seizure frequency and reported a significant decrease in the incidence of seizures compared to the baseline monitoring phase ( $p < 0.01$ ). Kotchoubey and colleagues (2001) compared SCP-feedback, respiration train-

ing, and anticonvulsive medication treatment on seizure frequency. Significant seizure reduction was observed for the SCP (33–100% reduction,  $p < 0.05$ ) and medication conditions, but not for the respiration training group. The stability of SCP self-regulation was observed at six-month follow-up and seizure reduction was maintained at twelve-month follow up (Tan et al., 2009).

gested disordered mitochondrial oxidative phosphorylation and decreased intracellular free magnesium in the brain and body tissue of migraineurs produce instability of neuronal functions due to neuronal hyperexcitability. In agreement of these findings, migraineurs also presented with increased CNV amplitudes and reduced habituation compared to healthy controls (review, see Kropp, Sin-

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*While the SCP research has focused heavily on epilepsy, ADHD, and migraine research, several researchers have investigated the scientific basis and application of this feedback method with other psychiatric disorders including schizophrenia, substance abuse, depression, and anxiety..*

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#### **Attention-Deficit/Hyperactivity Disorder**

SCP-feedback applications for ADHD have developed over the last few decades through the contributions of researchers at the University of Göttingen, University of Tübingen, and University of Zürich. Research studies have utilized passive or semi-active/active controls groups such as a wait-list control, EMG biofeedback, theta/beta neurofeedback, cognitive training, group therapy, as well as pre-post designs and long-term follow-up. Across treatment studies, the findings demonstrate that children and adults are able to learn to regulate SCP activity, show improved CNV amplitudes (Figure 1), report a decrease of core ADHD symptoms (inattention, hyperactivity, and impulsivity) on self-report and third-party rating scales, and show improvements on IQ and continuous performance tests (for review see Mayer, Wyckoff, & Strehl, 2012). The stability of SCP self-regulation and behavioral improvements has been observed at two-year follow up (Gani et al., 2008).

#### **Migraine**

The application of SCP-feedback to treat migraine was based on the findings of Welch and Ramadan (1995) that sug-

iatchkin, & Gerber, 2002). Thus, it was hypothesized that training migraineurs to regulate or suppress negative SCPs (i.e., to produce positive shifts) would attenuate cortical excitation resulting in a reduction of migraine frequency and intensity. Siniatchkin, Hierundar and colleagues (2000) investigated the clinical efficacy of SCP-feedback with 10 children suffering with migraines compared to 10 healthy controls and 10 wait-listed migraine sufferers. Following 10 sessions of SCP-feedback, migraine sufferers showed a significant reduction in CNV amplitudes and reported significant reductions in the number of days with migraine or other headache activity.

#### **Other Applications**

While the SCP research has focused heavily on epilepsy, ADHD, and migraine research, several researchers have investigated the scientific basis and application of this feedback method with other psychiatric disorders including schizophrenia, substance abuse, depression, and anxiety. For example, Schneider et al. (1992) was the first to report that individuals with schizophrenia were able

*Continued on page 50*



## The Deep Roots of Infra-Low Frequency Training

Siegfried Othmer, PhD, Chief Scientist, The EEG Institute



On first acquaintance, infra-low frequency training requires a lot of explanation because it seems to stand apart from conventional neurofeedback. If that were really the case, however, it would likely not have emerged out of this field at all. Infra-low frequency training did not burst full-grown upon the scene like Venus out of a lotus blossom. Its roots are traceable to the standard SMR training developed by Barry Sterman. It is instructive to review this history and to retrace the path of discovery.

### Signal-following feedback

The emergence of ILF training rests on three essential elements that take us back to the very origins of the field. The most basic of these was an emphasis on the continuous signal rather than the discrete rewards. This was what first set us apart from Sterman's continuing emphasis on the discrete rewards as the defining issue in operant conditioning. Well before all of these issues were clarified in our own minds, I had the relevant experience on my own head during my first EEG training sessions in Margaret Ayers' office in Beverly Hills in 1985. My EEG has rather low amplitude and was therefore incapable of routinely triggering the beta1 threshold even at the most sensitive setting on the instrument. There was nothing for me to do but to watch the continuous ebb and flow of the band amplitude. My brain responded nicely.

The instrument Ayers was using had been developed for Sterman's research, so credit must go to Sterman for having thought to provide the continuous feedback option on his instrument in the first place. But, the rationale for his doing so are not clear, since Barry never bought

into the idea of training on the continuous signal. Sterman first inquired into our new methods a couple of years ago, and on that occasion asked the fateful question: "With such a slow signal, what is your latency to a reward?" My response was straightforward, "There is no reward. The trainee is just watching the signal." That is really no different from what I had done in my very first encounter with this field.

So, EEG-training by means of "signal-following" can claim no novelty tied uniquely to the ILF training. (In fact, for

The discrete reward had effectively assumed the role of an inhibit.

### Bipolar Montage

The second element that was essential to the emergence of ILF training was the use of bipolar montage. It should not be necessary to make the case for the use of bipolar montage, since the entirety of Sterman's published research utilized that placement. But that 'fact of history' seems to have been airbrushed out of the picture, and controversy did emerge

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*EEG-training by means of "signal-following" can claim no novelty tied uniquely to the ILF training.*

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the first promotion of proportional feedback we have to go all the way back to Joe Kamiya.) The role of the discrete reward had been eclipsed for many years already in our work. When it finally became totally irrelevant, it was hardly missed. In the early years, clinician behavior was shaped to make the reward incidence ever more generous, in order to retain the attentions of the distractible ADHD child. Once reward incidence reached the ridiculous heights of 75%, 85%, and even 95%, it was no longer playing the role that Sterman and Lubar had in mind. They were continuing to insist that rewards be meted out sparingly, consistent with the operant conditioning model. In our kind of training, the object had become one of maintaining continuity in the 'successful' state—a continuous flow of "beeps" coming at a rate of two per second. In fact, there had been a kind of role reversal. The rare event that drew attention was when the reward stopped.

around that issue. That bit of history needs to be demystified. Barry made the switch to referential placement as part of the adoption of qEEG-based targeting in the early nineties, since the qEEG made specific targeting possible. The prior research history became mere prologue. The switch to qEEG-based protocols also had other more subtle effects on the way neurofeedback was thought about in those years. The localization hypothesis of neuropsychology was the implicit assumption of the approach, and supported the case for referential placement. If what happens at a single site is the issue, then bipolar montage needlessly confuses matters with ambiguities. Just what is changing in the signal, amplitude or phase, and at which site? How do we know what we are really doing?

More surreptitiously, the qEEG-based approach brought with it certain assumptions about how EEG data should

*Continued on page 35*

## Infra-Low Frequency Training— A European Perspective

*An interview with Meike Wiedemann, PhD, by Roger Riss*



*Meike Wiedemann, “Dr rer. nat.” is a neurobiologist and an associate professor for biofeedback and neurofeedback at the University Hohenheim/Germany. Her research interests include the development of pre-clinical screening models and the effect of micro gravitation on the central nervous system. Since 2002, she has had a private practice for biofeedback and hypnosis, with an emphasis on neurofeedback, in Stuttgart. Since early 2011 she has been employed as chief scientist at EEG Info Europe and has taught ILF-Neurofeedback since 2009.*

**RR:** Where were you raised?

**MW:** I lived most of my life in different areas in the beautiful south of Germany, but in my younger years also in the very north of Germany.

**RR:** What was your professional background before neurofeedback?

**MW:** Before Neurofeedback I worked in basic and preclinical research. I studied biology and specialized very early in neurobiology. For around 15 years I worked in a neurophysiology lab mainly with electrophysiology but also with optical methods.

**RR:** Your neurobiological research has focused on spreading cortical depression. Can you briefly explain this phenomenon?

**MW:** Spreading Depression (SD) is a slowly spreading excitation depression wave in the central nervous system that could be elicited by too much excitation of neurons. I like to interpret that as a kind of a pressure relief valve that prevents excitotoxic cell death. If the wave passes the neuronal tissue, the neurons cannot be excited for several minutes. The process is completely reversible, after 20 minutes everything is back to normal.

**RR:** I understand that spreading cortical depression plays an important role in disorders such as migraine headache, and can also interrupt important phenomena like consolidation of memory.

**MW:** The cortical spreading depression seems to be the physiological correlate to the migraine aura. If the wave spreads over the visual cortex this results in the well-known visual scotoma. If the wave travels over the auditory cortex the person is not able to hear properly, if the sensory cortex is affected, this results in paraesthesia. Spreading depression is also known to occur after seizures, elicited by the hyper excitation. In this case, it also could also play an important role in rescuing neurons from excitotoxic cell death. Spreading depression waves can also be found around central nervous lesions, when the dying cells release large amounts of potassium; this could lead to



Photo by Florian P.M. Kohn, University of Hohenheim

*Dr. Wiedemann demonstrating weightlessness during European space agency sponsored parabolic flight.*

extreme depolarization of the neighbor cells, and a spreading depression wave can be triggered.

**RR:** Are there similarities between the phenomena of spreading cortical depression and the slow cortical potentials which are the target of SCP neurofeedback training?

**MW:** Not really, although there might be some similarities. At the front of a spreading depression wave, a big extracellular DC potential shift can be measured that might be compared to the negativation of the SCPs. But normally this wouldn't be something you would come across during neurofeedback training, as it is restricted to extreme events that will only occur very rarely in some individuals. But both neurofeedback and spreading depression deal with the most important issue of the brain. That is to always fine-tune the very sensitive balance of excitation and inhibition of excitation during the whole lifetime. This is such a challenge for the brain that it costs most of the energy the brain is consuming.

**RR:** In your recent research with the European Space Agency, you have been studying the effects of different gravity conditions on the propagation of action potentials, and the function of the brain as an excitable medium. How did you get involved in that project, and what did you find?

**MW:** This actually started because in our lab we also worked with bilayers. Bilayers are artificial membranes that are comparable to cell membranes. In these experiments you can incorporate ion channels and investigate the electrophysiological properties of membranes and specific ion channels. We were approached from the German space agency, because they were interested if we could measure changes in membrane potentials during different gravity conditions. That is how this work started; we then continued to study gravity effects on different

organization levels of the CNS, single ion channels, whole cells, and nervous tissue, then ended up with the whole brain and the SCP experiments in parabolic flights that I described above.

For me, that was much more exciting than the pharmacological research that I did before. In these experiments we found that the excitability of neurons and neuronal tissue really depends on gravity. For example, in experiments with spreading depression we found that excitability of neuronal tissue is decreased in weightlessness and increased in hyper gravity. The results with SCPs in the human brain were not that clear; some subjects showed a positive potential shift during microgravity and a negative potential shift during hyper gravity, exactly what I expected. But there was another group of subjects who did the opposite, and in a few subjects the potentials did not change at all when gravity changed. But, the reactions within the subjects were always consistent, meaning they always reacted in the same way for all 30 parabolas in the flight.

**RR:** In another of your research papers, you discuss the effects of weak electrical fields on cortical excitability. This got me thinking about micro current therapies such as tDCS. Is it your impression that tDCS addresses similar cortical mechanisms as SCP and ILF training?

**MW:** In the theory of excitable media, a small stimulus can have a big effect. Actually I think this is the only reason why neurofeedback as well as other biophysical approaches that apply only a very small physical stimuli are effective. All of these methods interact with the self-organization processes of the brain.

**RR:** How long have you included neurofeedback as a component of your practice?

**MW:** It was actually during my time at university that I became interested in neurofeedback. This is now about 15

years ago. Together with the students, we started to design some of our own biofeedback and neurofeedback equipment in the electrophysiology courses, not for therapeutic issues, but more for technical teaching purposes. I was immediately fascinated and it was quite clear that I wanted to invest my professional energy in this field. When I started my own private practice more than 10 years ago, neurofeedback was one of my therapeutic tools right from the beginning. Besides neurofeedback I work with hypnotherapy, hypnoanalysis, and osteopathic methods.

**RR:** What types of patients do you see in your clinic?

**MW:** I work with children as well as with adults. Besides neurofeedback, biofeedback, and hypnosis I also do bodywork with pain patients, as I worked in a practice for chronic pain patients for more than 6 years. Patients' issues range from different kinds of anxiety, autism spectrum, ADHD, learning disorders, migraine, chronic pain, stroke rehabilitation, tinnitus, and psychosomatic disorders to peak performance.

**RR:** Who were some of the important mentors who influenced your interest in neurofeedback?

**MW:** First, I think I have to thank my PhD supervisor, Wolfgang Hanke; from him I learned to understand the brain as a complex system and prime example for self-organization. This definitely prepared the ground for my interest in neurofeedback. Even though he himself had nothing to do with neurofeedback, he gave me all conceivable support when I started to establish my own university courses in bio- and neurofeedback. After receiving academic training in bio- and neurofeedback from different courses in Europe I met Pete van Deusen in 2003. Although he had no scientific or clinical background, he was the first one who could really give me a first impression



how neurofeedback could be applied clinically with different indications. I used his assessment tools and frequency band training for several years.

Since I live and work in the south of Germany I was of course always aware of the work of the Niels Birbaumer group with slow cortical potentials at the University of Tübingen in Germany. As a student, and even before I was interested in neurofeedback, I was always a big fan of Niels Birbaumer's textbooks about Physiology and Biological Psychology. Later on, I met him and several people from his group on different occasions, which was always very inspiring. Nevertheless, the most important mentors for me were (and still are) Sue and Siegfried Othmer. It is an honor for me that I have the possibility to teach together with them now. I am really impressed how the Othmers never stop optimizing and teaching neurofeedback methods. It's fascinating how they ended up at the Infra Low Frequency training empirically, always being driven by the idea to optimize clinical outcomes. From Sue I definitely learned how spe-

cific neurofeedback training can be, depending on training parameters, and how important it is to clinically evaluate each patient's reaction on every single training session. And of course I always enjoy Siegfried's enthusiastic lessons about all the science and history behind neurofeedback. From a scientific point of view I am quite impressed by the work of Juri Kropotov and I love the stories he tells about neuroscience research in the former Soviet Union.

**RR:** You bring an interesting perspective to a discussion of low frequency training methods, because you are familiar with both SCP and ILF training techniques. How were you first introduced to SCP training?

**MW:** That was at the time when I was managing a neurobiological research project in space science with the European Space Agency. We were investigating the effects of microgravity on the CNS on different organizational levels. From our earlier research, we already knew that weightlessness has an impact on ion channel activity, action potentials, nerve conduction velocity, and excitability in neuronal tissue in animal models. Therefore, the next logical step was to verify this also for the human brain. A good method to measure changes of excitability in the brain is repetitive transcranial magnetic stimulation (rTMS), so I got some education in rTMS. Unfortunately this project was not funded, at least not as fast as I imagined. Therefore, we reflected on methods that we already had the equipment for. So I decided to measure changes of slow cortical potentials during different gravity phases in parabolic flights. That was actually the reason why I went to Ute Strehl's SCP courses. At that time I was still working with classical frequency band training in my practice and therefore was very happy to get the opportunity to learn the SCP Method.

*Dr. Wiedemann prepares to collect EEG slow cortical potential (SCP) data during microgravity parabolic flight.*

**RR:** When did you first train in the ILF approach?

**MW:** I always was very curious about the Othmer work, but for a long time I could not find a chance to meet them. It must have been in 2006, when the Cygnet Software was released for the first time. This software was especially designed for the needs of ILF Training. I did not know this before I went to the training course. At that time I worked with a lot of pain patients, and found that really many of them profit from temporal training, which was not very common in the field at that time. When I heard then that the Othmers start their training with T3-T4 for many clients, I was of course even more curious. On the other hand, I heard that they find an optimal reward frequency for every client and that they find the right individual training frequency by asking the client to feel the difference between small frequency steps. Similar to the procedure to adapt your glasses: better this way, or better that way? That really made me very skeptical. At that time the Othmers started with a reward frequency around 1.5 Hz. According to my earlier neurofeedback experiences, where I either worked with AC signals in classical frequency bands or with DC signals with the SCP, that really sounded strange. I was more impressed when I myself could experience, during the course, how a small adjustment in the reward frequency could make a big difference in my sensations. Going down with the frequency only 0.5 Hz made me immediately feel like being in a trance, going higher only 0.5 Hz made me really focused on the feedback and faded out everything that surrounded me. Going a few Hz up in reward frequency made me aware of everything that was around me. Wow, that really impressed me, especially because these changes came within minutes. From this moment on, it was quite clear that I needed to learn everything about this method and that I obviously had to expand my way of thinking



*Photo by European Space Agency*

about neurofeedback.

**RR:** Are the mechanisms underlying ILF training as well understood and well established as those underlying SCP, or is our understanding still emerging?

**MW:** SCP training arose from university-based research, and did then find its way into clinical practice. With ILF training it is the other way around, it evolved empirically from daily clinical work, of course having regard to the existing research, and then found the way to theoretical models. Probably a lot of the research done on SCPs could also be applied to explain the effects of ILF training. In recent research about the Default Mode Networks and other resting state networks, there seems to be a lot of evidence that this might be a mechanistic explanation for the effectiveness of both methods. I think when, in the future, research of neurofeedback and resting state networks is brought together, this will provide a lot of insight into why SCP and ILF training are as effective as we see in clinical practice.

**RR:** How would you compare SCP and ILF methods? What are the similarities and differences of the two methods?

**MW:** Well, I think from a physiological point of view both methods address similar or even the same mechanisms. The higher (classical) frequency bands do more reflect the arousal level, whereas the slow potentials deal more with excitability of neuronal networks. The similarities are definitely in the trained “frequency” range, where of course the term frequency doesn’t really fit. Both methods target the slow cortical potentials of the EEG.

I think that, from a technical point of view, both techniques are very easy to use and the therapist can focus on his therapeutic work with the client. Still, there are a lot of differences in the training, mainly in the training sites (electrode positions) and the type of the feedback:

1. From a theoretical standpoint, SCP training works with the “Bereitschaftspotential” which can be best measured at Cz. Therefore it is taught from the university of Tübingen that the SCP training site is always Cz. By contrast, in ILF training, different electrode positions are used to address different issues.
2. Whereas ILF training uses continuous, dynamic feedback, SCP training utilizes discontinuous feedback. SCP neurofeedback trains in 8-second epochs after the direction of the potential shift is indicated by an arrow (up or down) that shows the client in which direction the potential should be shifted for the following 8 seconds. That means that in SCP training the client is more aware of what he or she is doing. In ILF training, the feedback is much more subtle and the client is not instructed to do something special. It is more that the client is instructed to enjoy the movie or the animation while the brain is catching the feedback signals unconsciously.
3. In SCP training the signal is essentially shifted up or down, depending on the indicated stimulus at the beginning. In ILF training the “reward frequency” can be chosen from 0.1 to 100 mHz. Again, from a technical point of view, the term “reward frequency” doesn’t make much sense, but the term is still used, because the training historically is derived from the frequency band training. Nevertheless changing the “reward frequency” from 0.1 to 0.2 mHz can make a huge difference in the training effect and this has to be judged clinically in the ILF training. Frequency and training positions have to be continuously adapted to the training effects. In addition, ILF training still works with inhibits over the whole spectrum from 0.5 to 40 Hz, but this is an automated process and the cli-

nician doesn’t have to focus on that.

**RR:** What are the strengths of each technique?

**MW:** SCP training is especially suitable for research, because there is no big variability of the training parameters, which are maintained consistently. Also, I realized that it is easier to explain to the client what you are doing; you teach the brain to activate and to deactivate and then you learn in transfer trials to transfer this into your daily life. By contrast, in the ILF training you need to explain that the brain itself learns to regulate activation and deactivation just by regarding the feedback, and this is an automatic, unconscious learning process. Of course, in my opinion this is true for both methods, but most people, clients, therapists, as well as scientists seem to prefer the illusion that they consciously control the process. For some people it seems to be hard to accept that the brain is doing this by itself without letting us consciously know how. ILF training could be understood as a process-oriented training, where the next training step depends on the client’s reaction to the previous training session. This makes the training much more individualized. Therefore, the training effects in ILF training are really quick and specific. Unfortunately, this does not result in a decreased number in total training sessions; they are probably the same for SCP and ILF training.

**RR:** SCP training has been described as particularly suitable for conditions where modulation of cortical arousal is desired, such as ADHD and epilepsy. Are there particular conditions or types of patients for which ILF training is a good fit?

**MW:** I think this is what the scientists claim, that SCP is most suitable for ADHD and epilepsy. But this is only because these are the conditions where the most research has been done. Actually both training methods should be useful for all conditions where arousal

regulation is a main problem. And this is definitely more than ADHD and epilepsy. Besides ADHD and epilepsy, ILF training is especially useful for migraine, PTSD, sleep disorders, developmental disorders, especially the whole autistic spectrum, anxiety, depression, tinnitus, stroke rehabilitation, and all kinds of peak performance training. But this is of course is also true for SCP training, according to practitioners who mainly work with SCP.

One big advantage of ILF is that you can work readily with people to whom you cannot explain what they are supposed to do. That means that you can effectively work with people that are very young or mentally handicapped, which is still often claimed to be a contra indication for neurofeedback.

**RR:** It has been said that any treatment which is powerful enough to heal may have the potential for side effects. Have any transient adverse effects been observed with either SCP or ILF training?

**MW:** From the SCPs I only know that people might get tired during the session, or in very rare cases, if they do the train-

ing with too much effort, it can be the case that they get a little headache, but both phenomena will normally disappear shortly after the session. With ILF training we usually get strong and fast training effects, but this also means that some frequencies or electrode positions may not be tolerated by the client. In practical work it could be that symptoms of over-arousal or under-arousal might occur during or after the session, this helps the therapist to adjust the training parameters. Most of the time, existing symptoms can be reduced or diminished during the session. In some cases, existing symptoms might increase, but in these cases they indicate how the training needs to be adapted; after adaption of training parameters, symptoms will normally decrease again. If unwanted training effects occur after the session, they are normally not long lasting. If the person has no individual gain from the training effect, it could not be transferred in the daily life, because no operant conditioning will occur to consolidate the training effect. Nevertheless for ILF training it is very important that the therapist gets all information of training effects from the client, positive as well as negative, because this will help to optimize the training procedure.

**RR:** What is the status of neurotherapy as a field in Europe and in Germany? Is acceptance growing? What are the challenges to practitioners?

**MW:** In Germany I see that acceptance is definitely growing in the last few years. When I got interested in neurofeedback, more than 15 years ago, it was really hard to find adequate education in Germany or even in Europe. If you finally found a course where you could enroll, it was always questionable if there would be enough attendees. Then, for a while, it was the other way around; if you found a course, you had to enroll very quickly otherwise it was fully booked. Currently,

there are really several possibilities to get reputable education. I think there are several reasons for the growing acceptance. First of all, I think that there are more and more patients out there who have profited from neurofeedback and spread the word out and the medical system has begun to react to their needs (at least partly...). Secondly, most neurofeedback devices are now approved as medical devices, affordable and easy to use. And last but not least, there is increasingly good research available, in Germany especially, in the field of SCP. The biggest challenges for the practitioners are to find the method that best fits their needs and their style of practice, and of course to get neurofeedback accepted as treatment that is paid by health insurances.

**RR:** What forms of neurotherapy are most commonly used in Germany and Europe?

**MW:** This is difficult to say and I don't know if there are numbers about it. As I am teaching ILF training, I know that at the moment, we are teaching this method in 6 different languages in Europe. Since most SCP research is done in Germany, and consequently there are possibilities for university level education in SCP in Germany, this method is more common in Germany than in other countries. From a technical point of view I understand that it is quite easy to make devices and software for frequency based training and in Europe there are a lot of devices available with the opportunity for frequency band training, therefore this method is also used by a variety of practitioners all over Europe. What I like in Germany is that there are several practitioners that use different methods in their practice. Some started, for example, with frequency band training and then expanded their spectrum with other methods. We recently published a German book with eight authors representing different biofeedback and neurofeedback areas. In this book, all three methods and their practical applications are described.



Photo by Florian P.M. Kohn, University of Hohenheim

*The 50th ESA Parabolic flight campaign provided a scientific platform for investigation of cognitive processes in microgravity conditions.*



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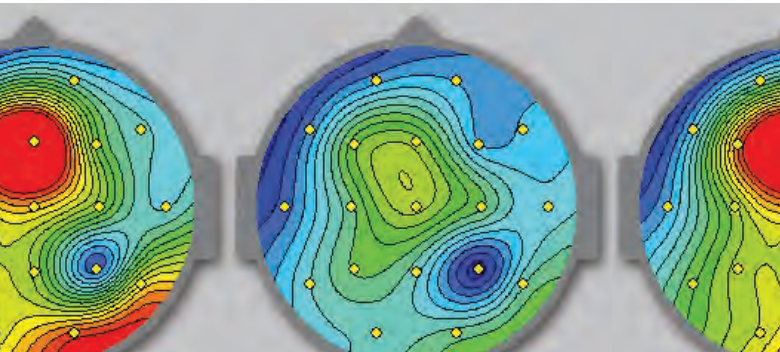
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**RR:** You teach neurotherapy at the University level. Is neurotherapy becoming accepted in academic circles?

**MW:** Unfortunately this seems to happen much slower than in clinical circles. This actually is the main reason why I decided to focus more on clinical than on academic work.

**RR:** What important trends do you see for neurotherapy in Europe and Germany in the future?

**MW:** I think there is still a lot of work to do to make neurofeedback more known and accepted in Europe. Fifteen years ago a lot of neurofeedback devices were not even medically approved; neurofeedback was mainly used by practitioners outside the medical field and was probably most popular in Switzerland. Now that most NFB devices are medically approved, neurofeedback is primarily used by medical professionals. In Germany, occupational therapists, in particular, find neurofeedback extremely useful for their work, but also medical doctors and psychologists. I would love to see if more hospitals would recognize the potential of neurofeedback and work with neurofeedback regularly. In Germany, psychiatric departments in hospitals are just beginning to work with neurofeedback, mainly in child and youth psychiatry. I think that there is a huge potential for neurofeedback for treatment of psychiatric disorders, if they are treated in a hospital setting, where the training could be very intensive and patients can be monitored closely.

From a technical point of view I feel that just in the last five to seven years, the technical and clinical developments have been really fast compared with the previous 15 or 20 years. For example, since I started with ILF training, there have been consistently huge improvements technically as well as clinically, and I am happy to be involved in development projects to use the new technological developments to improve clinical outcomes. 

### Infra-Low Frequency Training Continued from page 28

be treated ‘scientifically.’ This meant looking at the signal for its ‘central tendency,’ its steady-state or stationary values. The band-limited signals were treated as Gaussian-distributed, which then led to elevation of normative behavior as an objective in training. This also meant using methods that discriminated against the obvious variability we see in the real-time EEG, and that led to the use of large sampling intervals and to the averaging of many samples. Variability of the EEG had become the contaminant in the broth, rather than the broth itself. Seen from that vantage point, a focus on the moment-to-moment change in the EEG in feedback seemed contrarian at a minimum, and perhaps roguish and even bizarre at worst.

And yet, we were getting results, as indeed we had been all along with the very same strategy. We did not see a need to defend a strategy that had worked well for us all along. Yet we were up against the presumption that the qEEG-based training was intrinsically more ‘scientific.’ Given the ‘second-class’ status of the field at the time, working according to scientific principles was the least that one should aspire to do. For some years, qEEG-based training was essentially mandated by the mandarins of the field.

Old-timers may recall the controversy at the time regarding the issue of providing ‘real-time’ feedback. It became a battle between digital filtering of the signal and transform-based approaches. By now history has rendered its verdict. The transform-based systems, Lexicor and Autogenics, fell by the wayside after a few years, and the NeuroCybernetics we had designed for Ayers originally, came to dominate the marketplace in the nineties.

### The Optimization Procedure

In those early days all neurofeedback strategies had their limitations. None enjoyed more than limited success. Lu-

bar’s response to this was to be highly selective in choosing candidates for the training, helping to assure a good outcome. We proceeded on the assumption that everyone’s brain was trainable. The pressure was therefore always on to refine and improve our methods. This led us then to the third element that distinguishes our approach from that of others: the optimization procedure. The effects of the training were found to be highly sensitive to the specific choice of reward frequency in some people, compelling us to make adjustments.

The awareness that training effects were a function of reinforcement frequency was nothing new, of course. But this was thought to be the case at a coarse level of the standard bands, of alpha, SMR, beta1, etc. No one expected that sensitivity to prevail at a level of 0.5 Hz or even less. This was something new. And this had only become observable under circumstances where the brain had been given information on the EEG with all of its associated dynamics.

It is important to take note of the trade-off here. In the standard operant conditioning model, the contingencies are more tightly under the therapist’s control, and the outcome is then more specifiable. When we give the brain much more information to deal with per unit of time, how the brain interprets and acts upon that information is less predictable. And yet when the optimum reinforcement parameters have been established for a particular person, there are several fairly predictable consequences.

First of all, we can count on a certain stability of the value that we determined to be optimal. It would likely be much the same the next day and the next week. Secondly, if one deliberately moves off the optimum toward higher frequencies, one would likely move the person to higher arousal levels, whereas one could move the person to lower arousal levels by moving in the opposite direction. This finding gave support to the arousal model around which we were organizing

our thinking. Also implicit in this finding was the existence of an underlying fine structure to the EEG that was not being discerned in the customary measurements. And finally, this called into question the attempt to stand above the fray, so to speak, and prescribe neurofeedback on the basis of data that had had all the vitality sucked out of it.

This last point was perhaps the most discomfiting. Neurofeedback emerged in the heyday of the prescriptive model of modern medicine. The only way in which recognition from the mainstream was ever going to be achieved was with an approach that led to reasonably predictable outcomes. And yet here we had a method where it was essential to be guided in real time by the clinical results. The only thing predictable here was the process, not the immediate impact of the intervention. What could be largely counted on was that the reinforcement on the real-time EEG would lead to shifts in the person's state of arousal, vigilance, autonomic balance, etc. One could not readily predict what these shifts would be—particularly among those who arrived at our door with highly dysregulated nervous systems.

The induced state shifts were the ubiquitous observable that would then guide the process toward the calmest and most euthymic state of which that nervous system was capable—with maintenance of alertness. This then constituted the most propitious state for the conduct of the training. It was our consistent observation that if training could be conducted under such conditions, then the client was also moving toward the resolution of his clinical complaints. There was congruence between the conditions of homeodynamic equilibrium in the moment and the conditions required to achieve improved self-regulatory status over the longer term. Consider this in the perspective of state-dependent learning; residence in the best-regulated state is also the best platform for the learning of self-regulation. In any event, this gave

us a real-time guide to the conduct of the training, even in the absence of any *a priori* prescription.

It is only with all three elements in place that the training strategy expanded from the relative confines of the SMR-beta bands to cover the entire EEG spectrum out to 40 Hz, and then even encroached upon the infra-low frequency region. It is important to observe that essentially the same strategy serves, and hence the same rules apply, across the entire spectrum, from the lowest frequencies that are of biological relevance (e.g., diurnal rhythms) all the way out to the gamma band. The implication is that there is a fine structure to the EEG that has yet to be explored, and that within the above paradigm optimal training conditions prevail throughout the band.

### Frequency Domain Rules

The best testimony to the fact that a unitary model applies across the band is given by the frequency rules that govern the optimization procedure. It has been clear since the early days of our SMR/beta protocols that the left hemisphere optimizes differently from the right. For years we taught the dual protocol of admixing “C3beta” training on the left with “C4SMR” training on the right. The standard bands that we had inherited from prior work by Stermann and Lubar were 3 Hz apart. With the optimization procedure in place, it turned out that the optimum separation was really 2 Hz rather than 3. This value holds throughout the range from 2 Hz to 40 Hz. At lower frequencies, yet another rule has been observed; the left hemisphere trains optimally at twice the frequency of

the right. This rule holds over four orders of magnitude in frequency below 2 Hz. The two rules converge with mutual consistency at 2 Hz on the right side. These frequency rules are perhaps the most solidly established “facts” of the neurofeedback field, and the universality of the rules in turn constitutes the best evidence for the range of validity of the model, which jointly covers more than five orders of magnitude in EEG frequency. The frequency rules are graphically represented in Figures 1 and 2.

In the early days, starting in the late eighties, we were busy training mostly ADHD kids, and these are by and large monumentally insensitive to their own state, and largely hopeless in reporting on their own state. It is only when the clinical agenda broadened to include migraines, pain conditions, the anxiety/depression spectrum, and many other types of dysregulation that the optimization strategy even became viable. At the same time it also became a necessity. One could not be casual in the deployment of these methods.

Migraines, being exquisitely responsive to this kind of training, were

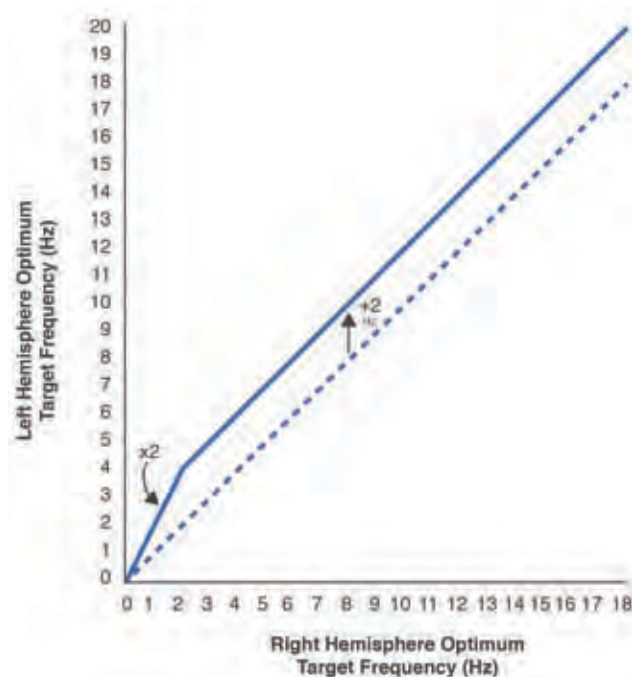


Figure 1: Optimum R vs. L hemisphere target frequency differential; 0 to 18 Hz range



the principal stalking horse. At the optimum reward frequency, a migraine could be sent onto a path of resolution within mere minutes. At the same time, migration away from the optimum might well kindle a migraine. The training strategy served to shape clinician behavior. One did not abandon the responsive client. With a sensitive client in the chair, one did not even step out for a cup of coffee.

It was the sensitive and responsive client who drove the frontier progressively toward ever lower frequencies. Every step of the way aroused controversy within the field. “We were training in the theta band,” cautioned the critics! (Hadn’t Lubar shown that was a bad idea?) “We were training delta,” the alarmists warned!

(Hadn’t Sterman said there isn’t any such thing in the waking EEG?) And then came the infra-low frequency region, which compelled the abandonment of conventional threshold-based training for pure waveform-following. (‘Is that even possible?’ was the question in the minds of many.)

### The Infra-Low Frequency Domain

Throughout all this time, the rules of engagement remained much the same. The ‘system response’ was qualitatively similar, regardless of the target frequency. But we extended our effectiveness to more severely compromised nervous systems as we went lower. What, then, is the driver toward the low-frequency training? Or, conversely, who were we not reaching at the higher frequencies? With each type of symptom we observe a distribution in severity, and within each of them we were reaching greater levels of severity than before. The common element was usually a compromised early childhood neurological or psychological history. The common manifestation was then typically one or another profound emotional dysregulation.

The infra-low-frequency training is giving us preferential access to the network organization of emotional regulation, and concomitantly of autonomic regulation, and of central arousal. At the infra-low frequencies, we are witnessing the time course of activation—and of connectivity—of our intrinsic connectivity networks. By putting the brain in the loop, we are making passive observation into an active process in which the brain engages with the information to its own benefit. This places the brain at the center of the process of feedback, and merely provides the information necessary for the brain to effect—or to restore—improved self-regulatory competence.

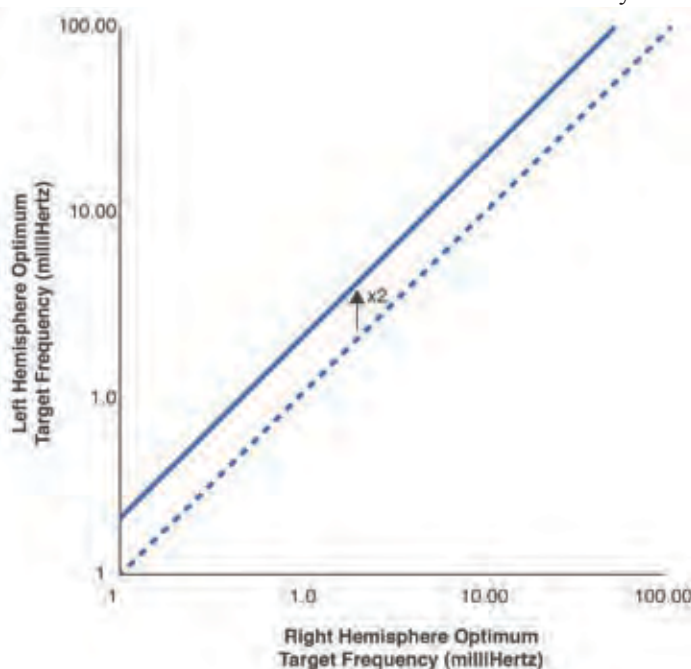
A recent survey indicates that over the past six-plus years, between a

quarter- and a half-million individuals have experienced infra-low frequency training around the world with our new instrument, Cygnet. We estimate that perhaps half of one percent of these have been active duty service members or veterans of our wars suffering from PTSD or TBI or substance dependency. It is reasonable to project that infra-low frequency neurofeedback will change the face of mental health, and finally make inroads into our hitherto most intractable mental disorders.

*Siegfried and Susan Othmer entered the field of neurofeedback in the mid-eighties. The impetus was the beta-training of their son Brian for his epilepsy. The Othmers became identified with SMR/beta training, in particular the “C3-beta/C4-SMR” protocol, through the development of the NeuroCybernetics instrument. Over time, the clinical work led them to explore the entire EEG spectrum with the same basic approach. This led to opening up a productive new mode of feedback, and with it, the development of the Cygnet system. Siegfried Othmer is the author of the new book, “Brian’s legacy,” that recounts their son’s neurofeedback experience and subsequent developments. Sue Othmer describes her clinical approach in the Fourth Edition of the Protocol Guide, as well as in two papers in the neurology literature.*

### References

- Othmer, S., Othmer, S., Legarda, S. (2011). Clinical neurofeedback: training brain behavior. *Treatment Strategies—Pediatric Neurology and Psychiatry*, 2(1), 67–73.
- Legarda, S., McMahon, D., Othmer, S., Othmer, S. (2011). Clinical neurofeedback: case studies, proposed mechanism, and implications for pediatric neurology practice. *Journal of Child Neurology*, 26 (8), 1045–1051
- Othmer, S., Othmer, S. (2009). Post traumatic stress disorder—the neurofeedback remedy. *Biofeedback Magazine*, 37(1), 24–31
- Jensen, M., Grierson, C., Tracy-Smith, V., Baciagalupi, S., Othmer, S. (2007). Neurofeedback treatment for pain associated with Complex Regional Pain Syndrome Type I. *Journal of Neurotherapy*, 11(1), 45–53.



**Figure 2:** Optimum R vs. L hemisphere target frequency differential; 1 to 100 mHz range

## Infra-Slow Fluctuation Training: On the Down-Low in Neuromodulation

Mark Llewellyn Smith, LCSW, BCN



Infra-slow fluctuation (ISF) training focuses on the lowest frequencies the brain produces. It is performed with Ag/AgCl or Silver/Silver Chloride electrodes and a direct current (DC) coupled amplifier. Why a DC encoder? Because a DC amplifier is better suited to image the low frequencies. The integration of the lower, direct current (DC), and higher, alternating current (AC), energies produces enough “bounce” in the low alternating current domain to filter and train the frequencies that researchers Satu and Matias Palva (Palva & Palva 2012) have named the Ultradian ( $<0.01$ ) and Infra-Slow Fluctuations (ISF) (0.01-0.1), with more clarity and less noise in the signal.

What follows is a discussion of the technical, historical, and clinical circumstances that led to the development of ISF training and its current clinical application. Among researchers, there is no precise definition of the frequencies that determine the bottom end of the infra-slow regime. However, there is at least an agreement among most researchers that the low frequency band begins at 0.1 hertz. The terms used to describe this band in research and in clinical work are Infra-Slow Fluctuation (ISF), Infra-Slow Frequencies (ISF), Infra-Slow Oscillations (ISO), and Infra-Low Frequency (ILF). These terms will be used interchangeably to denote the energy below 0.1 hertz. All human EEG contains AC and DC current unless one is filtered out. DC was eliminated by the introduction of a high pass filter on most EEG amplifiers. The high pass filter acts like a gate and allows the faster frequencies to “pass” and cuts off or attenuates the lower ones.

The advent of the built-in high pass filter on AC amplifiers with a “corner” or cut off frequency of approximately 0.5 hertz, is more than half-a-century old.

These AC amplifiers produced signals that allowed researchers and neurofeedback practitioners to focus on the faster oscillations, considered the most salient features in the human EEG at that time. Before that time, attempts to record slow events produced electrode drifts that tended to saturate the amplifiers and so hastened the initiation of high pass filtering on all amplifiers. The consequence of the ubiquitous installation of high pass filtering was a loss of all infra-slow dynamics whether artifactual or physiological. All human EEG contains AC and DC current unless one is filtered out. DC was eliminated by the introduction of a high pass filter on most EEG amplifiers. The high pass filter acts like a gate and allows the faster frequencies to “pass” and cuts off or attenuates the lower ones.

The first human direct current recordings became possible with the introduction of chopper-stabilized amplifiers in the 1950’s. A lack of stable electrodes and the need to manually cancel offset voltages prevented the widespread use of the technology (Tallgren 2006). As DC equipment improved, researchers began to describe the observed phenomena at frequencies below the conventional limits. One definition proposed that EEG in the frequency range below 0.5 hertz consisted of a standing potential (SP) and a slowly changing potential (SCP) (Manakka & Sano 1979).

In the following decades, DC-coupled amplifiers became more common. The terms changed from standing potential to “DC potential shifts” and slowly changing potential to “slow cortical potentials” (Birbaumer et al. 1990, Elbert et al. 1980). DC potential shifts are non-oscillatory fluctuations in amplitude measured in millivolts (Collura 2009).

Until very recently, AC amplifiers

capable of training higher frequencies but less proficient with the lower ones, were the only amplifiers available to neurofeedback clinicians. Amplifier designs that led to the elimination of lower frequencies determined the scope of neurofeedback training. Led by practitioners and researchers, largely in Europe, that began to change in the last three decades. The proliferation of DC-coupled amplifiers led to a focus on the energy below the cut off frequencies in AC amplifiers. This in turn steered practitioners toward the development of Slow Cortical Potential (SCP) training.

This was a precipitous event for ISF training. Infra-Low Training (ILF), the precursor to the development of ISF, was implemented on an AC platform, the BrainMaster 2E amplifier, with a typical cut-off frequency 0.5 hertz. As the targeted frequencies of ILF training moved lower and lower, challenges presented by this AC amplifier became more apparent. A noisy signal, saturated amplifiers, and infrequent rewards were the obstacles of equipment not optimized to filter infra-slow oscillations. The availability of DC-coupled amplifiers led to an exploration of the DC-coupled platform with ILF training in 2006. It was immediately clear that the inclusion of direct current in the training paradigm minimized the obstacles presented by alternating current amplifiers. The inclusion of DC clarified minute changes in the ISF signal. Frequencies that had been obscured by noise were now illuminated with more subtlety. Small changes in the ISO that had previously been hidden in AC amplifier limitations were now available for feedback. Small vicissitudes of current that appeared as a singular bump in AC mediated training amplitude became rendered as a series or wave of amplitude

*Continued on page 42*

## Recovery is Possible

Jackie de Vries, MS & Sheryl Leventhal, MD



The belief that recovery is possible is the underlying tenet that drives the focus of activities at the Crossroads Center of NJ. It is a goal we hold for each client we work with and it requires a shift from therapy provider to care manager. Connecting with each child is paramount in this endeavor, for to be the most that we can be, a loving human connection must underlie the work that is entailed. It provides the basis of the partnership that we create with parents and caregivers, so that all aspects that affect recovery are proactively considered and pursued. These include:

- Diet and proper nutrition
- Targeted biomedical support
- Healthy living environments
- Healthy family relationships
- Neurocognitive support
- Neurophysiological development
- Energetic therapies

Instead of performing a service, we are contemplating impact. Our decision tree and what is offered is driven from this alternative focus. Ultimately, we are tasked to provide the best of the best, as our goals have set the bar very high for each and every client.

A typical client session at Crossroads incorporates 30 minutes of neurofeedback followed by an additional 30 minutes of somatic therapy. A combined session spans 75 minutes with setup, cleanup, and transitions. We strive to improve brain regulation first, and then follow this with therapies that enhance the child's neurophysiological development, which, when received by a more open neurological system, can go deeper and hold better.

In June of 2010, I was privileged to trial the BrainMaster DC Amplifier-based

protocol developed by Mark Llewellyn Smith, that today is known as Infra-Slow Fluctuation (ISF) training. As is customary, I first utilized it on myself and found its regulation capabilities very deep and lasting. As a person recovering from a toxic mold exposure and Lyme disease, its benefits were paramount. So, without much ado, I started trialing it with the children.

What is most important about ISF is to establish an appropriate frequency for each individual. At that time, the software provided for three decimal place settings. For most of my children, this was sufficient, however for a few, we needed more specificity, which Tom Collura delivered later that year. What was significant about this protocol was what happened after a session. My colleague Sandy Beltramini, who sees the children immediately after their neurofeedback session, asked the question, "What do you have over there, a magic wand?" The children were so present and open for the neurodevelopmental therapies that the sessions flew by, and the resultant changes were fast and furious. One 12-year-old child required an updated Individual Education Plan (IEP) every two months, as he was knocking off his new educational goals that quickly. He left his self-contained classroom and now attends a school for children with learning disabilities, where he is quickly advancing with his academics.

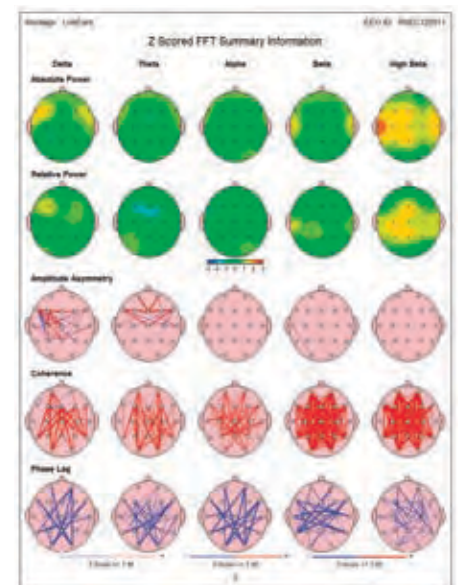
ISF took front seat as the neurofeedback modality of choice, even proving itself over time for other rehabilitation requirements. The following stories provide a window into how ISF has affected some of our clients:

### Autism/Developmental Delay

R came for his preliminary intake at the end of December, 2011. He was 11 years

old, and was diagnosed as developmentally delayed. In our center, he spoke very little. R had already received the standard OT/PT/SLP therapies since he was two years old, as well as a year of traditional neurofeedback with minimal results, right before coming to see us. His mother reported that he was often angry and would throw and break things (iPad/phones/etc.) and she said he was reticent to participate in the family activity of swimming at the Y. His qEEG indicated elevated power in hi-beta and significant hypercoherence in both the beta and hi-beta bands, the latter is often found in children on the spectrum (Figure 1).

R participates in the Option Institute SonRise program, a home program that is exquisitely designed to draw the child out through a very conscious engagement process. His SonRise program includes academics and replaces school attendance. When he started with us, he was at SonRise Level 2, partway through the level. Through the SonRise weekly



**Figure 1:** Pre-treatment qEEG, 11-year-old developmentally delayed child



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program reporting, his primary SonRise therapist documents his progress and shares observations about team member interactions with R

- January: Increased calmness, more spontaneous and complex sentences.
- February: Started swimming the same number of laps as his dad (30-32), up from 4.
- March: Great interactivity on Florida vacation, high levels of eye contact and socially appropriate.
- April: Completed Stage 1 & 2 Interactive Skills (SonRise) and on his way to acquiring Stage 3 & 4.
- May: Approaching Stage 4 Flexibility (SonRise).
- June: Anger management skills have improved.
- July: Handwriting improvements, writing slower and more age appropriately.
- August: Improved verbal responses, more immediate and natural.
- September: More chatty, longer sentences with advanced structure.
- October: Started using the dictionary during the rhyming game.
- November: More flexibility in symbolic play.
- December: Spontaneous talking has improved.
- January: Expressing regret and taking initiative in doing workbooks.

Presently R is actively tackling academics and advancing quickly. While R still has more distance to travel in his recovery journey, his qEEGs and history demonstrate how far he has come in his first 12 months utilizing ISF neurofeedback (Figure 2). During this period, R has also experienced Craniosacral Fascial Therapy (CFT), Quantum Reflex Integration (QRI), has had constitutional homeopathics recommended, and modified his diet to be gluten free. CFT is a somatic therapy whose goal is to identify and release fascia strain, as fascia strain

has been found to affect everything from posture to organ function (see Gillespie-Approach.com for more information). QRI is a somatic therapy that uses low-level laser therapy (LLLT) on specific points and neurological pathways to enhance the integration of primitive and postural reflexes. Primitive reflexes have been found to affect emotional regulation, memory, and learning (see Reflex-Integration.net for more information).

### Stroke

A 41-year-old female referral from a physical therapist colleague had suffered a stroke at age 29. Unfortunately misdiagnosed as a heart attack, her care had been a series of unfortunate events, resulting in an emergency hemicraniectomy (skull bone removal) that eventually required replacement with hipbone and screws. She presented with right-side atrophy, very limited mobility in her leg and arm, with a fully clenched hand. Her communication consisted of one to two word exchanges. I later learned she had only 25% visual field function and no sensation on the right side of her body. She was also dramatically affected by changes in barometric pressure.

Her qEEG was deemed significantly

affected by the metal screws anchoring the top of her cranium, providing little guidance for specific therapeutic approach.

Over her ten sessions of treatment, utilizing ISF inter-hemispherically, working on the homunculus brought the most dramatic changes. Her hand unclenched, her arm moved more freely, and both hot and cold sensation returned to her face and arm. Her leg demonstrated the least response. Her verbal capacity increased to 8–10 words, she reported being able to think and type on her iPad simultaneously (new gain), and her visual field increased to 50%. Her weather-related effects diminished in severity. This case is a true testament to the neuroplasticity of the brain, which had incurred the damage 12 years prior.

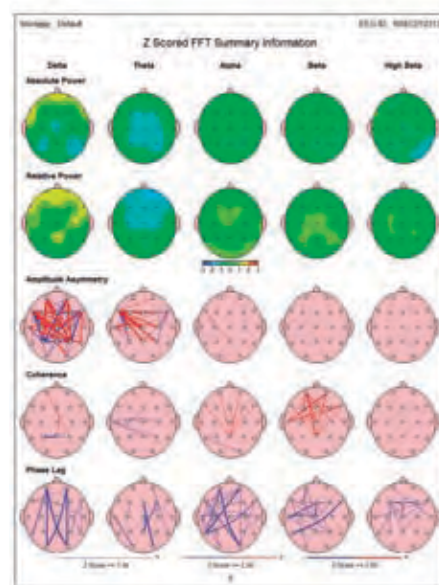
### Heart Attack/Anoxia

A 62-year-old male referral from a speech language pathologist had suffered a heart attack and had been revived after more than ten minutes of cardiac arrest. He presented with great physical stiffness, in a depressed state with poor memory, low energy, and no motivation.

His qEEG indicated global low power, initially leading me to utilize other modalities, in hopes of enhancing his energy. While that equipment was out being upgraded, I opted to do an ISF session with him, and finally the game started changing. Suddenly, he was making witty quips, like his old self. Little by little more of him returned, despite the significant impact of an ejection fracture rate of 10-20% (poor circulation due to heart damage). Ultimately, he handled social situations with interactive vigor, however his overall physical stamina remained low, as did his depressed mood.

### ISF Frequency and Protocol Selection

Utilizing the ISF protocol requires following a process for identifying an effective frequency for the client, and learning a set of fundamentals for choosing sensor placements. The optimum frequency



**Figure 2:** Post-treatment qEEG, 11-year-old developmentally delayed child

is determined through multiple factors, including “in session” feedback from the client, observation of physiological responses (skin tone, pupil dilation and body temperature changes), and 24 hour “post session” reporting. Like other modalities, the most significant issues are tracked to assess frequency effectiveness and sensor placements. Most of my ASD clients cannot self-report during a session, making observation of physiological changes and the 24-hour report a more critical component of care. Sensor placements include T4-P4 for sensory calming, T4-T6 to enhance empathy and facial recognition, T4-F8 to enhance speech production, and T4-FP2 to enhance emotional control.

## Summary

Among the many neuromodulation approaches used at the Crossroads Center of NJ, the Infra-Slow Fluctuation approach has taken a prominent role. While I employ qEEG-based neurofeedback and still sporadically utilize Z-score, S-Loreta, LENS, HEG, TDCS, NeuroField, and traditional symptom-based neurofeedback approaches, all my clients receive Infra-Slow Fluctuation neurofeedback. The improvements clients experience are surprisingly fast and positive. It is the modality of choice for children with developmental delays and with people experiencing chronic illness; it has also been highly effective with traumatic brain injuries.

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*Sheryl Leventhal, MD is the Medical Director at Crossroads and provides functional medicine consults at Hudson Valley Functional Medicine ([www.hudsonvalleyfunctionalmedicine.com](http://www.hudsonvalleyfunctionalmedicine.com)), located in Valley Cottage, NY. Crossroads specializes in neurofeedback to support recovery from medically related conditions.*

## Infra-Slow Fluctuation Training continued from page 38

fluctuations measured in tenths of microvolts with the inclusion of DC.

As our spectral displays improved, the relationship between DC shifts in amplitude, measured in millivolts, and the infra-slow frequencies, measured in microvolts, became illuminated. The rise and fall of the large amplitude of the DC potential shift was observed to be correlated with the smaller energy of the frequency domain measured in microvolts. We see this in spectral displays in our current training screens when both the DC and ISF signal are imaged simultaneously (Figure 1).

It is this interaction between DC shifts and frequencies that directed the name change from Infra-low frequency to Infra-slow fluctuation training. The DC shifts were observed to impact microvolt fluctuations in the slow frequency regime and offer a target for feedback.

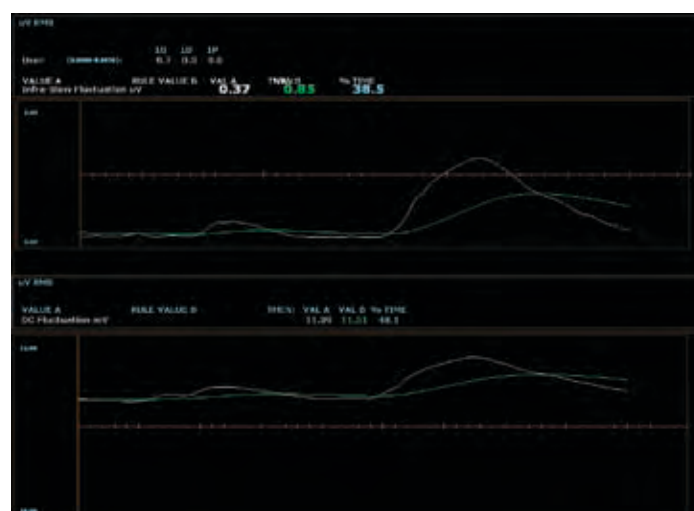
Small, recurrent amplitude changes of the ISF signal are the focus of reinforcement, not the return of the slow oscillation itself. We do not reinforce an oscillation that takes scores of seconds or minutes to complete its cycle, a common misconception. During the cycle of a .01 hertz frequency, a frequency that takes 1 minute and 24 seconds to fully oscillate, DC shifts in amplitude much more frequently and induces the ISF signal

to rise and fall in very small amplitude increments. The amplitude change is often a fraction of one microvolt. It is this minute rise and fall in amplitude that ISF training targets.

Reinforcing this slow signal has produced rapid and profound behavioral changes in a multitude of presentations as measured by qEEG and pre/post treatment behavioral scales. Autism, reactive attachment disorder, generalized anxiety disorder, panic disorder, and ADHD are a few of the many presentations treated by clinicians using ISF training over the last six years.

The clinical results presented in this article are typical within the ISF provider network and resonant with the fifty years of research that has been executed involving the frequencies below .1 hertz.

The infra-slow rhythm was first identified by Russian researchers nearly sixty years ago (Aladjalova 1957, Aladjalova 1964). Scientists at the Institute of Biophysics in Moscow implanted electrodes in the brains of rabbits. The infra slow band was observed to increase in amplitude and frequency when animals were subjected to stress producing stimuli. They theorized that the increase in amplitude of the infra slow oscillations reflected the hypothalamus’s reparative, parasympathetic response. Supporting a role for the



**Figure 1:** ISF signal in the top box with both green (damped ISF signal) and white (Undamped Signal measured in microvolts: .37 uV). DC in bottom box measured in millivolts; white line (here approximately 11 mV). The DC shift amplitude in the bottom panel is more than a thousand times greater than the ISF fluctuation in the top panel. Notice the similarity of the amplitude fluctuations as imaged by the morphology of the white lines.



ISO in the function of the neuroendocrine system, Marshall (Marshall et al. 2000) discovered an association between ISOs and hypothalamic-pituitary secretory activity. An increase in the amplitude of the infra-slow periodicities was coupled with the onset of the pulse of the luteinizing hormone. This hormone is released by the hypothalamus and triggers ovulation in females and stimulates the production of testosterone in males.

This research is resonant with our treatment outcomes, in that it suggests that ISF training may impact hypothalamic/pituitary/adrenal activity. ISF training routinely reduces anxiety, promotes relaxation, regulates sleep architecture, and results in behavioral scales that make observations of arousal reduction, affective regulation, and attention promotion among trainees (See our Child Behavior Check List (CBCL) results with children in a special needs educational setting, in the final section of this paper, following).

We consistently observe within-session indications of autonomic regulation. Typically, ISF training produces in-session state changes associated with parasympathetic functioning. Increases in peripheral body temperature, as measured with a simple stress thermometer, often reflect temperature increases of ten degrees or more. Increases in coherence of heart rate variability measures reflected by the HeartMath instrument: EmWaves have been reported within the ISF clinical network. Capnography instruments measuring End Tidal CO<sub>2</sub> have revealed normalization of CO<sub>2</sub> with increased diaphragmatic breathing accompanied by reductions in the number of breaths per minute. Routine clinician observations of client pupil restriction and client reports of tingling in peripheral body parts are all suggestive of increased relaxation and parasympathetic response.

The organization of autonomic regulation so characteristic of ISF training may reflect the centrality of these slower frequencies in the control of cortical excitation. Cross frequency correlations be-

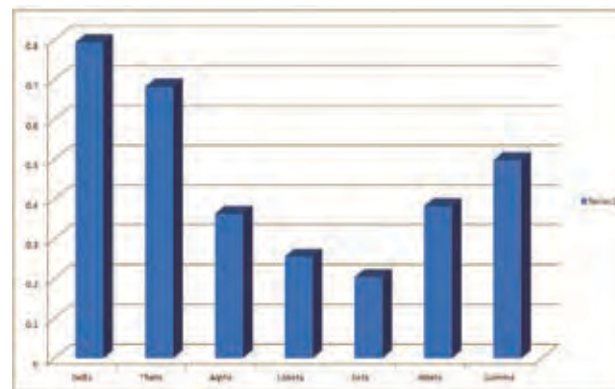
tween ISOs and faster frequencies have been observed in research for the last two decades (Keković et al. 2012, Nir et al. 2008, Pfurtscheller et al. 2012, Vanhatalo et al. 2004, Zschocke & J. 1993).

Our post hoc treatment analysis is consistent with this research outcome. Strong cross frequency correlations between our ISF training band and faster frequencies were identified across all bands. The strongest correlations were observed in the delta, theta, and gamma bands as evidenced by the cross frequency correlation coefficient graph illustrated in Figure 2.

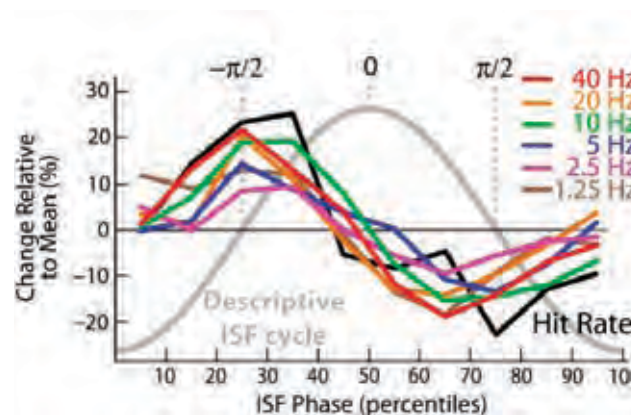
Vanhatalo and co-workers (Vanhatalo et al. 2004) proposed a role for the infra-slow frequencies in determining cortical excitability. They found that the phase of ISOs modulate gross cortical excitation as evidenced by their association with interictal-epileptiform events, high amplitude paroxysmal activity in cortex and K complexes, the largest event in

the human EEG, linked with suppressing cortical arousal in the sleeping brain, and promoting memory consolidation.

ISFs reflect the centrality of these slower frequencies in cortical network control. Recent research revealed that the default mode network (DMN) is characterized by high gamma band coherence that is modulated at infra-slow frequencies (Ko et al. 2011). According to Ko and workers, this coherence modulation forms the neurophysiological basis of the DMN. During goal-oriented activity, the DMN is deactivated and another network, the task-positive network (TPN) is activated. Recent research in the USA and England identified coherent low frequency oscillations that are attenuated in the DMN during task positive activities (Broyd et al. 2009). This resting brain network is anti-correlated with the task positive network. The ISF reflects a toggling mechanism that switches between the DMN, the network of introspective



**Figure 2:** With Thomas Collura Cancun 2012. Correlation Coefficients of ISF and traditional frequency bands



**Figure 3:** EEG ISFs are salient in awake human EEG. A. Large amplitude ISFs are readily observable in raw full-band EEG data (gray line: phase, unfiltered, black line amplitude: band-pass filtering from 0.01 to 0.1 Hz. Amplitudes of 1–40 Hz oscillations are correlated with the ISF phase. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.) Adapted with permission from (Monto et al. 2008)

and self-referential thought, and the TPN, that responds to extrospective stimuli.

Monto and co-workers (Monto et al. 2008; see Figure 3, page 43) discovered that behavioral performance, in the form of a somatosensory detection task, was robustly correlated with the phase of the infra-slow fluctuations band passed between 0.1 and 0.01 hertz. Stimulus detection was greatest during the rising phase of the ISF amplitude. Moreover, these researchers observed the amplitudes 1–40 hertz nested in the phase of the ISF: amplitudes of faster frequencies were largest in the rising phase of the ISF. As with the Broyd study above, this research correlates performance, the ISF, and overall cortical excitation.

Palva and Palva (Palva & Palva 2012) make a demarcation between the infra-slow (0.01-0.1) and the Ultradian rhythm (<0.01) and refer to the former as infra-slow fluctuations. They point out in their research that the blood-oxygenation-level-dependent (BOLD) signals are correlated with constellations of brain regions that are very similar to networks that are correlated with the ISF signal. They note the direct association between ISFs in amplitude with ISFs in the BOLD signal. The researchers conclude that ISFs arise from local cellular level mechanisms in neurons and glia, as well as blood, and reflect the same underlying physiological phenomena: a superstructure of interrelating ISFs that regulates the integration within and decoupling between active neuronal networks.

We propose that ISF neurofeedback addresses this superstructure of interrelating neuronal networks. We submit that our pre/post qEEGs reveal profound changes in activation measures, but especially in network dynamics, as reflected by the coherence metric. The modification of information sharing between cortical areas produced by ISF training is consistent with research that demonstrates a role for the ISF in the regulation of neuronal networks. Addressing the integration of networks responsible for

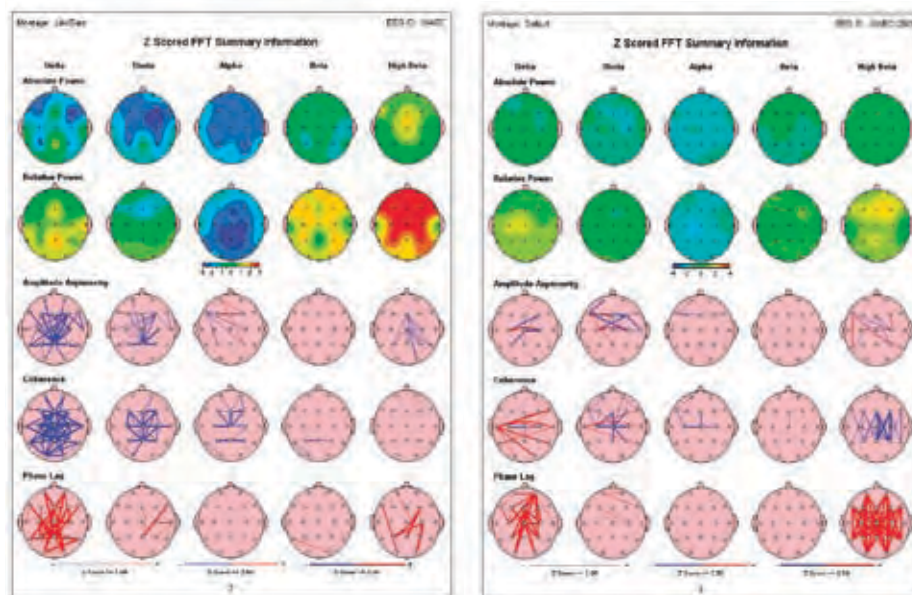
memory, affective response, autonomic regulation, and attention, to mention a few, may account for the reduction in symptom severity among our clients.

One clear demarcation between ISF practitioners and others in the area of slow-frequency training is the regular use of qEEG in treatment. As with any symptom-based approach, qEEG is not necessary to train effectively with ISF. However, it is taking a more central role in the application of the intervention, as it proves helpful with determining a variety of treatment parameters. From separating potential treatment responders from mixed-responders and determining beginning ten/twenty placements, to defining inhibit strategies and shaping treatment course, it continues to take a more principal role in ISF training. The use of qEEG has inevitably led to the use of multiple channel assessments during training. With Ag/AgCl 19-channel caps and two-channel electrode arrays, ISF clinicians become capable of assessments while simultaneously training in the traditional bipolar montage. This has allowed us a window on connectivity and activation unavailable to the simple one-channel bipolar mon-

tage. It has also allowed us to implement varieties of training that combine referential and bipolar montages, permitting simultaneous ISF and Z-score training or ISF and sLORETA training. We are exploring a substitution of Z-scores for the traditional broadband inhibit strategy of slow frequency training. Our analysis capability has suggested that a “one size fits all” inhibit strategy may not be optimal for all clients. Rewarding transients both high and low, as Z-score training does, may be a better overall strategy than the unidirectional training of traditional inhibits. Moreover, inhibiting low voltage EEG when it is present in any individual frequency band may not be optimal. QEEG makes these determinations readily available, and multiple-channel training allows for the implementation of a precise ISF protocol tailored to the specific neuronal needs of an individual client.

The following pre/post treatment qEEGs (figures 4 and 5) are taken from a 50-year-old a male with PTSD. His history included a fractured skull, witness to violence in his family of origin, and substance abuse in remission. He suf-

*Continued on page 46*

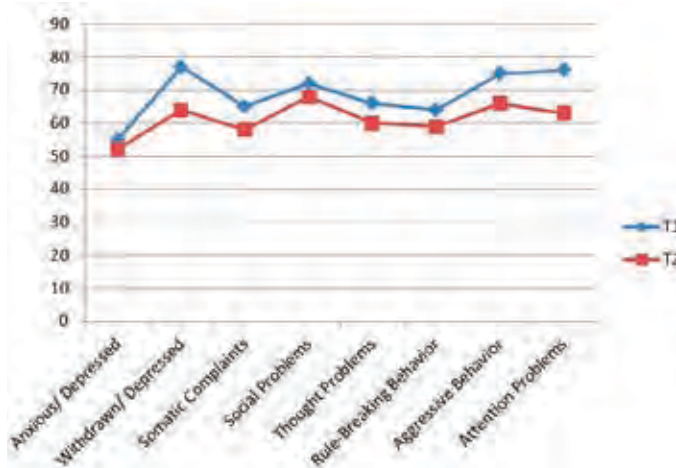


**Figures 4 & 5:** Figure 4 on the left is the pre-treatment qEEG. Figure 5 on the right is the post treatment qEEG. Results include vivid improvements in absolute power and amplitude asymmetry, and dramatic changes in network information sharing as assessed by the coherence metric.

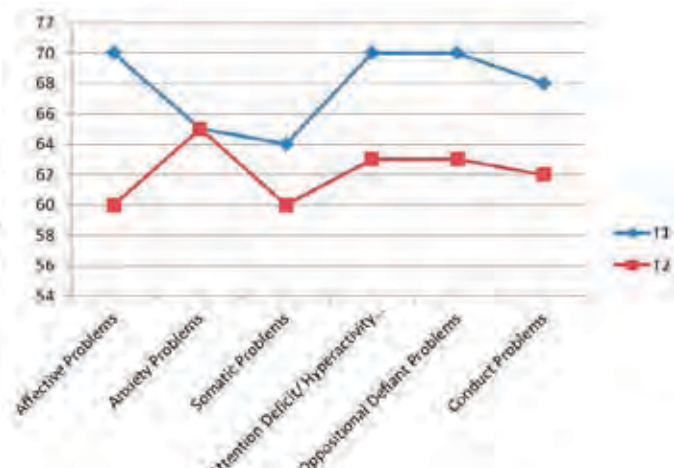
**The following two cases are typical of the other successful outcomes.**

**Case #1:** Six-year-old, in kindergarten, forty sessions of ISF training. At the beginning of treatment, the child was unable to remain in class all week. Oppositional behavior, tantruming, running out of the classroom, taking off clothes, hitting, and biting were displayed. **After treatment:** the child remained in class all week and showed improved social interactions with peers and adults as well as beginning to make academic and developmental gains.

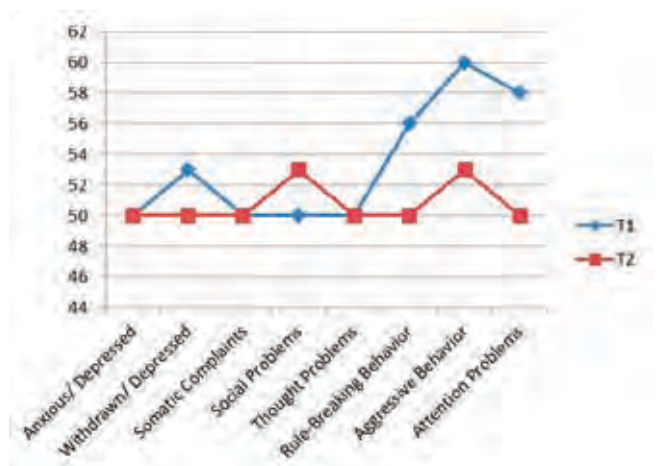
**Case #2:** Reactive attachment disorder. Under-stimulated; hyperactive, impulsive, labile, emotionally reactive. Pushes boundaries by breaking rules and taking advantage of others in social situations. Above average intelligence, average academic skills. **After treatment:** Much better regulated, behavior at school improved significantly. Psychologist reports that he is able to “slow his thoughts down.” Parents are very happy with treatment; they even come for neurofeedback during school vacations.



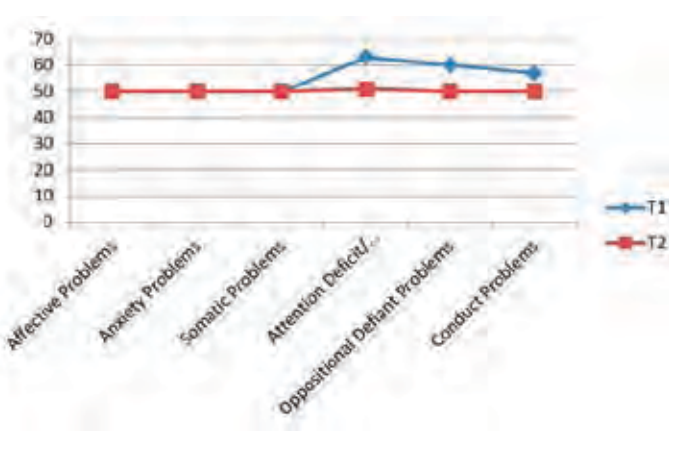
**Figure 6:** CBCL Teacher Rating Scale, Case 1: Pre-treatment (blue) vs. Post-treatment (red) symptom severity ratings



**Figure 7:** CBCL Teacher Rating Scale (DSM Scales), Case 1: Pre-treatment (blue) vs. Post-treatment (red) ratings



**Figure 8:** CBCL Teacher Rating Scale Case 2: Pre-treatment (blue) vs. Post-treatment (red) symptom severity ratings



**Figure 9:** CBCL Teacher Rating Scale (DSM Scales) Case 2: Pre-treatment (blue) vs. Post-treatment (red) ratings



ferred with acute anxiety and depression before treatment. The client reported that he slept with a rifle to manage his fear of nighttime attack. The client had 31 sessions of ISF training in bilateral temporal

neurofeedback program. Fourteen of the 16 students had a positive response that involved either: a significant reduction of tantruming behavior; reduction/elimination of psychotropic medication; and/or

*Fourteen of the 16 students had a positive response that involved either: a significant reduction of tantruming behavior; reduction/elimination of psychotropic medication; and/or improved ability to sustain attention, resulting in academic progress.*

lobes, parietal, and pre-frontal regions.

Post treatment results included reduced anxiety, depression, and improved sleep. He reported that he no longer sleeps with a rifle. Notice the dramatic changes in absolute power, amplitude asymmetry, and coherence.

#### **ISF Neurofeedback Program in a Special Needs School in New York City**

With John Ferrera, PhD, an ISF treatment program was established at a special needs school in New York City. The school has developed a curriculum and programs for special needs children with a variety of issues, including autism, ADHD, and reactive attachment disorder. In the first year we had a total of 16 students in the

improved ability to sustain attention, resulting in academic progress. The improvement was assessed with the Child Behavior Check List.

The Child Behavior Check List is a commonly used method of assessing problem behavior in children. Developed by Thomas M. Achenbach, it is a module of the Achenbach System of Empirically Based Assessment. The school-age checklist consists of 120 questions that are asked of a parent or caregiver who knows the child well. Responses are recorded on a Likert scale.

*Mark Llewellyn Smith LCSW, BCN, is a licensed clinical social worker whose early career was established in the world*

*of work as the director of clinical services to nurses, doctors, and staff of NYU Medical Center and Downtown Hospital in New York City. In private practice since 2000, Mark is a leading developer, teacher, and clinician of neurofeedback interventions for a variety of disorders. He was an early adopter and developer of Z-score and infra-slow fluctuation training, both now primary interventions in EEG-biofeedback therapy. Currently, he is developing sLORETA training with Thomas Collura and others. Mark has taught neurofeedback and qEEG on four continents and continues to educate and train neurofeedback providers in international workshops and conferences. Mark was the founder and Clinical Supervisor of the Child School's Neurofeedback Program. The program provided neuro-modulation interventions in a special needs school setting. He is the founder and clinical director of Neurofeedback Services of New York, PC, neurofeedbackservicesny.com.*



References are available in the supplement at: <http://isnr.org/neurofeedback-info/neuroconnections-newsletters.cfm>.

## Mary St. Clair—Still a Part of Us

Mary St. Clair died peacefully on Tuesday, July 23, 2013, surrounded by her family. She was born June 8, 1953, and practiced in West Bloomfield, Michigan. Mary was a leading light in the Neurofeedback Society. Many practitioners have written about Mary and these are some of those thoughts: Gretchen wrote that Mary's infectious passion for neurofeedback led to her influencing a healthy growth of neurofeedback practitioners in Michigan. She was instrumental in founding and growing what is now the Midwest Society for Biofeedback and Behavioral Medicine, was an active participant in the TLC community, and on the list-serve. Mostly, Mary was a kind and generous person as well as a gifted healer. She was wise, patient, and very giving of her time and knowledge. We have missed her vigorous participation since her illness and now feel deeper loss with her passing. Sara Harper wrote, "Mary fought for life every day these past five years. She pursued traditional and non-traditional treatments. She lived to see her precious daughter married to a wonderful man. She lived to see the birth of a grandchild. When these goals were accomplished, only then did she let go." Diane Stoler shared, "What we have once enjoyed we can never lose. All that we love deeply becomes a part of us. ~Helen Keller" Mary St. Clair was and still is a part of us.

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## Research Update

The Research Foundation is gearing up for fun at the ISNR conference September 18-22 in Dallas. We hope to see you there. Get your morning coffee at our booth. Join us on Friday night for a dinner and talk by Dr. Joel Lubar. Bid on silent auction items—help support research. More information at [www.isnr-researchfoundation.org](http://www.isnr-researchfoundation.org).

### 2013 Mini Grant recipients to be announced August 31, 2013

The Collaborative Neurofeedback Project (CNP), which has been working for the past two years to ascertain funding for the study, “Double-Blind Randomized Clinical Trial of Neurofeedback for ADHD” has published its excellent study design in the *Journal of Attention Disorders*. You can find it here: <http://www.ncbi.nlm.nih.gov/pubmed/23590978>. The design responded to tough budgeting, sham control, blinding and multi-site fidelity issues in neurofeedback research.

Participate in the Foundation’s recurring contribution program. It’s simple and a great way to contribute.

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Thank you to the authors: Richard Soutar and Robert Longo
- *The Other Side of the Desk*, the story of a chronic pain specialist who became a chronic pain patient and his advice for chronic pain sufferers.  
Thank you to the author: Stuart Donaldson

**Got an idea for a book? Let us know!**



## I've Learned the Neurofeedback Basics— So Now What's Next?

Judy Crawford



**B**CIA best serves the field by setting the standards for educational and clinical training that support the legitimacy of the modality. BCIA is not a government agency assigned to police and control the field, and sometimes it gets murky when deciding what is or what is not within our purview.

As the popularity and acceptance of biofeedback grows and new applications arise, issues surface that need the best counsel and guidance that we have to offer. We must always consider how we can best fit into the current medical care delivery model and serve as a resource for clients, academics, researchers, clinicians, and our certificants.

This article will review some of our most recent work.

### MOOCs

A what? Massive Open Online Courses (MOOCs) are free university-based educational opportunities offering topics and instructors from many top schools. BCIA has chosen to accept appropriate courses to document completion of either the human anatomy/physiology requirement for certification or as CE credit toward recertification. If you find a course of interest, please send us an email with the link, identify its intended use, and we'll let you know if we can award credit for it.

### The HRV Biofeedback Certificate

BCIA has formally launched the HRV Biofeedback Certificate program with a small group of applicants to allow us time to evaluate the training and application processes while also allowing our educational partners time to build their courses. We are proud to announce that the very first certificate holders are from

Truman State University and we send our appreciation to Truman for supporting and endorsing our first university-based program.

The blueprint has been covered in pre-conference workshops offered at both AAPB and ISNR meetings, and we look forward to announcing more ways to gain the formal blueprint-based training.

There will be some other important changes for the recertification class of 2014—stay tuned!

Appropriate Credentials on the BCIA “Find a Practitioner” search

The American Psychological Association and the American Medical Association, among others, are very concerned with how health care practitioners

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*As the popularity and acceptance of biofeedback grows and new applications arise, issues surface that need the best counsel and guidance that we have to offer.*

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### How Does a License Fit With Certification?

Education is the prerequisite standard used for BCIA certification. A state-issued health care license is what determines how one can legally use the modality to treat medical or psychological disorders. Since 1981, BCIA has welcomed appropriately educated, yet unlicensed providers. In order for our field to continue to gain respect and acceptance from the medical community, our providers need to work within the laws that regulate health care.

The board recently voted to require all unlicensed providers to document the name and contact information of their current supervisor for all clinical work on diagnosed disorders, starting with recertification applications in 2014. If a person is using biofeedback or neurofeedback strictly for relaxation or peak/optimal performance, no license would be required, and that can be noted on your application. This change has already been implemented on new certification appli-

represent themselves to the public. Unfortunately, the US has seen an unprecedented increase in educational entities who offer degrees with no recognition by the US Department of Education and no standing in any professional environment, and misrepresentation by using a PhD or other degree that is from an unrelated field.

The APA in fact states: *(c) Psychologists claim degrees as credentials for their health services only if those degrees (1) were earned from a regionally accredited educational institution or (2) were the basis for psychology licensure by the state in which they practice.* Ethical Principles, 2010. State licensing boards have already taken action and censured health care professionals who listed an inappropriate degree.

The Board voted to allow only those credentials that identify degrees and licensure from fields that we accept as the prerequisite for certification to be posted on our “Find a Practitioner” search area of our website.

## International Credentialing


We are delighted to let you know more about the heightened interest in certification outside of North America. Most countries have licensing or credentialing laws that regulate the practice of health care, even though the standards may be different than those we recognize. BCIA does not have the resources to appropriately evaluate the education or professional background of international applicants, the capability to understand which professionals would be legally able to use biofeedback or neurofeedback, and the power to deal with ethical violations or substandard practice.

Until such time as each country or region forms a recognized organization

to take on the decisions of who should be allowed to provide biofeedback services, the Board voted to accept international applications only from professionals who can demonstrate a government-issued health care credential. This applies to all applicants outside of the US and Canada. In the future, we hope that each country or region will organize a professional group to have more autonomy and control over prerequisites for BCIA certification by entering into an affiliate relationship as Australia has done. All documents for international applicants related to prerequisite education and license/credential as required for certification must be translated and evaluated by an organization who is a member of

NACES—the National Association of Credential Evaluation Services at [www.naces.org](http://www.naces.org).

## Conclusion

The mission of BCIA is to certify individuals who meet education and training standards in biofeedback and progressively recertify those who advance their knowledge through continuing education. In order to uphold this mission, BCIA strives to stay abreast of changes to the health care landscape and to be attentive to what keeps our credential one to be respected and sought after. That is why we believe that our professionals uphold the tagline, “more than qualified—they are BCIA certified!” 

## Slow Cortical Potentials Neurofeedback Continued from page 27

to learn self-regulation and differentiation of SCP shifts, while Gruzelier et al. (1999) was able to show that the ability of this population to shift SCP negativity in the left and right hemisphere correlated with positive and negative symptoms of schizophrenia. After 10 or more sessions, some participants showed a reduction of anxiety and depression symptoms on the Positive and Negative Symptom Scale (Gruzelier et al., 1999).


In establishing the scientific basis for SCP-feedback in other populations, Schneider et al. (1993) reported that the ability of individuals with alcohol dependency issues to regulate SCP negativity was related to relapse prevention. Although the clinical efficacy of SCP-feedback in the treatment of depression and anxiety has not been directly investigated, SCP-feedback has led to the reduction of comorbid depressive symptoms in an adult ADHD population (Mayer, Wyckoff, Shultz, & Strehl, 2012) and the reduction of depressive and anxious symptoms among individuals with schizophrenia (Gruzelier et al., 1999). These findings, along with

data indicating CNV attenuation among individuals with depression (Ashton et al., 1988; Giedke & Bolz, 1980; Timsit-Berthier, 1993) and CNV enhancement among individuals with anxiety (Ansari & Derakshan, 2011; Proulx & Picton, 1984) compared to control participants (healthy or sub-clinical severity scores) supports the need for further investigation of SCP-feedback as a therapeutic application for mood and anxiety disorders.

## Conclusion

SCP-feedback is a semi-standardized neurofeedback method that targets threshold regulation mechanisms of attention, cortical activation, and inhibition. This method of neurofeedback has been shown to be clinically efficacious in the treatment of epilepsy (Tan et al., 2009), ADHD (Arns et al., 2009; Mayer et al., 2013), and migraine (Siniatchkin et al., 2000). Self-regulation skills and symptom improvements have been shown to have long-term and stable effects (Gani et al., 2008; Kotchoubey et al., 1997; Tan et al., 2009). Research findings support the scientific basis for the investigation of SCP-feedback in the treatment of schizophrenia and substance-related, mood, and anxiety disorders. If you would

like to learn more about SCP training for epilepsy and other neurological disorders you are encouraged to examine the studies, meta-analyses, and reviews cited within the text, as a majority are available for full text download online.

*Sarah Wyckoff, PhD is a post-doctoral researcher investigating physiological mechanisms of comorbidity and specificity for generalized anxiety and depression in the Department of Psychology at the University of Pennsylvania. She is a doctoral candidate at the Graduate School for Neural and Behavioral Sciences at the University of Tübingen and is scheduled to defend her doctoral thesis on neurophysiological models of adult ADHD this summer. Sarah has 10 years of experience in the psycho/neurophysiological assessments and bio/neurofeedback training of children and adults with ADHD, anxiety, and depression. She was certified as a QEEG Technologist by the QEEG Certification Board in 2012 and has been BCIA certified in biofeedback and neurofeedback since 2007* 

References are available in the supplement at: <http://isnr.org/neurofeedback-info/neuroconnections-newsletters.cfm>.

NeuroConnections would like to thank Dr. Uwe Konietzko, PhD, from the University of Zurich, for permission to use his photo Neuron & Glial Cells on our cover.



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# WHY CHOOSE BIOGRAPH INFINITI?

## A CLINICAL SYSTEM YOU CAN RELY ON

### Prioritizing data validity and reliability

One of BioGraph's key design principles has always been to put your data's safety first. The system is crash proof and ensures optimal signal quality. Integrated electrode impedance and artifact rejection are essential to clinical work. If you cannot rely on quality sensor data, you cannot ensure valid statistical analyses or demonstrate positive clinical outcomes.

### Streamlining for ease of use

Version after version, in response to your feedback, we've made our system easier to use in order to help you work more efficiently. Version 5.0 introduced Quick Start functionality, which packs all the complexity of recording sessions into a simple desktop icon. Version 6.0's many enhancements radically expand your clinical choices.

### Engaging yet contingent multimedia feedback

As a multimedia biofeedback and neurofeedback platform, BioGraph's audio and visual capabilities are exceptional. From the ability to manipulate MIDI audio files to the BioFun games, we have constantly maintained that enjoyable and engaging feedback is important, but accurate, informative and contingent biofeedback is essential.

### Enhancing reporting capabilities

As a clinical software platform, BioGraph Infinity analyzes your data accurately and generates easy to understand reports that make your client's clinical progress evident. Release after release, we have created many Specialized Application Suites to provide you with training and reporting screens for standard and user-definable protocols. The CardioPro Infinity HRV Analysis module goes even further in providing high-end reporting capabilities.



BioGraph Infinity v6.0 runs on the most versatile and reliable equipment on the market. Highly accurate sensors and low noise cables ensure quality signals, so you can focus on your work. Conforming to strict ISO and medical device policies and regulatory registrations across the world, including the newly released IEEE Recommendations for Neurofeedback Systems, the Infinity platform meets the highest standards in the field and beyond.



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There has never been a better time to get on the Infiniti platform. The evolution of BioGraph Infiniti software has culminated in version 6.0, which will change the way you do biofeedback and neurofeedback forever. With a wide variety of usability features, a new look and feel, a powerful new sound engine, and the most comprehensive set of computations on the market, you can offer your clients training capabilities that are unavailable anywhere else. Add to that graphical user manuals, context dependant online help, year round workshops and weekly online training, and the transition to the most powerful biofeedback and neurofeedback software in the world is made easy. **What are you waiting for? Start using Infiniti now!**



### Simplify your practice - Focus on your clients

With each new version, BioGraph's designers focus a lot of effort on making the platform easier to use. BioGraph 6.0's reorganised user interface is more intuitive and groups features functionally so you always find what you need when you need it. The new Tools menu offers more capabilities than ever before.

- Click a Quick-Start item for our exclusive one-click session launch.
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- Interact easily with the new interface to do more with fewer mouse clicks.



### Powerful capabilities

BioGraph's audio feedback functions were rebuilt using a powerful video game sound engine, which gives it full control over sound responses and virtually eliminates feedback lag. With the addition of many new reviewing tools, unseen in other biofeedback systems, BioGraph Infiniti continues to be the most powerful multimedia bio/neurofeedback system on the market.

- Explore dynamic EEG entrainment with the new dynamic binaural beat pacer.
- Improve reporting with revamped artifact rejection.
- Exchange data better with new export/import capabilities.
- Use real-time trending and segment analysis.



### Exciting biofeedback tools

With this new release, we've greatly expanded your bio/neurofeedback horizons.

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Z-score biofeedback provides a strong research-based approach to training and offers a wealth of information from a simple, concise set of metrics.

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- Take advantage of fully automated functionality, including automatic artifact rejection.