

PROFESSIONAL ISSUES

The Foundations Supporting Biofeedback and Neurofeedback: II. FERB Supports Research in Biofeedback

Cynthia R. Kerson, PhD, QEEGD, BCN, BCB

ISNR Research Foundation, San Rafael, CA

Keywords: neurofeedback, biofeedback, research in applied psychophysiology, AAPB Foundation for Research and Education in Biofeedback (FERB)

Research in the field of biofeedback has suffered both for lack of adequate methodological rigor and lack of adequate funding. The ISNR Research Foundation and the AAPB Foundation for Education and Research in Biofeedback are nonprofit foundations developed to promote and support a broad program of research in biofeedback and neurofeedback. A previous article featured an interview with the director of the ISNR Research Foundation, David Trudeau. The present article provides an interview with Paul Lehrer, Chair of the AAPB Foundation for Education and Research in Biofeedback. This interview series provides insight into the two foundations and invites professionals in the broad field of self-regulation therapies to support both.

Interview with Paul Lehrer, PhD, Chair of the AAPB Foundation for Education and Research in Biofeedback

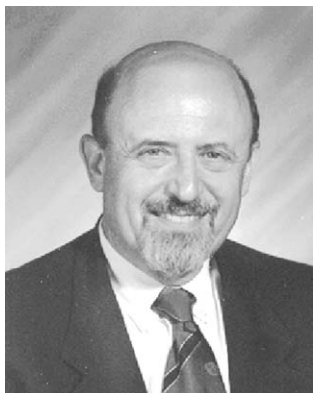
Paul Lehrer is professor of psychiatry at Robert Wood Johnson Medical School, which, on July 1, 2013, became part of Rutgers University. He is a clinical psychologist and has been practicing biofeedback, stress management, and various applied psychophysiology techniques for more

than 40 years. He is the lead author on a classic textbook on stress management (Lehrer, Woolfolk, & Sime, 2007). Dr. Lehrer, his laboratory team, and students have conducted extensive research on many biofeedback applications, primarily heart rate variability (HRV), electromyography, muscle relaxation, self-hypnosis, and autogenic training, and has been awarded three R01 research grants by the National Institutes of Health (NIH) to study HRV and HRV biofeedback. He is a Fellow of Divisions 12 (clinical psychology) and 38 (Health Psychology) of the American Psychological Association. He has served as president for the Association for Applied Psychophysiology and Biofeedback and has been given the Association's Distinguished Scientist Award. He also has received the Exceptional Achievement Award from the Biofeedback Foundation of Europe.

Cynthia R. Kerson (CRK): And so this interview is mostly focusing on your role with the AAPB foundation, which is now FERB—the Foundation for Education and Research of Biofeedback. So in your role as the head of FERB, what trend in research would you say has been the most outstanding?

Paul Lehrer (PL): Well, most recently, the major trends have been work on HRV biofeedback and neurofeedback.

FERB primarily funds student research, and as a result, we want to fund research of the highest quality. This year, in fact, we have not funded any research, primarily because we haven't received any applications that have met our standards. In the past, though, we have funded student research projects in both biofeedback and neurofeedback. We recently funded an interesting study on the psychophysiological effects of the tsunami in Japan. Rather than focusing on a particular modality, we search for the best quality in research, using good methodology, looking for studies that are publishable and which could ultimately lead to a fundable project.



Dr. Paul Lehrer

This year, we have given funding to support travel to AAPB meetings for students who present their research. But we do intend to fund more research.

CRK: Great. A recent look at the amount of publications we can find in PubMed and other searchable indexes when searching for *neurofeedback* or *biofeedback* finds there to be an exponential growth in peer-reviewed and indexed papers. With this current interest in investigating biofeedback, why do you think it is still considered experimental?

PL: In some areas, biofeedback is accepted as standard medical practice, for example, pelvic floor applications for incontinence. Neurofeedback for treating epilepsy has been quite solidly researched. However, the standards for accepting treatment methods as standard medical practice are very high, and the amount of funding available for biofeedback research is nowhere near what is available for drug research. Drug companies can put millions and millions of dollars into research on new products. The profit margin in biofeedback is much smaller; hence, the relative paucity of private funding. Most biofeedback research is funded by NIH, which has given only modest support. For better or worse, they have tended to favor more high-tech areas, such as gene splicing, cellular biology, and brain imaging.

Compared with drug research, biofeedback has some additional problems that detract from its ability to provide definitive proof of effectiveness. Most obviously, double-blind experimental procedures cannot be used. The therapist always knows the treatment he or she is offering. Also, choice of control conditions can be problematic. Various “placebo” conditions often are either counter-therapeutic (which would exaggerate the positive effects of biofeedback) or have some beneficial effects (which would minimize biofeedback effects). Also, biofeedback is a rather complicated procedure, involving the therapist’s interpersonal sensitivity and warmth as well as properly nuanced use of biofeedback techniques. Additionally, some recent clinical trials have been criticized both from within and outside the biofeedback community for technical faults, or difficulty in ascribing treatment effects specifically to biofeedback, in more complex protocols.

Finally, when you are doing a large clinical trial, it is difficult to repeat it if you find, afterward, that the methodology has led to some confusion in interpreting results. If you are a drug company doing the research, and you administer a slightly wrong dose, or you use a formulation that is not exactly right, and if the financial incentives are high, you usually can find the funding to tweak the procedure and try again. Biofeedback researchers rarely get this chance.

CRK: Or you just change the name of the medication and remarket it. Or change the name of the disorder. . . .

PL: Right! But they often just do another clinical trial. They make a lot of money selling medications, so they can put a lot of money into their research. We try our best, but the perfect research design often cannot be known until the study has been completed and the results analyzed. Sometimes we even end up asking a different question from the one we first had asked when we planned the research.

Even when dramatic findings do occur in biofeedback research, they often are not picked up by the medical community, for many complicated reasons, both scientific and political. For example, in 2004, I conducted what, in my opinion, was a definitive trial for HRV biofeedback to treat asthma. It found 100% effectiveness in preventing asthma exacerbations. 100%. That’s pretty good. Patients in the biofeedback condition also took less asthma medication, had better pulmonary function, and fewer asthma symptoms, compared with three credible control groups.

CRK: That’s great!

PL: The NIH considers this technique to be worthy of further research, but nothing more. Our study was published in a reputable pulmonary journal, but has been mostly ignored or trivialized by the medical community. This is not unusual, and, indeed, most medical advances are accepted only after effectiveness has been replicated a number of times by different investigative teams, but the pool of biofeedback researchers and sources of research funding are often too small to carry out these repeated trials.

These conditions may apply to behavioral interventions in general, but I think cognitive behavioral therapy is a bit ahead of us on this score. Multiple clinical trials for cognitive behavior therapy have been generously supported, in part because funding agencies have become interested in this approach, and in part because of a greater number of researchers, and perhaps the availability of higher-quality researchers.

There aren’t that many biofeedback researchers holding positions in academic departments, supervising students doing doctoral dissertations on biofeedback topics and applying for research grants, whereas almost every psychology department in the country has specialists in cognitive behavioral therapy.

Indeed, in some ways, applied psychophysiology is as an orphan in psychology. It began in psychology, as an application of operant conditioning, but few psychology departments teach it.

CRK: Or medical departments for that matter. Most people in medical schools hardly know what psychophysiology is.

PL: Yes. That's also true. But biofeedback is recognized by the American Psychological Association as a subspecialty in psychology. One would think that psychology would be the natural home for it.

CRK: What do you think of the integration of biofeedback and neurofeedback in clinical application and also in research?

PL: I have never understood why the biofeedback society (AAPB) and the neurofeedback society (ISNR) decided to split in the first place. That never made any sense to me. In a relatively small field, why do we need two organizations whose members are simply focusing on different parts of the body? One would think we would have more impact and influence if we were united.

CRK: But in terms of the clinical intervention or research applications? For example, is incorporating HRV biofeedback and neurofeedback together viable?

PL: In fact people are combining the two techniques in research as well as clinical practice. Several studies have already been published, and more are in the pipeline, looking at brain correlates of HRV biofeedback and HRV during neurofeedback. We are now involved in a study looking at functional magnetic resonance imaging correlates of resonance frequency breathing. We know that some important HRV biofeedback effects occur because the technique affects various brain circuits. We even know what some of these circuits are. HRV biofeedback specifically targets the baroreflexes, which, in turn, are controlled by the nucleus tractus solitarius in the brain. We also know that this nucleus communicates directly with the insula and the amygdale, which are centrally involved in various anxiety and mood disorders, although these brain mechanisms have not been verified for particular psychiatric disorders. The brain and the heart are closely connected. HRV biofeedback directly affects activity in a major parasympathetic nerve, the vagus nerve. Seventy percent of the fibers from this nerve are afferent, communicating to the brain.

One of the major and most consistent effects of HRV biofeedback has been on depression, even in studies where depression was not the major focus. There is obviously a connection between HRV and the brain. We need to understand it.

Years ago, I studied progressive muscle relaxation with Edmund Jacobson, who really originated this technique in the early 1900s. He practiced a technique that involved much more detail than the kind of muscle relaxation that

most cognitive behavioral therapy practitioners and even biofeedback therapists use today. When he was 93 years old, he wrote his last book, *The Human Mind*. In it, he asked whether an alien with a gelatinous body but a brain similar to ours would have the same kind of thoughts that we do. He said no, because we think with our whole body, particularly our muscles. He cited clinical and research evidence that one cannot think without activating muscles in the eyes and/or vocal cords. Vocal muscles are activated by verbal thoughts and eye muscles by visual thoughts. Kinesthetic thoughts activate muscles throughout the body.

Of course, the brain is centrally involved in thinking, but muscles are involved. There is a connection. We also know that the muscles are an intricate part of the sympathetic nervous system (SNS), and the SNS is a part of the central nervous system, thus connected to the brain. So everything is connected to everything else. When people do HRV biofeedback, many practitioners also measure finger temperature and/or skin conductance. Why not electroencephalography (EEG)? The body is a complex interactive system. We need to understand how all aspects of it work and how we can maximize health and functioning by understanding its full complexity.

I have recently published a paper updating cybernetics theory to our understanding of applied psychophysiology, published in *Applied Psychophysiology and Biofeedback*. In it, I argue that complexity is a hallmark of a stable system, particularly chaotic complexity. Chaos does not mean randomness, but rather organized complexity. Thus far, we have only been able to get as far as looking at the complexity in individual systems, including heart rate and EEG. In both cases, chaotic processes are related to health and stability.

So what about between-systems chaotic processes? Now, with current computer capabilities, we can begin to model these interactive processes. This is a very exciting time to be working in this field. So it seems to me that AAPB and the neurofeedback society (ISNR) should join forces since we are both really working on different sides of the same thing.

CRK: I'm glad to hear that is your opinion. It certainly is mine. How do you feel that nonspecific effects or placebo effects fit in the clinic or in research?

PL: What is the placebo effect? That's a complicated thing in and of itself. Some people think every psychological or biofeedback effect is an aspect of the placebo effect. Of course, expectancies have powerful effects. Some studies on asthma provide an example of this. When asthma patients are told to inhale a saline solution but are told that it is a powerful bronchoconstrictor, 40% of them show

clinically significant bronchoconstriction. It works the other way as well. About 40% of asthma patients show bronchodilation when told that the saline is a bronchodilator. We should capitalize on this effect, not dismiss it!

The question for biofeedback, however, is whether biofeedback has effects over and above the suggestion effects. I try to answer this question in my research by using powerful and credible control conditions. When you're looking for a control condition that is capitalizing on the placebo effect, you want something that is not going to be relaxing but also is not going to be arousing.

In fact, a number of neurofeedback people became angry with me because I used an EEG biofeedback condition as a control for a study using HRV biofeedback in asthma, and criticized my neurofeedback technique. They didn't get the point! We used a terrible neurofeedback procedure by design! We wanted it to be a placebo!

CRK: Was it a sham protocol or did it feed back real-time information?

PL: It did a bad job of feeding back real-time information. We used an old machine that had a lot of noise. Half the time it worked, and half the time it didn't. People's EEG didn't change very much. I didn't *want* to do it right!

CRK: You simply wanted something to compare. If a research project similar to that came across FERB, would you fund a study of that nature?

PL: It depends on what the study is about. I didn't expect huge EEG effects for asthma, to tell you the truth. On the other hand, if we were doing a study on anxiety, neurofeedback would be highly inappropriate as a control condition. The further away you are from the central nervous system effects, the more comfortable I'd be to use neurofeedback as a comparison condition. If you're studying something that neurofeedback should affect, then even a badly done control isn't really a control.

CRK: Because you want to separate specific from nonspecific effect.

PL: Right. I'm planning some studies like that right now. I want something that's mildly relaxing. A placebo I've used in the past is listening to relaxing music. But that has an effect, too, as found in music therapy research. But I don't think it's as powerful as biofeedback. Others have just given patients information. But even that has an effect. It's a very strong cognitive intervention. As I mentioned before, it is difficult to find something that is just a placebo. Control groups too often end up being either too powerful or either unconvincing or countertherapeutic.

CRK: Let's switch gears. What funding are you doing at FERB right now? Currently are there any grants or calls for submissions?

PL: We're open to proposals from graduate students for funding. The funding varies from year to year and enables a student to get a project going. Our standards are high but not impossibly so. The student must adequately specify the procedures and the measures. Statistics should be specified. The research should be designed so as to answer a question of interest to biofeedback or neurofeedback. That's all!

CRK: The Board must have spent some time reorganizing from the AAPB Research Foundation to FERB—an autonomous nonprofit foundation.

PL: I came in after the transition, so I do not know the details of the transition. Members of the FERB Board in addition to myself (president) are Fred Shaffer (treasurer), Michael McKee, Alan Glaros, John Arena, Aubrey Ewing, Gabriel Tan, and Jeffrey Bolek. We would like to invite someone who specializes in neurofeedback. (Please contact Dr. Lehrer if you're interested!)

Ali Hashemian and the Brain Science International people really helped FERB a lot this year. They contributed substantially to helping fund the largest group of students ever to come to an AAPB meeting. We had 5 or 6 times the number of applicants that we've had in the past. This past year, FERB subsidized attendance of 40 students at our meeting in Portland, Oregon. It was fabulous, although it did strain our resources a bit.

The ISNR Research Foundation has helped a lot as well—indeed, you supported one of my students, who was doing neurofeedback research. This is the way we ought to do things.

CRK: What are FERB's goals for the future?

PL: We're not a huge foundation; we don't have the resources to fund major projects. We would like to expand.

CRK: Is your funding mostly through donations from members? The ISNR Research Foundation publishes books to help fund its administration. Does FERB have any programs like this? Also, the ISNR Research Foundation will help procure equipment from vendors to help with students' projects and/or mentoring or expert advice on project design.

PL: FERB is entirely funded by donations. We don't offer these services directly, but vendors involved with AAPB, particularly Thought Technology, have been very generous in lending their equipment to students.

CRK: How do you see that ISNR and FERB can collaborate?

PL: It seems to me that we're doing the same things, so I don't see why we should not work together. The main difference, frankly, is that we fund activities taking place in two different organizations. I don't think our field is big enough to have two separate organizations. Competing

with each other is a detriment to the field. Although use of biofeedback is growing exponentially in the general community, the societies aren't growing at the same pace. Perhaps students and young professionals may feel that they have better professional opportunities by joining larger organizations, such as the American Psychological Association or other academic societies, especially those who are going onto academic or high-profile professional careers. If we can find a way to make the biofeedback societies more prominent, we might get more attention.

Partnering with other organizations in the field would be the way to do it. AAPB meets at the same time of the year as the American Psychosomatic Society. Why should we meet separately and on opposite sides of the country? In a perfect world, we should have one big society that is involved in research and clinical aspects. Unfortunately, it's not a perfect world.

In contrast, ISNR and AAPB want to work together, but they meet at different times in the year. How would they share leadership? Frankly, it would be in the interest of everyone to make collaboration work. I know that important vendors have expressed a strong desire not to go to both ISNR and AAPB. They wish to attend only one meeting.

CRK: Any parting comments?

PL: I'm very grateful to the folks at BSI who helped bring a lot of students to AAPB this year. I would like to build on that and make our conferences a place where students want to come. I want to encourage growth in our field.

Conclusions from the Interviewer

As Albert Einstein once said, "If we knew what we were doing, it wouldn't be research." As our biofeedback and

neurofeedback field matures, we know a little better what we should be doing. And mainstream researchers know how to get the research done. Most of the advocates for biofeedback and neurotherapy are clinicians, with little or no experience in research. It is collaboration that could be most effective. Hopefully, some day soon, large, well-funded, peer-reviewed studies that are co-designed by experts in specific areas of research, along with experts in biofeedback and/or neurofeedback practitioners, will fill your media inbox. The ISNR Research Foundation and the AAPB FERB can help achieve that goal.

Reference

Lehrer, P. M., Woolfolk, R. L., & Sime, W. (2007). *Principles and practice of stress management* (3rd ed.). New York: Guilford.



Cynthia Kerson

Correspondence: Cynthia R. Kerson, PhD, QEEGD, BCN, BCB, 1925 Francisco Blvd. E. #12, San Rafael, CA 94901, email: cynthiakerson@gmail.com.
