

## **INTRODUCTION:**

### **BIOFEEDBACK AS A TOOL FOR THE STUDY OF CONSCIOUSNESS \***

**Joe Kamiya, Ph.D.**

*Joe Kamiya, Ph.D., has been a major pioneer in biofeedback research since 1957. For many years he was a professor of medical psychology at the University of California at San Francisco, and was Project Director of the Psychophysiology of Consciousness at UCSF's Langlely Porter Neuropsychiatric Institute. Though he is now retired, he is still very active in the various national societies devoted to neurofeedback and the study of consciousness.*

“...Biofeedback presents ideal opportunities for the general education of children. Increasing all children's knowledge of physiology can start at all ages with biofeedback explorations. More important, helping them discover that states of consciousness are related to their physiology could be a long lasting contribution to their education. Letting the child learn, for example, that embarrassment, pleasure, surprise, anger and relaxed calmness have immediate effects on skin conductance, muscle tension, blood pressure, facial blood perfusion and many other measures is hard to top as a method of teaching body awareness. Many kinds of biofeedback equipment ought to be made available in the classroom, much like jungle gym equipment is made available on the playground at recess. These would include monitors of finger skin conductance and finger pulse volume, muscle tension, blood oxygen saturation, heart rate and heart rate variability, abdominal-thoracic respiration ratios. The aim would be to encourage their use simply for exploration of the children's own internal worlds, and to promote the enjoyment of self-discovery. One interesting commercial product featured a game in which two persons would compete to determine who could remain the calmest and for the longest duration. Calmness was measured by the electrical conductivity of the skin at the fingertips of both competitors. The closer to victory one person could see he was getting, the more likely he would suffer from the physiological excitement of the anticipation of winning. The pronoun gender change is deliberate; this game may be a good corrective for hyper-competitive boys!

**What Heaven has disposed and sealed  
Is called the inborn nature.**

**The realization of this nature  
Is called the process.**

**The clarification of this process  
Is called education.**

**---- CONFUCIUS -- 551 - 478 B.C.E.**

**By Jean Millay, Ph.D.**

With the portable EEG equipment, designed by R. Timothy Scully, Ph. D., we built the first *Stereo Brainwave Biofeedback Light Sculpture (SBBLs)*. This allowed us to see the brainwaves (beta, alpha, theta and delta frequencies) displayed as differently colored mandala patterns for the signals from both hemispheres simultaneously. Later, an AUM tone was added for clearer sound feedback of simultaneous alpha frequencies, with a harmonic tone added when the two alpha frequencies were also in a coherent phase relationship. In 1974, I began a brainwave biofeedback research project with college students, and I continued to use the equipment for many years with individuals as well as with students of different ages in a variety of types of classrooms.

We found that fifth grade students responded very enthusiastically to the brainwave light sculpture as well as to other types of biofeedback machines. (Seventh and eighth graders, however, seemed to resist getting electrode paste in their hairdos.) However, most junior and senior high school students, who tried it, took an intense interest. College students could choose, as an elective, classes devoted solely to self-exploration using the various forms of biofeedback. For example at Santa Rosa Junior College, special classes have used biofeedback successfully to help the handicapped improve their self-management skills. Eleanor Criswell, Ph.D., a pioneer in biofeedback and in Humanistic Psychology, has taught biofeedback classes successfully for over twenty-five years at California State University at Sonoma.

Here are quotes from college students who took part in my research or who practiced biofeedback in classes devoted to self-discovery:

*“...The brainwave synchronization training we did...continues to help me center myself. I don't need the EEG machines anymore, but I always use the feeling of it, even today...”*

*“...It took me days to learn to warm my hands. But now my old fears that my hands and feet would always be cold are over...”*

I enjoyed teaching biofeedback at the junior college and the university, but the most rewarding students for me were the eager fifth graders in an elementary school in San Francisco. The racial mix included Chinese, African Americans, white, Russian Jewish emigrants, Vietnamese and others. The children had all learned to speak English, even if their parents had not. The golden opportunity I had hoped for came when I was asked to be a substitute in that school for seven weeks. I brought in all the biofeedback equipment I could find, along with a few pocket calculators. The children were curious enough about the machines to pay attention. The colorful light sculpture was a special attraction.

In the school's storeroom, I was lucky when I found a large roll of butcher paper already marked with 2” squares. The children and I worked together to tack up twenty-four feet of it along the back wall of the classroom. Each set of squares was marked off to represent the progression of the frequencies (Hz = cycles per second)

of the electromagnetic spectrum from extremely low frequencies (ELF) to very high frequencies (VHF) to the cosmic radiation as measured in quadrillions of mega cycles per seconds. Each team of students took responsibility for illustrating a portion of the EM spectrum and to make a final report on their chosen set of frequencies, such as, radio, TV, microwaves, visible light, x-rays, etc. At the end of all their reports, I demonstrated how our own brainwaves (EEG) were also measured in cycles per second, and they could be compared with those from the sun and with those of the Earth on the slow end of the EM chart among the (ELF) Extremely Low Frequencies. My portable brainwave machines could detect frequencies between 4Hz and 30Hz accurately.

By then, we were ready to experiment with the way the EEG made the mandala lights change color on the *Stereo Brainwave Biofeedback Light Sculpture*. A special team was elected, from many eager volunteers. These students learned very quickly to hook up the electrodes, and listen for the correct sounds that indicated they were well connected to the head. Other students learned to take notes from the numbers on the dials on both brainwave analyzers. This allowed personalized biofeedback activity to continue even though I was busy with the other 36 students. Students signed-up if they wanted a chance to practicing biofeedback with the EMG's (Electromyograph), GSR's (Galvanic Skin Resistance), Skin Temperature machines, and of course EEG (brainwaves) with the *SBBLs*. No student was required to do it, but all were eager to try.

Here are brief reports about four students (the fictitious names protect identities):

1. "Gary" was a hyperactive child who excelled at kick ball. He created a constant distraction during class, as though he were always on stage. Many of the children laughed at his pranks, while others were annoyed. His reading level in fifth grade was at the third grade level. When we went to the library to choose a book for a report, the only book Gary would consider choosing would be a short story about a sports hero in large type. When I suggested another sort of story, he refused, saying, "*No! Sports have to be my life. If I'm not picked up by the major's, by the time I'm out of school, I'm gonna commit suicide.*" It was clear that he felt already branded as dumb, and his only chance of 'success' in life would be as an athlete.

When I announced that the book reports were due on Friday, Gary complained bitterly, that he absolutely needed two weeks to finish his book and to write his report. (I knew that Gary's parents were getting a divorce, and that his home was not a peaceful place to study at this time.) Nevertheless, I was adamant. Reports were due on Friday. After that announcement, it was Gary's turn to see his brainwaves in the light sculpture. As soon as he was properly connected to the electrodes, I sat beside him and softly suggested this to him, "*If you could learn to focus your attention, you could become a genius. Do you believe that?*" He shook his head for "*No,*" but said nothing. So I pointed to one of the dials on the brainwave analyzer (the dial was continuously fluctuating widely as one might expect of the EEG of a hyperactive child). I tuned the machine to provide a feedback tone in the faster beta rhythm (13 Hz to 30 Hz - the upper limit of that machine). The percentage of beta rhythms showing was about 30%. I said to him, "*See if you can raise the number on this dial by focusing a lot of attention on it.*" After that I had to turn my attention back to the rest of the class.

When his turn was over, Gary returned to his seat and quietly began his reading assignment. Eventually, one of the children spoke up and asked, *"What happened to Gary? Ever since he was on the brain machine, he's been quiet all afternoon."* Gary had raised the percent time of his beta rhythms from 30% to 60%, and he was impressed with his own ability. The next day, Gary came to me with great personal pride and excitement, *"Dr. Millay, Dr. Millay, I finished the book in two hours!"* For the first time in his life he discovered that he could gain voluntary control over his mind. No one could convince him again, that he was just born dumb and that he couldn't do anything about it. He was still hyperactive, but he was developing an inner strength to expand his ability to focus attention.

2. Lee was a good student. He was not athletic; in fact he was awkward and overweight. He wore thick glasses. He was kind and considerate, even though sometimes the athletes of the class made fun of him. His experience with biofeedback was most rewarding to him when he used the EMG to relax the muscles of his forehead. This seemed to help prevent his frequent headaches. He paid close attention when I told the class that learning to focus attention at will was an important key in the process of becoming more intelligent. His parents were both very supportive at home. His father came to school twice a week to help as needed.

Months later, when I dashed into a drug store in Chinatown for some Tiger Balm, I discovered that Lee's father was the pharmacist there. He was proud to tell me that his son had been transferred into the gifted program. Once Lee had learned to control his muscle tension and headaches, he also learned better study habits. His father thanked me for what I had done for them. Actually Lee had done it for himself. He just needed the feedback to show him how.

3. Tom's records showed him to have been a "C" average student for some time. He would become extremely nervous if he had to stand up in front of the class. His parents were concerned and tried to help by enrolling him in a private drama class on Saturdays. Tom hoped to be as invisible in my class as possible. He didn't volunteer for anything.

He pleaded with me to let him settle for the written part of his book report. He did not want to give it orally to the class. Again I was adamant, but friendly and encouraging. As he stood in front of the class, his face and freckles began to turn as red as his curly hair. When he could speak, his voice was so low that we could barely hear him, but he did manage to finish. His classmates empathized with his pain and applauded his success. His report had been written well (perhaps with parental assistance).

However, later he complained about having a terrible stomachache and he needed to call his father to take him home. His father was out of the office at the time, so he came back to class. I gave him the GSR and told him to sit back in the corner of the classroom and try to bring the tone of the GSR down as much as he could. I suggested that one way to do this would be to relax and visualize a golden light going through his stomach. During recess, I saw Tom running across the playground. I asked, *"Isn't your father going to pick you up?"* He said, *"I didn't call him again, my stomach doesn't hurt anymore."*

Months later while I was standing in line at the grocery store, Tom and his father

were also there. Tom ran up to me, eager to tell me that he had made the honor roll. He introduced me to his father, because he really wanted to say to us both that he wasn't afraid to stand in front of the class anymore.

4. Marybeth could read fairly well, but her scores in math were really low. She had given up any idea that she would ever understand anything about numbers. Her clothes were usually sloppy, and the other children ignored her. One day, she broke her arm and couldn't fix her hair herself. To make her feel less depressed about her arm, her mother had braided every inch of her hair in 'corn rows' with beads at the end. She looked better groomed than she ever had before. This 'new look' allowed her to hold her head up more and gave her some needed attention from some of the other children for a while. However, she couldn't play with the others during recess because of her arm. She complained about being bored.

I gave her a pocket calculator and suggested that she create a guessing game for herself. Because of the immediate feedback the calculator provides, she discovered for herself a pattern in numbers that had eluded her before. Other students enjoyed playing her game as well. I asked her to introduce the game in front of the whole class. It became known as Marybeth's math game. She was proud of it and her math scores improved dramatically.

In most schools fifth grade is the last grade before middle school. Students have one major teacher to relate to and each student has a personal desk--a place to *be* in that one classroom. If stress management has not begun for these children sooner, it should begin here, before the multiple teachers, multiple classroom separation begins. By fifth grade, students know very well where they stand in the range of abilities as graded on standardized tests. The pressure is on them and if they are not guided at this time, unhealthy habits of dealing with stress can be locked in at this age--habits that can haunt them for life. Those stuck at the third grade reading level are nervous, with low self-esteem. Those who are judged to be 'average' are nervous, because of pressure to do 'better.' And those who read at the eighth grade level are nervous, because their unique abilities are often derided through social pressure. Alcohol, nicotine, drug and food abuse may begin here. It has become the accepted peer group response to stress. This is where the abuse of such substances might be stopped as well. Biofeedback, used as self-discovery, can provide the fundamental education needed for the whole peer group as a class. Through biofeedback they have a chance to discover that their personal power does not depend upon someone, or something, outside of themselves.

Fifth grade is the ideal time to begin biofeedback training (though biofeedback is useful at any age). Fifth graders want to learn to be somebody. They can learn more easily than adults to increase their ability to focus attention, to raise and lower their skin temperature to overcome chronically cold feet or hands, to relax tense muscles around their eyes (and perhaps help prevent near sightedness or chronic headaches), to raise or lower their galvanic skin response to emotional upsets, to gain voluntary control over some aspects of their brainwaves. Even if they only learn some of these skills, that learning can last a lifetime and can have a positive effect building on a healthy lifestyle.

It is my strong belief that when a child learns to increase his or her ability to focus attention, that child can learn to become more intelligent. The methods of becoming

more intelligent increases that child's own self-esteem. All children can explore the wisdom within their own bodies; can touch into their own higher selves. All children can learn to have access to their own insights and higher intelligence.

Biofeedback is a way of linking each person to a feeling of being connected to all things. It is a way of discovering that our vital energies are an integral part of the continuum with the resonance of Earth and Sun, the sources of life. Biofeedback introduces the students to their electrical and magnetic dimensions. They can see that their thoughts have a direct effect on their health. This fact alone could eventually cause our attitudes about the field of medicine to evolve in a positive way. Biofeedback is a powerful way to teach a science of consciousness and health to everyone.

I believe I can make a solid case  
for the existence and potential  
of a superior intelligence within **everyone**,  
a mind born of brain  
but existing apart from brain,  
a mind with extraordinary, unacknowledged  
potency and range of powers.

---- Barbara B. Brown, Ph.D.

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