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## [Neurofeedback Tunes the Brain for Better Singing and Performing](#)

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by [Erica Rosenberg](#)

If Anne Graczyk focused on anything during her high school opera performances, it was the fact that her pantyhose were too tight.



She thought of pantyhose through Mozart, Sondheim, and Jerome Kern. Other recital-time musings included homework and the weather. As long as the aria continued, she figured no one would notice. She had a larger than life voice, and the sound emitted from her tiny frame could easily fill the Windsor Locks High School auditorium.

Yet, while teachers gravitated towards Anne's raw talent, on stage they saw a schizophrenic energy.

"I thought if I learned the song and my voice felt right, that was the end of my practice," Anne said. "Even though I had unfocused eyes and intentions, my voice still came out."

But Rae Tattenbaum, a performance coach and licensed clinical social worker, knew a good voice wasn't everything. She saw that Anne, 16, was a talented singer lacking in other aspects of performance. This artful but scattered high school singer would inspire Tattenbaum to modify her career. After meeting Anne in 1996, Tattenbaum became the first-- and only-- practitioner in the country to specialize in using neurofeedback with singers.

Tattenbaum had quit her work coaching in the corporate world in 1994 to become an expert in neurofeedback. She began coaching people towards an attentive mind by "feeding back" information to them about their brainwaves. Sensors placed on a person's scalp fed brainwave information to a TV screen, and over time, a person would learn to improve his focus. Each time a bird appeared on the screen, a person would identify with the attentive state of her brain and learn to maintain this state. A constant tone would also inform her of focused brainwaves, while blips of sound would reveal faltering attention.

Neurofeedback can be used to improve many conditions, but Tattenbaum, after meeting Anne in 1996, decided to focus on singers and performers.

Tattenbaum created her peak performance program called "[Inner Act](#)," a five-component program designed to enhance performance, and in the process became the first person to combine the first and most important component, neurofeedback, with four crucial elements: mental imagery, or images of achievement; "inner journey work," an internal visualization technique that removes barriers to singing; "open focus," or attention training; and coaching.

"You're programming yourself," Tattenbaum said in between sessions at her Connecticut office. "Neurofeedback and other techniques I use activate the brain and its connection to the muscles. Then you create a multi-sensory image of the ideal performance and embed this image in your brain, muscles and cells until it becomes automatic."

Her work, which started with a few clients in West Hartford, CT, has now reached about 700 performers worldwide, and she commonly travels to the Metropolitan Opera to work with internationally renowned singers like base-barritone John Cheek and soprano Mary Dunleavy. Tattenbaum's success hasn't come without difficulties—she's been sick with Lyme Disease for the past two years. But now she's back to full time, and so far this year has taught over 500 people about her work, given workshops at top universities such as UCLA and USC, and is co-authoring a chapter in a neurofeedback textbook, "Introduction to Quantitative EEG and Neurofeedback, 2nd Edition" due to be published in 2007 by Academic Press.

"She's the first to use this combination of techniques," said Nancy Anderson, a voice teacher for the Hart School of Music in Hartford, CT, who has sent several dozen students to Tattenbaum and helped her quantify the program's success in a scientific study. "Rae weaves together a tapestry for the individual that addresses all the aspects of performance so many young singers lack—she coordinates singing with breathing, body movements, and acting."

Anne Graczyk, now 25 and accepted into the Chicago Opera Theater's Young Artist Program-- one of the most reputable apprentice programs in the country-- tilts back in the leather chair in Tattenbaum's Connecticut office. Covered with a comforter and a couple of electrodes, she watches the TV images. After seeing Tattenbaum for three hour-long sessions per week over two years, she mostly practices on her own, returning to Tattenbaum only before major performances, such as her upcoming performance November 7 as a mezzo intern for the American Opera Projects. Her composer will design a piece based on her performance, which she will then sing at the Lincoln Center Theater. The program has been a starting point for

opera singers going professional.

Tattenbaum watches Graczyk's computerized brainwaves, standing beside a basket of drums and other musical instruments and a model of the brain. A gong sound starts and stops, indicating Graczyk's level of focus, as the TV images continue.

"There will be a moment when all the noisiness of your brain begins to go away," Tattenbaum says. "Your lack of focus is creating a few stuck points, some irritation."

As Graczyk's attention increases, she makes the computerized gong sound constant. She knows she's succeeding as the sound continues, and accesses this state again when she performs.

Tattenbaum commonly uses a second technique along with this neurofeedback that she calls "Inner Journey Work" when performers are wrestling with barriers. Barriers may include anxiety or lack of focus with difficult pieces, physical constraints like allergies, or emotional blocks such as pressure of being the youngest singer in a musical family. While in a relaxed state, the performer recognizes rehearses through constraints.

Metropolitan Opera soprano and internationally acclaimed singer Mary Dunleavy remembers what brought her to Tattenbaum. She had just performed in "The Tales of Hoffmann" for the Connecticut Opera in 2002. Her character was a mechanical doll-- on roller skates.

"My body was tightening up," Dunleavy said. "The challenge didn't hit me until the performance. This doll was so artificial and mechanical I could barely breathe, and I kept worrying about the roller skates."

Tattenbaum guided Dunleavy through mental imagery, the third of five parts of the peak performance program. Mental imagery consists of separating out each component of the role and imagining its ideal execution. Dunleavy pictured the movements of the doll's body, the skating, and the place she'd begin singing. Then she imagined everything together on top of the page of music-- a visual movie of the performance attached to the score.

Neurofeedback activates the brain so it's easy to get a vivid picture of the ideal performance. It's then easier to solidify the picture, to store it in the body so the performer can return to it later.

Dunleavy returns to the mental imagery so her brain can tell her body how she wishes to perform. She'll be repeating the same part in her upcoming performance of "The Tales of Hoffmann" in Dallas, TX. This time, she says, will be different.

"I'm actually enjoying performing so much more," Dunleavy said. "I have a technique I can depend on for the role this time around. The challenges are the same but now, I can correct myself quickly and refocus. I know I can make myself centered and calm. And this calmness and joy is translated to the audience."

Tattenbaum uses a fourth tool called "Open Focus," originally developed in 1975 by Dr. Lester Fehmi, a psychologist and co-founder of the Biofeedback Society of America, which she adapts especially for singers. Open Focus is an attention-training technique that engages both hemispheres of the brain during a performance. Singers focus on the space within the body and expand their attention to what is going on around them while performing. This flexibility of attention makes it easier to synchronize the voice box, pelvic and diaphragm muscles needed to sing.

"Open focus removes the distractions and creates a calmness that transcends the situation, the opera house and who's in the audience," Dunleavy said.

Tattenbaum's expertise in coaching makes up the fifth component of her program. After attaining her social work degree from Columbia University, Tattenbaum worked as an adviser and coach at Northern Telecom. Her performance work extends back to the 1970s when she started the Long Island Promenade Theater. This peak performance work is a melding of her expertise.

"The coaching is about managing the noise inside the performer," Tattenbaum said. "It's not enough to sing beautiful notes. The mind is a critical component of singing that many people haven't focused on. To sing well, you must quiet the noise in your brain."

Quieting the noise might not sound like the intuitive answer to an opera singer. Yet while some voice teachers were initially skeptical of the idea before seeing it, they say Tattenbaum's ability to quiet the noise in the brain actually enhances the sound on stage. A big sound is critical-- opera singers must project their voices over a 1,500 to 3,000 person audience and 60-piece orchestra without amplification.

"I've seen immediate changes to a deeper, more beautiful, more resonant sound," said Mitchell Piper, chairman of Voice and Theater at the Hart School of Music in Connecticut. "In golf, the second you take the club away from the ball, there's so many small things you can do to ruin the shot; 1/2 performers have a calm place in their psyche that's zoned into everything that must come together for success. Tattenbaum's work diminishes anxiety so singers can be centered onstage."

While a recent article in The New York Times focused on the end of the "big American voice," Tattenbaum works to synchronize the voice with other critical aspects of opera. "John Cheek, for example, has a really big voice that he owns and controls," Tattenbaum said. "My work helps him band together the voice with all the emotionality and inner aspects of the character."

A survey on biofeedback published by Grove Press in 2000 called *A Symphony in the Brain* by Jim Robbins, a science writer for The New York Times, featured Tattenbaum as the biofeedback practitioner specializing in opera singers. Biofeedback has been used extensively since the 1970s for disorders ranging from epilepsy to ADD, yet before the book, biofeedback was relatively unknown to the performance world. Biofeedback was known for mitigating disorders rather than enhancing talents.

Since then, Tattenbaum has expanded her practice, teaching others her techniques since she cannot work with more than 40 clients simultaneously. Universities have sought her out for workshops, from UCLA to Switzerland's Tonhalle Orchestra. Last December she became Chair of a section of the Association for Applied Psychophysiology and Biofeedback, a biofeedback association of over 2000 health care professionals. Thomas Budzynski PhD, a psychologist in Washington and one of the association's founders in 1969, is editing the second edition of "An Introduction to Quantitative EEG and Neurofeedback." He decided the second edition must include peak performance, and chose Tattenbaum to co-author the chapter.

"Peak performance, the idea of using neurofeedback to enhance normal brains rather than just treat disorders, is getting to be a much more important area of application, and Tattenbaum is the best known name in this area." Budzynski said. "She's also the only one so far who's specialized in using neurofeedback with opera singers."

In 2001 Tattenbaum supported her five-part program with a scientific study, analyzing voices using coaches and digital recordings of opera singers' voices in an acoustic lab. The study, while small, found noticeable improvements in the singers' voices and performances who used Tattenbaum's program, compared to controls. "The voices were richer and more resonant, and they weren't fatigued or wiped out," said Nancy Anderson one of the vocal coaches. "It allows singers to combine their ability to move with voice, drama and acting."

Tattenbaum's work hasn't always been easy. The research substantiating the success seen by hundreds of voice teachers and performers is just beginning. Neurofeedback is a changing field of many viewpoints regarding the complicated brain. Unfortunately, some practitioners are barely trained with a mere 3-day course. Tattenbaum was certified by The Biofeedback Institute of America, which requires a health care degree, 36-hour neurofeedback course, anatomy course, and 145 hours of mentor-guided training.

Despite these challenges, the successes of professional performers are helping Tattenbaum's practice grow.

"Many performers lose their edge, and I've been here 35 years and I'm doing some of my peak work," said John Cheek.

In his recent performance of "La Grand Duchess" for the LA Opera, Cheek faced dual challenges of acting out a strutting, overbearing general and being flexible for the comedy's spontaneous laughter. He worked with Tattenbaum before the performance.

"Peak performance training allows me to be in the moment and be consistent. I'm more present and relaxed onstage and during rehearsals, when I have to take all the critiques and put them together without becoming overloaded."

Graczyk's voice fills the room as she longingly begins "Must the Winter Come So Soon," looking out toward falling leaves outside Tattenbaum's window. Isolated and emotional, her character fills the room, like a cold draft through a cracked door.

A cell phone rings-- but the music doesn't stop. Graczyk has already quieted her noise, and this one doesn't phase her.

Rae Tattenbaum will be doing a two day training on her techniques, January 17-18, 2007 at the [Futurehealth Winter Brain Meeting](#) in Palm Springs CA.

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Erica Rosenberg wrote this article while attending the graduate journalism program at Columbia University. Erica first learned about Rae's work when a family member was working with her. When Erica was making application for Med school she taught out Rae's process and later continued with a California based practitioner. After finishing her Journalism Degree, Erica has returned to Medical school at University of Penn.