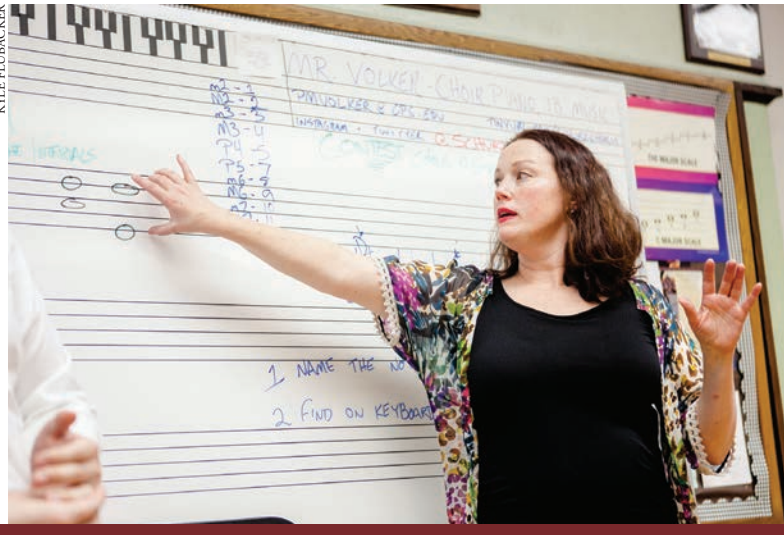
NATIONAL INSTITUTES OF HEALTH

*Dr. David Jangraw, a scientist at the National Institute of Mental Health, joins Renée Fleming in examining the soprano's brain scan.*

KYLE FLUBACKER

*Heather Aranyi, a Lyric Unlimited Teaching Artist, explaining the concept of intervals in music.*

# NOTES OF THE MIND

## *How music strengthens, heals, and shapes the human brain*

**By Nathaniel Hamilton**

*Music enriches the lives of virtually everyone it reaches. Its ability to expand the mind, as no other art form can, is a source of fascination for world-renowned soprano Renée Fleming, Lyric's creative consultant. When Fleming teamed up with scientists to study the medical impact of music on the human mind, the results were nothing short of extraordinary. Fleming's study, along with stories from Lyric Unlimited's education programs, shows how music can literally mold our minds and change our lives.*

After the third-grader finished his performance at the piano and took a small obligatory bow to the sound of his classmates' applause, Lyric Unlimited Teaching Artist Heather Aranyi noticed his teacher's look of wonder – and shock.

Aranyi is used to seeing the emotional impact music can have on listeners, especially students. Working with Lyric Unlimited's elementary school residency program, Aranyi spends 18 weeks each semester teaching students across Chicago to sing, act, and tell stories through the magic of music.

When Aranyi was talking to the third-grade teacher after her weekly lesson with the class, she was expecting a reaction she'd heard many times before about music's great influence on children. "No, you don't understand," said the stunned teacher. "That student doesn't speak. Ever. And you just got him to sing in front of the class!"

Music is an astounding thing. It can help educate students previously thought to be unteachable, converse with people thought to be lost to the conscious world, and influence parts of the mind that may be unreachable by any other means.

The recipient of graduate degrees in voice and opera from Northwestern University and early childhood development from The Erikson Institute at Loyola University, Aranyi is an authority in how music affects the developing mind. As she describes it, "A lot of people think that when you do something like singing, you're just doing something vocal, but music and singing have much deeper emotional and physical effects. When students are around music, many of them feel like they have a voice for the first time – literally and figuratively. I don't know any other tool that is more powerful."

Music's impact on students – and their education – is so special that after one of Aranyi's third-grade students participated in the opera residency program, the student's mother wrote Aranyi a letter of thanks for the inspiration that music created for her child: "These plays [operas] brought all the students together with happiness and made them so proud."

Ask teachers or performing artists about the power of music to change people's lives and they'll have countless examples and anecdotes to share. But what is the actual scientific impact of music on an individual student, singer, patient, or someone simply trying to expand their life through music? The influence of music on the human mind is what inspired Renée Fleming to begin her own exploration of that question.

In 2017, Fleming teamed up with the National Institutes of Health and Washington's John F. Kennedy Center for the Performing Arts to develop the Sound Health partnership. Sound Health studies and presents music's impact on the brain, and what happens to people on a physical, mental, and neural level when they hear or play music. Using data from this study and others, Fleming has given a presentation called **Music and the Mind** across the country, including at the Kennedy Center.

USC NEWS/UNIVERSITY OF SOUTHERN CALIFORNIA

*Neuroscientist and University of Southern California professor Antonio Damasio (left) makes a point in conversation with Renée Fleming and Christopher Koelsch, chief executive officer of LA Opera.*

**The information Fleming presents is truly revelatory. For example:**

- Study after study has shown how **music impacts the entire body**. According to the Weill Music Institute at Carnegie Hall, even day-old infants breathe in different patterns depending on whether they're listening to Mozart or Stravinsky. Studies have shown how, on average, students who learned a musical instrument scored **significantly higher on cognitive skills tests** than students with no musical background.

**The benefits of music aren't relegated just to children:**

- A 2014 study by researchers at Boston Children's Hospital, Harvard, and UCLA found that both child and adult musicians showed **enhanced problem-solving, goal-directed, and task-oriented behavior**, as compared to adults and children with no musical background.

- According to a National Endowment for the Arts study, adults in their "golden" years who both created and were exposed to art and music had **higher levels of cognitive functioning** and fewer limitations in daily physical functioning. They also had **lower rates of hypertension**, relative to older adults who had no arts or music interactions. Additionally, multiple studies have shown that people who play music throughout their lives have less auditory brain decline.

There are reams of data showing the amazing impact of listening to and participating in music throughout people's lives.

As part of Fleming's Sound Health partnership with the Kennedy Center and the NIH, she agreed to let NIH researchers scan her brain while she was singing to see exactly what a musical mind looks like. To accomplish this, Fleming undertook the daunting task of remaining in an MRI machine for two hours to see just how significant that impact could be.

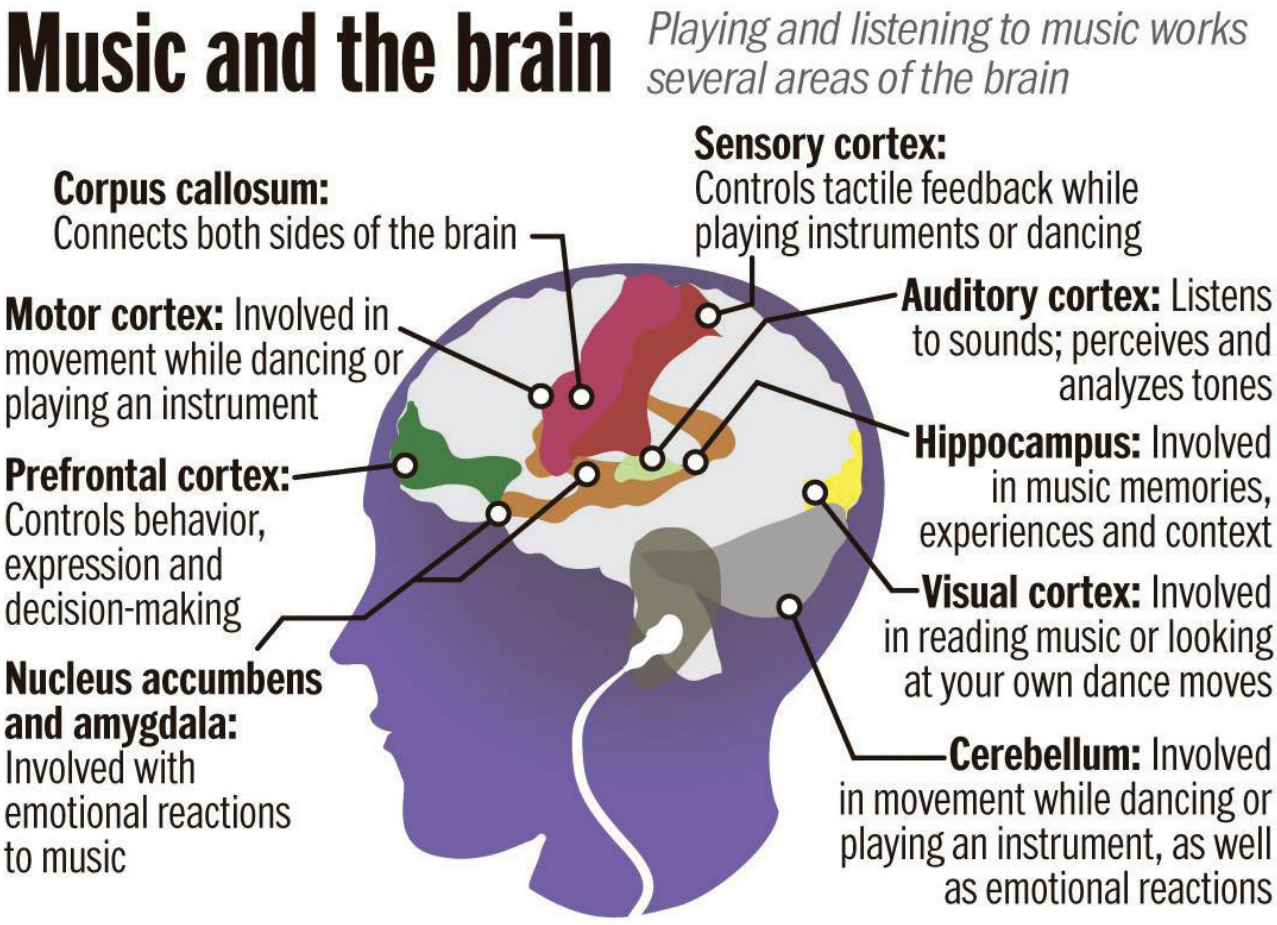
The testing procedure for Fleming was developed and conducted by Dr. David Jangraw, a scientist at the National Institute of Mental Health. As a scientist, Dr. Jangraw sees music's potential for medicine, science, and art: "Music interacts with so many different parts of our brain. **The motor cortex, the auditory cortex, the frontal cortex** [responsible for speech, memory, personality, and much more] **are all firing when someone is making or listening to music."**

While inside the MRI machine, Fleming was instructed by Dr. Jangraw to speak song lyrics, sing a song, and just *imagine* singing. By having Fleming undertake all three activities, Jangraw and the other NIH researchers would be able to see the differences of brain activity with different aspects of music.

For the experiment, Fleming chose the beloved Scottish folk song "The Water is Wide." It's rare to hear one of the most beautiful voices of our time filling a hospital testing room. But with only her feet peeking out of the MRI machine and the din of the medical equipment acting as a makeshift metronome, Fleming sent her soprano voice sailing through the examination room and a constellation of her brain activity started lighting up the researchers' screens.

The data from the experiment was expected to be impressive. However, when Dr. Jangraw and his colleagues saw the detailed view of music's effect on Fleming's brain, they recognized how **music can penetrate through mental noise and influence our minds.**

When someone is speaking, the parts of the brain that operate speech, hearing, movement, and memory activate. **When a person sings, all those areas of the brain activate at greater levels and with greater intensity**. During singing, the parts of the brain that control vision and emotion are activated. Scientists believe that when Fleming was singing in the MRI machine, she automatically pictured herself




onstage, and because she chose a beautiful song, its lyrics induced real emotions that the brain was processing.

Surprisingly however, many parts of Fleming's brain moved into another gear when she simply imagined herself singing. The researchers believe that because there were no outside cues (for example, instruments, sheet music, or the sound of Fleming's own voice) that her brain could rely on to process the musical signals it was getting, *imagining* singing took more effort than actually singing or speaking song lyrics. **Even in complete silence, music still shapes how our brain operate**.

"We think of brain activity just as the mechanics of what you do," explained Dr. Jangraw, "but it's the mechanics of what you think even more."

Tracing the pathways that music takes through the brain has allowed researchers to also come up with new therapies for diseases or accidents. For example, "when someone loses the ability to speak because of a stroke, sometimes they can use the music pathway in the brain to learn to sing important phrases instead," said Dr. Jangraw.

After seeing the results of her brain scan, Fleming marveled at the seemingly limitless possibilities music can have on our psyches. "There are musical elements we will eventually understand that have more power over us," she said later in a video prepared by the Kennedy Center, "whether it's melody, certain harmonies, or harmonic tension. Why do we cry during certain music? Why does certain music lift us up and make us feel joy or inspire us to action?"

Dr. Francis Collins, director of the National Institutes of Health, who has helped Fleming spearhead the **Music and the Mind** program, explained in the same video that "we're starting to learn ways in which music can influence all kinds of other aspects of someone's brain function, and especially how we can use that information to use music therapeutically."

It's music's place in therapy that has many patients and doctors exploring music's role in the healing process. OPERA America recently explored the subject of how music – and opera specifically – can help people battling with memory diseases, such as dementia and Alzheimer's. They highlighted an innovative program called "Memory Mornings," run by LA Opera in collaboration with other nonprofits. The program uses professional pianists and singers working with Alzheimer's patients, using music to open up parts of their minds that have been shut off by age or ailment. Heather Cooper Ortner, the president and CEO of Alzheimer's Greater Los Angeles, explained to OPERA America, "When people move through the levels of Alzheimer's, they lose the ability to express and manage their emotions. **Singing allows them to connect with those emotions, and with deep, powerful memories**, often taking them back to their childhood."

*(continued on page 19)*

*Renée Fleming giving her "Music and the Mind" presentation, which she has brought to audiences in many venues nationwide.*

WHOLE MUSIC

*Music therapy has a remarkable effect on patients of all ages.*

KYLE FLUBACKER

*Heather Aranyi with students at Schurz High School.*

Music therapy is even having an impact fighting diseases that can trap people in their own bodies. A study by the University of Toronto and the University of Colorado researched how music could potentially help Parkinson's patients who had difficulty walking and had suffered multiple falls because of the disease. After four months of music and rhythmic therapy, **the music-therapy patients suffered significantly fewer falls and were actually able to walk easier and faster** than they had before the therapy and better than patients without music therapy.

The power of music over the mind and the heart is undeniable. How many parents have been compelled to pick up their newborn baby and dance together when a favorite song comes on? How many of those young children have heard that same song a few months or even years later and instinctively reached up to their parent for a dance?

Over time, our bodies begin to feel the inevitable effects of age or are attacked by a disease stealing our physical or mental abilities. Music can help reverse some of time and fate's cruelty where conventional medicines and treatments might fall short.

Music's power as an art form has been known for generations. Teachers like Heather Aranyi have realized how music can inspire confidence in even the most closed-off young minds when they see their students open up around music like never before. Certainly anyone experiencing great music will recognize the inspiration it can create, whether in a grand setting (as you are about to experience at Lyric) or an intimate one. When Dr. Jangraw and the other scientists at the NIH saw the electricity of Renée Fleming's brain as her singing voice bounced off the sides of an MRI machine, they saw music's power too.

So in a few minutes, when the house lights dim and the orchestra begins its overture, before you lose yourself in the larger-than-life characters and world of our stage, take a moment to think about your own mind and the magic taking place inside.

*Nathaniel Hamilton is public relations manager at Lyric Opera of Chicago. Nathaniel joined Lyric in 2018 after previous marketing and writing roles with Chicago and Illinois nonprofit organizations, including Project Six and the Illinois Policy Institute. He holds a B. A. in economics and English from Butler University.*