

# Opera Singer Turned Neuroscientist Uses Music as Medicine for Dementia, Autism, and More

By [Conan Milner, Epoch Times](#) | November 26, 2015 | Last Updated: May 25, 2016 2:14 pm



Linda Maguire is an internationally renowned musician with a red carpet career spanning 23 years. She has done over 80 live radio broadcasts, several recordings, and has been a featured soloist at the Kennedy Center eight times performing pieces by Mahler, Bach, Beethoven, and Handel.

Maguire is still performing, but in the last few years she has turned her musical talents toward a new theme: [healing](#). In her quest to marry music and medicine, she recently acquired two master's degrees, one from George Mason University in cognitive and behavioral neuroscience, and another at the Johns Hopkins Bloomberg School of Public Health where she studied health science and gerontology.

The fruits of this marriage already show. Earlier this year Maguire published a study which strongly suggests that music can improve mood, behavior, and cognition. The study was a collaboration with Jane Flinn, a behavioral neuroscientist at George Mason, and published in the [Journal of the American Geriatrics Society](#). The team looked at 45 patients with either Alzheimer's or other dementia. Participants sang songs that Maguire selected for their therapeutic value. They included 'Edelweiss' from the Sound of Music, and 'Somewhere Over the Rainbow' from the Wizard of Oz.

After four months of Maguire's singing regimen, test subjects demonstrated remarkable improvements in cognition.

There is no cure for Alzheimer's, and after decades of research, no drug maker has been able to create anything very effective in slowing the mental deterioration characteristic of the disease. However, after four months of Maguire's singing regimen, test subjects demonstrated remarkable improvements in cognition. Previous research shows that music can influence positive improvements in heart rate, blood pressure, oxygen saturation, cortisol, dopamine, and melatonin levels.

## Rediscovering Music Therapy

We usually think of music as entertainment, but in the ancient world, music was often considered a form of medicine. Apollo, for example, was the god of both healing and music. Plato declared that melody and rhythm could restore the soul. In the Chinese language, the character for [music is the base of the character for medicine](#).

Over the past few decades, scientists have rediscovered music's healing abilities, and studies have shown that music can effectively treat conditions such as schizophrenia, depression, chronic pain, Parkinson's, PTSD, autism, help stroke patients recover, and more.

Harvard Medical School had a [presentation](#) on April 14, 2015 showcasing the music based therapies currently in development.

While science has shown that performing music has [verifiable benefits](#), merely listening to music can aid the brain as well. One of Maguire's many music based therapy projects is developing a treatment that everyone can use. Her plan is to create "prescriptive iPods" where compositions are strategically selected and composed to help individual brain function, from improving concentration, to encouraging exercise, to calming the mind.



Renowned opera singer and neurologist Linda Maguire. (Courtesy of Linda Maguire).

The Epoch Times talked to Maguire about how music can change our brain.

**Epoch Times:** How did your music career lead you toward neuroscience?

**Linda Maguire:** I went to visit a friend who had developed dementia. She was in a room with all these other patients who were having severe problems: verbal outbursts, wandering, hand movements, and very confused. It was chaos.

I had heard just in passing that people with Alzheimer's like music. I saw a piano, so I sat down and I played something—I think it was the national anthem, or 'Amazing Grace.' They all stopped and started singing. I thought, "What is going on here?"

I'm a performer, that's how I come to this work. Performance is the greatest teacher and my job was to hold audiences on the tip of my little finger from 45 minutes to three hour operas. I know how to control an audience, but I was just dumbfounded that the Alzheimer's patients all stopped. And I barely did anything.

It got me very interested in the power of music in dementia patients, and within in 10 years I had a master's degree in neuroscience. I realized that the brain was responding to music. I learned how you could wield music as a precision tool to change and transform different parts of the brain.

They liked repetitive compositions in bright keys from Haydn, Mozart, Bach, and Clementi—the really clean, classical, highly structured compositions.

So I started working with dementia patients once a week. I committed every Friday to go into these facilities and play the piano and sing songs and see what they reacted to—see what worked, and what didn't work.

I realized they didn't like emotional pieces, like Strauss or Brahms, or even Beethoven. They liked repetitive compositions in bright keys from Haydn, Mozart, Bach, and Clementi—the really clean, classical, highly structured compositions.

So I developed six one hour [programs](#) where you play specific notes and you just carve into their psyche and stop the problems. It's music mostly that they've never heard before and they love it.

**Epoch Times:** How does singing treat Alzheimer's disease?

**Ms. Maguire:** Music gives Alzheimer's patients a sense of power and ownership. They can't follow life. They can't follow conversations. They don't remember people. They get lost. They get confused. They've lost working memory. But because the part of the brain that internalizes music and marks rhythm particularly is very healthy in Alzheimer's patients they can follow music, and remember it, and that makes them feel in control. They're very keen listeners.

The power of singing gives you better posture, better oxygenation, you can stimulate tissue. The heart and lungs are literally vibrating. ... Singing can potentially target your thalamus and your pituitary gland. You can make it shake. [sings high note] I get a little dizzy and disoriented when that happens. You can target resonance when you're singing.

When a neurotransmitter like dopamine is shot out of a synaptic terminal in the brain, that takes movement, and sound creates movement. It literally shakes that terminal. It's like shaking apples out of a tree.

**Epoch Times:** When I watched the [video](#) describing the protocol you used in your study, I noticed your whole body was engaged in making the sound, not just your mouth. There is a strong emphasis on posture and breath in your vocal technique.

**Maguire:** It's a set of principles that I call BOAST. B is for buoyancy, the universe is expanding we're part of that. We don't have to succumb to gravity. We ride the gravity of this planet. That lifts the ribs off the lungs so we can take in a healthier breath. O is for oxygenation. The brain is very oxygen greedy. If you study Alzheimer's, anxiety, and brain death, you're looking at hypoxia [oxygen deficiency], so staying oxygenated is really important. A is for Activation: looking at the music, turning the pages, smiling at your friends, lifting you cheek bones. S is Stimulus. There's a lot of stimulation in the sound you're making. This enables the T for Transformation.

By the way, the point of those videos is not to entertain. That was not a performance. It is for scientists to reproduce what I did. This is exactly what I did. That's how I got improved cognition. This is how I worked with them. If I were performing those pieces it would be a whole different game, because I would have a whole different audience.

**Epoch Times:** In the past few years we've seen studies which suggest that music can treat a number of different issues. But very few of these studies (2 percent) actually say what music they used. Your study is unique in that you were very specific about the music you chose. Why is this important?

**Ms. Maguire:** Well, it needs to be reproducible for one thing. If you say music works to help lower anxiety and you don't tell anybody what music to use, then you can't go out there and do it yourself and say they were right or they were wrong.

So it was important for other researchers, but also for caregivers, and the patients themselves.

There has to be some method to it. You can't just have patients choosing their own stuff. If you talk about nutrition like other researchers talk about music in these studies they would say, "We let them select their own food, or their caregivers told us what food they liked in the past, or what relaxed them." But nobody is a nutritionist.

I like Doritos, potato chips, and onion dip. I love it, but that's not what I need. That's not where I want to go. That's not where my doctor wants me to go.

I'm a music nutritionist. So if a patient likes the musical equivalent of Doritos, I'll give them carrots and spicy hummus.

**Epoch Times:** As a musical nutritionist, what qualities do you look for when you select a piece of music for a patient?

**Ms. Maguire:** First of all, there are different aspects of what I do and how it's applied. The prescription part is really schedule based and preferred outcome based, while the working application of actually singing or playing an instrument is a tremendous sensory experience.

My work in prescription music programming targets physiology. First of all, heart rate. If your goal is to relax the listener, the beat has to be slower than their heart rate and the heart will respond to that immediately.

Our body and brain have a relationship with our own heart rate before birth. When you introduce sustained organized resonance, as in music with a meter and rhythm and beat, it talks to the heartrate at a subconscious level. You're going to get mood, cognitive and behavioral changes, because the heart rate is going to try to match it.



You want to go with what works, so in schizophrenia and autism you want to give them classical guitar, soft, warm violin, high cello, warm clarinet. (Frinck51/Wikimedia Commons)

Very basically, you want to raise or lower the heart rate, and when you do that you're raising or lowering blood pressure, you're influencing cortisol and immunoglobulin response. There are also hormones and neurotransmitters that you can play with as well. If you want the patient to move, you want percussion—a strong rhythm.

I look at a person's schedule of activities, so if you got a male Alzheimer's patient who gets aggressive during bath time at 3:00 pm, then five minutes before 3:00 pm you want to play something like Debussy's '[Clair De Lune](#).' It's very relaxing. It's almost like going to sleep. It disengages that aggression. You're lowering the heart rate, lowering the blood pressure, and relaxing the physiology. So by 3:00 it's almost impossible for that patient to get aggressive, because you subvert those physiological parameters. That's one example.

When you look at schizophrenia and autism, they both have a dysfunctional motor system, cerebellum (that small brain in the back that coordinates movement)—40 to 50 percent of it doesn't work in much of these cohorts. So you don't want to give them rhythm. They can't process rhythm like most people can.

In Alzheimer's, their motor cortex is working just fine. So you can go in with lots of rhythm. The instrument I prefer to use with Alzheimer's is the piano, because it's really a rhythmic, percussive instrument. It also has a very wide range.

You want to go with what works, so in schizophrenia and autism you want to give them classical guitar, soft, warm violin, high cello, warm clarinet. You want to influence executive arenas that are working just fine. The guitar provides a much gentler, non-percussive rhythmic pulse, while the solo instruments often feature long, engaging melodies of a single mood or cognitive focus. This keeps patients mentally focused, yet less physically activated.

I design music interventions for researchers. I'm working on one now for autistic children with a researcher connected to the Kennedy Krieger institute at Johns Hopkins. These kids have a hard time getting to sleep at night. Their minds are really, really busy. So I use songs where I take away the rhythm and give them singing with lots of air. My example is 'When you Wish Upon a Star,' but there's a [handful of them](#).

[sings in soft, breathy voice]: When you wish upon a star, makes no difference who you are...

You're blowing air face to face with this child, and in 10 seconds their eyelids droop and in 60 seconds their body has collapsed. So you're feeding into this physiology. Also the tonal center of the song is very evasive. It takes like 40 notes to get to home [the root note]. They're following that, and their brain is not developed enough to stop the physiological response. They're helpless.

**Epoch Times:** Tell me about your plans for prescription iPods. What goes into making a therapeutic playlist?

**Ms. Maguire:** It's a clinical interface model, and I'm looking for funding from NIH. It's a huge endeavor. I'm designing interventions using the principles from it.

Basically, it takes all the demographics from an individual: age; gender; BMI; weight; psychological profile; introvert/extrovert; unique psychiatric profile; pharmaceutical drugs and side effects from those; and your music preferences (if you hate opera I'm not going to give you opera for another year or so). There is also cultural background. I'm Irish, so a good Celtic song comes on and I'll want to listen to that. Don't underestimate genetic influences on music preferences. We're not that far removed from our countries of origin.

I also look at schedule of activities, and schedule of issues. So if you have a hard time waking up in the morning, there is a piece of music that will escort you happily and cheerfully and functionally out of your bed and into the day with a happy heart, and a bright mind. All sorts of music will do that.

Music can spur you toward your healthy, desired outcome. There's capability of so much transformation through music.

I also look at your clinical best case diagnosis. Do you need to lose 10 pounds and exercise at 3:00 every day? Then the music will start at ten to 3:00. It will help you put your shoes on, and get out the door with a kick in your step. What do you want to do with your life? Do you want to garden? Do you want to start cooking? Do you want to do mosaics? There is music for each of those. Mahler, for example, is full of nature sounds. You hear a Mahler piece and you think, "I want to go to the garden

shop.” Music can spur you toward your healthy, desired outcome. There’s capability of so much transformation through music.

Every 10 to 14 days you get a new playlist which builds upon the pre-established blends from music you never heard before.

**Epoch Times:** If music has the power to transform us for the better, are there certain songs that can harm us or keep us stuck?

**Ms. Maguire:** Research finds that depressed people choose depressing music. They choose lower keys, lower tempi, and morbid, drooping songs. Why? Because it matches the way they feel. It matches their low heart rate and their droopy physiology. So when they listen to that music, they’re not alone anymore. That music keeps them company.

For post-traumatic stress disorder veterans, they love heavy metal, hard metal, because that’s what they’re living. They have this grinding chaos in their head.

But music has the power to transform, change key, raise the tempo, and leave them on a sunny hillside for two minutes and they don’t even realize it’s happened. They just realize they feel different at the end of that song.

So therapeutically, you want to get in through the problem. You want to get in through what’s working in the brain, and then tap into dysfunctional areas through that platform.

**Epoch Times:** So if composers and performers have a good understanding of music and neuroscience they can make music to elicit a very specific physiological response.

**Ms. Maguire:** Absolutely. I want to get into a position where I can train a whole field of performers. Music therapists work behind closed doors and they’re usually not professionally trained as performers. I’m trying to develop a field of medical musicians who know exactly what they’re doing and can go in like a precision scalpel and shift and change and transform.

From my experience I would say only about three percent of music has therapeutic value. Like Beethoven—he writes great stuff, but he’s all over the map. But he’ll have 20 measures in one of his symphonies that is just sublime. It’s so powerfully beautiful, relaxing, and idyllic. It’s like meditation in a bottle. So you want to take those 20 measures and give them to a good composer and say, “I need 12 minutes of this.”

Or the [‘Flower Duet’](#) from Lakmé by Delibes—it’s a wonderful duet and it’s gorgeous. I want to give it to a composer and say, “Spin this out for 8 and 1/2 minutes. Take what’s here and make it longer. Let’s turn it into a therapeutic application.”

**Epoch Times:** What has changed in the past few decades that we’re shifting our thinking of music as merely entertainment to a valid form of therapy?

**Ms. Maguire:** The top researchers are very interested in music because it’s the only thing that brings Alzheimer’s patients back. Drugs do not work, and they have a lot of side effects. But music has relatively zero side effects. It works, it stops the problem, it helps the behavior, and it helps the caregiver.

In Alzheimer’s, music is said to improve overall quality of their lives, provides social interaction with peers and caregivers, provides a sense of self (they remember circumstances of many songs they remember) and sense of empowerment (in that they can control their memory of songs). It improves activity rate and simply provides pleasure for them.

Music also reduces pain and pain is a sensory thing. We’re feeling it. Music is also very sensory. The insula [a region of the brain deep inside the cerebral cortex] is very engaged when you’re listening to emotional music. It hijacks the system that pain grinds into.

That’s a very specific reason why this works, and why you don’t just play anything. For pain you want music that is emotional and very sensuous—long lines, rich, robust orchestration. Again, you want to keep in mind baseline heart rate of the patient and any other issues.

It also depends on where the pain is too. Music that is going to relax your hands is different than music that is going to take the pain away from your feet. For feet you want music that has movement in it. Whereas if you're trying to take away hand pain, you want to play something soft and lush on the piano. The brain has all sorts of mirror neurons. So when you see someone pick something up, your motor cortex is doing that too. When you hear piano playing, subconsciously, your fingers are also moving in premotor areas.

There's quite a few studies on Mozart's K. 448. Just five minutes of this piano concerto stops epilepsy significantly, even in comatose patients.

There's quite a few studies on Mozart's' [K. 448](#). Just five minutes of this piano concerto stops epilepsy significantly, even in comatose patients.

So what I did this summer is dig into this thing. I printed out the music. It's a concerto for two pianos, four hands. And it hijacks the system immediately. It starts out with a huge spread that outlines a D major chord.

In K. 448, fast progressive rhythmic elements (all within the first 16 measures) quickly compound and go from half notes, into to quarter notes, trills, triplets, dotted rhythms, syncopations, eighth and 16<sup>th</sup> notes—all of which serve to engage, pair, and reshift neural networks through physiological response. The clinical implication is that epileptic pathways may progressively reform through precision music and transform to normal function.

Thematic elements in K. 448 begin and build rapidly, using many of the most compelling, powerful musical elements and in very short order. These include upward arpeggiated scales, downward cascading roulades, fast octave oscillations, and sustained ground bass.

### Read More

- [Musician and Orchestra Founder Chi-chi Nwanoku: Classical Music Nourishes Us, Body and Soul](#)
- [Could Music Beat Drugs for Anxiety and Mood?](#)

**Epoch Times:** Does the key a song is in also have an influence on physiology?

**Maguire:** It really does. It has to do with what area of tissue it targets. It has a frequency. You can play the song 'If I Had a Million Dollars' in the original key and then knock it down a step and the whole mood changes.

The happy stuff is written in the ascending circle of fifths: C,G, and D. And the sadder, nostalgic, sentimental, comforting music is written in the descending circle of fifths: F, B flat, E flat. I've played hundreds of funerals to pay my way through schools. That music uses all these dark keys. You rarely find happy pieces written in D flat. You will find nostalgia, pastoral, and melancholy instead.

*Answers have been edited for clarity and brevity.*

Contact: [imaguire@jhsph.edu](mailto:imaguire@jhsph.edu) or [Maguire.usa@gmail.com](mailto:Maguire.usa@gmail.com)

---

Article printed from The Epoch Times: <http://www.theepochtimes.com>

URL to article: <http://www.theepochtimes.com/n3/1905111-opera-singer-turned-neuroscientist-uses-music-as-medicine-for-dementia-autism-and-more/>

Click [here](#) to print.