**Tapping music’s power to heal the brain**

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Medieval churches were so convinced of music’s mind-altering powers that they forbade dissonant chords such as the tritone, the “Devil in music,” believed to incite demonic acts. Although their fears were unfounded, the priests were right about one thing: Music really can rewire the brain.

Neuroscientists are studying music as a medical intervention for patients with conditions such as stroke, speech loss and Parkinson’s disease.

The interventions are similar to those used in music therapy, a centuries-old approach to treating mood disorders and other conditions. The difference is that academic researchers, many of them based in Canada, are investigating music’s healing potential using brain imaging and other high-tech tools.

Unlike drug therapies or surgical brain implants, musical interventions are safe, enjoyable and noninvasive, notes Jessica Grahn, a neuroscientist at the University of Western Ontario. “There is essentially no downside.”

Dr. Grahn is heading a new lab to study how the brain processes music and whether specific characteristics of music can help patients with movement disorders improve their gait.

Researchers will use functional MRI to see which motor areas of the brain are activated in listening to music. The lab, due to open by fall, will include a mat equipped with sensors in a walkway. Using computer software to analyze data, Dr. Grahn’s team will assess whether listening to pulsations affects things like the symmetry between the stride, “which is really important for balance in Parkinson’s patients,” she says.

Meanwhile, in Toronto, neuroscientist Takako Fujioka is studying musical interventions in stroke patients at Baycrest’s Rotman Research Institute. Dr. Fujioka has just secured funding to conduct a three-year study involving 60 stroke patients with movement problems in one hand – one of the most lingering disabilities among stroke survivors.

Researchers will randomly select patients to receive physiotherapy or participate in activities such as hitting a drum to a beat using a stick, palm or fist. Patients will wear helmets equipped with sensors used for magnetoencephalography (MEG), a technique for mapping brain activity.

In an earlier study, Dr. Fujioka found that listening to the beat of a metronome and tapping a finger to a metronome used the same parts of the brain. Dr. Fujioka hypothesizes that the sense of timing embedded in music may engage auditory memory and motor control in ways that conventional therapies do not. “Our interest is to see how the brain rewires after a stroke if you do the exercises in such a multimodal way,” she explains.

In the near future, Dr. Fujioka and colleagues throughout Ontario may combine their efforts at the University of Toronto’s new Music and Health Research Collaboratory. Operating within the faculty of music building, the initiative will bring together experts in medicine, neuroscience and psychology to decode how musical interventions work and explore the limits of their potential.

Similar work is under way at other facilities including the International Laboratory for Brain, Music and Sound Research, jointly affiliated with the University of Montreal and McGill University, and Beth Israel Medical Center’s Louis Armstrong Center for Music and Medicine in New York.

The challenge of studying musical interventions is that it’s tough to design a double-blind study comparing them with conventional therapies, specialists say. Although thousands of studies have been done on music therapy, the sample sizes have been small and the variables difficult to control.

Music is complex and stimulates the brain in all kinds of ways, says Amy Clements-Cortes, a professor of music therapy at the University of Windsor. For example, her research has found that listening to live versus taped versions of the same music makes a difference in patients’ pain perception. “Live music was significantly more effective,” says Dr. Clements-Cortes, who has also studied the use of music in palliative care and in seniors with dementia.

Musical interventions work better for some patients than others, notes Michael De Georgia, a neuroscientist and director of the Center for Music and Medicine at University Hospitals Case Medical Center in Cleveland, Ohio.

He points out that some patients with speech loss after a stroke improve with melodic intonation therapy – a technique shown in television footage of congresswoman Gabrielle Giffords’s rehabilitation after she was shot in the head last January. Singing familiar songs, such as *Happy Birthday*, can stimulate neurons important for melody as well as language, which are linked in the brain, Dr. De Georgia explains.

Some patients who are completely mute “can belt out a song right then and there,” whereas others take a long time to recover language functions even with extensive music therapy, he says.

Many of music’s therapeutic benefits remain untapped, he adds. Dr. De Georgia suggests that music may offer an alternative to the powerful anesthetics and stimulant drugs used in intensive care units.

Studies have already shown that playing Mozart sonatas in the ICU helps lower stress hormones, he says. The question is whether doctors could use music to perk up their patients instead of relying on potent medications. “It may be healthier and safer to listen to Iron Maiden or AC/DC or heavy metal than it is to be on a norepinephrine drip,” he says.

And the only real risk is of violating patients’ musical tastes.

**Music on the brain**

Music’s profound effect on the brain is well known to fans of books such as Oliver Sacks’s *Musicophilia*, Daniel J. Levitin’s *This is Your Brain on Music*, and more recently, *Your Playlist Can Change Your Life*, by authors Galina Mindlin, Don DuRousseau and Joseph Cardillo.

Brain-imaging studies have shown that music is processed in large-scale networks throughout both hemispheres, activating areas responsible for language, listening, motor skills, emotion, memory and creativity, among others.

Music therapy activates multiple pathways by stimulating parts of the brain that process pitch, rhythm, lyrics and melody. In theory, music can also fire up neurons in damaged areas responsible for speech and motor functions, as well as in parts of the brain not normally used for those tasks.