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The 128-electrode cap, which registers the effect of different sounds on the brain.

JASON JONES PHOTO

Look down any bus, subway car or sidewalk and you'll see many a pair of slim wires dangling from earlobes, the telltale signs of our obsession with music.

We pipe it directly to our eardrums. We surround ourselves with it at home, in the car and while shopping.

We instinctively know our favourite song or the perfect piece to fit or change a mood. We pump up volume and tempo to get our adrenaline flowing. We look for slow melodies and easy harmonies to unwind after a stressful day.

Could it be that this is the ultimate in psychological self-medication?

Although most of us don't know why we choose to listen to a particular kind of music at any given time, we know it affects how we feel. And we know how and when to administer the right dose.

Filmmakers have worked the art of emotional manipulation through music from the days when the soundtrack came from a live piano or organ player in the theatre.

Consumer marketers know how to push these buttons as well. Next time you walk through Ikea, stop to listen how the ambient music is different in each department.

But this is nothing new.

Three hundred years ago, William Congreve wrote the now-immortal words in his play *The Mourning Bride*: "Music hath charms to soothe the savage breast/To soften rocks, or bend a knotted oak."

Two thousand years before that, Socrates sat down with his pupils Glaucon and Adeimantus to discuss how to create a good and noble human being. As recorded in Plato's *Republic*, Socrates stated that, "rhythm and harmony find their way to the inmost soul and take strongest hold upon it, bringing with them and imparting grace..."

Yet for all of history (and iPod playlists), the science of understanding the link between music and the brain is only in its infancy.

Thanks to electronic and magnetic brain-imaging equipment and sophisticated computer data analysis, a cutting edge of scientists is accumulating data that show precisely what is going on between the ear buds and the smile on our lips.

Last year, Montreal cognitive psychologist Daniel Levitin published *This Is Your Brain on Music*, a lively book based on his research at the Laboratory for Music Perception, Cognition and Expertise at McGill University.

Last week saw the release of prominent American neurologist Oliver Sacks's latest opus, *Musicophilia*, a riveting compilation of his decades of work with people and music.

A former music producer and punk-rocker, Levitin indulged in such public scientific spectacles as attaching hundreds of electrodes to symphony orchestra conductor Keith Lockhart, five members of the orchestra, and a handful of audience members during a live performance last year.

Levitin's computer screen showed instant physical responses to changes in the music's tempo and pitch.

Sacks's approach is deeply personal, yet the accumulated weight of his experiences is even more compelling.

Somehow the issue remains abstract until someone places electrodes on your own head.

Deep inside a building on the Hamilton's McMaster University campus recently, I sat down in a soundproof studio while a research assistant placed a "cap" containing 128 electrodes on my head.

I sat facing a video monitor so that I could see the 128 lines of data being sent to a computer in the next room.

The slightest twitch of my head or the blink of an eye would send the steady lines into jagged paroxysms. "So try to stay as still as possible," I was instructed. Yeah, right.

I was about to hear sequences of two simple tones. In most instances, the second tone would be higher than the first. But then, without warning, would come a tone manipulated to sound like it was lower than the others.

If my brain worked like everyone else's, it would register the sound of something different as a sudden increase in activity. And, blinking aside, that's exactly what happened. As soon as the tonal pattern was broken, the jagged waves would appear once again on the video monitor.

THIS EXPERIMENT, and dozens like it, is being repeated several times a day in that room, mainly with infants and children, so that we can better learn how young brains develop.

The research is led by Dr. Laurel Trainor, the founding force of the McMaster Institute for Music and the Mind (MIMM).

Started in January 2006, it and the research institute at McGill University are Canada's contribution to unlocking the electro-chemical secrets of how our brains respond to music.

But the focus at MIMM is a bit different than in Montreal, as Trainor has included professors and researchers from other departments and faculties.

"This is an interdisciplinary effort," she says in her office, in which every flat surface testifies to the international conferences she has attended, or is about to visit, and to the reams of research coming out of MIMM and its counterparts.

"Because McMaster's music department is focused on education," says Trainor, "much of our research is aimed at helping improve how music is taught to children." She introduces Dr. Keith Kinder, director of the McMaster School of the Arts, who is keen on building on the institution's reputation in the music-teaching field.

In the course of a day, we also meet Dr. Ian Bruce at the Engineering faculty. As one of the world's experts on electronic signal processing, he is involved in trying to develop better hearing aids.

At the department of Mathematics, Dr. David Earn is honing the language used to compile, interpret and extrapolate research data.

McMaster School of the Arts professor David Gerry also has a part – both as teacher and student.

A professional flutist, Gerry is acknowledged as the world's leading flute teacher using the Suzuki-method (where students learn to play an instrument by imitation and repetition, in a group). His teaching travels regularly take him to Central and South America, where he realized that children from Latin cultures had a much more highly developed sense of rhythm than children in Ontario.

"It has to do with the more complex rhythms that are part of the music," says Gerry. Wanting to find ways to better teach rhythm here, the flute player looked into the research at MIMM and decided he wanted to be a part of it.

"There is so much we can learn," he says as he begins a year of post-graduate work with the institute. "I'm nervous about going back to school, but this is also very exciting."

As with Gerry, observation is at the roots of Oliver Sacks's insights. The son of a musician who still plays his father's vintage Bechstein grand piano, Sacks has always been curious about how our brains and music interact.

In *Musicophilia,* Sacks describes how his professional, neurological connection to music blossomed after he began working with immobile patients in a long-term-care hospital in the Bronx four decades ago:

"In 1966, there was no medication of any use to these patients – no medication, at least, for their frozenness, their parkinsonian motionlessness. And yet it was common knowledge among the nurses and staff that these patients could move on occasion, with an ease and grace that seemed to belie their parkinsonism – and that the most potent occasioner of such movement was, in fact, music."

In the course of 350-plus pages, Sacks shares the extraordinary stories of people whose personal worlds have been transformed by music –

from a non-musical football player who became obsessed with classical music after being struck by lightning, to explaining the nature of musical "brainworms," those nasty little songs that get stuck inside our heads.

Sacks leads us inside the brain to show how and why we combine tone, rhythm and shape into the entity we call music. Along the way, we see how the brain has an almost miraculous ability to adapt to injuries and disease.

The most touching of Sacks's stories is also the most powerful example of music as medicine.

In 1985, British musicologist Clive Wearing, then in his forties, came down with a severe brain infection that left him with a memory span of a few seconds, condemning him to live every moment of his life as if it was his first.

Sacks tells in powerful detail how doctors and Wearing's wife almost gave up hope of giving back Wearing a semblance of meaning to his existence. It took years, but, in the end, salvation lay in reintroducing Wearing to the piano, which he had once played so well.

"The rope that is let down from heaven for Clive comes not with recalling the past, as for Proust, but with performance – and it holds only as long as the performance lasts. Without performance, the thread is broken, and he is thrown back once again into the abyss."

In essence, the melodic line and rhythm carry with them an inevitable momentum that engages our mind in special ways.

"Listening to music is not a passive process but intensely active, involving a stream of inferences, hypotheses, expectations and anticipations," writes Sacks. It's a tonic at once simple and complex that can soothe the savage breast – or straighten a ravaged brain.

Although neither Sacks nor Levitin nor Trainor would ever stoop to such a blunt conclusion, it seems increasingly clear that we are, each in our own way, experts in musical self-medication.

A more elegant summary belongs to Sacks: "Music, uniquely among the arts, is both abstract and profoundly emotional. It has no power to represent anything particular or eternal, but it has a unique power to express inner states or feelings. Music can pierce the heart directly; it needs no mediation."