

"Music gives your body and brain a chance to reset"

We are finally starting to understand why music has the power to heal us, as neuroscientist

Daniel Levitin tells Linda Rodriguez-McRobbie

MOST of us already know that music can have a profound effect on mind and body. Consider the feeling of empowerment when you slip on some headphones and go for a run, the rush of nostalgia you get from hearing your favourite song from your childhood or the joy of singalongs in the car – music moves us, literally and figuratively. It can make us happy when we are sad, sad when we are happy, as well as make us dance, laugh and relax.

But what if it could do more than that – what if music had the power to actually heal us? In his new book *I Heard There Was a Secret Chord: Music as medicine*, neuroscientist Daniel Levitin explains why he believes it can.

The idea that music is medicine isn't new – there is evidence that shamans and healers in cultures across the world have used music, especially drumming, to treat people for thousands of years.

Only in recent decades, however, has science offered a rational basis for music as a mechanism for healing, demonstrating that it has a direct and measurable impact on our nervous system.

Advances in neuroimaging coupled with more rigorous experimentation drawing on music theory, cognitive psychology and physiology suggest that music can be useful in aiding everything from Parkinson's disease to Alzheimer's and depression.

Levitin spoke to *New Scientist* about these

health benefits, and how music might be added to our medical toolkit.

Linda Rodriguez-McRobbie: It seems intuitive that music can affect the body, but what has improved our recent understanding of its influence on our health?

Daniel Levitin: Historically, we have had little good evidence for music as medicine. We had a lot of stories. Now we have a lot more rigorous studies looking at the neurological processes underlying our response to music, looking at the overlap between music and non-musical activity in the brain, and clinical models testing the therapeutic effects of music.

We have also come to understand the importance of movement to cognition – we call that "embodied cognition". It's the idea that cognition is fundamentally shaped by the body's interaction with the physical world, rather than being solely a product of abstract mental processes.

So listening to music is a more full-bodied experience than just what happens in your ears?

That's exactly right. I did an event with Stewart Copeland from The Police, and he articulated it as "music is the only art form that makes you want to twitch and wiggle your body". Few people are standing in the Louvre looking at the *Mona Lisa* and wanting to dance to it. But music triggers activity between our ears and our brain's motor system. ➤

Meaning we can't help but move to music?

One thing I've seen in my own neuroimaging studies is that even when people in a scanner who are listening to music are explicitly instructed not to move, the parts of their brains that would be planning and coordinating movement are still active. We have mapped direct connections between the music perception areas of the brain and the motor planning and movement parts of the brain. It's not merely the rhythm of music that drives this, because metronomes don't have the same powerful effect on movement; it is something about the totality, the gestalt of music that causes this.

What do we know about how different kinds of music impact us?

At a really rudimentary level, music with a deep rhythm like James Brown – as opposed to, say, [18th-century composer] Domenico Scarlatti – is going to make you want to move. Listening to different styles of music elicits different strengths of activity in the auditory-movement circuits. For instance, one study showed that reggae evoked the highest activity in this area compared with folk, electronic and classical music.

But our tastes are very subjective. How it affects you depends on what the music means to you, whether or not you like it. So, when we talk about medicinal effects of music, it's not that Joseph Haydn is going to cure the common cold, Joni Mitchell is going to cure depression and [swing-era bandleader] Cab Calloway is going to cure Alzheimer's. It's got to be what it is that you like, because your emotional circuits seem to be involved in music's health effects.

Can you tell me more about these effects and the mechanism behind them?

There's not a single mechanism. If you have a bacterial infection, you take an antibiotic, but if you have arthritis, the antibiotic won't work. The mechanisms of action of particular drugs need to be directed at particular ailments. So, to expand the analogy, not all music makes you want to move and not all movement is curative or "healing".

But when music gets you dancing, it's aerobic and boosts the mood-stabilising hormone serotonin. Playing an instrument can help hand-eye coordination, which is neuroprotective because it encourages growth of new nerve pathways.

"Music can help
recontextualise
experiences"

Joni Mitchell's music
isn't going to heal
everyone – but it
might help some



So could music help with conditions that affect the brain, like Parkinson's?

When it comes to Parkinson's or other movement disorders, such as motor neuron disease, where there is progressive degeneration of nerve cells in the brain and spinal cord, music helps us synchronise our movements. It can also help us maintain a steady gait, which people with Parkinson's can otherwise find difficult to do.

We think this is because music with a strong rhythm helps populations of neurons fire in synchrony. It's not just the rhythm of the music that is responsible for this. We speculate that music is more effective at synchronising neuronal activity than a metronome because it is engaging and emotional and also has a social aspect to it. Numerous studies have shown how different features of music contribute to this synchronisation of brain responses, each is like a strand of a rope that works together to promote synchronisation.

I've heard that music can also help people who have lost the ability to speak after a stroke

Yes, you can use music to cure aphasia, loss of speech – that's a different mechanism entirely. Music circuits can be preserved in the face of damage to the speech centres, and so you can learn to sing what you want to say, and, eventually, the brain rewires itself so that you can say it without singing.



Playing instruments can help promote new connections between brain cells



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You mention in your book that music can even help people with Alzheimer's. How?

With Alzheimer's, it's something completely different again. Music seems to help you access old memories that you have lost touch with. Everything that has happened to you, every experience, is encoded in memory somewhere. Memories also encode the context surrounding an event. If there's a particular song that you heard and it was associated with a particular span of time – like that summer you turned 13 years old – the music becomes associated with all the other events of that time: your friends, the movies you saw, the books you read and so on.

Alzheimer's destroys areas of the hippocampus, which is where we believe memories are indexed, if not stored. We believe that music acts as a retrieval cue, which helps you access memories that are preserved but difficult to locate.

Does music also help with conditions like depression?

Yes, it can have a significant effect on reducing symptoms of depression. Music helps you recontextualise your experiences. As an example, we know that when people "pull out" a memory, the mood they are in can alter the original memory such that when it gets "put back" into storage, it can take on a different valence. In this way, calm music can help

to make a traumatic memory less powerful, and uplifting music can make a memory less fearful.

You have written that music also engages the brain's default mode network, allowing us to get into a trance-like state. How does that benefit us?

It's easier to understand it when you contrast that state with our regular mode of thinking, where we use "the executive attention network". This is where you are trying to focus on something and consciously guiding your thoughts. The default mode network is the opposite – you're not in control of your thoughts, it's like a daydream state. These two networks function like a seesaw, a teeter-totter, because one is active when the other isn't.

It takes an act of will, of deliberate intervention, for us to focus on something. That focusing comes with a biological, metabolic cost in the form of spent glucose, the brain's fuel. The default mode helps to replenish that glucose, in a similar way that sleep does.

We also think that some kind of physical healing happens while in the default mode. The brain typically repairs damaged cells while you are asleep. We think this is partly because acetylcholine and other chemicals, some of which are involved in the immune system, set up a kind of programme for cellular

housekeeping. We don't know for sure, but it seems as though this kind of housekeeping can happen when you're in the default mode, too.

Music engages your default mode network and therefore gives your body and brain a chance to reset.

We know that people have emotional connections to the music that is right for them, but can, say, listening to calming sounds like water make you feel better?

Sounds of nature that aren't threatening – like a river flowing rather than a hurricane – those tend to be calming. Music with a slow tempo and stepwise motion also tends to be calming. Most people wouldn't find distorted electric guitar music calming, but there are some people that will, there's always going to be individual differences. Why some songs are calming and others are not is an area of active research that we are working on.

That said, none of the playlists that are on the commercial services for relaxing music are chosen by scientists. They're just a bunch of people saying this relaxes me, so there's no science behind them. ■



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