

Music Can Literally Change Your Life, Few Genes at a Time



Music is an artistic expression of emotion through the play of harmony, melody, and rhythm. A vast selection of tunes and rhythms that are literal music to the ears serves as an ideal accompaniment to different human mood settings. More interestingly, music has been identified as a brain modulator by influencing how humans respond to stress, pain, and depression. The extension of music's contribution to brain function also covers aspects of cognitive ability, memory, and learning.

Bruce Springsteen, an iconic American singer, songwriter, and musician revealed that The Beatles' "*I Wanna Hold Your Hand*" was a song that caused a meteoric impact on his life.

"This was another song that changed the course of my life... [It] came on the radio in 1964 — that was going to change my life because I was going to successfully pick the guitar up and learn how to play," [he](#) disclosed.

Getting inspired to pluck the strings of a guitar is not the only way to have someone's life course redirected through music. It turns out that a group of researchers has identified how listening to music can regulate the expression of specific microRNA.

Music-Listening Regulates Gene Expression

Research conducted by a representative team of the Department of Medical Genetics, University of Helsinki addressed the biological link between music-listening and gene regulation. In their paper, they affirmed the intricate, yet sublime clash between the sensory and emotional processing pathways subdued on the brain during music-listening [1]. Specifically, they identified microRNA segments that respond to musical exposure via upregulation and downregulation.

The study employed the usage of microRNA samples from 43 volunteers (aged 18–73; mean 42.5); 37 of which were in the test group characterized as participants who listened to Wolfgang Amadeus Mozart's Violin Concerto No. 3 in G major, K.216 which lasts about 20 minutes, with

the other 7 being the control with no exposure to music starting from the day before the phlebotomy test. Blood samples were drawn before and immediately after listening to the Mozart concert. Participants were also phenotypically grouped according to their levels of music education and musical aptitude under the COMB score distributions.

By running the samples through TAM 2.0, a tool for MicroRNA set analysis, statistically significant data demonstrating the up-and down-regulation of several specific genes are observed. Data snippets disclosed upregulation of *hsa-miR-132-3p*, *hsa-miR-361-5p*, *hsa-miR-421*, *hsa-miR-23a-3p*, *hsa-miR-23b-3p*, *hsa-miR-25-3p* and downregulation of *hsa-miR-378a-3p* and *hsa-miR-16-2-3p* in the test group. To put into understandable context, some of the aforementioned microRNA are vital regulators of neuronal apoptosis, neurotoxicity, cell death, hormone-mediated signaling pathway, wound healing, and glucose metabolism.

A further meaningful finding on the impact of music on three upregulated microRNAs in the study (*hsa-miR-23a-3p*, *hsa-miR-23b-3p*, and *hsa-miR-25-3p*) revealed their association with a promoter of apoptotic mechanism, PTEN. The finding supports the neuroprotective quality of music-listening through a programmed cycle of neuronal apoptosis. Of the identified miRNAs, *mir-132* is recognized to be protective against dopaminergic neurons and responds immediately to neuronal stimulation.

Elder Population Should Get Grooving to Music



On a similar tangent as the study result, individuals with Alzheimer's and mild cognitive impairment exhibit lower expression levels of miR-132. Music-listening on the other offers upregulation of neuroprotective microRNAs and molecules associated with neurodegenerative diseases. In practice, music can act as an adjunct treatment for immediate and long-term behavioral and psychological symptoms of dementia. Numerous studies have reported the cognitive benefits of music in the aging population citing the improvements in memory, cognition, and processing speed [2].

“Usually in the late stages, Alzheimer’s patients are unresponsive,” [Kiminobu Sugaya](#), a neuroscientist at the University of Central Florida revealed. “But once you put in the headphones that play [their favorite] music, their eyes light up. They start moving and sometimes singing. The effect lasts maybe 10 minutes or so even after you turn off the music.”

Beyond studying how the brain processes the auditorium aspects of music, the study enforces the value of music towards improving quality of life. Across societies, music is associated with human behaviors from processions, rituals, healing, and love, and rightfully so. Music-listening can single-handedly regulate gene expression and no exaggeration can change someone's life, just as it did to Bruce Springsteen.

References

1. Preethy Sasidharan Nair, Pirre Raijas, Minna Ahvenainen, Anju K. Philips, Liisa Ukkola-Vuoti & Irma Järvelä (2021) Music-listening regulates human microRNA expression, *Epigenetics*, 16:5, 554-566, DOI: 10.1080/15592294.2020.1809853
2. Moreira, S. V., Justi, F., & Moreira, M. (2018). Can musical intervention improve memory in Alzheimer's patients? Evidence from a systematic review. *Dementia & neuropsychologia*, 12(2), 133–142. <https://doi.org/10.1590/1980-57642018dn12-020005>