



Enjoy the Beat: Music, Brain Health, and MS

Presented by:

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Co-Presented by:

Brittany Quiroz of “A Hot MS”

Yahaira Rivera:

Hello, everyone. Welcome to MSAA’s live webinar, “Enjoy the Beat.” During this hour presentation, guided by Dr. Augusto Miravalle and guest speaker Brittany Quiroz, “A Hot MS,” we will learn more about music, brain health, and the health benefits of music in the MS experience. Thank you for taking the time to join us tonight. My name is Yahaira Rivera and I'm the Director of Mission Delivery and Program Development for MSAA and your host. In case this is the first time you're joining one of our programs, I would like to share some information about MSAA and review some housekeeping items.

MSAA is a national nonprofit organization dedicated to improving lives today through vital services and support for the MS community. Our initiatives are designed to advance educational, wellness, and supportive resources. Our free programs and services include a national helpline, an equipment and cooling distribution program, educational programs, award winning publications, shared-management tools, peer-to-peer online forum, and more. For more information about our programs and services, please visit our website, mysaa.org. During tonight’s program you will have the opportunity to submit your questions by using the Q&A Chat box. As time permits, we will address some of those questions during the Q&A portion of tonight’s webinar. Also, please know that the program is being recorded and will be available as an on demand video on our MSAA’s Video Library within the next couple of weeks. Finally, at the end of the program, we ask that you please complete a brief survey. Your feedback is extremely important and helps us develop future content and programs. A link to the survey will also be included in the chat box.

And now a friendly reminder: This program is for educational and informational purposes only and does not constitute formal recommendations. Please speak with your doctor or healthcare provider team if you have specific questions or concerns.

And now I am happy and pleased to introduce our guest speakers for this evening. We are excited to have Doctor Augusto Miravalle. He’s the Chief of the MS and Neuroimmunology Division, as well as Associate Professor of Neurology at Rush University in Chicago. Doctor Miller Bailey is a board certified neurologist and MS specialist who has been involved in both clinical and science based research in the fields of multiple sclerosis and neuroimmunology.

He's a member of many professional societies and advisory boards, including MSAA's Hispanic LatinX Advisory Board, and Healthcare Advisory Council.

Also joining us tonight, Brittany Quiroz, known as "A Hot MS." She is an MS advocate, motivational speaker, recording artist and entrepreneur. After her MS diagnosis in 2019, Brittany Quiroz created A Hot MS to help change the perception of what disability looks like. She utilizes her ability to be transparent about her disease and her talents as a writer, speaker, artist, singer, songwriter, and content creator to advocate and bring love and acceptance to others living with multiple sclerosis. Having grown up as a singer and songwriter, Quiroz knew that music would always be a part of her life and is now a crucial part of her MS experience. Welcome Brittany and Dr. Miravalle. We're so happy that you're joining us tonight, and I will pass it now to Dr. Miravalle.

Dr. Augusto Miravalle:

Thank you, Yahaira. It's a true pleasure being here. And great also sharing the stage with Brittany. I cannot wait to be able to listen to your story and get inspired by that. And I just would like to thank MSAA for having this wonderful idea of including this very important topic, which has to do with music and brain health, one that is very rarely discussed and something that I think we all can relate, whether it's personally or professionally, about the importance and relevance of music in our lives. So I'd like to thank the MSAA on behalf of myself and everyone involved in this important field.

So without further ado, let's just start reviewing some of the science behind how music impacts brain health. And before doing that, I thought to start with a quote from Plato that said, "I would teach children music, physics and philosophy, but most importantly music, for the patterns in music and all the arts are the keys to learning." So he understood very early on that music is one of the most powerful influences to the brain, to allow the brain to learn. And brain health is something that is relatively new. We started talking about brain health I would say, probably a decade ago. And it took many years for the scientific community to come together. And we didn't have a definition of brain health. And then finally, we had a very recent publication by the American Academy of Neurology that gives us this sense that brain health is a continuous state of attaining and maintaining the optimal neurologic function of the brain that best supports one's physical, mental and social well-being for every stage of life. What I like about this definition is that it's not the brain health you ever graduate from, it's not an "on and off" state that you "lose it" or you "have it." This is a continuous state, something that everyday we have the opportunity to add points toward our brain health, or conversely, subtract points by the things that we choose to do in our life, the diet that we follow, the exercise, life interventions, and in the case of today's presentation, it will be music. And so I like this because it gives us hope that regardless of what you are in your journey, there's always something that you can do to continue to attain and maintain the ultimate function of the brain. Let's go to the next slide.

So there are some publications that came recently that actually start to link the use of music to brain health. Even though there's a robust amount of literature that discusses the benefits of music in the brain itself, but linking directly to brain health is very recent, and this was a survey done by AARP. And if you look at the numbers, it's really impressive that you can see that 70% of individuals who regularly attend a musical performance, rated their brain health as excellent, compared to 52% of individuals who didn't attend a musical performance. This is just attending a musical performance. The same is true with having exposure to music in your childhood, and 68% of individuals exposed to music as a child had an excellent ability to learn new things. And this isn't necessarily any formal training, but essentially being exposed to music on a regular basis as a kid, compared to 50% of those who were not regularly exposed to music. And then of

course, having an active music engagement in this survey was associated with higher rates of happiness and good cognitive function. Let's go to the next slide.

So what I would like to do today is give you some important anatomical correlations between music and brain health. What are the parts of the brain that get the most benefit from music? And of course I'm a neurologist, I have to go into the "nerdiness" of the brain and all these different pathways and functions of the brain, because I find it fascinating. But, actually, I also want to go more into the practical approach, also discussing the role of music therapy in neurological conditions. Let's go to the next slide.

So, the limbic system is a part of the brain that actually is very primitive, and it has many nuclei, including the thalamus, for example, that is pretty commonly involved in multiple sclerosis. The amygdala is a part of the brain that actually has to deal with emotional responses, to fear, for example. The hypothalamus. But most importantly, this part of the brain that we call the hippocampus, and the hippocampus is where we store memories. And so our memories are stored in that part of the brain. And it's critical to understand that anything that impacts the hippocampus will have a direct effect with our memories. And something that we didn't know until a few decades ago is that this part of the brain, we can continue to create new neurons, something we call neurogenesis. So even though we learned in med school that we are born with X number of neurons in the brain and we can't change that, that is no longer true. Parts of the brain, including the hippocampus, they can create new neurons, and that's how we learn. That's how we create new memories. And it is interesting to see that in music, as we'll review in a minute, has a profound direct effect on the hippocampus. Let's go to the next slide.

So, and this is just to show you that when you look at evolutionary, how the brain evolved from animals all the way to humans, as you probably know, the humans developed this very impressive cortex, the cortical brain, the rational brain, the brain that allows us to think, to speak, the language areas of the brain, to make rational decisions, for the most part. But, the primitive brain, the limbic brain, is very similar across different species, to the point that when you look at that limbic brain in animals, in dogs, in monkeys, it's very similar, structurally and functionally, to our limbic brain. And that explains how this emotional brain sometimes needs this constant feedback from the cortical, or rational brain, in order to sometimes suppress certain emotions. And that explains why, when we are babies, perhaps, we can't control emotions, and babies cry when they get angry. But then, as you get older and you develop a more cortical brain, you are able to suppress those limbic responses, and perhaps you get a little bit angry when you are hungry, or even cry. So that the brain is constantly evolving and this cortical brain and the limbic brain are constantly communicating with each other, trying to influence in a positive and, sometimes, in a negative way. Let's go to the next slide.

So, I thought to create this link between music and the brain by reminding us that there is this triad, these three elements that actually go together in music and brain function. One is the relationship between sound and motion, or movement, and also the relationship between sound and emotions. So, when the sound gets into our brain, goes through the ears and goes through the primary auditory cortex, and that primary auditory cortex, which, by the way, is right next to the hippocampus, where you store memories, it has a direct relationship on pathways to the frontal lobe, which is the lobe that we use to move. I think everyone knows this, when you listen to music and you inadvertently start tapping your foot, following the rhythm, that's exactly how this connection happens. You hear something and you feel the need to move or dance to music. And this is an important phenomenon because we can use this correlation to help patients with difficulties with ambulation, or their gait, to be able to walk better by using music. The other relationship that is important to remember is the relationship between sound and emotions. And

I guess everyone experiences that, that certain music makes us feel happy or certain music makes us feel sad. And that is also directly linked to the relationship between the primary auditory cortex and the limbic system that controls emotions. So let's go to the next slide.

So, throughout the presentation I'm going to dive a little bit deeper into these concepts, because I want to get to the bottom of how music affects our behavior in the long run. And it's kind of complex to understand, but hopefully I can walk you through the whole process. So these are different neighborhoods in the brain and how the different elements of music are going to affect these different parts of the brain. We spoke about the primary auditory cortex, everything that comes through the ear from an external stimulation is going to go there, first stop. But then we know that, for example, the rhythm, as you can see, will have a profound effect onto the frontal lobe. The emotions and pleasure that we get from music will go into the limbic system. But also cognition, which is that prefrontal cortex, the anterior part of the brain, has a direct correlation with music, and that explains how with music, sometimes, we get inspired or we start daydreaming, or we start thinking about certain things, or stories that our brain creates. And that's the relationship between music and this very frontal part of the brain or the prefrontal cortex. Let's go to the next slide.

So, just to clarify and bring this all up to speed. So, these are some of the elements of music: rhythm, we discussed before, that's the duration of sound. And there's a direct relationship between the rhythm that we hear and our ability or wanting to move. Melody, of course, is that coordination of sounds that creates a series of pitches that makes a tune. Harmony, that's what supports the melody with chords. And we have the dynamics, the forte, piano, pianissimo, and that's how loud or soft the music is. And then the timbre will be the different sound quality of the instrument. So all of these factors will be perceived in the brain in different locations and will have a different effect in the brain function.. Let's go to the next slide please.

So as discussed before, this coupling between what we hear and the movement that our brain wants to do is called the Auditory-Motor Coupling. And that follows a very basic principle called the Grounding Principle. And the Grounding Principle in music has to do with rhythm creates a framework. And if you think about, for example, tennis players, we just finished the French Open, and you see these amazing athletes, and how can they be so coordinated? Because they have lines around the space that creates this sense of a field, and they know that they have to keep the ball in certain areas because they see those lines. Well rhythm is equivalent to the lines in a tennis court. So rhythm creates this framework, and then the whole music builds around that framework. And out of all the elements of music, rhythm is perhaps the most impactful in our movement or our need to move. We can use that with another principle called entrainment, that is our need to synchronize with the rhythm that we hear. So naturally, if you hear a certain rhythm while you're moving, you're going to try to match that. And we can use that for an individual, for example, with Parkinson's disease, in which they have slow gait, and we can create music using sequentially faster rhythms to try to help them walk faster. Also, we can do that with individuals, let's say, with a stroke or with multiple sclerosis, that all of a sudden they have a weakness in one foot, or they have a foot-drop, and they have an asymmetric gait. So with certain rhythms, use of therapies, and physical therapies can help patients try to match the rhythm, and in that way bring that gait, or the balance of that gait, a little bit more rhythmic and more balanced. Let's go to the next slide.

So there are now multiple research studies that actively looked at the use of rhythm and music to improve, for example, fine motor control, something that lives in the back of our brain called the cerebellum. And this study looked at individuals and older adults, after one year of piano lessons, they had significant improvement not only in fine motor control but also cognition. And

another study, now nearly a decade ago, looked at patients with multiple sclerosis that were able to improve upward mobility and hand function, with the use of a musical instrument and a keyboard. Let's go to the next slide.

So there is another principle. So, we talked about entrainment, we talked about the grounding, which has to do mostly with rhythm, but now we're going to talk about the ISO principle. And the ISO principle has to do with this coupling between what we hear and our emotions. And the ISO principle says that if we are in a certain state of mind, let's say we've had a long day and we're tired, we are perhaps a little bit depressed and sad, we get to the car and the first thing that we hear is a very uplifting, fast tune, that music is not going to match where we are, and probably we are not going to enjoy that. Or similarly, we are very happy and we had a great day and a great time and somebody puts on very slow, sad music, that's not going to feel right to us. So that's called the ISO principle, which has to do with music has to match our state of mood. And we can use that for music therapy in different ways. Let's say, for example, a patient with multiple sclerosis has fatigue, which is a very common symptom in MS. And patients describe this lack of energy that I have difficulty actually getting out of a chair. And I know that I have these things that I want to accomplish. I don't have the energy. Well, you can use the ISO principle to create a playlist that is going to match where patients are, in that case, it's going to be a song that is slow and perhaps a little bit of a slow tempo and maybe sad music, and slowly introduce songs in the playlist that gradually are going to bring that tempo and the tone of the song to a faster pace. So hopefully we can bring that state of mood from more of a fatigue state to more of an energized state.

Conversely, you can use the ISO principle, let's say a patient has insomnia and anxiety, and it's difficult for that patient to fall asleep, because their constantly on that high. Well, we can use the ISO principle to create the opposite playlist. So basically, we would be starting with a song that is very fast and gradually bringing that tempo of the songs to a slower rate and hopefully helping that patient sleep. So, I'm going to pause here for a minute and bring Brittany to the conversation. So Brittany, how has been your experience with music so far?

Brittany Quiroz:

Oh my goodness. I don't know how to function in the world without being a musician. It's something that's always been in my life. I grew up around musicians. My mother is my music partner and co-writer for over 30 years, Kristen Spath, we are 828 is our band name. But no, I mean, I was always right underneath her piano as an infant, listening to her play. And my grandfather was a big band musician, so it was something that I was always subjected to. And it's so interesting to hear from a scientific and neurological standpoint the connection between neurology and music, because it is all tied together. And it's something that I think is widely underestimated in terms of the validity that there is such an immense emotional connection. And it's interesting being so young. You know, I started singing and performing when I was four years old, and I remember having really, really overwhelming emotions that I was probably emotionally too young to process. But my body knew that it was something important, and it was something big. So what you say in terms of the connection between sound and emotion, it's just... it's remarkable to me. It really is.

Dr. Augusto Miravalle:

Very good. Well, yeah, I agree with you. I think that, overall, the field of the science behind music and the brain is evolving very rapidly. Recently. But up until recently, we didn't understand exactly what was the the mechanisms behind how music can affect brain function. So, you know, we spoke so far about a few of these principles. I think the entrainment that we discussed before with relation to gait, the ISO principle, those are very popular ones that music

therapists use in their practice. But I wanted to bring to another area that is perhaps a bit more recent, if we go to the next slide, which has to do with how we can modulate emotions through the induction of these relationships between music and mood, the so-called ISO principle, in a clinical study. And this was published three, four years ago, and they introduced different types of songs to patients and individuals, a sad song and a happy song. And they were able to look at emotion responses to different songs that were pretty immediate, actually, the brain and the chemicals in the brain that actually control emotions have a direct relationship with the type of music that you hear. So we can actually now start to measure these responses more from a biological standpoint. Let's go to the next slide please.

So, let's dive a little bit deeper, and let's go to the next slide and try to talk about certain networks in the brain. And there is a principle that we talk a lot about in brain health called neuronal plasticity. And that's the principle that explains how the brain adapts and changes to internal or external stimulation. And this is a constant state of adaptation. And different things can actually make that process easier or more difficult for the brain. And MS patients, due to the nature of the disease, they're constantly relying on the neuronal plasticity to adapt to lesions, for example, to compensate for inflammation, to compensate for atrophy in the brain. So this is a mechanism that our MS patients rely on a lot in order to be able to function, despite having, for example, lesions in certain parts of the brain. So the relationship between music and neuroplasticity has been studied recently. And exposure to music, whether it is with formally trained musicians or just simply listening to music, has a direct effect on cognitive flexibility, being able to think, being able to adjust to different environments, attention, reward, motivation and emotional processing. Let's go to the next slide.

So this was a very recent study published a month ago, looking at individuals who sing in a choir. And they were able to measure these pathways in the brain that are directly linked to the way the brain processes information, and they actually saw that individuals who sing in a choir have significantly enhanced connectivity in all of these pathways that are critical for cognitive flexibility. So this gives you a sense of how much interest is being recently placed in understanding this relationship between musical exposure and brain connectivity and structural responses in the brain. Let's go to the next slide, please.

Brittany Quiroz:

I would assume, Dr. Miravalle, that this would also be a correlation of why it is often spoken about for infants to listen to even classical music in their infancy.

Dr. Augusto Miravalle:

Absolutely. And, Brittany, I'm glad you brought up classical music because we're going to talk about that, and which has to do with "does the type of music matter" or "music is one thing," "do we really need to listen to Mozart?" Put that question on hold, we're going to get there.

Brittany Quiroz:

Perfect, thank you.

Dr. Augusto Miravalle:

Of course we know that there are certain chemicals in the brain that are going to impact the way we feel. And we know that cortisol is that stress hormone. And then we feel that our brain is pretty much in that state of anxiety, that's probably a lot of cortisol that has been released. We know that music reduces chronic stress by lowering cortisol levels. And these studies have been done in the ICU, and intensive care units, and with individuals who were in combat. When they

were exposed to music, they had significant drops in blood pressure and heart rate. And that's just the intervention that differs between these individuals and other individuals without music. So we also know that music increases one other neurotransmitter chemical called dopamine. And dopamine is very commonly linked to Parkinson's disease. But it's also... we all have dopamine and we all benefit from dopamine. And it's also known as the motivation molecule in the brain. And music directly increases the levels of dopamine. And then the last one is this hormone called oxytocin, which is the "love hormone" and the one that actually increases when we eat chocolate, for example, or we receive a hug from someone. And, of course, music and enjoying music with others increases the levels of oxytocin. So let's go to the next slide.

So a lot of interest has been placed in music and depression, as you can imagine, because all these hormones play a role in depression. And there are now over 25 controlled trials that showed a positive effect between music therapy and the levels of anxiety and depression. Let's go to the next slide. And this is just to show you that not only did these studies look at the clinical effect on depression, but also we were able to measure, through this study called PET, the levels of certain chemicals in the brain, in this case, dopamine, in individuals who were exposed to music. So I'm going to ask you, Brittany, to maybe share some stories or thoughts about how you see perhaps in your journey with MS helped with mood or with the way you felt about certain situations.

Brittany Quiroz:

From a very, very young age. Doctor Miravalle, I have had just a really emotional connection with music. I mean, I was four and five years old. I was performing with my mother, who had a jazz quartet at the time, classically trained pianist. So I was always listening to classical music from infancy and up. And I remember, you know, while I was born in '88, so other kids were listening to, you know, Backstreet Boys and, of course I love them, who doesn't? I'm an 80s baby. But I really loved listening to the Celine Dions and the Whitney Houstons. And there was just something about that powerful... a power ballad, the way that it was composed and the way that it moves and... it just moved me.

And it's very interesting when you were talking about the hippocampus and memory. So standardized memory with me, in particular as an MS patient, fails me nine times out of ten. I cannot remember little things. I have a hard time even remembering what I did yesterday. As far as musical memory goes, and this is actually a question that I have for you too, is how on earth, as someone living with multiple sclerosis, do I have such a hard time remembering basic things like what I did yesterday or plans that I have a few days down the road, but I can remember a repertoire of over a thousand pieces of music for songs that I haven't even sung or heard in over 25 years. That to this day baffles me and it baffles my family and my husband as well. He's like, you don't remember what we did yesterday, but you've never heard this song, you haven't heard the song in over 25 years. What is the differentiating factor here with hippocampus as far as standardized memory and musical memory?

Dr. Augusto Miravalle:

Yeah, that's a great question. And let me know if this sounds better. I've been trying to adjust. But there is this something called muscle memory that we usually say, and that's not only in the hippocampus, but also in the back of our head called the cerebellum. And there's a video that is so inspirational, that is this patient with Alzheimer's disease that he can barely recognize his wife. But then he goes to the piano and he plays a song by memory. And so our memories are stored in different places, but any memory that includes movement or singing or playing of performing, is going to have that extra storage in the cerebellum that allows you to have this almost automated retrieval of this song or whatever we're trying to see.

Brittany Quiroz:

And, you know, my mother can contest to this as well. So her and I, we are recording and performing regularly, but she also performs as a solo pianist for Memory Care, through, I don't even... maybe it's 10 or 10 plus or so Alzheimer units. And she comments and tells me, you know, she'll go to a show and she'll do a performance, and these folks, they're not even sure where they are. But the second she starts playing, she'll hit a song and they're dancing, they're singing along. And then the second the song is over, it's almost like somebody pulls the shade down again.

Dr. Augusto Miravalle:

Exactly, exactly. And that's that powerful effectiveness that enhances the entire brain. It's like a workout to the brain, right? Our emotions, our movements, our chemicals, all of that goes into this heightened state of activity. So, thank you for sharing that. That speaks to, I think, all of our hearts in terms of how music impacts our entire journey. And so, let's go to another topic now, you can go to the next slide please, which I think you brought up before: Does the type of music matter? And so, even though, and you referred to that before, that Mozart Effect that was popular in the late 90s and early 2000s, that scientists were trying to understand if we exposed babies to classical music, are they going to get a benefit from that. And the answer is yes, they did. But the type of music, it turns out, that is not what is making a difference. It's actually whether you like or enjoy the music or you don't.

So, and this has to do with the pathway of the brain that I would like to discuss today. For some of you, maybe it's the first time that you're hearing about it. But it's a very important pathway, particularly in multiple sclerosis, something that we call the Default Mode Network. And this network, think of that network as this very large, interconnected nuclei in the deep part of the brain, that cells cannot restore that state of resting. Unlike most of the networks in the brain, this network is active when we are not doing something, when we are not focusing on something, or when we are not actively thinking about something. So this state of, you know, wondering or daydreaming or that state of, you know, don't be exposed, let's say you go for a walk and you sit on a bench and you start just thinking about things, you let your brain wander. That's when your Default Mode Network is the most active. Contrary to that, let's say that you're working, you're multi-tasking, you're trying to send this email, or you're answering the phone. Well, you're inactivating that Default Mode Network. Let's go to the next slide. And if you can continue to click because there are some animations here.

So these are examples of circumstances in which we activate the Default Mode Network. We started to talk about the daydreaming, but also when we start planning things. Let's say that you wake up in the morning with a cup of coffee and you start thinking about your day, or you start thinking about your future. We consolidate experiences and we make sense of memories when we are activating this Default Mode Network. Some people will relate to this - sometimes you go for a walk or a bike ride, and in that process you get inspired about things more than if you were trying to work in front of your computer. Some people find that joy when listening to music, and all of a sudden you may be thinking that your brain is inactive because you're not actively thinking. But that state of of daydreaming and wandering is actually helping consolidate the memories. It's helping to also build resilience, helping to build empathy. It also creates this sense of situational awareness. Sometimes this happens to all of us, when you go to a party and you enter the room, and even though we're not talking or doing much with friends, capturing all of this information from the outside and you start thinking, okay, do they really like me? Am I in the right place? Am I doing a good job here or not? So all that process is that Default Mode Network.

And guess what? When we listen to music, we are activating this network. And why is that important to know? Because this is great in normal circumstances. But sometimes that switch between activating the formal network, during daydreaming, and deactivating that to focus attention gets impaired. And that happens a lot in multiple sclerosis patients. And that's why sometimes patients say, well, I tried to go to work and I'm not focused. I can not get my head straight to actually do what I want to do. Or sometimes it's the opposite - I'm thinking too much about my future and then I start to worry about my future. Or when I start to have these recurring thoughts and worries about things, or situational awareness becomes unhealthy and then you start to become paranoid about certain social interactions. So those are symptoms that explains how sometimes it's difficult to deactivate the Default Mode Network. Let's go to the next slide.

So in MS, we know that, due to inflammation and due to all the things that MS causes in the brain, there might be an inadequate suspension of this network during that switch. And that's something that we can help to train to be able to deactivate the Default Mode Network. But any function in the brain, if you're using it too long, then problems occur. So we need to deactivate this network. One of the most effective ways is by using music. So by using music, what we do is we activate the network and then when we stop listening to music, it helps to switch that off again. So one way we can use music in a practical way is saying, well, if I feel my head is all over the place, I can't concentrate, I can just take a break, go to a quiet room, and listen to a song. And it turns out, actually, sad songs are the most effective at manipulating the Default Mode Network. So if you listen to a sad song that you like, it might seem a bit stranger, you're able to kind of like recalibrate that network. And when you stop listening to the music, you can take a break, and try to answer that email and go to work. So those are examples of how you can take this knowledge about the Default Mode Network and use music to recalibrate that and create that artificial switch between the "on" and the "off."

Brittany Quiroz:

So it is almost like a reset, isn't it?

Dr. Augusto Miravalle:

Exactly.

Brittany Quiroz:

It's so funny, when you said the sad song thing, I go, gosh, I remember being really, really stressed out about something and I'll just listen to, you know, a Celine Dion power ballad. It's really emotional, and by the end of it, I'm emotionally exhausted because the song was just fantastic and I'm just engulfed in it. But no, it really does feel like an emotional reset.

Dr. Augusto Miravalle:

That's exactly right. That's what we do. We reboot the system. We create that reset with this sad song, and that way we can say, well, this is a natural stop for the network. Let's move on with our lives. So let's go to the next slide, please.

And this is exactly what we were looking at. So they did this study looking at areas that are involved in the Default Mode Network. This is a functional MRI. And they looked at things like sad music, whether you like the music, if you dislike the music, or it's your favorite music. And long story short, if you listen to a sad song that is one of your favorite songs, that's the most

efficient way to activate and then deactivate this Default Mode Network. Create that reset that Brittany mentioned. Let's go to the next slide.

Other ways that we can do this is through meditation. So meditation is a very powerful way to control that activity, that Default Mode Network. And another click, please. And these are just animations. So mindfulness is another way to create that reset, as we mentioned before. Let's do another click. And so anxiety is one of the consequences of not being able to shut off the network. And if you continue to ruminate, if you continue to think about these fears that we have, these concerns, that's perhaps a manifestation that this network is not being properly controlled. And I think there is another publication that I have here, that was in individuals, that practice yoga. And yoga is another way to help recalibrate and reset this network. So mindfulness, sad music, music that you like, meditation, yoga. So how is that sounding to you, Brittany?

Brittany Quiroz:

Fabulous. Sounds like a vacation. And it's so funny too, because as a musician, you know, it's so easy to get kind of pigeonholed into one genre of music. But I think that's the beauty of it, is that when you really allow yourself to expand and appreciate, and have musical and artistic respect for multiple genres, you get to experience so much audibly. I listen to everything from gospel and Elvis to B.B. King and blues and then pop, you know, what's on the radio now. Well, some of what's on the radio now, that's a whole different webinar and tea time. But, you know, I think it's really, really good to expose yourself to a magnitude of genres and options because you never know what's going to tickle your brain, pardon the pun.

Dr. Augusto Miravalle:

Absolutely. And then you can play around with this principle. So something I've been doing recently is I listen to music when I'm driving. But then, you know, of course I'm activating my Default Mode Network. But then I want to concentrate on one instrument. So let's say I'm listening to an orchestra. So okay, I'm only going to listen to the violins and follow that. So what I do then is deactivate the network because...

Brittany Quiroz:

Right, you're isolating it.

Dr. Augusto Miravalle:

I'm paying attention to something. Right? So that way you can create this training in your own brain to say, well, I'm going to let it go or I'm going to shut it off. And that's a very practical way to use music to that benefit.

Brittany Quiroz:

Yeah. That's amazing that you say that too, because my mother says that all the time. She'll be able to completely isolate. I work as a vocalist, so I'm a classically trained vocalist. People get confused, they're like, wait a minute, the tattooed girl sings opera? Yes, everyone, she does. But I primarily, when I'm listening to a piece of music, I'm listening to the lyrics, I'm listening to the emotion behind it and the complexity of where it's going emotionally. She isolates the instrumentals, so she can do exactly what you're saying and isolate a specific horn part or a specific bassline. And I'm like, I just want to focus on the lyrics because I hear everything else and it's moving and, you know, you have that dynamic flow. but that's amazing how you can isolate a specific instrument line like that. It's just amazing. It's so cool.

Dr. Augusto Miravalle:

And what a beautiful workout? I mean, think about it. We are using our brain, we are creating dopamine, we are making our brains happier, and we're improving cognition. At the same time, we are recalibrating these networks of the brain just by using music. And that's just the wonderful message here, is that, you know, we are starting to learn more about the effect of music on the brain, but the more we learn is that there are no side effects. It's actually... unless you decide to dance and perhaps you fall, but that's on you, right? But it's not the music itself. There is nothing that the music can do wrong for our brains.

Brittany Quiroz:

Amen. Couldn't agree more.

Dr. Augusto Miravalle:

Let's go to the next slide please. I think we are getting to the end. So this has to do with "dose." Right? So, does music follow that solution of dose-response, so "the more the better." Well it turns out that it does. So these studies looked at, for example, the brain of musicians compared to healthier brains. And not surprisingly, musicians have bigger, better connected, more sensitive brains. Also the brains of musicians, particularly those who play keyboard or instruments that require simultaneous use of the hands, were more symmetrical from a functional standpoint. Musicians have also a larger corpus callosum, and that's a really important part of the brain for multiple sclerosis. The corpus callosum is that bridge that connects the right to the left, and in most MS cases there's an atrophy. So I mean, more development of that area could be beneficial. And as we talked before, musicians also have superior working memory, auditory skills, and cognitive flexibility. Even though we are not musicians, for the most part, but we listen to a lot of music. And these studies looked at, for example, more than 32 hours per week, you get similar benefits. So you don't have to be a musician in order to get the benefits. How do you feel about that, Brittany?

Brittany Quiroz:

I am starting to think that in order for my hippocampus to be activated during standardized memory, I should just turn everything into a song.

Dr. Augusto Miravalle:

It helps.

Brittany Quiroz:

Yeah, that's my vote.

Dr. Augusto Miravalle:

Hey, didn't we all learn the ABCs with a song?

Brittany Quiroz:

Exactly, exactly. It's so funny. Oh my gosh, I love it. But no, I really think that, I mean, when I'm thinking of having... I struggle with cognitive dysfunction horribly. And in the last year, I've noticed that it's gotten significantly worse, but it has not changed at all with my ability to either record, perform, or create music. I always joke and I say that I'm more awkward in life than I am on stage or in a recording studio. It's just very, very natural to me. This is weirder, believe it or not, but no, I think that we have to be able to be willing to be creatively explorative and not pigeonhole ourselves and be openly, I guess, vulnerable with learning new things about ourselves in a musical sense. Try different things. You know, maybe you have to have complete

silence. Maybe put on meditation music. When I'm really trying to focus on something, if there's lyrics in it, that's where my brain's going to go. So I have to listen to something that is completely instrumental, no lyrics, because it just sort of clouds everything.

Dr. Augusto Miravalle:

I love that, and I really like what you said about "Listen to Your Body." Right? So sometimes that applies to many things in brain health, whether it's exercise or diet. But there are certain things that we actually have to push ourselves, a little bit. And I will say with music, I will challenge all of us here to push ourselves to listen to more music, because it's easy to forget. Or maybe use music as background, but perhaps take ten minutes of the day, and just listen to the music, and just have that be the only activity that you have for those ten minutes and that's going to have a profound effect on how you feel about it.

Brittany Quiroz:

I couldn't agree more.

Dr. Augusto Miravalle:

Well, I believe we're coming to the end. There are a few more slides. So if you can go to the next one please. So, we kind of talked about this, so we can skip that one. And these are the highlights. So I think, you know, I hope that I walked you through some of the science behind how music affects both structural and functional changes in the brain. We talked about plasticity, networks, how we can actually modify the Default Mode Network in a way that helps to restore that balance. We also talked about how music affects some of the chemicals, particularly the motivational hormone called dopamine, the love hormone called oxytocin. We also discussed how music therapy could be used, understanding the ISO principle and the entrainment principle, or grounding, to help people do coupling between auditory and motor function or auditory and emotional responses. And then last but not least, as Brittany mentioned, we can use music for cognitive decline, for memory, to remember things through song, with singing, in other words. So I believe that's the last slide. So we can probably stop the presentation and maybe open the floor for questions or comments from the audience.

Brittany Quiroz:

Don't be shy. This is a fantastic, fantastic topic.

Yahaira Rivera:

Thank you so much, Dr. Miravalle and Brittany. Yes, we are beyond excited. It's been so interesting and we have enjoyed the learning so much. We have received so many questions and I know some of the topics you addressed, but it's just good to revisit, questions about the genre. Is there one that is better over the other, especially for MS patients?

Dr. Augusto Miravalle:

Yeah, as we discussed, no there are not. But what it does make a difference is whether you like it or not. So, and the studies that I reviewed, I didn't go into detail, but that activation of these networks in the brain is, in a sense, blunted, or even the opposite, sometimes inhibited, if you don't like the music. And so you have to listen to something you like. That doesn't mean it has to be always the same, as Brittany mentioned. You can explore different things. You can learn to like something different. But, if you get to that stage of enjoying music, that's when you get the most benefit.

Brittany Quiroz:

Right. From a listener and as well as a performer. So prior to my diagnosis, we were working with record labels that were very structured of, okay, this is marketable, this is going to sell. And after my diagnosis, we made a complete genre shift that now we only write, produce and perform music that is dedicated to the space of multiple sclerosis, chronic illness and disability. So you have to enjoy what you're doing in terms of entertaining and performing as well as enjoying what you're listening to. So try everything. Try everything.

Yahaira Rivera:

Thank you for that. So we have another question. Instrumental music versus music with lyrics. Is there a difference on the impact on the brain?

Dr. Augusto Miravalle:

So in terms of the impact, no, they both have a benefit, in terms of the parts of the brain that gets activated, of course, anything that includes verbal language is going to have an impact in those places of the brain that includes auditory perception and understanding language. So, there is a part of the brain called the Wernicke area, it is an area which is in the temporal lobe. And that's the part that we activate when we try to understand verbal inputs. So when someone talks to you or when someone is singing a song, you might be activating those areas. But in terms of the benefits, they are both equally beneficial.

Brittany Quiroz:

And it's funny too, even listening, though, sometimes even through instrumental, I can hear words. Not like, I'm crazy, I hear words, but there is some sort of subtextual undertone in even an instrumental piece where you can hear the alluded emotion that it wants you to feel without there actually being a lyric there. It's really cool.

Yahaira Rivera:

Thank you. Another question that came in is about music and MRI. Are my brain MRIs different depending on whether I was listening to music or no.

Dr. Augusto Miravalle:

That's a great question. So the studies that I shared with you used a particular sequence in an MRI called functional MRI, which is different to the structural MRIs that we do for clinical care. So in a sense, no, with the type of MRIs that we use, it doesn't matter whether you listen to music or not during the MRI. However, if you never use functional MRIs, you better believe, if someone is listening to music or moving, they're going to activate different parts of the brain.

Yahaira Rivera:

Such an interesting topic. Right? So other questions are about more related to the MS symptoms. For someone who has brain fog, cognitive issues, pain and fatigue, how can I apply music and how does it benefit my MS?

Dr. Augusto Miravalle:

Yeah, so those are very common symptoms. And so, one of the ways I look at fatigue is, you know, understanding is that a fatigue state, meaning you woke up and were already tired and there's nothing we can do to wake you up or to improve that level of energy, or is it circumstantial based on the things you did. So in the first case, I would say, well, you need to pay attention to your sleep, you need to pay attention to your patients, perhaps there's some underlying disorders like thyroid disorders. So many things can affect that fatigue state. In terms of fatigue ability, which is the other example, you know, I wake up fine and refreshed, but then I

can't get on my feet at all. And that's very common, particularly early in MS, I think music would be a fantastic way to help with that, because you can create those breaks. And I always say try to break before you are exhausted and you can work the breaks, in which you're going to stop working or doing whatever you're doing, and just spend ten minutes in a quiet room listening to music. And that will help you to reset, as we were talking before, and use music to kind of like refresh what you were doing and gives you that necessary break.

Yahaira Rivera:

Thank you Dr. Miravalle. Our next question is can you learn to play the piano after years of an MS diagnosis?

Dr. Augusto Miravalle:

That is a question that is dear to my heart, because I was a pianist before I became a physician, and I stopped playing for a long time. And then I'm slowly re-learning. The pandemic did that for me. And I have to be honest with you, it's not easy. But yes, you can. So the brain, as we were talking before, has that muscle memory that allows you to remember things that we learned early on in life. So I will challenge you to say yes. Try it again. Try to set up expectations in a way that they're enjoyable. Don't try to go from 0 to 100 in one day. But just use music as a therapy. Use, perhaps, music performance or piano performance as another form of physical activity.

Yahaira Rivera:

Thank you. We have another question and it says, I used to sing. Now it's hard to harmonize and write my music. Did MS take that away from me?

Dr. Augusto Miravalle:

Brittany, that question is for you.

Brittany Quiroz:

I have to say no, it did not. Doing what I do now, it is absolutely like driving someone else's car. And what I mean when I say that is, I mean, I've studied classical voice from the age of seven years old on, and with MS, it changes daily. Sometimes it changes hourly. We have to be able to listen to our body's cues, listen to what it's saying, listen to those limitations that it may be giving us. And say to ourselves, okay, well, how can I navigate around this or what can I change? Do I need to redesign my set list? Do I need to limit my time in the studio? It doesn't matter how much training or preparation you have, MS is going to do what MS wants to do, and we have to be able to really chameleonize ourselves around, you know, those hurdles and those obstacles. But from an artistic standpoint, oh my gosh, please do not stop. If it rings true in your heart and in your soul and it moves you, find a way to make it work. Do not say goodbye to the things that you love to do in life. Do not say goodbye to music. I don't plan on stopping. Ever. However, I need to figure it out. You know, recording sessions are very different now. I used to be able to do 6 to 8 hours. Now I go in maybe two hours, max. I make sure my engineer is ready to go, and it's a one take wonder sort of thing, because after two hours things can get a little hairy. But if you love it, please figure out a creative way of maintaining it. Don't say goodbye to it.

Dr. Augusto Miravalle:

That's beautiful.

Yahaira Rivera:

That was beautiful. Thank you so much, Brittany. Our next question is about walking. Would it help my gait or walk to listen to music at the tempo that allows me to walk at a certain pace with confidence?

Dr. Augusto Miravalle:

Absolutely. So I would say just to be safer, work with a physical therapist that will allow you to understand what is that safe tempo that relates to you. And that could be different to everyone. But absolutely. So, and, you know, we can all relate. Imagine going to the gym and working out in the gym with or without music or going for a walk. Right? So I think music creates the framework, as we were talking before, that grounding that creates that almost artificial sense of where we are supposed to be exercising and moving. So yes. And creating playlists is a very smart way to also go about physical activity, because you can start with a slow tempo, and as you get a little more comfortable walking and you get into a better place, you can also increase the tempo. So you can actually push yourself a little bit faster. And the same way when you're relaxing at the end of that workout, you can bring the tempo down in the playlist. So I will say to everyone here your homework will be start creating those playlists. Right? Look at songs that, you know, I have my morning drive when I go to work, when I listen to the songs in the morning, which is totally different to the songs that I listen to at the end of the day, when my brain is full of ideas and I'm tired and emotionally exhausted, so I can't listen to that soft music that I listen to in the morning. So, we can create those playlists, anticipating certain circumstances so you can help yourself.

Yahaira Rivera:

Thank you. And we have time for one last question. Does the hippocampus ever fill up? Do we ever hit a point when no additional memories can be saved?

Dr. Augusto Miravalle:

No. And that's the beauty of the brain. That's one of the biggest mysteries of the brain. The brain is ever changing and evolving. And we can always... It's never too late, it's never too early to modulate the brain functions with the things we choose to do in life. And now we know that there are 14 modifiable risk factors for dementia. And those are the things we can do, whether with exercise, education, hearing loss. So, all of those things have a profound effect on brain function. And that's through every stage of life.

Yahaira Rivera:

Do you both have any advice or last words before we wrap up our webinar? Any advice for the audience?

Brittany Quiroz:

Music is so, so important. Oh my gosh, why am I going to cry? It's that important. It's that important that tears are coming, apparently. No. I just think that there is a profound connection emotionally. Now we know, medically. Dr. Miravalle, thank you so, so much for making such profound connections between the neurological relationship between our brains and how it responds to music. I think it is something that is widely underestimated, extremely valuable. Don't think too much of it. You know, there are so many things out there that people can say, well, I need to do it right. It's like, just start. Just start somewhere. If you still love to sing and you feel like you can't, just start. Start somewhere. Start writing, start banging on a drum set, you know, create that playlist. Don't be afraid of diversity. You know, there is so much, I think, that music can give to us, and it can feed us and it can feed our souls.

Dr. Augusto Miravalle:

I don't think I can add anything. That was beautiful. I will just simply say enjoy and create that safe space and share it with others. I think there's a lot of benefit that we get with music. But even better, if you are with a group of people enjoying music. So I think music can bring so many benefits that go beyond just simply brain function.

Yahaira Rivera:

Thank you both, once again. This was such an engaging and wonderful presentation. It's amazing what music can do to our brain, our health, and our souls. This concludes our webinar. On behalf of MSAA, we want to thank Dr. Miravalle and Brittany for their unwavering support and dedication to the MS community. And to all of you at home, thank you for participating. This program was recorded and will be archived on our MSAA's website in the upcoming weeks. Please take a few minutes to complete the brief survey. Thank you everyone. Take care and have a wonderful evening. Bye bye.