Welcome to the Huberman Lab Podcast,
where we discuss science and science-based tools
for everyday life.
I'm Andrew Huberman and I'm a professor
in neurobiology and ophthalmology
at Stanford School of Medicine.
Today we are discussing music and your brain.
However, this episode could have just as easily
been entitled, music is your brain or your brain is music.
And that's because music, believe it or not,
is a neurological phenomenon.
Most of us think of music as something
that happens outside of us, the sounds we hear,
the lyrics we hear, their meaning,
how they anchor us to pieces of our history,
both emotional or social.
It turns out that when we listen to music,
it activates nearly every piece of our brain.
Moreover, when we listen to music,
it activates our brain in ways that our brain itself,
and indeed our body as well, help to create that music
at the level of so-called neural ensembles,
that is the firing of neurons.
In other words, when we listen to music,
our brain and our body become part of the instrument
that contributes to our perception of that music.
Today I'm going to make clear how all of that happens.
We will also discuss how music can be leveraged
towards shifting our brain states and our bodily states.
For instance, what sorts of music to listen to
in order to make ourselves happy?
Yes, studies have been done on that,
as well as how long to listen to music
in order to shift our mood or our overall bodily state,
including how to process feelings of sadness.
Many of you are probably familiar with particular songs
that anchor us to particular times in our history
or people in our history.
And there's an age-old question really
as to whether or not listening to sad music
can help us process our feelings of sadness
or whether or not they drive us further down the spiral
of sadness and despair.

And indeed, studies have explored this as well.
So today I will explain how music,
indeed how different types of music,
activate different neural circuits in your brain
to create different brain and bodily states,
how we can leverage music toward things
like emotional processing, shifting our emotions,
as well as to enhance learning and memory.
And we will also talk about the use of music
to enhance brain plasticity.
That is your brain's ability to change
in response to experience,
not just in response to that music,
but rather using music as a tool
to expand our capacity for neural plasticity,
giving us the ability to learn far more
in other contexts and areas of life.
I confess that in researching this episode,
I found myself continually delighted as to, first of all,
how impressive the science of the study of music
in the brain is.
And secondly, how fundamental music is to all of our lives.
And this is true whether or not you're somebody
who listens to music often
or you're somebody that really prefers silence.
Indeed, we will talk about whether or not
it's better to listen to music
or remain in silence when you perform certain kinds of work.
It turns out that there's a very clear answer to that.
If you want a little bit of a hint,
it is best to listen to music in between bouts of work
or during brief rest periods,
as opposed to listening to music while you work.
And for those of you that listen to music while you work
and thoroughly enjoy listening to music while you work,
we will also discuss what that means
about your brain in particular,
because it's likely that it got wired up that way
at a particular phase of development.
And each and all of you can learn today
how to best leverage music toward productivity,
but perhaps equally important,
how to leverage music for enrichment and enjoyment of life.

I'm pleased to announce
that we will be hosting three live events in Australia.
All three events will cover science and science-related tools
for mental health, physical health, and performance.
There will also be a live question and answer session.
The first live event will take place
on February 10th in Melbourne at the Plenary Theater.
The second live event will take place
on February 17th in Sydney at the Sydney Opera House.
And the third event will take place on February 23rd
in Brisbane at the Great Hall.
To access tickets to any of these events,
simply go to hubermanlab.com slash tour
and use the code Huberman.
I hope to see you there.
And last but certainly not least,
thank you for your interest in science.
Before we begin, I'd like to emphasize
that this podcast is separate
from my teaching and research roles at Stanford.
It is, however, part of my desire and effort
to bring zero cost to consumer information
about science and science-related tools
to the general public.
In keeping with that theme,
I'd like to thank the sponsors of today's podcast.
Our first sponsor is AteSleep.
AteSleep makes smart mattress covers
with cooling, heating, and sleep tracking capacity.
I've spoken many times before on this podcast
about the fact that sleep,
that is getting enough quality sleep each night,
is the foundation of mental health,
physical health, and performance.
One of the key things to getting a great night's sleep
is to make sure that your body temperature drops
by about one to three degrees at the beginning of the night.
Indeed, that is how your body falls
and stays deeply asleep.
As well, in order to wake up
in the morning feeling refreshed,
your bodily temperature needs to increase
by about one to three degrees.

AteSleep mattress covers make it extremely easy
to control the temperature of your sleeping environment,
allowing you to fall and stay deeply asleep
throughout the night and to wake up feeling refreshed.
I started sleeping on an AteSleep mattress cover
well over two years ago,
and it has completely transformed my sleep.
It's allowed me to fall asleep more quickly.
It's allowed me to sleep more deeply throughout the night.
And if I happen to wake up during the middle of the night,
something that's perfectly normal to do once or even twice,
I fall back asleep far more quickly
and I wake up feeling refreshed as a consequence.
My mood focus and alertness throughout the day
is greatly elevated as compared to prior to sleeping
on my AteSleep mattress cover.
If you'd like to try an AteSleep mattress cover,
you can go to AteSleep.com slash Huberman
to save $150 off their Pod 3 cover.
AteSleep currently ships in the USA, Canada, UK,
select countries in the EU and Australia.
Again, that's AteSleep.com slash Huberman.
Today's episode is also brought to us by Roka.
Roka makes eyeglasses and sunglasses
that are the absolute highest quality.
I've spent a lifetime working on the biology,
the visual system, and I can tell you
that your visual system has to contend
with an enormous number of challenges
in order for you to be able to see clearly
in different environments.
Roka understands the biology, the visual system,
and has designed their eyeglasses and sunglasses
so that you always see with crystal clarity.
Originally, their glasses were designed for performance,
that is for running and cycling and for sport,
and indeed, they can still be used for performance.
They won't slip off your face if you get sweaty,
they're extremely lightweight,
but I should mention that Roka eyeglasses and sunglasses
come in some of the aesthetics
more typically associated with performance glasses,
like those cyborg-style glasses,

but they also have a number of styles
that you would be perfectly comfortable
wearing out to dinner or to work.
I wear readers at night or when I drive,
and I wear sunglasses during the day
if I happen to be driving into bright light
or outside and it's just overwhelmingly bright.
I do not wear sunglasses when I do my morning sunlight viewing
to set my circadian rhythm,
and I suggest that you do the same.
If you'd like to try Roka eyeglasses or sunglasses,
you can go to rokaroka.com
and enter the code Huberman
to save 20% off your first order.
Again, that's rokaroka.com
and enter the code Huberman at checkout.
Okay, let's talk about music and your brain.
And to start off, I just wanna take a step back
and acknowledge something that is absolutely remarkable
about music, which is if you think about language,
I could describe to you a glass,
I could describe to you an apple,
I could describe to you a story,
I could describe to you a face,
I could describe to you any number of different things
and you could do the same for me.
Language is essentially infinite
in the number of things that it can explain
and the ways that it can explain it.
And yet, if you think about music,
music provided there are no lyrics in that music
can't explain how a glass is shaped.
It can't even tell you
that there's a glass present in the room or on a table.
It can't tell you what a face looks like.
It can't tell you what that person
who owns that face did or is doing.
So in some ways, you might think, wow,
music is fairly diminished
in terms of its qualitative depth compared to language.
And yet, if you take a step back
and think about what music can do,
it's astonishing and it actually overwhelms

what language can do.
What can music do?
Well, even in the absence of any lyrics,
any words put to music, music can describe an emotion.
In fact, music can describe numerous types of emotions
and they can do it with a lot of nuance.
So not just displaying for us happy or sad,
but rather different degrees of happiness,
different degrees of sadness.
Music can be used to convey a sense of longing,
a sense of nostalgia, a sense of delight,
a sense of awe and on and on.
So whereas music can't describe nouns very well,
it can beautifully describe emotions.
And not only can music describe emotions
with a tremendous degree of nuance,
music can evoke emotions with a tremendous degree of nuance.
Now this is spectacular.
And it's not only spectacular, it is important
because as we move through today's episode,
you'll soon come to realize that it's very likely,
and indeed we have a lot of scientific evidence
to support the fact,
that music evolved prior to spoken language.
Moreover, it's very likely
that singing evolved prior to spoken language
and that music, singing and dance together
evolved prior to language.
Making music as well as singing and dance,
but really just music even on its own
in the absence of any lyrics or any bodily movement
as the fundamental form of human communication.
Indeed, music can evoke empathy.
Again, we're talking about music
in the absence of any lyrics.
And when I say music can evoke empathy,
I'm not talking about the sort of empathy
where you look at somebody and nod and understand
so-called cognitive empathy,
which is important by the way in relational dynamics,
or emotional empathy,
where you're actually feeling
what the other person is feeling.

But of course, you never really know
what somebody else is feeling.
How could you?
You can only have a sense of what they might be feeling
and you have a sense of what you're feeling.
But let's be honest,
as one of our prior guests on the Huberman Lab podcast,
Dr. Carl Deiseroth, so aptly noted,
rarely do we ever understand how anyone else truly feels
because indeed rarely do we ever understand
how we ourselves truly feel.
And certainly with language,
it's very hard to explain our feelings with words
in a way that can convey the way that we feel
with the kind of nuance that represents our own reality.
Even in a state of extreme happiness or extreme sadness,
words fall short of explaining how we feel inside.
And yet, as I mentioned earlier,
music not only can describe emotions,
it can evoke emotions within us.
And in doing so, it can evoke emotions
that give us a sense of empathy
for the person playing the music
or simply for others in the world.
And music can do that so powerfully
because not only does music come in through our ears,
and we'll talk about the process of how sound
is converted into what we perceive as music in a little bit
because indeed it comes in through our ears
and we can hear that music, of course.
But the nerve cells, the neurons in your brain,
as well as the nerve cells in your body
can become activated by music in a way
that the firing of those neurons,
literally the frequency of those neural impulses
comes to match the frequency of the sounds
that you're hearing in your outside environment.
In other words, when you listen to music,
not only is that music coming into your body
through your sense organs, your hearing,
but your body itself is an instrument
playing that music from within.
So for instance, if you listen to a piece of music

that has a lightness to it, that evokes a sense in you
of the turning of the seasons from winter to spring.
It's something that's common in certain classical music
but other forms of music as well.
When you hear that music, indeed,
it's coming in through your ears,
but also the firing of the neurons in your brain and body,
responding to those particular frequencies of sound
is such that your body itself is an instrument
playing that sense of the turning of the seasons
from winter to spring within you,
which is why your body starts to feel lifted in some cases
or it starts to feel a lightness in some cases
and an entire set of emotions starts to be recruited
that at least for you,
resemble the turning of the seasons from winter to spring.
Now that may sound rather complex,
but we're going to break that process down
into its component parts.
But what I essentially just said
is that when you listen to music,
not only are you hearing that music,
but your body, that is your neurons
and indeed your hormones as well,
things like oxytocin and some other hormones
in your brain and body that we'll discuss,
are contributing to a symphony of emotion
from within your body and brain.
Okay, so while music can't explain objects,
it can't describe them,
it can explain in a very nuanced ways emotions
and it can evoke emotions within us.
Now, if that's not amazing enough,
music can not only describe and evoke emotions,
it can also imply intent.
Think for instance, about drumming
that you would hear off in the distance
and we're not talking about,
we're talking drumming of this sort.
Doom, doom, doom.
And perhaps the cadence of that drumming changes
such that as it's approaching,
it gets more and more frequent.

Doom, doom, doom.
What is the intent being implied?
Well, we know from numerous studies
and you know from numerous movies that you've seen
and heard that that sort of low frequency drumming
of increasing cadence as it approaches
is implying the intent of aggression or war
or at least is implying that something serious
is going to happen.
Now, contrast that with a different frequency of sound
played at a higher cadence.
Da-da-da-da-da-da-da-da-da-da-da-da-da-da-da-da.
Now, the second set of tones,
da-da-da-da-da-da-da-da-da-da-da-da
are far less clear in terms of what they mean,
what their intent is,
but if we contrast them with,
let's just call them what they're typically called,
the war drums or the drums that convey a sense
of aggressive intent.
Doom, doom, doom.
What we create then is a juxtaposition
of two different emotional states in you perhaps,
or maybe you don't respond to those
with any robust emotional shift,
but we are conveying two separate
or distinct sets of intent.
Now, of course, spoken language can convey intent.
I could say, for instance, you know, I'm going to help you.
How can I help you today?
Or I could say, I'm gonna hurt you, right?
Of course, with spoken language, you could do that
and you could change the intonation of that language,
you could change the frequency.
So if I were to say, I'm going to hurt you,
it's very different than if I say, I'm gonna hurt you, okay?
Or if I put it as a question, I'm gonna hurt you, okay?
So with language, of course,
there's also the opportunity for a lot of nuance
depending on where the inflections,
where the accents are on a particular phrase,
even a particular word.
But with music, as you recall,

when we convey a sense of intent,
we are also conveying that sense of intent
through the body of the listener,
not just bringing it in through their ears.
And so when we do that, what we do is we start to recruit
a huge number of neural circuits that are involved
not just in understanding or a sense of empathy
for an emotion, but rather that can recruit movement
or what we call premotor circuits in the body.
Premotor circuits are the neurons that start to fire
before a particular pattern of action is generated.
And so when we hear music that conveys emotion,
that evokes emotion, and especially when we hear music
that conveys a sense of intent from the outside,
we too start to feel as if we need to move
or respond to that music in a particular way.
Now, what I just described to you
is not something that's learned.
In fact, it is innate.
How do we know that?
Well, there are some beautiful studies
that have explored how babies respond to music.
Indeed, how babies respond to specific types of music,
specific frequencies of sound,
spacing between particular notes, and on and on.
It's been demonstrated, for instance,
that babies as young as three months old
respond to music very differently than they respond
to just other forms of sound scrambled in time.
Now, of course, babies that are three months old
aren't speaking, so you could ask them,
does that sound like music?
How does it make you feel, et cetera?
They're not going to answer,
at least not with any coherence,
because they don't have spoken language yet,
but despite their absence of language,
we know that babies as young as three months old
respond to music because they do so
with rhythmic movements of their bodily limbs
and actually their torso as well.
Now, a little bit later,
we will touch on this issue of what types of music

evoke movement of the torso versus movement of the limbs
versus movement of the torso and limbs.
No, I'm not going to dance for you during this podcast.
However, there's a really interesting story there
that relates to how primitive or evolved the motor neurons,
the neurons that actually move the musculature are,
and how primitive or evolved the music
that one listens to is.
But just to give you a sense of where that's headed,
in this study where they examined the responses
of very young babies to music,
what they found is that certain frequencies of sound
evoked movements in those babies that were rhythmic,
where it was mostly their torso moving back and forth,
and maybe their head a little bit,
whereas other patterns of sound,
different frequencies in different arrangements,
evoked movement of their limbs more than their torso,
and still other patterns of sounds,
evoked movement of their torso, limbs, and head.
In other words, babies dancing.
And if you've ever been to a wedding or a party
or been out dancing,
you will see people who include more torso versus limb
and torso movement when they dance.
And yes, of course, some of this relates to proficiency
in dancing, comfort on the dance floor, et cetera.
But there are some universal rules out there
about how certain frequencies and patterns of sound,
aka music, evokes different types of bodily movements.
So starting from a very young age,
prior to any instruction in terms of how to dance,
or what music is, babies are dancing to music.
And that highlights an important point
that we will return to again and again
throughout today's episode,
which is that the systems of the brain
that respond specifically to movement,
not just sound, but specifically to musical sounds
are intimately tied to the neural circuits of the body
that generate movement.
And this is especially important to understand
when we get into our discussion

about music and our sense of motivation.
Okay, so the list of incredible things
that music can evoke within us
by way of how it activates our nervous system and body
is starting to grow.
We've talked about how music can convey emotion,
how music can evoke emotion,
and how music can convey a sense of intent,
as well now as how music can generate action within us.
This is a pretty spectacular list if you think about it.
In addition, music causes changes
within our bodily physiology
that extends beyond the nervous system,
although it has a relationship to the nervous system.
In particular, there've been a lot of studies
that have explored how music changes things
like our blood pressure
or how fast our heart is beating
our so-called resting heart rate.
And here we've made some important discoveries
in recent years.
And when I say we, I don't mean my laboratory.
I mean laboratories that focus on the relationship
between music and our bodily physiology
because we've long known that music
can change various health metrics.
There's some really nice studies
and I'll link to one or two of the meta-analyses
of these studies in the show note captions
that have showed that if people listen to anywhere
from 10 to 30 minutes of music per day,
and by the way, the selection of music in these studies
ranged everything from rock and roll
to classical music to country music,
typically these studies would ask subjects
what their favorite music is,
and then they would have them listen
to that particular genre of music
for anywhere from 10 to 30 minutes per day.
And if you look at the meta-analyses of those studies,
what you find is that almost all of them
see some sort of significant effect.
That is some statistically significant shift

in the bodily physiology of people
that deliberately listen to music
for 10 to 30 minutes per day.
Not while doing anything else,
but just listening to that music.
They find, for instance, that their resting heart rate
is reduced, if not during the period
in which they're listening to the music,
then after the time in which they're listening to the music,
they find that their so-called heart rate variability
tends to increase.
For those of you that aren't familiar
with heart rate variability,
having increased heart rate variability is a good thing,
and that's because heart rate variability
reflects the sort of push and pull
or the balance, rather, of the activation
of the so-called sympathetic nervous system,
which is the one sometimes called the fight or flight system,
although I don't really like that nomenclature.
The sympathetic nervous system,
by the way, is not about emotional sympathy.
It's what drives your heart rate higher.
It tends to put us into activated states
where we favor movement and motion
and makes us alert,
whereas the parasympathetic aspect of our nervous system
is the portion of our autonomic nervous system,
sometimes called the rest and digest system.
The parasympathetic nervous system
drives states of deeper relaxation, of calm.
In any event, heart rate variability
reflects a periodic breaking,
a slowing down of heart rate and breathing,
and other aspects of our neural system function
that works alongside with sympathetic activation.
Think of sympathetic activation as an accelerator,
parasympathetic activation as a break,
and when heart rate variability is higher,
it reflects the fact that our parasympathetic nervous system
is periodically engaging, it's getting activated,
and slowing our heart rate, slowing our breathing down.
Music seems to have the effect

of activating that parasympathetic aspect of our nervous system,
and so we are pumping the break every once in a while,
slowing down our heart rate, slowing down our breathing.
In other words, when people listen to music
for a dedicated period of time each day
of about 10 to 30 minutes,
some studies looked at as much as 60 minutes,
but typically 10 to 30 minutes,
what one finds is that heart rate variability increases
not just during the period
when they're listening to the music,
this is very important,
but also heart rate variability is increased around the clock
in those subjects even during sleep,
making listening to 10 to 30 minutes
of your favorite music each day,
not just what I would think to be a enjoyable protocol,
if you could even call it a protocol,
it's so enjoyable to listen to your favorite music
that it feels almost inappropriate to call it a protocol
because protocol sounds kind of rigid,
like you're imposing that on yourself,
but if you need an excuse to listen to your favorite music
for 10 to 30, maybe 60 minutes per day,
and just attending to that music,
not while doing anything else,
which is what these studies had subjects do,
well, indeed that's been shown
to increase heart rate variability around the clock,
which we know is beneficial for your mental
and physical health more generally.
Okay, so there are dozens, if not hundreds of studies
that have explored how music impacts our physiology,
and as I just mentioned,
it seems that if we listen to music that we like
for 10 to 30, maybe 60 minutes a day,
our physiology, certain health metrics,
heart rate variability in particular, improve.
Now, in light of the positive effects
of listening to music on one's health,
there's a recent meta-analysis
that I found particularly interesting.
The title of this meta-analysis

is Effects of Music on the Cardiovascular System,
and it was published in Trends in Cardiovascular Medicine.
Now, from the title of this paper,
Effects of Music on the Cardiovascular System,
you might think that it's just yet another meta-analysis
exploring how music impacts heart rate variability
and things of that sort.
But what's interesting about this study
is that it identifies that the way
in which listening to one's favorite music
positively impacts the cardiovascular system
and other aspects of our physiology
is very likely not through direct changes
on our heart rate simply by listening to music,
but rather through changes in our breathing.
And this is true even if people
were not singing along with the music, by the way.
Now, the relationship between breathing and heart rate
is something that I've touched on before,
but if you haven't heard me discuss this,
I'm just going to briefly tell you the relationship
in two or three sentences,
and then I'll explain the mechanism
also in about two to three sentences.
So if you have a background in biology
or even if you don't,
this will all be very simple and very clear.
When you deliberately inhale with a lot of vigor
or you deliberately make your inhale longer
than you naturally would.
So for instance, if I breathe in very vigorously
through my nose, something very specific happens
to your heart rate, it increases.
Whereas when you deliberately exhale,
meaning when you exhale and deliberately
make that exhale longer,
or you deliberately add vigor to that exhale,
or even a shorter, deliberate, more vigorous exhale,
you slow down your heart rate.
And that's because of a phenomenon
called respiratory sinus arrhythmia,
which because it includes the word arrhythmia,
sounds like a bad thing, but it's actually a wonderful thing.

It has to do with the relationship
between a particular muscle in your body
called the diaphragm,
which when you inhale, our lungs fill with air,
our diaphragm moves down,
and our heart therefore has a little bit more space.
It actually gets bigger, temporarily bigger, but bigger.
And when it does that,
whatever volume of blood is in the heart
is now moving through a larger space.
So it's the same amount of blood
moving through a larger space,
and the nervous system registers that
as the blood moving more slowly
through that temporarily enlarged heart.
And as a consequence, there's a signal sent
through various stations of the nervous system
to the heart to speed the heart up.
In other words, just as I said before,
when we inhale, our heart rate speeds up.
Conversely, when we exhale, our lungs empty out some air,
our diaphragm moves up, and as a consequence of that,
there's less space for the heart.
And so our heart temporarily becomes smaller.
And when that happens,
the volume of blood within that smaller heart
moves more quickly.
And that's detected by the nervous system,
which then triggers a neural signal
from the parasympathetic arm of the autonomic nervous system,
which is just fancy nerd speak
for a neural signal is sent to your heart
every time you exhale to slow your heart down.
So the well-established effects
of listening to your favorite music,
increasing your heart rate variability
is not a direct interaction
between the sounds coming in through your ears
and changes in your heart rate
while you're listening to the music.
That's actually what I would have thought happened,
but this more recent meta-analysis
pulls apart the variables in these different studies.

It really illustrates that when we are listening to music,
we are subconsciously, most of the time subconsciously,
changing our patterns of breathing.
We are inhaling in anticipation
of certain things happening in the music.
We're exhaling when we feel a relief of tension.
We get excited, we may get sad, we may get happy.
We may even just be listening to music
that we don't think is impacting our physiology
at such a core level, but indeed it is.
Music is able to route into our nervous system
at levels below our conscious awareness
and literally turn the various knobs, if you will,
of our cardiovascular system, of our breathing apparatus,
the diaphragm, the lungs.
It can evoke respiratory sinus arrhythmia,
which again, sounds like a terrible thing,
but is actually the reflection
of a healthy nervous system in heart.
And in doing so, yes, it increases heart rate variability,
something that is beneficial to all of us,
but it's doing so by changing our patterns of breathing.
So if you've ever wondered why music can change
how you feel so robustly,
well, it's doing that at a deep foundational level
of your nervous system,
indeed at the levels of your nervous system
that typically are not in your conscious awareness,
because I have to imagine that most of you
are probably not listening to music and thinking,
oh, here comes that one chorus
or here comes that one melody
and this is where I always exhale
or this is where I always hold my breath,
this sort of thing.
No, most people are just listening to music,
it's coming in through their ears,
they're experiencing some bodily sensations,
maybe they're moving their torso, arms,
maybe your arms and torso,
maybe you're not moving at all, no dancing,
maybe just listening within your head
or maybe it's just dropped into the background

below your conscious awareness at all.
And yet that music is communicating emotion,
it's evoking emotion, it's communicating intent,
it's activating those premotor circuits
that would have you move if it could.
And we'll talk about dance a little bit later,
but even if you're not dancing,
even if you're not swaying the tiniest bit,
your patterns of breathing are changing
and through respiratory sinus arrhythmia,
your heart rate is changing
and through changes in your heart rate,
your heart rate variability is increasing.
So if ever you wanted a tool or protocol
that was easy to use but could positively impact
your mental and physical health,
well, listening to your favorite music for 10 to 30,
maybe 60 minutes, maybe more per day is that protocol.
As many of you know, I've been taking AG1 daily
since 2012, so I'm delighted that they're sponsoring
the podcast.
AG1 is a vitamin mineral probiotic drink
that's designed to meet all
of your foundational nutrition needs.
Now, of course, I try to get enough servings
of vitamins and minerals through whole food sources
that include vegetables and fruits every day,
but oftentimes I simply can't get enough servings.
But with AG1, I'm sure to get enough vitamins
and minerals and the probiotics that I need,
and it also contains adaptogens to help buffer stress.
Simply put, I always feel better when I take AG1.
I have more focus and energy and I sleep better,
and it also happens to taste great.
For all these reasons, whenever I'm asked,
if you could take just one supplement, what would it be?
I answer AG1.
If you'd like to try AG1,
go to drinkag1.com slash huberman
to claim a special offer.
They'll give you five free travel packs
plus a year supply of vitamin D3K2.
Again, that's drinkag1.com slash huberman.

So hopefully it's becoming clear
just how absolutely powerful music is
at evoking different physiological responses within you
that is within your brain and body.
But there's an additional one
that I find particularly interesting
because it addresses and indeed answers
one of the most common questions that I receive all the time,
which is how can I get more motivated?
Not how I, Andrew can get more motivated,
although of course I ask myself that question
from time to time, although admittedly,
most of the time I'm wondering how I'm just gonna get
everything that I need to get done,
but I often get the question,
how can I feel more motivated?
Or what can I do to sustain my motivation over time?
And we hear a lot of different strategies
about how to do that.
We hear about the quote unquote, just do it strategy,
the incredible slogan that Nike created
and that persists to this day
has become commonplace in culture.
And indeed, the just do it form of advice
can be a good one, but for a lot of people,
just hearing just do it or telling themselves just do it
is not something that can evoke action in them.
Other people will listen to motivational speeches,
they'll look at motivational videos,
they'll read motivational books,
they may even hire coaches.
In other words, people invest a ton of time, energy,
and money into trying to be more motivated.
And indeed, a number of episodes
of the Huberman Lab podcast have focused
on the relationship between say motivation drive
and the neuromodulator dopamine.
We have several episodes about that as well as a toolkit,
all of which are available zero cost at HubermanLab.com.
You can access those easily by putting motivation
into the search function at HubermanLab.com.
All of that will come up time-stamped, et cetera.
But perhaps surprisingly, today's conversation

about music offers us a particularly potent tool
to increase motivation.
And that's because one of the fundamental properties
of listening to music is that it evokes activation
of these premotor and motor circuits
within our brain and body.
That is the neural circuits whose specific job
is to mobilize our body from its current position in state
to a new position in state.
So for those of you that listen to music
while you work out or prior to when you work out,
you are definitely onto something.
For those of you that don't, that's fine too.
What I'm going to describe now
are the specific sets of neural circuits
that listening to music activates.
As I mentioned earlier,
listening to music activates so many circuits
throughout the brain and body
that really one can take a step back
from the scientific literature on this
and say anytime someone has done a study
where human beings listen to music
and people record from a particular brain area,
believe it or not, even from the olfactory system,
from the system and the brain responsible for smell,
there seems to be some significant shift
in terms of the neural firing there
or the release of neural chemicals,
which on the one hand might lead you to conclude
that listening to music is just sort of a non-specific
generalized activator of nervous system function.
It's just kind of like turning all the lights on.
But that's not the case.
Music in fact is activating different neural circuits
differently in time and space
to evoke a whole set of specific reactions
in your brain and body,
but not the least of which is the propensity for you to move.
And this is something that you can leverage
and indeed I'll describe a protocol
by which you can leverage music
in order to greatly increase your state of motivation.

Okay, so this is the portion of today's episode
where we're going to discuss some specific neural circuits.
But I want to assure you that if you're a neurobiologist,
you can understand this.
If you are not a neurobiologist,
in fact, if you took no biology ever in your life,
I'm gonna make it clear and easy for you to understand.
As I mentioned before, when we hear music,
it activates many, many circuits
throughout the brain and body.
When I say circuits, I mean neurons, nerve cells
communicate with one another in sort of chains of reactions.
When I say respond to one another,
what I mean is when neurons are quote unquote activated,
they release chemicals.
Those chemicals are called neurotransmitters,
things like glutamate, GABA.
They're also called neuromodulators,
things like dopamine, serotonin.
The names don't really matter
for sake of today's discussion,
but what those things do is they influence the likelihood
that the next neuron will be active or less active.
Okay, so neurons speak the language, if you will,
of electricity because that's how they evoke
release of these chemicals and chemistry.
They vomit out these chemicals.
Those chemicals then bind to little parking spots
on the next neuron called receptors
and then the next neuron gets activated electrically
and then to the next neuron and next neuron and so on.
It's a chain of electrochemical reactions, okay?
So there's your Neuroscience 101 lesson for today.
When people listen to music,
there is heightened activation
of the so-called frontal cortex,
the area of your brain which is on the surface,
below your skull, but just behind your forehead, more or less.
And that area of your brain is involved
in a lot of different things.
It's involved in understanding context,
what sorts of behaviors and thoughts and actions
are appropriate for a given environment.

By the way, if any of you have ever been in an environment
where everyone was really quiet and you thought,
oh my gosh, what's keeping me from just blurting out
my name right now or saying something totally inappropriate,
your frontal cortex is the one providing the so-called
top-down inhibition on that impulse
to blurt something inappropriate out.
And by the way, your thoughts about that impulse
are perfectly normal.
They actually reflect a heightened sense of normalcy
because it means that your brain is thinking
about how it's not going to do that.
And so therefore you're not going to do that.
Likewise, if you are ever at the edge of a high bridge,
please stay on the safe side of the railing.
But if you think, oh my goodness,
what's keeping me from just jumping off the bridge right now,
what's keeping you from doing that is your frontal cortex.
It's suppressing certain actions in a context-dependent way,
in particular actions that are dangerous to you,
socially, physically, dangerous to others,
socially, physically, et cetera.
Now, the frontal cortex in order to do that
also has an incredible ability to make predictions.
So this is the function of the frontal cortex
that I want to focus on for the moment.
Your frontal cortex is great at doing the
if this, then that type of analysis.
If I say this, everyone will be offended.
Or if I say this, maybe they'll laugh.
Or if I don't say this, I'll be safe.
If I do say that, I won't be safe.
This kind of thing.
Frontal cortex is activated when we listen to music
because within music, there are some regularities.
Sometimes these are described as motifs
or melodies or choruses.
Again, this is the entire landscape of discussion
that we could have and we will have with an expert guest
about how the mathematics of music impacts
the electrochemical signaling within the brain
and the coding that is the mathematics of brain function,
which leads us to predict that certain things

because they just happened are likely to happen again
or not happen again.
But let's set all that aside for the moment
and just state the simple fact,
which is that when you listen to music,
your frontal cortex increases in activation
because it is predicting what you're going to hear next
based on what you're currently hearing
and what you heard before.
Now, I am from the generation that we didn't have iPods
when I was a kid.
We did have CDs, we did have tapes,
but you had to fast forward or rewind a cassette tape
or you had to skip on the CD
in order to move about the album in time.
Nowadays, you can cue up different songs
in different order really easily,
but if you are somebody who listens to albums start to finish
or if you're like me and you grew up listening
to albums start to finish,
maybe occasionally skipping a song,
but you will be very familiar with this phenomenon,
which is that right as a given song ends,
if you're familiar with that album,
you already anticipate the start of the next song
in your head and that just speaks to the predictive function
that the frontal cortex plays.
So if you have a mixed tape with a bunch of different songs,
sure, you don't expect one song of a given artist
to lead into the next,
but if you're somebody who's listened to that mixed tape
a lot, so you're familiar with what song comes next,
or if you're listening to a given album start to finish
and you're very familiar with it,
well, then you'll immediately resonate
with what I'm saying here,
which is that your frontal cortex is always anticipating
what sound is likely to come next.
And this is very important because one of the key things
about music and its ability to evoke our sense of surprise
or delight through the release of a neuromodulator
called dopamine, we'll get to this a bit more later,
is because that prediction machinery is thinking,

oh, I heard that set of chords a moment ago,
I'm going to hear it again.
And then when it changes up, your brain goes,
oh, whoa, hold on, that wasn't what I expected.
And it sometimes does that with a sense of delight,
like, oh, yes.
And sometimes it hears that and goes, oh, wait,
what's this?
I don't really like this that much.
I like the opener of that song,
but I don't really like the rest.
I think of that as, you know, there's certain pastries,
muffins in particular, where I really like the top,
it's got the little crumbs, it's got the berries
and stuff and then you get down past the top
and then you get to the middle and then you're like,
oh, this thing is not that good.
Okay, there's certain songs like that for me,
so I always thought of those as muffin songs
because the top of the muffin is always the best,
whereas a donut is great the whole way through.
And now I'm going on a tangent
because I'm thinking about muffins and donuts.
So I'm going to take us back to music,
but the point is relevant nonetheless,
which is that your frontal cortex is making predictions.
And when those predictions are broken,
that's a sense of novelty.
And when that novelty is something that you like,
okay, so it evokes a sense of, yes, I like that.
Well, then dopamine is deployed.
And when that novelty is something you don't like,
typically there's a reduction in the amount of dopamine
released in a separate set of brain circuits
below whatever level of dopamine happened to be there
prior your so-called baseline level of dopamine.
Okay, so when you listen to music,
there's a strong activation
of the prediction machinery in your brain.
There's also activation of the circuits in your brain
that register novelty.
What are those circuits?
These are things like the ventral tegmental area

and the nucleus accumbens.
I've talked about these before on the podcast.
Again, you don't need to know those names.
Those are the names given to certain brain areas
that control the release of dopamine in time
according to whatever you happen to be experiencing
in that moment.
Okay, so the Mesolympic reward pathway
could perhaps better be called
the Mesolympic reinforcement pathway.
So for those of you out there shouting,
wait, the Mesolympic pathway does a bunch of other things.
It's not just dopamine, I agree.
It's also serotonin, it's a bunch of other things.
But for today's discussion,
we're thinking about the Mesolympic pathway
as deploying dopamine, which it does
when we hear something novel,
meaning not what we predicted and we like what we hear.
And then there are a bunch of other brain centers
and circuits that listening to music activates.
I'll just list off a few.
Again, this isn't intended to confuse anybody
or add a lot of useless nomenclature,
but since I am a neuroscientist
and this is a science and science-informed tools podcast,
I'd be remiss if I didn't mention
that we get strong activation of a brain structure.
You actually have two of them,
one on each side of the brain called the amygdala.
This is a brain area that's part of a larger set of circuits
that's associated with arousal, okay?
Meaning becoming more alert,
becoming more aware of our surroundings
and the particular sensory stimuli
that are coming in at that particular time,
such as the notes of the music
or a particular set of lyrics.
And music also activates areas of the brain
such as the parahippocampal formation,
the cortex and the hippocampus itself,
brain areas that encode and store memories.
And this is something

that I think everyone will be familiar with.
When you hear certain songs or even songs
that sound like certain songs
or even songs that you swear you've never heard before,
it can evoke a sense of nostalgia,
of longing for something, of missing somebody,
of sadness or of delight and happiness.
And positive memories of somebody or something.
Indeed, I think it's fair to say
that hearing particular pieces of music,
particular songs, more than any other experience
can activate a whole library of memory and emotions
within us.
And that's because of its ability
to activate the parahippocampal regions of the brain,
the cortex and the hippocampus itself.
Again, several different brain areas,
all which communicate with one another
and other areas of the brain
in order to encode our memories,
our sense of self, our sense of others,
our sense of history with those people and on and on.
Now, rather than just make this a catalog
of different brain areas that music evokes,
what I'm trying to do is spell out
how music activating these different brain areas
is creating different components
of what we are familiar with as our experience of music.
So frontal cortex prediction,
mesolimbic reward pathway, novelty, amygdala,
the sense of emotion and arousal.
Parahippocampal cortex and cortex and hippocampus,
our memories in particular, our emotional memories
and our location memories
associated with a particular piece of music, right?
Haven't you ever heard a song from,
let's say a summer camp that you went to when you were a kid?
All of a sudden, you're remembering the smell of the grasses
at that summer camp.
You're remembering how some of the kids were really great
and how some of the kids were really obnoxious.
You're remembering some things that you did.
You're remembering your counselors.

I mean, there's just a whole landscape
of neural information there, life information stored
in your head that hearing a particular song
that was sung when you were what, eight years old,
10 years old at camp just flips the lid on
and it comes geysering out, remarkable.
Now there are two other sets of brain circuits
that are activated by music that deserve specific attention
and deserve that specific attention now
in the context of discussing motivation
and music's ability to motivate us in particular ways.
And those brain circuits are the basal ganglia.
Okay, so this is a set of circuits within the brain
that are associated with action initiation,
so-called go circuits and withholding action,
so-called no-go circuits.
But basically the basal ganglia
are involved in regulating movement.
And the cerebellum.
The cerebellum is sometimes referred to as the mini brain.
It looks like a little mini brain
in the bottom back of the human brain.
In some species, the cerebellum is much larger
relative to the rest of the brain,
but in humans it's like this little piece in the back
that looks like a little mini brain.
Like you're carrying a second brain back there,
that's why I call it mini brain, cerebellum.
And it's involved in a lot of things,
but one of its primary functions
is to encode rhythmic timing and processing.
And along with its outputs to some deeper brainstem areas,
things like the vestibular and cochlear nuclei,
we'll talk about this, the parabracial nucleus.
Again, you don't need to know these names.
It, meaning the cerebellum,
along with the basal ganglia,
creates patterns of activity in our brain
that cascade down to particular circuits in our body.
So these are so-called premotor circuits
and motor circuits that generate the sense
that we not only can move,
but that we want to move

and that we want to move in particular ways.
So if you internalize nothing from the last five minutes
or so in which I've been describing
how music impacts different neural circuits in the brain,
please do take away this important point,
which is that when we listen to music,
we think of that as an auditory experience,
but now you know that it's also an emotional experience.
And, and this is a very important and,
when we listen to music,
it is programming a specific set of motor actions
that are more likely to occur.
Put differently, when we listen to music,
we are more likely to move our body
and not just dance, not just move our torso,
our limbs, or our limbs and torso together
in concert with the music,
but rather move our body from its current position
to another position.
And this is one of the most important things
to understand about music.
Music, despite being an auditory stimulus
coming in through our ears,
evokes the activation of neural circuits in our brain
that creates a sort of inertia.
It creates a propensity for action across our entire body.
So now that you understand that listening to music
activates lots of different brain circuits,
of course, the circuits that respond to auditory stimuli,
so called primary auditory cortex,
is powerfully activated by listening to music,
but also circuits associated with novelty, anticipation.
We talked about circuits in the brain associated with memory,
but also circuits in the brain
that are associated with generating movement
and not just movement that is in sync with
or corresponds to the music that we're listening to,
but all forms of movement.
But when we listen to music that has a relatively fast cadence
and we can actually define what that cadence needs to be,
and we'll do that in a moment.
When we do that, so-called premotor circuitry,
the circuitry that's going to initiate that kind of inertia

or that pressure for movement within the neural circuits
that actually evoke movement are all activated.
So for those of you that like to listen to music
while you exercise, you're familiar with the fact
that listening to great songs with a great beat,
with particular lyrics, or that associate you
with a particular time or place in your life
can be very motivating.
But there are data showing that when people listen to music
that's faster than about 140 to 150 beats per minute,
that it creates a heightened state of motivation
in the body to move.
And the way that it does that is by way of shifting
the balance between those go circuits
and no-go circuits of the basal ganglia.
There's some other ways that it does it as well.
For instance, music can evoke the release
of certain neurochemicals called the catecholamines.
These include dopamine, but also norepinephrine
and epinephrine from centers in the brain and body,
glands in the body like the adrenal gland
that shift the body toward a predisposition
of being more likely to move.
So if we want to distill all this out
to a simple actionable takeaway, simply know this.
Listening to music, relatively faster music,
predisposes you to be more motivated to move.
And that is independent.
This is what I find so cool.
It's independent of whether or not you're familiar
with the song, independent of whether or not
the lyrics of the song are motivating lyrics.
If they are, that's just going to layer on top
of the faster cadence, which is going to predispose you
to move, but what's remarkable is that just listening
to that faster cadence music is creating
a neuronal resonance, if you will,
a pattern of neuronal firing within you
that is going to essentially take your,
and here I'm using metaphor,
is going to put your state of motivation
from either back on your heels to being flat-footed
or let's say you're mildly motivated,

so I'll call that flat-footed,
to being forward center of mass.
So for any of you that are suffering
from lack of motivation, in particular to exercise,
but believe it or not, also to do cognitive work
where you're going to be still
and you're going to sit down and you're going to read
or learn or practice something.
Listening to music for 10 to 15 minutes
prior to doing that work, prior to doing that exercise
is one of the best ways to get motivated
in order to engage in that work or engage in that exercise.
That's been demonstrated in the data very conclusively
using a variety of different types of music.
And again, there are multiple mechanisms
that converge to create that heightened state of motivation.
Some of those mechanisms are neurochemical,
like the release of the so-called catecholamine,
dopamine, norepinephrine, and nepinephrine.
Some of them are strictly neural circuit-based,
so activation of premotor circuitry,
and those are going to combine with neural circuits
that are going to narrow your field of vision.
This is a good thing whenever you want to be motivated.
They're going to literally constrict your field of vision
to more of a tunnel type of vision
as opposed to more panoramic vision,
and that I described it as
placing you into a forward center of mass.
I don't necessarily mean literally a forward center of mass,
and thus perhaps you're exercising,
like running, leaning slightly forward.
What I'm talking about is using music as a way
to deliberately shift your state of mind and body
from one that is amotivated, not motivated,
to more motivated.
And it's a very simple protocol
extracted from the peer-reviewed literature.
You simply find some faster music,
hopefully music that you like, it would be even better
if it was music that had lyrics that you find motivating,
and listening to that for 10 to 15 minutes
prior to engaging in whatever that work

may be physical or cognitive.
On the topic of cognitive work,
one of the most common questions I get
is what sorts of sounds or music should I listen to
in order to increase my state of productivity,
motivation, concentration, et cetera.
On previous podcasts related to focus and motivation,
I touched on the use of so-called binaural beats,
which are different frequencies of beats
presented to one or the other ear.
This is best accomplished with headphones,
and there are a lot of different frequencies
of binaural beats that you can get out there.
If you want to get detailed about this,
binaural beats also involve the differential
between the frequency of beats,
between the two presented to the two ears,
and then that difference then is heard
by higher-order processing centers in the brain.
In any event, we don't have to get too technical about it.
We can simply say that, yes,
there are some decent peer-reviewed studies
demonstrating that when people listen to so-called 40 hertz,
particular frequency of sound,
40 hertz binaural beats,
that it can enhance concentration and focus.
However, this is important, there are some recent studies
that show that binaural beats sometimes
can impede concentration and focus,
and thereby can impede cognitive performance
on various tasks.
However, the studies that show that binaural beats
can be detrimental to performance
on various cognitive tasks
did not use 40 hertz binaural beats specifically.
So we are still awaiting more studies on binaural beats.
Meanwhile, I'll just restate what I said before,
is that there is some evidence
that listening to 40 hertz binaural beats
can enhance concentration and focus.
There are also data showing that other frequencies
of binaural beats might be detrimental
to concentration and cognitive performance.

And previously, I've also discussed studies
showing that, for instance,
if people listen to white noise in the background,
you could do this on your computer
or speakers in the room or headphones
or so-called brown noise,
which is essentially like white noise,
all frequencies of sound
or most frequencies of sound combined,
but with particular frequencies of sounds
that are accentuated and others are notched out
as it's called, so-called brown noise.
Rather than understand all of this at a technical level,
because I've covered that before in previous podcasts,
suffice to say, if you go to YouTube
and you just put in white noise background
for cognitive focus
or brown noise background for cognitive focus,
you can just try those if you like during a session
in which you're trying to read or learn
or do mathematics or music
or any kind of cognitive work.
If you don't like them, if they don't work for you,
then there's certainly no obligation to use them.
Likewise with 40 Hertz binaural beats.
And for binaural beats,
you can also find those as zero-cost YouTube scripts
that are a number of zero-cost apps
that will allow you to listen to binaural beats.
I've used the app Brainwave for some period of time now.
To be honest, I've never done this strict control experiment
on myself of listening to the 40 Hertz binaural beats
or not listening to 40 Hertz binaural beats
doing the equivalent types of tasks.
I can be fairly regimented with my work and behavior
but I haven't run a detailed controlled study
on myself around this.
Rather, if I want to heighten my level of focus
or rule out distractions, what I will do
is I will listen to either white noise or brown noise
while I do work
or I will listen to 40 Hertz binaural beats
while I do certain types of work

or sometimes frankly, I just work in silence.
Other times I will listen to classical music in the background.
I'm a big fan of listening to classical piano.
I particularly like Glenn Gould, the Bach variations.
Those are very pleasant to me
but and this is really important
in researching this episode about music in the brain.
What I discovered was in the controlled studies
that have been carried out
as to whether or not people perform better
on cognitive tasks that require a lot of focus
especially learning tasks
that compared silence in the background
to purely instrumental music in the background
to music with lyrics in the background
to one's favorite music with or without lyrics.
The data are very clear.
It's very clear that most people
that means statistically on average
people perform best on cognitive tasks
or tasks that require a lot of focus to perform.
Again, these are mental tasks, not physical tasks
when they are doing those tasks in complete silence.
So that was somewhat surprising to me.
Second best conditions are to do those tasks
in the presence of instrumental music only.
And in that case, there was a lot of variation
as to whether or not people preferred faster cadence music
so 140 to 150 beats per minute or faster
or slower music, 60 beats per minute or slower.
I'll get back to those specific numbers later
because they represent thresholds
for inducing different types of emotional states
either happy or sad.
But meanwhile, it's very clear
when people work in silence
they perform better than when they work
with music instrumentals in the background.
And they perform even less well
when they listen to music with lyrics in the background.
We'll talk about why that is the case in a moment.
And then people perform especially poorly
relative to their performance in silence

or any of the other conditions I mentioned
when they listened to their favorite music
while doing cognitive work.
And that to me was a bit surprising,
especially since I spent a lot of my university years
studying while listening to my favorite music
in different forms that listen to slower music
than faster music and go back and forth.
And then sometimes turn it off altogether
and work in silence.
But the center of mass of the literature around this issue
of whether or not to listen to music
while one studies or tries to learn something,
the data are pretty clear.
The data show that it's best to study
and learn either in silence
or with quiet instrumentals in the background.
Now I mentioned before that previous studies compared
the effects of working in silence
versus working with 40 Hertz binaural beats
or white noise or brown noise in the background.
And in those studies,
it was found that the white noise, brown noise
and 40 Hertz binaural beats background
produced better levels of focus,
I should say heightened levels of focus
and cognitive performance and learning
than working in silence.
But I've not yet seen the study that compared
40 Hertz binaural beats, brown noise, white noise
to music directly.
Perhaps there's one out there, if there is,
please send it to me,
I'd be very curious to learn what the results of those are.
Now that might seem like a lot of information
but the takeaways from it are very clear
and it's always nice when things are clear, right?
It's clear that if we want to focus and learn
that working in silence or with white noise
or brown noise or 40 Hertz binaural beats
is going to be preferable to working
while listening to music.
But if you're going to listen to music while you work,

that is do cognitive work,
then you're going to want to listen to music
that is purely instrumental
and ideally the music would be somewhat faster
than 140 to 150 beats per minute.
Now, I do not expect you to go and measure
the frequency of beats per minute
in the music that you listen to
and of course the beats per minute are going to change,
right?
That's an average 140 to 150 beats per minute.
I don't expect you to get super technical,
break down the music that you're listening to.
That is not my goal
nor is that really what this podcast is about.
I think occasionally people think that,
you know, the goal of a science
and science-based protocols podcast
is to optimize everything.
In fact, I'm not such a fan of the word optimize
because optimal really depends on the situation
that you happen to be in.
The point here is simply this,
that many people out there, including myself,
have been listening to some of our favorite music
while working, but it's very clear
as to why that degrades cognitive performance.
We know, for instance, that when we read,
we are creating a semantic narrative in our own head.
And when we listen to music with lyrics,
especially music with lyrics that we recognize,
the semantic content of the song, the lyrics,
competes with our comprehension of the narrative
within our head from the material
that we're supposed to be learning.
So now it should be sort of obvious
why listening to your favorite music that includes lyrics
while trying to learn something else
is going to impede learning.
It's because you've got multiple scripts,
multiple dialogues happening in your head.
And in fact, this is an opportunity for me
to take a slight tangent, but a relevant one,

which is to say a lot of times people will ask me
how I can retain a lot of information.
I confess I never use a teleprompter for podcasting.
I do have usually a short stack of notes,
anywhere from one to six or seven pages
of just bullet-pointed notes that queue up things
that I want to talk about
and that I have researched in the literature.
And then of course I'll refer to papers from time to time.
But one of the things that's been very useful for me,
which was taught to me by the way by a professor
when I was in university,
to read and retain information that I've read by memory
is that when I read,
I'm trying to listen to the words being spoken in my head.
Typically in my own voice,
although sometimes in someone else's voice,
doesn't really matter, I find.
So when I'm reading,
yes, it's a process of visual scanning,
but I'm also listening to the words within my head
as if they're being spoken.
Some of you may be familiar with this
because you do it, others of you perhaps
might find this a bit more foreign.
I'd be curious to know what your process of reading
and retaining that information is,
whether or not it includes an internal dialogue.
But nonetheless, it should be very straightforward now
to see why if you're listening to words
that you're reading on a page,
maybe even mumbling them a little bit,
moving your lips a little bit while you read,
which by the way,
if you heard our episode on language
and auditory processing with Dr. Eddie Chang,
who's chair of neurosurgery at UCSF,
he talked about the fact that when we read any material
that the brain is generating premotor activity,
you now know what premotor activity is,
premotor activity down to the muscles of the throat,
larynx and spherinx,
which would speak those words,

were those signals to get above a certain level,
but that when we read typically the signals
that are getting sent through those premotor circuits
are just below the threshold
of what would have us actually speak those words.
Put simply, when we read,
we are just shy of saying what we are reading.
And so when I say that when I read,
I'm listening to the words in my head,
that's what I'm referring to.
So we're starting to funnel in on some general principles
of music and how it impacts the brain
and how that can be leveraged toward better learning
and better motivation,
both in the context of physical and cognitive endeavors.
Okay, so if you want to get motivated listening to music
prior to doing something that you're trying to motivate to do
is a good idea.
That's what the data say.
If you're trying to learn something that's cognitive,
then requires reading, focus and concentration,
silence, 40 Hertz binaural beats,
white noise or brown noise is probably best.
And if you are going to listen to music,
listening to music that includes instrumentals,
but not lyrics would be best.
And listening to music that includes lyrics
that you're very familiar with
would be the worst condition.
Now, with that said, there are nice studies.
And by the way, I'm going to link to a number of reviews
and primary studies in the show note captions
that refer back to this point I'm about to tell you,
which is that listening to music while trying to do
cognitive tasks can be detrimental
toward learning that material.
Turns out that if you listen to music in the breaks
between trying to learn certain material,
you can actually heighten your level of cognition
and focus in your ability to learn.
So I find this particularly cool.
It's not that music is bad for focus
and cognition and learning.

It's that listening to music,
especially music that you're familiar with
that includes lyrics at the same time
as trying to learn something else is not a good idea.
But listening to music with lyrics,
especially music with lyrics that you're familiar with
that you find particularly uplifting and motivating
is a cognitive and performance enhancer
when you go back to doing that work in silence
or perhaps while listening to white noise,
brown noise or 40 Hertz by Noro Beats.
So like so many things, the answer is not black and white.
It's not that silence is better than music
or that music is bad for learning.
It turns out that listening to music,
even music with lyrics you're very familiar with
can be highly beneficial for learning,
but that you want to listen to that music in the breaks
between these bouts of cognitive work.
Now, I've done previous podcasts that talk about
how long a bout of cognitive work can or should be.
Typically 90 minutes is going to be the upper limit
before you take a break.
Some people can't work for 90 minutes without a break.
And by the way, folks, when I say without a break,
I don't mean remaining in a deep trench of focus
for 90 minutes, nobody does that.
Actually, I suppose there are a few folks
that with neurochemical assistance
or just by way of training can get themselves
into a deep, deep trench of focus for 90 minutes or more,
but most people are going to focus on something
and then have their attention flip out of focus
and then they're going to have to draw their focus
back to whatever it is they're doing.
That's not just typical, that's absolutely normal
and you shouldn't be concerned at all
if you try and focus for three minutes
and find your attention jumping around
two or three times during that attempt.
But if you're somebody who is going to do say a 90 minute
or even 60 minute or even 30 minute bout of work
and you are going to get up for a moment

and use the restroom or you're going to take a break
in between bouts of work.
So maybe you work for 30 minutes, take 10 minutes
or five minutes off or 90 minutes, take 30 minutes off,
listening to music in those breaks,
it seems can increase our ability to focus
and to learn new material once we return
to those bouts of cognitive focus.
Now, when it comes to physical exertion,
cardiovascular exercise, resistance training of any kind,
many people including myself like to listen to music
while performing that physical exercise
or that physical exertion.
The data on whether or not music
improve physical performance is a bit mixed.
Certainly you can find studies that show
that it improves physical output.
Other studies will say that it doesn't make a difference.
Other studies will say that it reduces physical output.
However, this is a very important,
however, the type of physical exercise
is not very well matched between those different studies.
So this is something that I believe
is going to be highly individual.
In accordance with the published data, I mix it up.
There are times when I will head out for a run
or I will do a resistance training session
and I will listen to music,
usually an album all the way through
or a playlist all the way through.
And that's because I don't want to be going
onto my phone very often.
In fact, these days I use an older separate phone
that doesn't have any text messaging
or communication to the outside world,
but it has music loaded into it or onto it.
That allows me to just listen to music
so that I don't run the risk of getting distracted,
texting and doing things like that.
I just want to focus on my physical exercise.
I should say that phone also has audio books,
podcasts, things I've downloaded to it.
So it's a place where I can listen to things

but not communicate with the outside world
at least while exercising.
Some people do very well to listen to music,
literally in between and during their sets
of resistance training throughout their entire runs.
It's going to be individual.
You have to figure out what's best for you.
However, one of the most interesting things
about the scientific literature on this
shows that if people listen to music,
in particular music that tends to be faster, more upbeat,
typically it's going to be in these studies,
rock and roll music as opposed to classical,
although there are some studies that have explored
classical and other forms of music
as it relates to exercise.
Listening to that music in between bouts of exertion,
so in the rest between sets of resistance training
or periodically during say a run or a bout of cycling
can indeed enhance performance in a way
that at least by my read of the data
exceeds that which is observed
when people just listen to music throughout.
In other words, if you find it useful to listen to music
before, during and after your workouts, great, be my guest.
However, what the data say is that switching up
between silence and listening to music,
and in this case it would be listening to music
that you're very familiar with
and that can evoke a sense of motivation
and desired action in you for whatever reason,
the music, the beat, the memories that it draws you to,
et cetera, well then that's going to be useful.
So there really isn't one protocol
for how to get the most out of music
for sake of physical exertion,
but if you're interested in playing
with some of these variables
as they've been examined within the peer reviewed literature,
I find it interesting and indeed I found it useful
to for instance, do a workout where I only listen to music
in between sets of resistance training
or to listen to music prior to going out for a run.

And then oftentimes when I do that,
the song or songs will be sort of on loop in my head,
although I confess that a lot of times nowadays
I listen to podcasts while I run or while I hike
and when I'm in the gym and I'm doing resistance training,
I like to listen to music as opposed to content
that requires that I really focus very heavily
on that content, such as a podcast, such as a book.
I'd like to take a quick break
and acknowledge our sponsor, Inside Tracker.
Inside Tracker is a personalized nutrition platform
that analyzes data from your blood and DNA
to help you better understand your body
and help you meet your health goals.
I'm a big believer in getting regular blood work done
for the simple reason that many of the factors
that impact your immediate and long-term health
can only be analyzed from a quality blood test.
However, with a lot of blood tests out there,
you get information back about blood lipids,
about hormones and so on,
but you don't know what to do with that information.
With Inside Tracker, they have a personalized platform
that makes it very easy to understand your data,
that is to understand what those lipids,
what those hormone levels, et cetera mean,
and behavioral supplement, nutrition and other protocols
to adjust those numbers to bring them into the ranges
that are ideal for your immediate and long-term health.
Inside Tracker's ultimate plan now includes measures
of both ApoB and of insulin,
which are key indicators of cardiovascular health
and energy regulation.
If you'd like to try Inside Tracker,
you can visit insidetracker.com slash Huberman
to get 20% off any of Inside Tracker's plans.
Again, that's insidetracker.com slash Huberman
to get 20% off.
Now I'd like to talk about the use of music
to shift our mood and indeed to get us
out of states of anxiety.
This is a really interesting scientific literature
with some very specific actionable takeaways

that I think everyone will find beneficial.
I certainly did.
However, I wanna point out that we don't need
a scientific study to illustrate for us
the way that music can shift our mood.
And you already know why it is that listening
to a sad song can sometimes make us feel sad.
Listening to happy music can make us feel happy.
It's because when we listen to music,
there are some fundamental components of that music,
literally the mathematical structure of that music,
including the frequency of sounds,
the cadence of those sounds, as well as the lyrics,
but even in the absence of lyrics
that are activating brain circuits within us
such that the frequencies of sound that we're hearing
are evoking firing of neurons in the brain
of the same frequency.
In other words, your brain becomes a bit of a piano
playing the same song that you're hearing inside your head.
Now that's sort of a duh, right?
You hear music in your head,
even if you're listening to it from outside in the room,
but when you understand that neurons speak the language
of electrochemical communication,
what we're talking about here is particular music
evoking the release of neurochemicals in your brain
at a particular frequency.
So just think about that for a second.
We know that neurochemicals such as dopamine, serotonin,
some of the so-called endogenous opioids, right?
These aren't opioids that people take.
This isn't related to the opioid crisis.
We're talking about endogenous opioids
that are released in response to music, things like exercise,
different types of social interactions.
Those and other chemicals are released
according to the firing of specific neurons.
And we know that when you listen to music
at particular frequencies arranged in particular motifs,
et cetera, that the neurons that release those neurochemicals
are firing at those same frequencies.
In other words, that the sound is causing a sound dependent

pharmacologic concert within your brain.
So that fact should make it incredibly clear
as to why certain music, even in the absence of lyrics,
can evoke certain emotional states.
Certain sound frequencies are transformed
into the neural language within your brain
that releases certain neurochemicals
that create certain emotional states of brain and body.
Just to drill in how incredible that really is
a little bit further, if you see a beautiful painting
or the picture or presence of somebody's face in real life
that evokes a particularly strong positive
or negative emotion, you can imagine that of course
it creates the release of certain neurochemicals
or perhaps in the case of a negative face,
suppresses the release of certain neurochemicals.
But we can't say that a particular frequency of color,
say reds against oranges or the presence of a rainbow
evokes a sort of rainbow-like cascade of neurochemicals.
Whereas with sound, that's exactly what's happening.
And this isn't to diminish the value of vision
in terms of its ability to evoke emotional states within us.
After all, I'm foremost a neuroscientist
but under the umbrella of neuroscientists,
I started off as and I continue to be a vision neuroscientist
studying the visual system
and its ability to evoke emotional states within us.
But I have to acknowledge that the auditory system
and in particular the circuits in the brain
that respond to music have a remarkably potent ability
to evoke these emotional states,
which is why when surveys have been done
asking people why they listen to music,
the responses that have come back
generally resemble the following statistics.
Approximately 90% of people say
they listen to music to relax.
Approximately 82% of people self-report
that they listen to music in order to make themselves happy.
Approximately 46.5% of people say
that they listen to music in order to process
particular states of emotion.
We'll get back to what process means in a moment,

but more often than not,
when the studies have asked specific questions
about what particular types of emotions people are listening
to in order to process their emotions better,
it is the emotion of sadness.
And 32.5% of people report
that they listened to music in order
to increase their sense of concentration.
And we already talked about the role of music
in concentration or its ability,
in some cases to inhibit concentration a few minutes ago.
Now, you might be asking yourself,
how can 90% of people listen to music for one thing
and 82% of people for another thing and so on and so forth
were well over 100% of people?
Well, in this survey and other surveys like it,
people had the option to give multiple reasons
for listening to music,
because of course most people have multiple reasons
for listening to music.
Now, with that said,
if we are to examine this one particular category,
nearly half of people who report listening to music
on a regular basis,
listen to music in order to process their emotions,
we can ask what does the scientific literature
tell us about how certain types of music
evoke certain types of emotions
or help us process certain emotions?
Again, we'll get back to what we mean by process in a moment,
but a number of studies have been done on this.
There's some meta-analyses that converge
on some general themes,
what I refer to as the center of mass of data, right?
When there are a lot of studies in a given area,
the outcomes of some of those studies conflict
with one another, generally in a good meta-analysis,
what happens is different studies
are considered more powerful or less powerful than others,
depending on how many subjects were involved,
the different control conditions
or lack of control conditions and so on and so forth.
This is one of the great values of meta-analyses.

Is that they don't treat all studies equally.
They separate out studies based on their level
of rigor and thoroughness.
Well, what we can say with confidence is that music
that makes us quote unquote happy
or tends to shift people's state from less happy to happier
regardless of how they entered the experiment
tends to be faster music,
meaning music that on average contains 140 to 150 beats
per minute or faster, okay?
And there's some other features to quote unquote
happy music, if you will,
that it tends to be in a major key
that if there are lyrics to that music
that the lyrics tend to report things that are happy
or get this total nonsense.
In fact, when the type of lyrics in this quote unquote
happy music is I guess singing about great events in life
and positive things falling in love, being in love,
positive memories, birth of children,
connection to friends, great adventures.
Those lyrics where I should say
that music containing those lyrics
was no more effective in creating states of happiness
than was music of equivalent cadence.
So again, music that was 140 to 150 beats per minute
or faster on average.
Well, even if the lyrics were complete nonsense,
even if the vocalizations weren't actual words,
it still evoked the same increase
in the level of happiness in the subjects
than when compared to the music containing
coherent lyrics around happy events.
What this means is that the cadence of music
is no doubt the critical variable
when one is trying to shift one's mood
from a state of whatever could be depressed or sad
to non-depressed, non-sad or neutral to positive
and so on and so forth.
But what this also explains is one hit wonders.
Rarely, if ever, by the way,
are one hit wonders sad and depressing songs.
Sometimes almost always these one hit wonders

are songs that are very effective
in shifting people's mood from not so happy to happier
or we could just say happier regardless of where they started
out before listening to the song.
They feel better while and after listening to the song.
And indeed more often than not,
the lyrical content of those songs
is not particularly meaningful.
It's not addressing a particularly meaningful state
or issue is just what some people call a party song
or it's something that's just uplifting,
not just to them, but to many other people,
which actually brings up an interesting
and future-looking point, which is that nowadays
we are seeing the emergence of AI,
artificial intelligence being used to generate new songs
by capturing these well-established rules
gleaned from neuroscience of how music impacts the brain
such that in the future, artificial intelligence
is going to be generating hit songs for us
as opposed to having people generating hit songs.
I know this evokes a state of concern and fear
in many people.
I think that this is a fear that needs to be matched
with, I don't know, perhaps a cautious optimism.
I mean, who knows, maybe there are patterns of music
including lyrics that human beings
in their current understanding of themselves
and of music have not yet been able to tap into.
And who knows, maybe AI will be generating the best music
that we've ever heard or perhaps music
that can shift our states from more depressed or sad
to heightened levels of happiness
in ways that humans have just not been able to accomplish.
So I think it's important to balance any pessimism
about AI and its ability to generate music
based on these rules of how music impacts the brain
with an open-mindedness.
After all, neuroscience, neuroimaging
and neural recordings directly with electrodes in the brain
while people are listening to music
is teaching us how the brain responds to that music
and is giving us information that indeed human beings

but also computers can use in order to generate
stimuli music that can shift our brain
into more positive states.
And if that's the case, wouldn't that be wonderful?
Another established feature of happy music is get this,
its ability to get people to relax the furrow of their brow
indeed to raise their eyebrows and to be a bit wide-eyed
and not just through autonomic arousal
but rather through activation of the muscles in the face.
Conversely, we know that sad music
and here we can define sad music.
This has actually been done in the literature.
Sad music tends to be slower than average,
slower than 60 beats per minute or so, again, on average.
And this again is independent of the lyrics
that might not even be present in the song.
Sad music tends to activate the corrugator muscles
of the forehead, which are the muscles
that furrow the brow and that lead to a kind of serious look.
It's a folding in of the face as opposed to a widening up
of the eyes and a relaxation of the brow.
Now, given where we are in the course of this discussion,
that shouldn't be surprising.
We already talked about how listening to particular sounds
evokes the release of particular neurochemicals
but in a more direct fashion, listening to particular sounds
activates certain premotor and motor circuits
within the brain and body,
not just the desire to move one's torso, limbs or both,
bob one's head or move a head side to side,
but also the micro structures of the face,
which because one of the main roles of the face
is to communicate emotion is going to cause
either a relaxation of the brow
and a lifting of the eyebrows or a furrowing
or a activation of the corrugator muscles of the eyebrow.
And if that's not obvious and yet interesting enough,
well, get this, there seems to be a direct relationship.
I'm chuckling because this still just blows my mind
because it's a total duh obvious when you hear it,
but it's still just so cool
that there's a direct relationship of the frequency
of the sound that you hear,

either low pitched or high pitched
and the cadence of that sound.
And here I realized I'm not using technical music theory
language, but whether or not that particular tone
is played over and over close in time
or more spaced out in time and facial expressions
and indeed when we listen to bass tones,
low frequency tones set apart from one another
with some distance so that they're not overlapping,
we get the all too familiar bass face.
So what I'm referring to here
is what neuroscientists would call a labeled line,
literally a circuit of neurons that goes from the periphery,
in this case, our ears into our brain
through several different stations
and then wicks out to impact all sorts of things
within us, states of emotion,
states of motivation, our propensity to move,
but also a labeled line circuit
coming from hearing low frequency sounds
played spaced apart from one another
that evokes a particular facial expression.
And again, this takes us back
to the earlier statement that I made,
which is not an original statement, frankly.
There are people within the field of auditory processing
and understanding how the brain processes music.
In fact, one of the world experts in this,
Dr. Eric Jarvis at the Rockefeller University
was a guest on this podcast
where we talked about the relationship
between music movement and singing
and the fact that music movement in particular dance
and singing likely preceded the evolution
of modern spoken language.
Well, Eric Jarvis and others have argued quite convincingly
that these circuits that I'm calling labeled lines
to particular facial expressions and states of emotion
are the most fundamental components of communication
and the ways that humans have communicated
about their emotional state
and literally induced that same emotional state
in other members of our species

dating back tens of thousands, if not more years.
One of the fun things about researching this episode
on music in the brain
is that there are a lot of quality studies
exploring how music impacts the brain,
neuroimaging, neural recording data
from excellent laboratories, as well as a lot of studies.
In fact, a surprising number of studies
exploring how particular types of music impacts mood states.
And fortunately, that allowed me
to glean some very specific recommendations
as to the minimum amounts of say happy music
that you need to listen to in order to shift your mood
into a happier state.
And indeed, the numbers exist in the literature
and it has been shown that the threshold
for significantly shifting one's mood
into a happier state by listening to the sorts of music
we talked about before, that faster cadence music
even with nonsense lyrics, although it could include
other lyrics, instead is nine minutes.
Not 10, not eight, but nine.
And I'm sort of joking when I say not 10, not eight,
but nine, because of course you could listen to music
for 10 minutes or 15 minutes or longer.
In fact, earlier we talked about the benefits of doing that.
But when one examines the various studies
that looked at how long subjects need to listen to music
in order to shift their mood into a happier state,
the threshold seems to be nine minutes.
So if you want to feel happier than you currently feel,
it seems that listening to happy music for nine minutes
or more is going to be the effective approach.
Okay, so nine minutes or more to shift one state to happier.
What about to process somber or sad feelings,
feelings of loss?
Well, this raises an even bigger question.
And it's a question that I also get very often.
You're noticing I get a lot of questions often.
In any event, one of the common questions that I get is
when we are feeling sad or experiencing a loss,
grieving the loss of a relationship by death or decision
or by somebody moving away or the loss of a pet, et cetera,

is it better to go into that state?
In other words, to quote unquote feel one's feelings
or to counter those feelings?
Now historically, that's been a very difficult question
for me to answer because who am I to say
whether or not you should feel your feelings
or whether or not feeling those feelings
will take you down a trench of feeling much worse
or much better.
In fact, there's an emerging literature
exactly about that issue.
That is whether or not the catharsis model
is really best catharsis being the expression
and feeling of one's emotions as a way to extrude
or get rid of those emotions
or whether or not that simply drives us further down
the trench of those emotions.
That's really something that we should address
in a separate podcast episode.
And I will have experts from the fields of psychiatry
and psychology to help us address that question directly.
But since we're talking about music in the brain
and the fact that music has a tremendous capacity
to evoke emotional states, including sad states,
what has been shown in the peer reviewed literature
is that when people who are feeling sad
for whatever reason, loss of relationship, death,
who knows, doesn't really matter why they're feeling sad
after all, it's that they're feeling sad.
Listening to 13 minutes or more of sad music,
that music can contain lyrics they are familiar with
or no lyrics, regardless of whether or not it contains
lyrics, it's going to be on average 50 or 60 beats
per minute or less, we established that already.
Listening to that for 13 minutes or more has been shown
to be effective in allowing people to quote unquote,
process their somber feelings and to some extent
to move past their feelings of sadness.
So those studies support the idea that when feeling sad,
feeling one's feelings and perhaps even amplifying
those feelings of sadness by listening to sad music
for 13 minutes or more can help people
process those sad feelings.

And while that point might seem overly reductionist,
I actually think it's of real value.
I'm certainly familiar with feelings of loss,
feelings of grief.
And I've often struggled with this question of,
gosh, do I try and just push it aside
or do I deal with those feelings?
Again, this is something that you really need
to determine for yourself, but what these studies show
pretty conclusively is that when we're feeling sad,
matching that sadness or amplifying that sadness
by listening to sad music for 13 minutes or more
can help us move through that state of sadness.
And one could argue this is more or less the use
of catharsis of amplifying emotional expression
or feeling in order to try and move that feeling out.
It was a classic idea for originating
in Freudian psychology, but probably before then as well.
But in any event, I think these data support the idea
that even when feeling sad, perhaps especially
when feeling sad, amplifying or matching those feelings
through the use of sad music for 13 minutes or more.
Again, you don't need to set a timer for 13 minutes,
but giving yourself a period of time
to just listen to that music is one way
that can help you move through that state of sadness
and then be able to lean back into other areas of life.
So we've talked about the role of music
in evoking or shifting states of happiness and sadness.
There are also interesting data that support the use of music
for shifting one out of a state of heightened anxiety.
And I find this especially interesting
because my laboratory for a long time has worked on
behavioral interventions to reduce anxiety,
things like the physiological sigh,
which if you're not familiar with,
you can put physiological sigh in my last name into YouTube
and there's a demonstration of that.
It's a breathing technique of two inhales through the nose
and a long exhale through the mouth to lungs empty
that at this point in time, we understand to be the fastest
and most effective way to reduce one's levels of anxiety
in real time.

So it's two inhales through the nose,
long to lungs empty, exhale through the mouth.
That's the physiological sigh.
Earlier we talked about the fact that one of the main ways
in which listening to music shifts heart rate
and increases heart rate variability
and thereby positively shifts a number
of different health metrics is through shifts in breathing.
So I justify that brief vignette about the physiological sigh
as within the general context
of what we're talking about today.
In any event, there are data that have explored
whether or not specific musical stimuli
can be used to significantly reduce anxiety.
In particular, one published out of the University
of Pennsylvania and I'll provide a link
to this study in the show note captions,
which shows that people that listen to a particular song
that I'll describe in a moment,
experience up to 65% reductions in their anxiety.
That's a significant reduction in anxiety.
And I should point out that 65% reduction in anxiety,
in this case, was accomplished with just three minutes
of listening to this one particular song.
And get this, that particular song was as effective
in reducing anxiety as one of the most commonly prescribed
benzodiazepines.
So what is this magical anxiety reducing song?
The title of the song is Waitless by Marconi Union.
I hadn't heard of this song prior to researching this episode.
I did indeed look up the song on YouTube
and listened to the song.
I will provide a link to the song in the show note captions.
I confess that it is a very relaxing song.
I also confess that I was not experiencing anxiety
when I listened to the song,
but it was successful in reducing my level
of overall autonomic arousal.
I found myself more relaxed, et cetera.
Now, of course, what I'm describing
in terms of my own experience is not a peer reviewed study.
It's what I would call anic data,
meaning I'm just describing my experience.

But again, there are peer reviewed studies exploring
how this particular song shifts one's autonomic state.
And I think this three minutes of listening to this one song
should at least be tried by anyone
that's trying to reduce their anxiety.
Because unless you're listening to the song
in some way that I'm not aware of,
like excessively loud or something of that sort,
I can't imagine how listening to the song
would be detrimental in any way.
And if you are anything like the subjects in the study
that they explored, it could very well be beneficial
and help you reduce your anxiety.
It's also something that you could keep queued up
in your phone or on any device,
such that if you think you may experience anxiety,
you just put your headphones in and listen to it.
You might be wondering whether or not
Marconi Union's waitlist is only three minutes long.
Well, I don't know the answer to that
because when you go on YouTube,
what you'll see is that clearly a number of people
are benefiting from listening to the song
to reduce their anxiety,
or at least that a number of people have listened
to this song because if you put Marconi Union waitlist
into the search function on YouTube,
what you'll quickly discover is that the top video
has get this 47 million views and it's 10 hours long.
Now across today's episode,
it's been in the back of my mind
that some of you out there perhaps are trained musicians
that you grew up playing an instrument,
perhaps sang, inquire or at school,
perhaps you played multiple instruments,
perhaps you even know music theory.
Whereas others, such as myself,
we're encouraged to play an instrument when we were younger
but then abandoned that instrument.
In fact, I'll just tell you a brief story.
When I was a kid, every kid in school was required
to pick an instrument.
My parents, for whatever reason,

clearly they didn't ask me what I wanted to do.
They asked me to play the violin in school
and I got the violin, I started playing the violin.
I took the Suzuki Method lessons.
This is where you don't learn to read music directly.
There's a number assignment to the different notes
and that's initially how you learn.
I was also supposed to listen to the songs while I slept,
this idea that some of the music and musical learning
could be encoded during sleep.
An interesting topic
because there's actually some emerging evidence
for that now, but at the time,
as far as I know, there were no peer reviewed studies
but nonetheless, it was thought that this works
and perhaps it does.
Well, I can tell you one thing for sure,
it did not work for me
because I have one photo and truly just one
from a concert that I played.
I must have been about eight or nine years old
and within this photo, what you'll notice
is there's a gallery of children all with violins,
all of whom's bows are up and my bow is down.
That in addition to the fact
that my fly was open in the picture
and the fact that every time I played the violin,
either by practice or with the teacher present
when we would go to these once a week sessions
with a individual teacher,
people would cringe, animals would cringe,
literally dogs would howl such that my parents
did not encourage me to continue playing.
In fact, they and many others encouraged me to quit playing.
So I quit playing.
I confess I don't know how to play any instrument.
I've attempted a few other instruments in my lifetime.
Yes, I believe in neuroplasticity.
It is a hallmark feature of our brain.
Our brain can learn things even as adults
but the point I've tried to make here
is that I am not of the category of kids
that played an instrument and understands music theory

or how to read music.
I simply don't.
And I realized that those of you that are listening to this
or watching this out there are probably
in a mixed category of proficiency
all the way down to what I would consider
my own relationship to music, which is deficiency.
Although I greatly enjoy listening to music
and I do have a pretty good ability to memorize lyrics
in any event.
The reason I raise this is that there are now dozens
if not hundreds of quality peer reviewed studies
using a variety of technical approaches
that show that when children, especially children
younger than eight, learn to play an instrument
and even better learn to play multiple instruments
regardless of whether or not they learn to read music
that it leads to greatly enhanced connectivity
within their brain that persists into adulthood
and that it facilitates other forms
of neuroplasticity and learning,
which is basically to say that my brain very likely
does not include these enhanced circuits.
Which circuits am I referring to?
Well, there are a number of different circuits
in the brain that have been shown to expand
when children learn how to play an instrument as a child,
eight or younger.
And again, eight isn't a strict cutoff
and I always have to highlight this, forgive the tangent,
but when we say eight or younger,
I don't want people with nine-year-old children
or a 10-year-old kid or even 16-year-old kid listening
or even adult listening to think,
oh, you know, the window is shut for me
because when one designs a study,
you have to have some thresholds of who you include
and who you don't include.
And sometimes that leads to these kind of
artificial perceptions about where the cutoffs are.
But in any event, it's very clear
that if you did learn an instrument when you were young
or ideally even multiple instruments

and even better would be to learn multiple instruments
and how to sing along with instrumentals,
especially in an improvised manner.
Well, your brain has expanded connectivity
on average relative to children
that did not have that experience.
Now, the good news is that learning how to play an instrument
or even, thankfully for me,
listening to novel forms of music,
music that you don't typically listen to
for 30 to 60 minutes per day,
and it doesn't have to be every day, in fact,
it can even be just three days a week for 30 to 60 minutes,
has been shown to expand brain connectivity
in ways that, of course,
lends itself to better musical comprehension
and even performance,
but learning how to play a musical instrument at any age,
as well as singing and singing,
especially with others in a group,
has been shown to enhance learning
and the acquisition of new skills
separate from musical learning and singing.
In other words, it seems that learning how to play
an instrument and singing are a gateway to neuroplasticity.
And this is, again, supported by neuroimaging data.
Some of the more striking of those data
are that children that learned how to play
one to three instruments when they were a kid
or that sang in a choir or a group
or that were taught to sing solo for that matter
show up to 30% greater connectivity
within this particular brain network
that links the two hemispheres of the brain.
Now, as soon as I say two hemispheres of the brain,
it starts drawing up a lot of ideas in people's heads,
mainly derived from pop psychology,
that there are left-brained people and right-brained people.
I've touched on this before,
but I want to make this abundantly clear again now.
Most of what you've heard about so-called left-brained people
or right-brained people is complete and total nonsense.
It's myth.

There are some functions in the brain
that are lateralized to the left or the right hemisphere,
in particular, prosody.
They sort of lilting and falling of speech
and in singing is highly lateralized in the brain.
Other aspects of language can be lateralized in the brain,
but really, if you hear that certain people
are more emotional or certain people are more logical
based on right-brained, left-brained stuff,
that stuff is completely false.
It's complete garbage, in fact.
It's not based in any real solid data.
So when I say that learning an instrument
or learning how to sing young or even as an adult
is beneficial for increasing the connectivity
between the two sides of the brain,
what that increased connectivity
between the two sides of the brain,
which is, by the way, mediated through a structure
called the corpus callosum,
is not about enhancing one's emotional capacity
or logical capacity.
It's really about increasing the capacity
of all brain circuits, or at least the brain circuits
that are connected up directly with the corpus callosum,
which includes many brain circuits
for things like cognition, language learning,
speech, mathematics, a lot of people don't realize this,
but a lot of musicians are also especially adept
at mathematics, and for you musicians,
you're probably nodding, of course, right?
Because music is grounded in theory
that has basis in math and in physics,
something that we will address in a future episode
about harmonics, et cetera.
When children or adults learn how to play
a musical instrument or several,
or how to sing and play musical instruments,
that increased connectivity in the corpus callosum
is essentially providing multiple highways of option
for learning all sorts of things.
So it's something that I highly encourage,
so much so that I intend to finally, finally,

learn how to play an instrument.
I've got a particular instrument in mind
that I've wanted to learn how to play for a very long time,
but based on my prior experience
with trying to learn an instrument,
and because I like to consider myself a considerate person,
I intend to do this more or less in isolation from people
and indeed from animals as well.
And for those of you that don't have the time
or energy or desire to learn new forms of music,
you'll be perhaps delighted to know
that just listening to novel forms of music,
and in particular, when you listen to novel forms of music
and you pay attention to that music,
not just letting it play in the background,
that too has been demonstrated
to expand the brain's capacity for neuroplasticity,
its ability to modify itself and make it better
at learning other sorts of things,
both cognitive and physical.
So I highly encourage you to listen to the music you love.
I certainly love to listen to the music
that I delight in and have for so many years,
but there's also strong scientific support
to encourage listening to new forms of music
that hopefully you will like,
but nonetheless, the mere foraging for
and listening to novel forms of music itself
seems to activate brain circuitry in a way
that allows for better learning and comprehension
of all sorts of things.
So today we've been talking about music in the brain,
and I confess this is an enormous topic,
so much so that I had to discard with entire sets of data
and discussion around, for instance,
the mathematical structure of music
and how that relates to the mathematical structure
of firing of neurons.
We touched on this a little bit, however,
in the context of certain frequencies of sounds
that we hear, creating certain frequencies
of neuronal firing and activation in the brain.
I mean, just think about that, how amazing that is.

It's literally like the brain playing your neurons
like a piano.
This is not what happens when you smell a particular odor
or taste a particular taste
or see a particular face or visual stimulus.
Incredible things happen within those senses as well,
but there is something oh so fundamental and incredible
about music and its ability to tap into our neural circuitry
and our neural chemistry in ways
that shift our emotional states and our motivational states.
So we talked about ways that music can be leveraged
to shift our emotional and motivational states.
Again, not as a way to reduce music
to its reductionist parts,
but rather to help us gain understanding
into how the brain responds to music
and how we can leverage music of all kinds
with and without lyrics,
how we can balance the contrast between music and silence
to increase motivation and so on and so on.
For those of you that are interested
in the more formal structure of music
and how it relates to brain function and vice versa,
as well as for those of you that are interested
in singing and songwriting
and more along the lines of lyrical content
and how singing in groups
and how improvisation of singing and musical playing
can impact brain function and plasticity.
I promise you there's going to be both an expert guest
coming on the podcast to discuss that
as well as a solo episode on those topics.
Again, the topic of music and the brain
being far too vast to cover in just one conversation.
With that said,
I hope that today's discussion allowed for you
to think about music differently.
Hopefully it will lead you to listen to music a bit differently,
perhaps even leverage music for different purposes
in your life and above all to think about music
and to enjoy music,
either listening to it or playing it or both,
because as you now know,

music isn't just able to activate your brain,
but rather your brain contains vast amounts of real estate
that are literally there to listen to music.
If you're learning from and or enjoying this podcast,
please subscribe to our YouTube channel.
That's a terrific zero cost way to support us.
In addition, please subscribe to the podcast
on both Spotify and Apple.
And on both Spotify and Apple,
you can leave us up to a five star review.
Please also check out the sponsors mentioned
at the beginning and throughout today's episode.
That's the best way to support this podcast.
If you have questions for me or comments about the podcast
or guests that you'd like me to consider
hosting on the Huberman Lab podcast,
please put those in the comments section on YouTube.
I do read all the comments.
Not on today's episode,
but on many previous episodes of the Huberman Lab podcast,
we've discussed supplements.
While supplements aren't necessary for everybody,
many people derive tremendous benefit from them
for things like improving sleep,
for hormone support and for focus.
The Huberman Lab podcast is partnered
with Momentus supplements,
because Momentus supplements are the very highest quality.
They also ship internationally
and they tend to focus on single ingredient formulations,
which makes it easy to develop the most biologically effective
and cost effective supplement regimen for you.
If you'd like to see the supplements discussed
on the Huberman Lab podcast,
you can go to livemomentus spelled O-U-S,
so it's livemomentus.com slash Huberman.
If you're not already following me on social media,
please do so.
I am Huberman Lab on all social media platforms.
So that's Instagram, Twitter, LinkedIn,
Threads and Facebook.
And on all those platforms,
I cover science and science related tools,

some of which overlaps with the content
of the Huberman Lab podcast,
but much of which is distinct from the content
on the Huberman Lab podcast.
So again, it's Huberman Lab on all social media platforms.
And if you haven't already subscribed to our newsletter,
we have a zero cost monthly newsletter,
it's called the Neural Network newsletter
that provides podcast summaries,
as well as tool kits such as a toolkit for sleep,
toolkit for focus, toolkit for neuroplasticity,
toolkit for fitness, deliberate cold exposure,
heat exposure and on and on,
again, all available zero costs.
You simply go to hubermanlab.com,
go to the menu, scroll down to newsletter,
tap on newsletter and then give us your email.
And I want to emphasize
we do not share your email with anybody.
Thank you once again for joining me for today's discussion
about music and your brain.
And last but certainly not least,
thank you for your interest in science.