Audio Transcript

Researchers Probe How Music Rewires the Brain

By Gabriel Spitzer
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In Chicago area classrooms, teachers are beginning their annual tug-o'-war for students' attention. It can be tough to focus on what the teacher is saying amid the hubbub of a restless classroom. New research shows some people are better than others at picking a voice out of the noise. The difference isn't in their ears—it's in their brains.

Say you're sitting in class. Let's call it science class. The teacher is talking, but so are the kids behind you. A chair scrapes on the linoleum floor, papers jostle, some kid has a cold. And the next thing you know, you can't hear what the teacher is saying at all.

Well it turns out, some of us are better than others at isolating the important sound in a noisy environment. To figure out why, you have to understand how the brain makes sense of sound. Professor Nina Kraus is working on that question at Northwestern University's auditory neuroscience laboratory.

KRAUS: My lab is interested in cracking the neural code—this transformation from sound wave to brain wave.

That transformation in the brain is crucial to how well we hear, learn, read and interact.

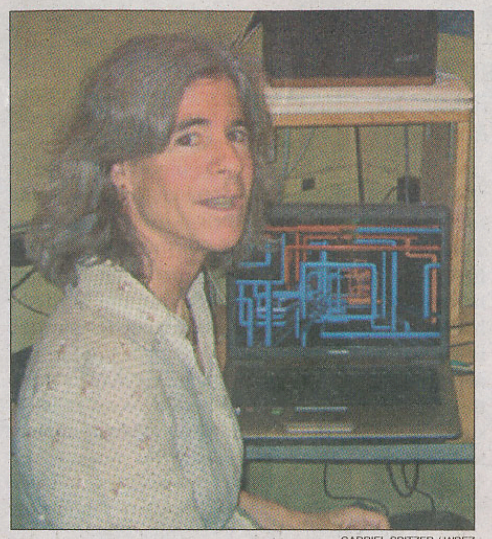
KRIZMAN: This is her brainstem response to the stimulus that we're playing ...

Spidery wave patterns unfold on researcher Jen Krizman's computer screen. And on the other side of a one-way mirror, 14-year-old Lexie Henning is getting comfortable.

HENNING: Well, this is the room where you sit in the big comfy chair. They recline you, give you blankets and pillows. You can watch a movie. I'm gonna watch "Madagascar." Then they have a microphone that they put in one ear only with somebody saying da da da.

As Lexie watches, and listens, there are three electrodes attached to her head. They read, millisecond by millisecond, how her brain is registering that da da da. It's all a bit baffling to Lexie.

HENNING: The brain is, to me, it's still just a big squiggly thing inside your head. It's just a big thing of goo. That's as close as I'm ever gonna get to understanding the brain.



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Professor Nina Kraus at the Auditory Neuroscience Lab at Northwestern.

But to a neuroscientist, that goo is a wildly complex tangle of neural pathways. By tapping into brains like Lexie's, Nina Kraus can eavesdrop on how the brain "hears." It all starts in the brainstem—which takes sound from the ear and rewrites it into brain waves. Kraus can put that brain wave next to the sound wave that triggered it, and—here's the wild part—play the brain wave out loud.

KRAUS: So here, this is a sound wave to the sound da. And the brain wave looks very much like the sound wave. If you play back the brain wave, it actually sounds like the sound wave.

In the brain wave, you can still hear elements of the original sound's pitch, timing and timbre.

So, listening to brainwaves is kind of weird and fun, but why care so much about the brainstem?

Well, how good a job it does recording sound is a crucial step in the process of hearing. Understanding how exact the recording is, or where it might get fuzzy, can tell us about a person's reading problems, or why she has a hard time focusing on her teacher in a noisy classroom. And that's where the music comes in.

It seems that through musical training, the brainstem can actually get better at picking out a desired signal in a noisy environment. Dana Strait is a doctoral student at the Kraus lab, and a long-time oboist. She says learning music appears to make people experts at picking apart complicated sounds—and not just musical sounds.

STRAIT: Musicians spend so much time manipulating the sound from their instruments, listening to the output from their teacher and mimicking it, communicating musically with other performers. And that can translate into how we process speech.

ULETT: Three times that loud, men. Men, would you go like this, please: Unh! Unh! Unh! Good, now sing!

Here at UIC College Prep on Chicago's West Side, music class isn't an elective, it's mandatory. Most of the kids here have never had musical training before. The Kraus lab plans to study some of them to see what effect musical training has on their brains.

ULETT: We've done a lot of work today in little bits. Now try to add it up, focus on thinking ahead.

Studying these kids over several years could help show how much musical training you'd need to get the benefits, and when you'd have to start. Music department chair Kate Ulett says it could also confirm something arts teachers have long believed: Music can train a person not just to sing or play, but to think.

ULETT: When the funding is tight it tends to be one of the things that get cut. We all know this. I feel as music educators and as arts educators we have a responsibility to try to make sure people understand how very important this is to human development, to cognitive development.

Besides helping hear speech in noise, musical training correlates with higher reading scores. And Kraus and her team have found musicians are better able to catch the emotional content of sound. These aren't just skills you pick up like you're learning to knit—Kraus says musical training seems to actually restructure the brain.

KRAUS: It changes what your nervous system turns into. And you can draw the analogy, if you're going to work out your bicep, it's going to look a certain way, whether you're awake or asleep. And the same is true of these brain responses that we record.

This research is still in the early stages, but Kraus says it has good prospects for future therapies. Some of the hearing elements that musical training seems to improve are exactly the ones that tend to misfire in people with, say, dyslexia or autism.

KRAUS: So the idea is that you could use the musical training to strengthen pathways that are not working as well as they could be.

There's a lot of uncertainty about who might benefit from the training or what kind they'd need. But possibilities really start to open up once you realize that, when it comes to hearing, the ears are just the beginning.

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