

Studying a virtuoso violinist's brain with fMRI

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Violinist Jennifer Koh used her visit to Duke to learn more about brain function.

Until just a few years ago, violinist Jennifer Koh had no particular interest in the inner workings of the brain.

But then she suffered a concussion resulting in speech and memory loss. She couldn't practice her violin for months; when she picked up the instrument again, she could play for no more than 20 minutes at a time.

Suddenly, Koh wanted all the knowledge she can muster about the brain. She read. She pestered friends who work in medical fields. And this week at Duke, she underwent a [functional magnetic resonance](#) imaging scan – known as an functional MRI – in the hope it can help explain how the brain of a professional musician works.

"I have a general curiosity about the relationship between human beings and music," said Koh, a touring professional who has played the violin since she was 3 years old. "No matter what the culture, no matter what the country ... music is a fundamental part of human beings."

Koh's fMRI this week was an unexpected offshoot of a visit to campus in January as an artist-in-residence sponsored by Duke Performances, during which time she gave a recital at Baldwin Auditorium and participated in some classes. One was "Music and the Brain," which explores the intersection of music and neuroscience and is taught jointly by professors Scott Lindroth of the music department and Tobias Overath from the Duke Institute for Brain Sciences.

Koh is among the nation's most well-regarded musicians. A Chicago native, she made her major symphony debut at age 11 with the Chicago Symphony Orchestra and has performed with dozens of professional symphonies around the world. She was recently named Instrumentalist of the Year by Musical America magazine, the oldest American magazine covering classical music.

Knowing Koh was returning to campus this week to perform the Beethoven violin concerto with the Duke Symphony Orchestra, Overath reserved an MRI slot at the Duke-UNC Brain Imaging and Analysis Center (BIAC) – which funded the test—and set out to create a research study with the violinist's brain as its subject.

Laying motionless on her back in the MRI machine while her brain

activity was being measured, Koh was asked to imagine playing a series of classical works for solo violin by Paganini and Bach, to listen to them, or to read their musical scores. Overath then studied how Koh's brain reacted to each.

The results, he said afterwards, showed a unique activation pattern for when she was listening, reading, and imagining playing music. However, there were also some common traits: For example, brain areas responsible for planning movements were active in all three tasks, even though Koh never lifted a finger.

"The musician's brain is exquisitely sensitive to all aspects of music, be it listening, reading or imagining playing music," Overath said. "Therefore, you engage a whole range of areas of your brain - it's quite literally a whole body experience. From a cognitive point of view, but also physically, it's incredibly strenuous."

Overath himself is a musician: he played violin for 16 years before transitioning to the viola, which he played for many years and still picks up from time to time. He studied musicology as a college undergraduate in Germany before realizing he was more interested in the brain chemistry of how us humans perceive [music](#) rather than the technical nitty-gritty of musical composition and theory. So he became a neuroscientist, one with the perfect background for Koh's study.

For Overath, the chance to study the working brain of a professional musician of Koh's caliber was a rare opportunity, and his students will benefit as well. He and Lindroth will discuss the results derived from Koh's scan in class.

"It certainly plays into the course content," said Lindroth, a composer. "We'll have a whole class on the ways the [brain](#) is engaged with the physical and auditory dimensions of musical performance. It's especially

wonderful that our students will have a personal connection to Jennifer from her visit to our class earlier in the semester."

Provided by Duke University

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